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APPENDIX D7

Soil Resources Assessment

Prepared by:
James Nyenhuis
Certified Professional Soil Scientist

July 2015

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D7 SOIL RESOURCES ASSESSMENT

D7.1 Introduction

This appendix describes the soil resources of the Brook Mine Area which is located in the Sheridan Coal Field of the Powder River Basin near the Montana – Wyoming state line. The proposed permit area is located approximately 6 miles northwest of Sheridan, Wyoming and lies along a portion of the north side of the Interstate 90 corridor between the Acme interchange and Ranchester, Wyoming. This appendix was prepared by James Nyenhuis, Certified Professional Soil Scientist, of Fort Collins, Colorado.

The identification and proper management of the soil resources in the Brook Mine Area is essential for the success of reclamation in the mine area and the achievement of the post-mining land use. The information presented in this soils report is designed to aid in formulating a practical and successful reclamation plan.

The Brook Mine Area comprises approximately 4,548.8 acres and is composed of Parcel 1, about 4,484.4 acres and Parcel 3, about 64.4 acres. The Brook Mine Area is located in portions of Sections 10, 11, 12, 13, 14, T.57N., R.85W., and portions of Sections 7, 8, 9, 10, 15, 17, 18, 20, 21, and 22, T.57N., R.84W. Approximately 1,113.5 acres are proposed for coal mining related disturbance and 2,624.4 acres could be affected by potential subsidence. Please refer to "Appendix 'C' – Right To Mine" Legal Description of the Permit Application for the complete legal descriptions of the proposed permit area.

Figure D7.1-1, Brook Mine Permit Area with Disturbance Boundary, shows the mine permit area as well as projected disturbance areas, potential subsidence areas, and other pertinent information.

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D7.2 Methodology

The soil resources of the Brook Mine Permit Area were investigated by James Nyenhuis, Certified Professional Soil Scientist/Soil Classifier (ARCPACS #2743), during the spring and summer of 2014. Soils mapping, soil profile and map unit description, taxonomic classification, and soil sampling was conducted in accordance with the procedures and standards of the National Cooperative Soil Survey (Soil Survey Staff, 1993, 1997, 1998, 1999, and 2010; and Schoeneberger et al., 2012), and "Guideline No. 1, Soils and Overburden" (WDEQ-LQD,1996). Reference was also made to "Guideline No.1A, Topsoil and Subsoil" (Draft, May 2014) as well as recent University of Wyoming soil and reclamation bulletins (B-1202, B-1204, B-1206, and B-1212). Based on definitions in the Wyoming Rules and Regulations, Topsoil means the A and E Horizons or any combination thereof; Subsoil means the B and C Horizons excluding consolidated bedrock material. The term "soil" refers to both topsoil and subsoil.

Initial mapping units were identified using Natural Resources and Conservation Service (NRCS) Sheridan County Order 3 soil survey map sheets 18, 19, 30, and 31 (Lupcho, 1986), recent air photo images, and the USGS 7.5' Monarch and Acme topographic quadrangle maps and surficial geologic maps (Barnum, 1983). An excellent recent digital orthophoto base map, with topographic contours, of the project area (created by Horizons, Inc., Rapid City, SD, photo date November 2, 2011) was also available and used during the soils field work. The previous soil map units and polygon delineation boundaries were viewed during initial field reconnaissance and observation but were soon determined to be inaccurate in some areas and generally not detailed enough.

Consistent with recommended procedures in Guideline No.1 (WDEQ-LQD, 1996), all areas projected to be disturbed by coal mining activities (affected lands) were mapped at the detailed Order 1-2 level of intensity. All non-to-be-disturbed areas (non-affected lands) were mapped either to the less detailed Order 3 level or to a better, more detailed level (Order 2 or Order 1-2)

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depending on area. The entire Brook Mine Area was traversed by vehicle where possible and generally on foot in most areas. Soil map unit boundaries were delineated by digging soil profiles using a "Montana spade sharpshooter" and six-foot bucket auger as well as observing surface conditions including geology, vegetation, and slope aspect/gradient.

Coal mining will be done primarily "underground" through "highwall mining panels" but will also include some small areas of surface mining. The areas above the highwall mining panels could have possible "subsidence" features and these areas are clearly delineated on the Brook Mine Area base map. The potential subsidence areas did not require the detailed Order 1-2 soils mapping as noted in a WDEQ memorandum to the project file (RAMACO Preliminary Permit Correspondence, TFN 6 2/025) and attached to this report as Exhibit D7.2-1, Soil Sampling Protocol (RAMACO, TFN 6 2/025). As stated in the memorandum, "Soils on surfaces underlain by mining without surface disturbance (potential subsidence areas) require a minimum Class 3 mapping" (WDEQ-LQD, 2014b). "Class 3" (an archaeological survey level of investigation term) is meant to mean "Order 3" (a soil survey level of investigation term).

For mapping units on affected (to-be-disturbed) lands, if soils were similar (low contrasting in physical and/or chemical properties and/or depth), consociations of a minimum size of five acres were delineated. Similar soils could be mapped as complexes or associations provided their physical and chemical properties would allow for the same salvage depth recommendation. If soils are dissimilar (highly contrasting in physical and/or chemical properties and/or depth), individual soil series (consociations) of a minimum size of two acres were delineated.

Soils on non-affected areas were not required to be sampled for laboratory analysis. Soils on affected (to-be-disturbed) lands were described and sampled for laboratory analysis according to recommended minimum intensities (WDEQ, 1996) as follows: 1 sample pedon was collected and analyzed in the laboratory if the soil series comprised up to 40 acres in size or

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was up to 2% of the affected mine area, 2 sample pedons were collected and analyzed in the laboratory if the soil series comprised between 40 and 160 acres or was at least 2 to 5% of the affected mine area, and 3 sample pedons were collected and analyzed in the laboratory if the soil series comprised greater than 160 acres or was greater than 5% of the affected mine area. Rock Outcrop, Disturbed Land, and Water, either as a consociation or part of a map unit complex, was not sampled for laboratory analysis but was carefully mapped for accurate geographic location and acreage determination.

As such, all soils, regardless of soil depth, were fully described and sampled by major horizons at representative sites at least the minimum required times. In addition, soil resource information for the adjacent and previously permitted Big Horn Coal Mine (Big Horn Coal Company, 1983), now reclaimed, was reviewed to determine whether soils and their recommended salvage depths were similar to those within the currently proposed Brook Mine Area.

Soil series names are based on site-specific characteristics and current NRCS soil series criteria as obtained from consultation with NRCS personnel and information from the official NRCS soils web site. Current Sheridan County soils information for the project area is available and was obtained and reviewed during the field survey (Lupcho, 1986). Any hydric soil indicators (NRCS, 2010), if present, in the freshly dug soil auger holes, would be described on the soil profile description forms filled out at the sample sites.

Following soil mapping, representative locations were selected for all mapped soils within the project area and these sites were fully described and sampled from freshly dug soil auger holes. Representative sample locations were selected to most accurately represent the soil series and to provide for adequate sample site distribution across the study area. Transition zones between map unit delineations, road edges, or previously disturbed areas were avoided. Representative profiles were selected on the basis of medial

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characteristics for physical and chemical soil parameters, parent material, landscape position, and vegetation.

Soil samples were collected from each major horizon and subhorizon at the sample sites. Approximately 1.5 to 2 quarts of soil material per sample was collected into clean Ziploc plastic bags. Sample material was field screened over a 2-mm (0.078 inch), U.S.A. Standard Testing #10 soil screen to determine coarse fragment content (percent by volume). A few samples with hard soil clods were not field screened, although estimated coarse fragment rock content was recorded based on visual determination.

Standard NRCS (Soil Survey Staff, 1994) "232" profile description forms were completed in the field at each sample site and are included with this report. The following data were recorded: sample site number, date, soil series name, map unit number, location, soil classification, vegetation, parent material, physiography, slope gradient and aspect, erosion condition, moisture status at time of sampling, drainage class, depth to groundwater if encountered, salts or alkali if present, permeability, horizon designations and depths, soil color (dry and moist), texture, coarse fragment content, structure, consistence, roots, effervescence (presence of carbonates), and horizon boundary.

A total of one hundred and eleven soil samples (111) were collected from twenty-seven (27) representative soil sample locations (sites "R1" through "R27"). The soil samples were delivered to Inter-Mountain Laboratories (IML) in Sheridan, Wyoming for standard soils analysis (WDEQ, 1996). The soil laboratory analyses included: pH, electrical conductivity (EC, dS/m); saturation percent; organic matter percent (Walkley Black method); calcium, magnesium, and sodium (meq/l); calculation of Sodium Adsorption Ratio (SAR); soil texture by hydrometer (percent sand, not including very fine sands fractionation; silt; and clay), Boron (ppm by Hot Water Boron method); and Selenium (ppm by Extractable Selenium method).

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Percent coarse fragments, by volume estimate, for each sample (sand >2mm, pebbles, gravel, and cobbles), as well as soil effervescence (EO, noneffervescent; SE, slightly effervescent; EM, moderately effervescent; ES, strongly effervescent; or EV, violently effervescent) were determined in the field at the time of sampling. Effervescence in dilute hydrochloric acid (.1N) is one measure of calcium carbonate content of the soil. IML maintains its own QA/QC laboratory procedures. The results of the IML soil laboratory analysis are included with this report.

The results of the soils field mapping, profile descriptions, and soils laboratory analysis were used to evaluate soil suitability and generate project-specific soil salvage recommendations. The suitability evaluation and salvage recommendation was completed for all component soils of survey map units. The evaluation followed parameters and threshold values contained in Table I-2 "Criteria to establish suitability of topsoil (or topsoil substitutes)" of Guideline No.1 "Topsoil and Overburden" (WDEQ, 1996).

Unsuitability threshold values include: pH <5.0 or > 9.0; electrical conductivity (EC) >12; sodium adsorption ratio (SAR) >15, or >12 for soils with greater than 40% clay; coarse fragment (rock) content >35%; saturation percent <25% or >80% (marginal rated); sand, clay, or silty clay texture (marginal rated); Boron (>5.0 ppm), and Selenium (<0.3 ppm = suitable, 0.3 to 0.8 ppm = marginal).

The recommended soil salvage depths are listed and discussed in the various soil mapping unit descriptions in the results section of this report. Topsoil volumes for salvaged soils are included in the project mine and reclamation plan.

D7.3 Results

D7.3.1 General Soils Information

The Brook Mine permit area is within a "mesic" soil temperature regime (average annual temperature about 45 to 47 degrees F.), an "ustic-aridic" soil

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moisture regime (average annual precipitation about 12 to 14 inches), and the average frost-free period is about 110 to 120 days (Lupcho, 1986). Surface elevations within the permit area range from 3,590 feet where the Tongue River crosses the permit in the east portion of the permit area in Section 15 of Township 57N Range 84W to the highest of 4,110 feet above mean sea level (amsl) in Section 7 of Township 57N Range 84W.

The Tongue River is the principal drainage in the permit area and generally flows along the southern edge of the area. Additional drainages in the permit area include Hidden Water and Slater Creek, both tributaries of the Tongue River. Hidden Water traverses northwest to southeast along the northeast part of the permit area. Slater Creek also traverses northwest to southeast and is in the west central part of the permit area. Both have narrow valley floors, Hidden Water more so than Slater Creek. Some mine subsidence features from previous underground coal mining are present on the land surface in a few areas. Some reclaimed land from Big Horn Coal (Permit No. 213 T7) is also present in the southeast portion of the Brook Mine permit area.

Soils in the permit area are forming in claystone, siltstone, shale, and sandstone of the Fort Union Formation of Paleocence age. Coal seams, including thin local seams as well as the Carney and Masters seams of mining interest, are interbedded within the formation. The permit and adjacent area is characterized by the presence of sixteen map units with ten dominant soils and four miscellaneous units: Cambria loam (Map Unit A), Zigweid loam (Map Unit B), Forkwood loam (Map Unit C), Shingle channery loam (Map Unit D), Samday clay loam (Map Units E and F), Bauxson loam (Map Unit G), Haverdad loam (Map Unit H), Wibaux channery loam (Map Units Wx and Wx-Bx-RO), Ulm clay loam (Map Unit U), and Worthenton clay loam (Map Unit Wo). Additional map units include: Reclaimed Land (Map Unit RL), Rock Outcrop (Map Unit RO), Disturbed Land (Map Unit DL), and Water (Map Unit W).

Cambria, Forkwood, Zigweid, and Haverdad soils are all deep, well-drained, nonsaline and nonsodic loamy soils mapped across the permit area.

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Haverdad is mapped on drainages. Worthenton is a deep, poorly-drained, fine textured hydric soil but is not mapped within the permit area. Ulm is also deep, well-drained, nonsaline and nonsodic but is fine textured rather than loamy. Shingle and Samday soils are both shallow, well drained, nonsaline and nonsodic upland soils. Shingle is loamy whereas Samday is clayey. Wibaux and Bauxson are both well-drained soils mapped on the extensive scoria landscape within the permit area. Wibaux is effectively a well-drained shallow soil with 7 to 20 inches of channery to very channery sandy loam to loam to the fragmental contact which has as high as 95% fractured scoria (porcelanite). Bauxson is similar to Wibaux but has slightly deeper loamy soil before the fractured scoria contact.

Since 1980, NRCS has revised its thinking concerning soil climate characteristics and subsequently soil series names. Certain soils were considered to be within a 10 to 14 inch precipitation zone, and others were in a 15 to 17 inch zone. Furthermore, some soils were put into a colder temperature and shorter growing season group (to be consistent with the climate of the northern PRB), and others were grouped with warmer and longer growing season soils mapped further south into northeastern Colorado.

As a result, there have been several name changes since 1980 (the time of the Big Horn Coal soil survey) for soils mapped in the general Brook Mine Area. For example, Samday replaces Samsil, Haverdad replaces Haverson, Forkwood replaces Fort Collins, Bauxson replaces Spearman, and Worthenton replaces Worthing taxajunct. These are the same soils morphologically, they just represent slightly different climatic and/or other taxonomic conditions. These changes were made by NRCS as part of recent northern Wyoming soil surveys including Sheridan County, Northern and Southern Campbell County, and Northern Johnson County (Westerman and Prink, 2004). The former soil names are no longer recognized as present in the survey area, and the new names replace them. These are not new soils, just renamed soils.

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Concerning Prime Farmland, none of the soils in the Brook Mine Area are listed by NRCS as meeting criteria for Prime Farmland status (NRCS, 2006a; NRCS, 2014). None of the soils on the adjacent, previous Big Horn Coal Mine area meet Prime Farmland status as well (Lupcho, 1980).

Exhibit D7.3-1, Brook Mine Area Soils Map, is attached to this report. It was compiled on a RAMACO ortho-photo base map at a scale of 1"=400', and digitized and produced by WWC Engineering of Sheridan, Wyoming. Base map details: Photo date November 2, 2011; Fugro Geospatial Inc. (Horizons Inc., Rapid City, South Dakota); details provided in email from David Holm to Jeff Baron, 6/27/2014. The Exhibit includes soil map unit delineations and sample site locations. Some soils mapping is also provided for areas outside of but immediately adjacent to the Brook Mine Area boundary. The map unit legend provides map unit symbols and names, including slope percentages, and recommended soil salvage depths.

Table D7.3-1, Brook Mine Area List of Soil Map Units and Acreages, provides a list of soil map units and acreages for both to-be-disturbed and non-affected areas within the Brook Mine Area.

Addendum D7-1, Soil Profile Descriptions, provides the legible, field soil profile description forms for all 27 soil series descriptions completed during the soil survey.

Addendum D7-2, Soil Laboratory Results, provides the results of the IML laboratory analysis of the 111 soil samples collected during the soil survey.

D7.3.2 Soil Suitability and Salvage Depth Recommendation

Soil suitability has been evaluated and soil salvage depths recommended for each component of all soil map units for the Brook Mine Area. Table D7.3-2, Criteria to Establish Topsoil and Overburden Suitability, lists parameter criteria and threshold values for this evaluation. Table D7.3-3, Brook Mine Area List of Soil Map Units and Salvage Depth Recommendations lists the soil map units within the permit area, their soil sample site numbers, and

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summarizes their estimated salvage depths and limitations to deeper salvage. The soils map for the Brook Mine Area also lists the recommended soil salvage depths by map unit. Projected disturbance acreage for each map unit, as well as estimated cubic yard volumes of recommended salvageable soil, will be contained in the Brook Mine mine and reclamation plan. An estimated weight-average suitable soil salvage depth of 20.2 inches, including both topsoil and subsoil, was calculated for the 1,113.5-acre Brook Mine Area proposed disturbance area. The mine plan will calculate the site-specific topsoil salvage and replacement depths and topsoil volumes for each projected mine disturbance area. The average salvage depth for individual disturbance areas may differ from that of the soils study area as a whole.

Results indicate that many map units (A, C, D, E, G, H, and RL) have both moderate acreage and a deep recommended soil salvage depth. These map units contain the best soils from a soil suitability perspective – Cambria, Forkwood, Shingle, Samday, Bauxson, Haverdad, and Reclaimed Land. Wibaux, Wibaux-Rock Outcrop, and Samday-Rock Outcrop have limited suitable soil for salvage. Disturbed Land, Rock Outcrop, and Water have no soil for salvage.

Based on the physical and chemical soil characteristics, and the topsoil suitability evaluation, it is apparent that sufficient suitable topsoil and subsoil, if properly salvaged, exists across the Brook Mine Area for the successful reclamation of any subsequent mining related disturbance areas.

D7.3.3 Soil Series and Map Unit Descriptions

The following text is a description of the sixteen soil map units on the Brook Mine Area and their component soil series, as well as an evaluation of their topsoil suitability and recommended estimated salvage depths. All soil sample sites are plotted on the soils map. Photographs of all soil sample sites are on file. The descriptions are presented below.

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D7.3.3.1 Map Unit A: Cambria loam, 2 to 8% slopes

Cambria loam (Map Unit A) is mapped in many map delineations scattered across the permit area and is located primarily on gently sloping alluvial fans, terraces, and lower sideslopes. Cambria loam is a deep (40+ inches to bedrock), well-drained soil developing in medium-textured to moderately fine-textured local alluvium from interbedded sedimentary rock including sandstone and shale.

In a typical profile, Cambria has a light brownish gray sandy loam to loam "A" horizon surface layer about 5 inches thick. The upper 5 inches of the "Bt" argillic subsoil horizon is a brown silty clay loam. The next 5 inches is a pale brown clay loam. The lower part of the profile to 40 inches or deeper is a pale brown loam. The soil is nonsaline and nonsodic and has slightly acid to neutral reaction (pH) in the upper horizons and slightly alkaline to moderately alkaline reaction throughout the rest of the profile.

Cambria loam has moderate permeability and high available water capacity. The effective rooting depth is greater than 40 inches, the depth to the underlying bedrock contact. Surface runoff is medium and the erosion hazard from water is moderate and severe from wind. The erosion "K Factor" is 0.32, the "T Factor" is 5, the Wind Erodibility Group is 3, and the Hydrologic Group is B. The Cambria soil is in the "Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Cambria soil is classified as a "fine-loamy, mixed, superactive, mesic Ustic Haplargid", and is an established soil series of moderate extent mapped in Wyoming. The most recent NRCS official soil series description for Cambria, dated 11/2005 is on file at RAMACO.

Cambria loam was described and sampled at three representative sites on the Brook Mine permit area (R5, R6, and R10), and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R5 is located in a portion of the NW1/4 of the SW1/4 of the

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SW1/4 of Section12, T.57N., R.85W. GPS coordinates: 44 degrees, 55′, 31″ North; 107 degrees, 4′, 10″ West. Sample site R6 is located in a portion of the SE1/4 of the NE1/4 of the NW1/4 of Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 53′, 40″ North; 107 degrees, 1′, 54″ West. Sample site R10 is located in a portion of the SE1/4 of the NE1/4 of the NW1/4 of Section17, T.57N., R.84W. GPS coordinates: 44 degrees, 40′, 24″ North; 106 degrees, 51′, 59″ West.

Map Unit A (Cambria loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 10″, Subsoil 15″

The upper 25 inches of Cambria loam (Map Unit A) is entirely "suitable" and recommended for salvage. The electrical conductivity (EC) in the three sampled Cambria pedons (R5, R6, and R10) increased below about 25 inches to values ranging from 6.19 to 6.81 (sample site R10), to 7.03 (sample site R5), and to 8.60 and then 9.49 (sample site R6). EC values above 8 are considered "marginal". Sodium Adsorption Ratio (SAR) values also increased below about 25 inches but not enough to be considered "marginal". Organic matter content in Cambria sample site R10 decreased significantly below 18 inches with values from 0.2 to <0.1 percent. As a result, 25 inches is a good cutoff for salvage in order to not dilute the higher quality of the upper soil material. It makes good sense to separately salvage Topsoil and Subsoil for Cambria (WDEQ-LQD, 2014, p.3). Therefore, the upper 10 inches of Cambria is recommended for salvage as Topsoil and the underlying 15 inches as Subsoil. Deeper Cambria marginal soil material could be salvaged if needed.

D7.3.3.2 Map Unit B: Zigweid loam, 0 to 3% slopes

Zigweid loam (Map Unit B) was mapped in five small delineations located on a low terrace of the Tongue River in an area of Section 13 (T.57N., R.85W.) immediately south of Interstate 90 that is now adjacent to but not within the Brook Mine Permit Area. The soils report retains Map Unit B and provides the following descriptive information. Zigweid loam is a deep (40+ inches to

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bedrock), well-drained soil developing in medium-textured to moderately fine-textured local alluvium from interbedded sedimentary rock including sandstone and shale. Zigweid was previously mapped in the Big Horn Coal soil survey as Map Unit a37A (Zigweid loam, 0 to 3% slopes).

In a typical profile, Zigweid has a brown loam "A" horizon surface layer about 4 inches thick. The upper part of the "Bw" cambic subsoil horizon is a brown loam to clay loam about 12 inches thick. The lower part of the "Bw" cambic subsoil horizon is a pale brown loam to clay loam about 12 inches thick. The underlying "C" horizon substratum is a pale brown to yellowish brown clay loam to loam to a depth of 40 inches to 72 inches. The soil is nonsaline and nonsodic and has neutral reaction (pH) in the surface layer and neutral to slightly alkaline reaction throughout the rest of the soil profile.

Zigweid loam has moderate permeability and high available water capacity. The effective rooting depth is greater than 40 inches, the depth to the underlying bedrock contact. Surface runoff is medium and the erosion hazard from water is slight and moderate from wind. The erosion "K Factor" is 0.32, the "T Factor" is 5, the Wind Erodibility Group is 4L, and the Hydrologic Group is B. The Zigweid soil is in the "Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Zigweid soil is classified as a "fine-loamy, mixed, superactive, mesic Ustic Haplocambid", and is an established soil series of moderate extent mapped in northeastern and central Wyoming. The most recent NRCS official soil series description for Zigweid, dated 03/2003 is on file at RAMACO.

Zigweid loam was described and sampled at one representative site (R26) located just outside the Brook Mine permit area. The soil profile description for R26 is contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R26 is located in a portion of the SW1/4 of the SW1/4 of Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 54′, 58″ North; 107 degrees, 5′, 52″ West.

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Map Unit B (Zigweid loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 16" (1.3'), Subsoil 56" (4.7')

The entire soil profile to 72 inches (6 feet) in depth is suitable and recommended for soil salvage. All soil parameters are suitable. It makes good sense to separately salvage Topsoil and Subsoil for Zigweid (WDEQ-LQD, 2014, p.3). The upper 16 inches of Zigweid are recommended for salvage as Topsoil and the underlying 56 inches as Subsoil.

D7.3.3.3 Map Unit C: Forkwood loam, 4 to 25% slopes

Forkwood loam (Map Unit C) is mapped in many delineations scattered across the permit area and is located primarily on hill slopes, alluvial fans, terraces, and lower sideslopes. Forkwood loam is a deep (40+ inches to bedrock), well-drained soil developing in medium-textured to moderately fine-textured local alluvium from interbedded sedimentary rock including sandstone and shale. Forkwood was previously mapped in the Big Horn Coal soil survey as Map Unit 88A (Fort Collins loam, 0 to 3% slopes) and Map Unit 88B (Fort Collins loam, 3 to 6% slopes).

In a typical profile, Forkwood has a light brownish gray loam "A" horizon surface layer about 4 inches thick. The upper 8 inches of the "Bt" argillic subsoil horizon is a grayish brown clay loam. The lower 12 inches of the "Bt" argillic subsoil horizon is a light brownish gray clay loam. The lower part of the profile, the "C" horizon substratum, to 40 inches or deeper is a pale brown loam to clay loam. The soil is nonsaline and nonsodic and has slightly acid to neutral reaction (pH) in the upper horizons and slightly alkaline to moderately alkaline reaction throughout the rest of the profile.

Forkwood loam has moderate permeability and high available water capacity. The effective rooting depth is greater than 40 inches, the depth to the underlying bedrock contact. Surface runoff is slow and the erosion hazard from water is slight and moderate from wind. The erosion "K Factor" is 0.32, the "T Factor" is 5, the Wind Erodibility Group is 5, and the Hydrologic Group

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is B. The Forkwood soil is in the "Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Forkwood soil is classified as a "fine-loamy, mixed, superactive, mesic Ustic Haplargid", and is an established soil series of large extent mapped in central and northern basin areas of Wyoming. It is also the State Soil of Wyoming. The most recent NRCS official soil series description for Forkwood, dated 10/2002 is on file at RAMACO.

Forkwood loam was described and sampled at three representative sites on the Brook Mine permit area (R9, R12, and R14), and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R9 is located in a portion of the NW1/4 of the NW1/4 of the NW1/4 of Section18, T.57N., R.84W. GPS coordinates: 44 degrees, 54', 31" North; 107 degrees, 8', 25" West. Sample site R12 is located in a portion of the SW1/4 of the SE1/4 of the SW1/4 of Section8, T.57N., R.84W. GPS coordinates: 44 degrees, 55', 23" North; 107 degrees, 1', 35" West. Sample site R14 is located in a portion of the SE1/4 of the SE1/4 of the NW1/4 of Section14, T.57N., R.85W. GPS coordinates: 44 degrees, 55', 2" North; 107 degrees, 4', 54" West.

Map Unit C (Forkwood loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 12" (1'), Subsoil 45" (3.75')

Forkwood loam pedons R12 and R14 are entirely suitable throughout their profile depths, 72 and 55 inches, respectively. Forkwood pedon R9, 46 inches deep to bedrock, however, has "marginal" EC (10.6) and "marginal" Selenium (0.37 ppm) from 35 to 46 inches in depth. Neither moderate value is a significant limitation and should dilute upon mixing, and therefore the entire Forkwood profile, an average depth of 57 inches, is recommended for salvage. It makes good sense to separately salvage Topsoil and Subsoil for Forkwood (WDEQ-LQD, 2014, p.3). Therefore, the upper 12 inches of Forkwood is recommended for salvage as Topsoil and the underlying 45 inches as Subsoil.

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D7.3.3.4 Map Unit D: Shingle channery loam, 2 to 25% slopes

Shingle channery loam (Map Unit D) is mapped in several delineations scattered across the permit area and is located primarily on hills and sideslopes. Shingle channery loam is a shallow (10 to 20 inches to bedrock), well-drained soil developing in loamy, medium-textured thin residuum and colluvium from interbedded sedimentary rock including claystone, mudstone, siltstone, and shale. Shingle was previously mapped in the Big Horn Coal soil survey as Map Unit 73 (Shingle clay loam, 0 to 45% slopes).

In a typical profile, Shingle has a light yellowish brown channery loam "A" horizon surface layer about 2 or 3 inches thick. The underlying "C" horizon substratum to 10 to 20 inches in depth is a light yellowish brown loam to clay loam over weathered siltstone, sandstone, or shale. The soil is nonsaline to slightly saline and nonsodic to slightly sodic and has slightly acid to neutral reaction (pH) in the upper horizons and slightly alkaline to moderately alkaline reaction in the lower horizons.

Shingle channery loam has slow permeability and very low available water capacity. The effective rooting depth is 10 to 20 inches, the depth to the underlying bedrock contact. Surface runoff is rapid and the erosion hazard from water is severe and moderate from wind. The erosion "K Factor" is 0.37, the "T Factor" is 1, the Wind Erodibility Group is 4L, and the Hydrologic Group is D. The Shingle soil is in the "Shallow Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Shingle soil is classified as a "Loamy, mixed, superactive, calcareous, mesic shallow Ustic Torriorthent", and is an established soil series of moderate extensively mapped in northern and eastern Wyoming. The most recent NRCS official soil series description for Shingle, dated 11/2005 is on file at RAMACO.

Shingle channery loam was described and sampled at two representative sites on the Brook Mine permit area (R8 and R16), and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum

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D7-2. Sample site R8 is located in a portion of the SE1/4 of the SE1/4 of the NE1/4 of Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 50', 48" North; 106 degrees, 59', 8" West. Sample site R16 is located in a portion of the NW1/4 of the SE1/4 of the NW1/4 Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 51', 27" North; 106 degrees, 59', 22" West.

Map Unit D (Shingle channery loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 19" (1.6')

Shingle channery loam is entirely "suitable" for soil salvage and has no limiting parameter. The entire soil profile of Shingle is recommended for salvage, an average depth of 19 inches (R8,20" and R16,18"). The organic matter content of the "C" horizon substratum, the lowest horizon in the soil profile, remains above 0.5 percent across all pedons and therefore the entire profile can be salvaged as one Topsoil lift, an average of 19 inches to the weathered bedrock.

D7.3.3.5 Map Unit E: Samday clay loam, 2 to 25% slopes

Samday clay loam (Map Unit E) is mapped in many delineations scattered across the permit area and is located primarily on hills and sideslopes. Samday clay loam is a shallow (10 to 20 inches to bedrock), well-drained soil developing in fine-textured thin residuum and colluvium from interbedded sedimentary rock including claystone, mudstone, siltstone, and shale. Samday was previously mapped in the Big Horn Coal soil survey as the Samsil soil.

In a typical profile, Samday has a light gray clay loam "A" horizon surface layer about 2 or 3 inches thick. The underlying "C" horizon substratum to 10 to 20 inches in depth is a grayish brown clay over weathered shale. The soil is nonsaline to slightly saline and nonsodic to slightly sodic and has slightly acid to neutral reaction (pH) in the upper horizons and slightly alkaline to moderately alkaline reaction in the lower horizons although it can be moderately acid near to bedrock contact in some profiles.

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Samday clay loam has slow permeability and very low available water capacity. The effective rooting depth is 10 to 20 inches, the depth to the underlying bedrock contact. Surface runoff is rapid and the erosion hazard from water is severe and moderate from wind. The erosion "K Factor" is 0.37, the "T Factor" is 1, the Wind Erodibility Group is 4, and the Hydrologic Group is D. The Samday soil is in the "Shallow Clayey, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Samday soil is classified as a "Clayey, smectitic, calcareous, mesic shallow Ustic Torriorthent", and is an established soil series of moderate extent mapped in northern and northeastern Wyoming. The most recent NRCS official soil series description for Samday, dated 11/2005 is on file at RAMACO.

Samday clay loam was described and sampled at three representative sites on the Brook Mine permit area (R15, R24, and R27), and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R15 is located in a portion of the NE1/4 of the SW1/4 of the NW1/4 of Section14, T.57N., R.85W. GPS coordinates: 44 degrees, 53′, 51″ North; 107 degrees, 3′, 10″ West. Sample site R24 is located in a portion of the SE1/4 of the SW1/4 of Section9, T.57N., R.84W. GPS coordinates: 44 degrees, 54′, 2″ North; 106 degrees, 59′, 47′ West. Sample site R27 is located in a portion of the SE1/4 of the NW1/4 of Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 54′, 52″ North; 107 degrees, 5′, 12″ West.

Map Unit E (Samday clay loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 16″ (1.33′)

Samday clay loam pedon R15 has "marginal" silty clay texture from 3 to 8 inches in depth, otherwise all parameters for Samday are "suitable". The one "marginal" value is not a significant limitation and should dilute upon mixing, and therefore the entire soil profile of Samday is recommended for salvage, an average depth of 16 inches (R15,13″; R24,18″; and R27,18″). The organic matter content of the "C" horizon substratum, the lowest horizon in the soil profile, remains above 0.5 percent across all pedons and therefore the entire

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profile can be salvaged as one Topsoil lift, an average of 16 inches to the weathered bedrock contact.

D7.3.3.6 Map Unit F: Samday-Rock Outcrop Complex

Samday-Rock Outcrop Complex (Map Unit F) is mapped on similar hilly and sideslope topography as Samday clay loam (Map Unit E) except there are scattered Rock Outcrop exposures within the unit. Samday clay loam comprises approximately 75 percent of the unit and Rock Outcrop 25 percent, including a few areas with Samday clay loam less than 3 inches thick. All soil characteristics for Samday are similar in both Map Unit E and Map Unit F. No additional soil sites for Samday were sampled in Map Unit F, three representative sites for the Samday soil series were already described and sampled in Map Unit E. Recommended salvage depth for Samday in Map Unit F is 16 inches Topsoil. Rock Outcrop has no soil available for salvage. The weight-average salvage depth for Map Unit F (Samday 75%, Rock Outcrop 25%) is 12 inches Topsoil.

D7.3.3.7 Map Unit G: Bauxson loam, 4 to 25% slopes

Bauxson loam (Map Unit G) is mapped in several delineations scattered across the Brook Mine Area and is located on porcelanite controlled ridges and hillslopes primarily in the central and eastern parts of the permit area. Bauxson loam is considered by NRCS to be a deep, well-drained soil developing in a thin mantle of colluvial and residual soil material over fractured, displaced red scoria (porcelanite). Bauxson is similar to Wibaux except the soil material to the scoria contact is "fine-loamy" (<35% coarse fragments) rather than "loamy-skeletal" (>35% coarse fragments). Bauxson was previously mapped in the Big Horn Coal soil survey as the Sear soil series in Map Unit 817 (Wibaux-Sear association, rolling).

In a typical profile, the "A" horizon surface layer of Bauxson is a reddish brown loam about 4 inches thick, with about 20 percent fine angular red scoria channers. A "Bt" argillic subsoil horizon, about 6 to 14 inches thick, is a

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reddish brown loam to clay loam with about 10 percent red scoria channers. The underlying material to the fractured scoria contact is a reddish brown very loam to clay loam, about 10 to 15 inches thick, with less than 35 percent red scoria channers. The underlying fractured scoria material is generally red scoria (porcelanite) fragments with little to no soil material (<5% soil fines) in the many voids between the rock fragments.

The fractured scoria substrate is considered by NRCS to be a "fragmental" texture class and part of the soil profile, thus creating a deep soil. However, Bauxson can also be viewed as a shallow to moderately deep soil with only 20 to 40 inches of soil to the fractured scoria contact (up to 95% scoria fragments at and below the contact) below which is not considered a part of the soil profile. Bauxson is considered a moderately deep soil in the current soil survey, and the average depth to the fractured scoria contact in the Brook Mine Area is about 35 inches.

Bauxson loam is nonsaline and nonsodic throughout the upper profile to the fractured scoria contact, and has slightly acid to neutral reaction (pH) in the upper horizons and slightly acid to moderately alkaline reaction in the lower horizons.

Bauxson has moderate permeability in the upper part of the profile and very rapid permeability in the underlying fractured scoria. It has low available water capacity. The effective rooting depth is 20 to 40 inches, the depth to the underlying fractured scoria. Surface runoff is rapid and the erosion hazard from water is severe and slight from wind. The erosion "K Factor" is 0.20, the "T Factor" is 1, the Wind Erodibility Group is 8, and the Hydrologic Group is B. The Bauxson soil is in the "Shallow Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Bauxson soil is classified as a "Fine-loamy over fragmental, mixed, superactive, mesic Aridic Argiustoll", and is an established soil series of moderate extent mapped in north central and northeastern Wyoming. The

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most recent NRCS official soil series description for Bauxson, dated 11/1998 is on file at RAMACO.

Bauxson loam was described and sampled at three representative sites in Map Unit G (R17, R19, and R22) on the Brook Mine Area, and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R17 is located in a portion of the NE1/4 of the SW1/4 of the SW1/4 of Section 11, T.57N., R.85W. GPS coordinates: 44 degrees, 55′, 29″ North; 107 degrees, 5′, 9″ West. Sample site R19 is located in a portion of the NE1/4 of the SE1/4 of the NW1/4 of Section18, T.57N., R.84W. GPS coordinates: 44 degrees, 55′, 6″ North; 107 degrees, 2′, 42″ West. Sample site R22 is located in a portion of the SW1/4 of the NE1/4 of Section18, T.57N., R.84W. GPS coordinates: 44 degrees, 50', 17" North; 106 degrees, 59′, 38″ West.

Map Unit G (Bauxson loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 14″ (1.2′), Subsoil 18″ (1.5′)

All soil parameters of Bauxson are "suitable" except coarse fragments (channer size and shape scoria fragments) which can range from 10 to 34 percent for the upper soil material to the fractured scoria contact, an average depth of 32 inches. Coarse fragment content below 32 inches (range of 26 to 36 inches) increases above 35 percent and is considered "unsuitable". In addition, Selenium values were "marginal" for the lower depths of Bauxson sample site R19 (Se=0.41 ppm for 22" to 36", and Se=0.37 ppm for 36" to 48"). This limited "marginal" rated material, which would become a small diluted part of the overall salvaged Bauxson subsoil material (from 14" to 32" in depth), is not "unsuitable" and should be salvaged for use in reclamation. It makes good sense to separately salvage Topsoil and Subsoil for Bauxson (WDEQ-LQD, 2014, p.3). Therefore, the upper 14 inches of Bauxson is recommended for salvage as Topsoil and the underlying 18 inches, or the depth to the fractured scoria contact if different, as Subsoil.

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D7.3.3.8 Map Unit H: Haverdad loam, 2 to 15% slopes

Haverdad loam (Map Unit H) is mapped in many elongated delineations scattered across the permit area and is located on low terraces and floodplains in upland drainages including Hidden Water and Slater Creek as well as short segments of minor, unnamed tributary drainages. Haverdad loam is a deep (40+ inches to bedrock), well-drained soil developing in medium-textured to moderately fine-textured local alluvium from interbedded sedimentary rock including sandstone and shale. Haverdad loam was previously mapped in the Big Horn Coal soil survey as Map Unit 19A (Haverson loam, 0 to 3% slopes) and Map Unit 464A (Haverson-Worthing complex, 0 to 3% slopes).

In a typical profile, Haverdad has a light brownish gray loam to very fine sandy loam "A" horizon surface layer about 4 inches thick. The underlying soil to a depth of 40 inches or more is a yellowish brown loam stratified with lenses of silt loam, sandy loam, and clay loam. The soil is nonsaline and nonsodic and has slightly acid to neutral reaction (pH) in the upper horizons and slightly alkaline to moderately alkaline reaction throughout the rest of the profile.

Haverdad loam has moderate permeability and high available water capacity. The effective rooting depth is greater than 40 inches, the depth to the underlying bedrock contact. Surface runoff is slow and the erosion hazard from water is slight and severe from wind. The soil is subject to rare flooding. The erosion "K Factor" is 0.37, the "T Factor" is 5, the Wind Erodibility Group is 3, and the Hydrologic Group is B. The Haverdad soil is in the "Lowland, 10 to 14-inch precipitation zone, Northern Plains" range site.

The Haverdad soil is classified as a "fine-loamy, mixed, superactive, mesic Ustic Torriorthent", and is an established soil series of large extent mapped in Wyoming, Colorado and Utah. The most recent NRCS official soil series description for Haverdad, dated 06/2002 is on file at RAMACO.

Haverdad loam was described and sampled at three representative sites on the Brook Mine permit area (R7, R20, and R23), and the profile descriptions

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are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R7 is located in a portion of the NE1/4 of the NE1/4 of the NW1/4 of Section13, T.57N., R.85W. GPS coordinates: 44 degrees, 55′, 17″ North; 107 degrees, 3′, 44″ West. Sample site R20 is located in a portion of the NW1/4 of the SE1/4 of the NW1/4 of Section18, T.57N., R.84W. GPS coordinates: 44 degrees, 54′, 46″ North; 107 degrees, 6′, 6″ West. Sample site R23 is located in a portion of the SE1/4 of the SE1/4 of Section9, T.57N., R.84W. GPS coordinates: 44 degrees, 50′, 50″ North; 106 degrees, 58′, 55″ West.

Map Unit H (Haverdad loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 15″ (1.25′), Subsoil 47″ (3.9′)

Haverdad loam pedons R7, R20, and R23 are entirely suitable throughout their profile depths of 72, 72, and 42 inches, respectively. Therefore, the entire Haverdad profile, an average depth of 62 inches, is recommended for salvage. It makes good sense to separately salvage Topsoil and Subsoil for Haverdad (WDEQ-LQD, 2014, p.3). Therefore, the upper 15 inches of Haverdad is recommended for salvage as Topsoil and the underlying 47 inches as Subsoil.

D7.3.3.9 Map Unit Wx: Wibaux channery loam, 2 to 20% slopes

Wibaux channery loam (Map Unit Wx) is mapped in many delineations scattered across the Brook Mine Area and is located on porcelanite controlled ridges and hillslopes primarily in the central and eastern parts of the permit area. Wibaux channery loam is considered by NRCS to be a deep, somewhat excessively drained soil developing in residuum from red scoria (porcelanite). Wibaux was previously mapped in the Big Horn Coal soil survey as Map Unit 218 (Wibaux-Rock Outcrop association, steep) and Map Unit 817 (Wibaux-Sear association, rolling).

In a typical profile, the "A" horizon surface layer of Wibaux is a light reddish brown channery loam about 3 to 5 inches thick, with about 25 percent

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angular red scoria channers. A thin "Bw" subsoil horizon, about 5 to 8 inches thick, exists in some profiles and is a channery to very channery, reddish brown loam to clay loam, with up to 30 percent red scoria channers. The upper part of the "C" horizon substratum is a reddish brown very channery loam, about 7 to 10 inches thick, with about 45 to 55 percent red scoria channers. The lower part of the substratum to 40 inches or deeper is fractured, displaced, generally red scoria (porcelanite) fragments with little to no soil material (<5% soil fines) in the many voids between the rock fragments.

The fractured scoria substrate is considered by NRCS to be a "fragmental" texture class and part of the soil profile, thus creating a deep soil. However, Wibaux can also be viewed as a shallow soil with only 10 to 20 inches of soil to the fractured scoria contact (up to 95% scoria fragments at and below the contact) below which is not considered to be part of the soil profile. Wibaux is considered a shallow soil in the current soil survey. The average soil depth of Wibaux to the fractured scoria contact in the Brook Mine Area is about 14.25 inches.

Wibaux channery loam is nonsaline and nonsodic throughout the upper profile to the fractured scoria contact, and has slightly acid to neutral reaction (pH) in the upper horizons and slightly acid to moderately alkaline reaction in the lower horizons.

Wibaux has moderate permeability in the upper part of the profile and very rapid permeability in the lower part and underlying fractured scoria. It has very low available water capacity. The effective rooting depth is 10 to 20 inches, the depth to the underlying fractured scoria. Surface runoff is medium and the erosion hazard from water and wind is moderate. The erosion "K Factor" is 0.20, the "T Factor" is 1, the Wind Erodibility Group is 6, and the Hydrologic Group is B. The Wibaux soil is in the "Shallow Loamy, 10 to 14-inch precipitation zone, Northern Plains" range site.

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The Wibaux soil is classified as a "Loamy-skeletal over fragmental, mixed, superactive, nonacid, mesic Ustic Torriorthent", and is an established soil series of moderate extent mapped in Wyoming, Montana, and South Dakota. The most recent NRCS official soil series description for Wibaux, dated 02/2000 is on file at RAMACO.

Wibaux channery loam was described and sampled at three representative sites in Map Unit Wx (R11, R13, and R21), and one site in Map Unit Wx-RO (R18) on the Brook Mine permit area, and the profile descriptions are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R11 is located in a portion of the NW1/4 of the SW1/4 of the SW1/4 of Section 8, T.57N., R.84W. GPS coordinates: 44 degrees, 49', 2" North; 106 degrees, 57', 47" West. Sample site R13 is located in a portion of the SE1/4 of the NW1/4 of the SE1/4 of Section8, T.57N., R.84W. GPS coordinates: 44 degrees, 49', 36" North; 106 degrees, 58', 17" West. Sample site R21 is located in a portion of the NE1/4 of the SW1/4 of Section18, T.57N., R.84W. GPS coordinates: 44 degrees, 54', 18" North; 107 degrees, 7', 48" West. Sample site R18 is located in a portion of the NW1/4 of the SW1/4 of the SW1/4 of Section11, T.57N., R.85W. GPS coordinates: 44 degrees, 55', 24" North; 107 degrees, 5', 19" West.

<u>Map Unit Wx (Wibaux channery loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 8" (0.67')</u>

The upper 8 inches of Wibaux channery loam is recommended for salvage as Topsoil. All soil parameters are "suitable" except coarse fragments (channer size and shape scoria fragments) which can range from 10 to 35 percent for the upper 8 inches of Wibaux. Coarse fragment content for the 8 to 14-inch depth, the average depth to the fractured scoria contact, ranges from 30 to 70 percent and is considered "unsuitable". In addition, both EC and SAR of the 8 to 15-inch depth of R13 was "unsuitable" with values of 12.8 and 17.3, respectively. These values were unexpected, all other EC and SAR values for Wibaux are entirely "suitable", but were confirmed through a rerun of the two

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analyses. The rerun data, 12.1 and 21.8 respectively, are contained in Addendum D7-2, Soils Laboratory Results. All 8 inches of the recommended salvage depth should be salvaged as one lift, 8 inches Topsoil. Material below 8 inches in depth is not recommended for salvage as soil.

D7.3.3.10 Map Unit Wx-RO: Wibaux-Rock Outcrop Complex, steep

Wibaux-Rock Outcrop Complex, steep (Map Unit Wx-RO) is mapped on similar ridge, hill, and sideslope topography as Wibaux channery loam (Map Unit Wx) except there are scattered Rock Outcrop exposures (red scoria outcrops) within the unit. Wibaux channery loam comprises approximately 75 percent of the unit and Rock Outcrop 25 percent, including a few areas with Wibaux channery loam less than 3 inches thick. All soil characteristics for Wibaux are similar in both Map Unit Wx and Map Unit Wx-RO. One additional soil site for Wibaux, R18, was sampled in Map Unit Wx-RO, and it was noted in the Wx Map Unit Description. Recommended salvage depth for Wibaux in Map Unit Wx-RO is 8 inches Topsoil. Any material below 8 inches in depth in Wibaux areas is not recommended for salvage as soil. Rock Outcrop has no soil available for salvage. The weight-average salvage depth for Map Unit F (Wibaux 75%, Rock Outcrop 25%) is 6 inches Topsoil.

D7.3.3.11 Map Unit U: Ulm clay loam, 0 to 3% slopes

Ulm clay loam (Map Unit U) was mapped in a couple of small delineations in a portion of the NE1/4 of the SE1/4 of Section 14, T57N, R85W. The mapped area is south of Interstate 90 in the former Parcel 2, a 97.3-acre area that has now been dropped from the Brook Mine Area. The soils report retains Ulm clay loam (Map Unit U) because it was part of the original survey and because it is mapped in the future Brook Mine, Phase 2 Area. Ulm was previously projected to be disturbed by mining activities and was sampled for laboratory characterization at representative site R25. Ulm was previously mapped in the Big Horn Coal soil survey as Map Unit 81AB (Bidman loam, 0 to 6% slopes).

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Ulm clay loam is a deep (40+ inches to bedrock), well-drained soil developing in local alluvium from interbedded sedimentary rock including sandstone and shale. In a typical profile, Ulm has an "A" horizon surface layer that is a grayish brown clay loam about 3 to 5 inches thick. The upper part of the "Bt" argillic subsoil layer is a grayish brown clay loam to clay about 5 inches thick. The lower part of the "Bt" to "Btk" argillic subsoil layer is a brown clay loam to clay about 15 inches thick. The underlying "Bk" calcic horizon is a light olive brown clay loam to clay to a depth of 40 inches or more. The soil is nonsaline to slightly saline and nonsodic. Soil reaction (pH) is slightly acid to neutral in the upper part and neutral to slightly alkaline in the lower part of the soil profile.

Ulm clay loam has slow permeability and high available water capacity. The effective rooting depth is greater than 40 inches, the depth to the underlying bedrock. Surface runoff is slow and the erosion hazard from water is slight and moderate from wind. The erosion "K Factor" is 0.32, the "T Factor" is 5, the Wind Erodibility Group is 6, and the Hydrologic Group is C. The Ulm soil is in the "Clayey, 15 to 19-inch precipitation zone, Northern Plains" range site.

The Ulm soil is classified as a "fine, smectitic, mesic Ustollic Haplargid", and is an established soil series mapped extensively in northern and northeastern Wyoming. The most recent NRCS official soil series description for Ulm, dated 12/2005 is on file at RAMACO.

Due to very small mapped acreage (<40 aces), Ulm clay loam was described and sampled at one representative site, R25, on Parcel 2, now not part of the Brook Mine permit area, and the profile description is contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2. Sample site R25 is located in a portion of the SE1/4 of the NE1/4 of the SE1/4 of Section14, T.57N., R.85W. GPS coordinates: 44 degrees, 52', 52" North; 107 degrees, 4', 24" West.

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Map Unit U (Ulm clay loam) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 16" (1.3'), Subsoil 56" (4.7')

If Ulm was in the Brook Mine Area and projected for disturbance, the entire soil profile to 72 inches (6 feet) in depth is suitable and recommended for soil salvage. All soil parameters are suitable except some horizons have silty clay texture which is "marginal" rated but not a significant limitation. It makes good sense to separately salvage Topsoil and Subsoil for Ulm (WDEQ-LQD, 2014, p.3). The upper 16 inches of Ulm are recommended for salvage as Topsoil and the underlying 56 inches as Subsoil.

D7.3.3.12 Map Unit Wo: Worthenton clay loam, 0 to 3% slopes

Worthenton clay loam (Map Unit Wo) was mapped in one small delineation, a former oxbow – now filled in with sediment – of the Tongue River in a portion of the SW1/4 of the SE1/4 of Section 13, T57N, R85W. The mapped area is south of Interstate 90 in the former Parcel 2, a 97.3-acre area that has now been dropped from the Brook Mine Area. The soils report retains Worthenton clay loam (Map Unit Wo) because it was part of the original survey and because it is mapped in the future Brook Mine, Phase 2 Area. Worthenton was not projected to be disturbed by mining activities and was not sampled for laboratory characterization. The soil was mapped as Worthing Taxajunct (Map Unit 96) in the Big Horn Coal soil survey (Big Horn Coal, 1983).

Worthenton clay loam is a deep (40+ inches to bedrock), poorly-drained soil developing in local alluvium from interbedded sedimentary rock including sandstone and shale. In a typical profile, Worthenton has an organic mat about 3 inches thick. The "A" horizon surface layer is a very dark gray silty clay about 8 inches thick. The "Btg" gleyed argillic subsoil layer is a dark grayish brown silty clay about 14 inches thick. The underlying "Bkg" gleyed cambic horizon is an olive gray silty clay and clay to a depth of 40 inches or more. The soil has prominent to distinct mottles (redoximorphic features) throughout the profile and has a fluctuating water table at a depth of 0.5 to 1.5

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feet from March through July and from 1.5 to 3.0 feet the remainder of the year. The soil is nonsaline and nonsodic and has moderately alkaline to strongly alkaline reaction (pH). Worthenton clay loam meets criteria "2B3" (poorly drained, Aquic suborder, with a water table at a depth of 1.0 foot or less during the growing season if permeability is less than 6.0 in/hr in any layer within a depth of 20 inches) for "hydric soil" status and is on the current list of hydric soils for Sheridan County (NRCS, 2006).

Worthenton clay loam has slow permeability and high available water capacity. The effective rooting depth is greater than 40 inches for water-tolerant plants and 6 to 18 inches for plants that are not water tolerant. Surface runoff is slow and the erosion hazard from water is slight and moderate from wind. The erosion "K Factor" is 0.43, the "T Factor" is 5, the Wind Erodibility Group is 4L, and the Hydrologic Group is D. The Worthenton soil is in the "Wetland, 15 to 19-inch precipitation zone, Northern Plains" range site.

The Worthenton soil is classified as a "fine, smectitic, mesic Typic Argiaquoll", and is an established soil series of very limited extent mapped in north-central Wyoming. The most recent NRCS official soil series description for Worthenton, dated 02/1997 is on file at RAMACO.

As stated above, Worthenton clay loam was not sampled for laboratory characterization because it was not projected to be disturbed, and it was not evaluated for soil suitability and salvage depth recommendation. If Worthenton were projected to be disturbed, salvage operations would need to follow specifications for hydric soil salvage as detailed in Appendix F – Hydric Soils of DEQ Guideline 1A (DEQ, 2014).

D7.3.3.13 Map Unit RL: Reclaimed Land

Reclaimed Land (Map Unit RL) is mapped primarily in the Big Horn Coal permit area where most of the previously disturbed land has been reclaimed. Big Horn Coal Company "Exhibit RH-4, Topsoil Verification Sites", details the

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verified depth of reapplied topsoil across the former mine area (Big Horn Coal Company, 2004). A few very small areas of RL are located on other areas where older previous mining activity has been reclaimed, most of it as part of the Abandoned Mine Land (AML) program.

Portions of Reclaimed Land are projected to be re-disturbed as part of the Brook Mine activity and four soil sample sites (R1, R2, R3, and R4) were located on Big Horn Coal reclaimed land. The soil profile descriptions for these sites are contained in Addendum D7-1 and the soils laboratory data in Addendum D7-2.

Sample site R1 is located near previous Big Horn Coal topsoil depth verification site "P4-3" in a portion of the SW1/4 of the NW1/4 of the NW1/4 of Section 15, T.57N., R.84W. GPS coordinates: 44 degrees, 53′ 50″ North; 106 degrees, 59′, 17″ West. Sample site R2 is located in a portion of the NE1/4 of the SW1/4 of the NW1/4 of Section15, T.57N., R.84W. GPS coordinates: 44 degrees, 53′, 17″ North; 106 degrees, 59′, 8″ West. Sample site R3 is located in a portion of the SE1/4 of the SW1/4 of the SE1/4 of Section15, T.57N., R.84W. GPS coordinates: 44 degrees, 54′, 25″ North; 106 degrees, 58′, 39″ West. Sample site R4 is located in a portion of the NW1/4 of the NE1/4 of the NE1/4 of Section22, T.57N., R.84W. GPS coordinates: 44 degrees, 54′, 24″ North; 106 degrees, 58′, 33″ West.

The Big Horn Coal reapplied topsoil material is nonsaline to slightly saline and nonsodic with clay loam, loam, and silt loam textures, in frequency order. Coarse fragment content ranged from about 5 to 20 percent with most samples about 10 percent. Reclaimed Land topsoil depth ranged from 12 inches for sites R3 and R4, to 30 and 32 inches for sites R2 and R1, respectively. The average reapplied topsoil depth was 21.5 inches and the currently sampled depth at each site was very similar to that noted for each area on Big Horn Coal's "Exhibit RH-4". At each site, even when soil sampling with a bucket auger, it was evident when the reapplied topsoil ended and the regraded spoil began and therefore the depth of reapplied topsoil.

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Map Unit RL (Reclaimed Land) Soil Suitability Evaluation and Salvage Depth Recommendation: Topsoil 22" (1.8')

All soil parameters are suitable and the reapplied topsoil can be resalvaged if disturbed. The average reapplied topsoil depth was 21.5 inches (rounded to 22 inches) and all of this material is best salvaged as one Topsoil lift. In each area, the guidance is to resalvage the soil material to the underlying regarded overburden spoil contact, a very visible contact at depth.

D7.3.3.14 Map Unit RO: Rock Outcrop

A few small delineations of Rock Outcrop Water (Map Unit RO), mostly red scoris outcrops, have been carefully mapped across the Brook Mine Area. There is no soil available for salvage from Map Unit RO and therefore the recommended soil salvage depth is 0 inches Topsoil.

D7.3.3.15 Map Unit W: Water

A few small delineations of Water (Map Unit W) have been carefully mapped across the Brook Mine Area. There is no soil available for salvage from Map Unit W and therefore the recommended soil salvage depth is 0 inches Topsoil.

D7.3.3.16 Map Unit DL: Disturbed Land

Various Disturbed Land (Map Unit DL) delineations (roads, pond embankments, non-reclaimed land, etc.) have been carefully mapped across the Brook Mine Area. There is no soil available for salvage from Map Unit DL and therefore the recommended soil salvage depth is 0 inches Topsoil.

D7.4 References

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Table D7.3-1. Brook Mine Area List of Soil Map Units and Acreages*

Map Unit	Soil Type	Acreage
A	Cambria loam	337.1
B	Zigweid loam	0.0
C	Forkwood loam	408.2
D	Shingle channery loam	354.1
E	Samday clay loam	257.4
F	Samday-Rock Outcrop Complex	184.2
G	Bauxson loam	315.3
H	Haverdad loam	181.9
Wx	Wibaux channery loam	479.0
Wx-RO	Wibaux-Rock Outcrop Complex	1280.1
U	Ulm clay loam	0.0
Wo	Worthenton clay loam	0.0
RL	Reclaimed Land	615.5
RO	Rock Outcrop	19.4
W	Water	11.9
DL	Disturbed Land	104.7

*Total acreage within surveyed permit boundary is 4,548.8 acres. All calculations, including map unit total, by WWC Engineering, 10-28-2014.

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Table D7.3-2. Criteria to Establish Topsoil and Overburden Suitability Adapted from WDEQ/LQD Guideline No. 1 Table I-2 and I-4

Parameter	Suitable	Surface (potential root zone) and Topsoil		Aquifer Restoration
		Marginal 1/	Unsuitable	Unsuitable
pH	5.5-8.5	5.0-5.5; 8.5-9.0	<5.0; >9.0	<5.0
EC (Conductivity) mmhos/cm	0-8	8-12	>12	Depends on premine levels
Saturation Percentage	25-80	<25; >80		
Texture		c,sic,s		
SAR 2/	0-10	10-12; 3/; 10-15	>12 3/; >15	Depends on premine levels
Selenium	<0.3 ppm	>0.3-0.8 ppm	>0.8 ppm	Depends on premine levels
Boron	<5.0 ppm		>5.0ppm	Depends on premine levels
Nitrate/Nitrogen				>50ppm
Molybdenum	<1.0ppm	>1.0ppm		
Acid/base Pot. 4/	>-5		<-5	<-5
Arsenic	<2.0ppm	>2.0ppm		
Organic Carbon	<10%		>10%	

1/ Evaluated on an individual basis for suitability.
2/ As an alternative to SAR calculations, ESP (exchangeable sodium percentage) can be determined. ESP should be determined if suitable SAR value is exceeded.
3/ For fine textured soils (Clay >40%).
4/ Record as Acid pot., Neutralization pot. and acid-base potential in + tons CaCO3 equivalent/1000 tons.

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Table D7.3-3. Brook Mine Area List of Soil Map Units and Salvage Depth Recommendations

Map Unit	Soil Type	Salvage Depth Recommendations
A	Cambria loam	Topsoil 10″, Subsoil 15″
B	Zigweid loam	Topsoil 16″ (1.3′), Subsoil 56″ (4.7′)
C	Forkwood loam	Topsoil 12″ (1′), Subsoil 45″ (3.75′)
D	Shingle channery loam	Topsoil 19″ (1.6′)
E	Samday clay loam	Topsoil 16″ (1.33′)
F	Samday-Rock Outcrop Complex	Topsoil 12” (1.0′)*
G	Bauxson loam	Topsoil 14″ (1.2′), Subsoil 18″ (1.5′)
H	Haverdad loam	Topsoil 15″ (1.25′), Subsoil 47″ (3.9′)
Wx	Wibaux channery loam	Topsoil 8″ (0.67′)
Wx-RO	Wibaux-Rock Outcrop Complex	Topsoil 6” (0.5′)**
U	Ulm clay loam	Topsoil 16″ (1.3′), Subsoil 56″ (4.7′)
Wo	Worthenton clay loam	0
RL	Reclaimed Land	Topsoil 22″ (1.8′)
RO	Rock Outcrop	0
W	Water	0
DL	Disturbed Land	0

- Map Unit F is 75% Samday clay loam with a recommended salvage depth of 16” Topsoil and 25% Rock Outcrop with a recommended salvage depth of 0”. The weight-average soil salvage depth for the map unit is 12” Topsoil. This assumes salvage equipment can maneuver around rock outcrops when salvaging Samday clay loam.
- Map Unit Wx-RO is 75% Wibaux channery loam with a recommended salvage depth of 8” Topsoil and 25% Rock Outcrop with a recommended salvage depth of 0”. The weight-average soil salvage depth for the map unit is 6” Topsoil. This assumes salvage equipment can maneuver around rock outcrops when salvaging Wibaux channery loam.

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RECD JUL 30, 2015

R.85 W. R.84 W.

E. 1375000 E. 1380000 E. 1385000 E. 1390000 E. 1395000 E. 1400000 E. 1405000

N. 1945000 N. 1940000 N. 1935000 N. 1930000 N. 1925000

T. 57 N.

HIDDEN WATER CREEK
SLATER CREEK
SLATER CREEK ROAD
SOUTH ASH CREEK ROAD
HIDDEN WATER ROAD
FUTURE HAULROAD
SM-1 HAULROAD
SM-2 HAULROAD
SM-3 HAULROAD
HAULROAD 2
HAULROAD 3
WYO 345
WYO338
WYO339
ACME ROAD
KLEENBURN ROAD
90
BNSF MAIN RAILWAY
EXISTING ACCESS ROAD

NOTE: MAP COORDINATE PROJECTION IS WY 83 EC

LEGEND

- BROOK MINE PERMIT BOUNDARY
- BIG HORN COAL PERMIT BOUNDARY (PERMIT NO. 213-T7)
- TAYLOR QUARRY PERMIT BOUNDARY (PERMIT NO. SP-757)
- AFFECTED AREA BOUNDARY
- STATE HIGHWAY
- INTERSTATE
- UNIMPROVED ROADS
- RAILROAD
- SURFACE MINING
- HIGHWALL MINING PANELS

N

0 500 1,000 1,500 2,000
GRAPHIC SCALE (FEET)
C.I. = 5'

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
06/15	ROUND 1 COMMENTS
10/15	ROUND 2 COMMENTS
12/15	ROUND 3 COMMENTS
08/18	ROUND 7 COMMENTS
09/19	ROUND 10 COMMENTS

FIGURE D7.1-1

TFN 6 2/025
RECD 09-20-19

BROOK MINE PERMIT AREA WITH DISTURBANCE BOUNDARY

Drawn By: DCJ
Checked By: JGB
Date: 10/17/14

FILE: FIG_D7-1_SOIL_DIST.dwg

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Scanned, 02/27/2020

Date: Thu, 30 Oct 2014 14:10:29 -0600
From: "Jeff Barron, P.E." <jbarron@wwcengineering.com>
Organization: WWC Engineering

To: andrew.cassiday@wy.usda.gov
CC: oakley.ingersoll@wy.usda.gov
Subject: Negative Prime Farm Land Declaration Letter

Andrew,

I understand you are out of the office today and I spoke with Oakley about providing a letter stating a negative declaration of prime farmland for the boundary provided as a shape file in this email. Please review the materials at your earliest convenience and provide a letter of your findings.

Thanks
--

Jeff Barron, P.E. | Project Manager

1849 Terra Avenue | Sheridan, WY 82801

Tel 307-672-0761 | Cell 307-751-1427

www.wwcengineering.com

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United States Department of Agriculture

NRCS
Natural Resources Conservation Service

Sheridan Field Office

1949 Sugarland Dr,
Suite 102
Sheridan, WY 82801

Phone 307.672.5820
Fax 866.574.1366

31 October 2014

Jeff Barron, PE
Project Manager
WWC Engineering
1849 Terra Avenue
Sheridan, WY 82801

Mr. Barron,

I have reviewed the RC Permit Area shapefile you sent. There are no designated Prime Farmland soils mapped within the RC Permit boundary. I have enclosed a map of the area showing the soils map units in the area of the PC Permit with designated Prime Farmland soils shown in green as well as a list of the map units designated as Prime Farmland.

Please let me know if I can assist further.

Thanks very much,

Andrew Cassiday
District Conservationist

An Equal Opportunity Provider and Employer

Sheridan County Conservation District
Sheridan County, Wyoming

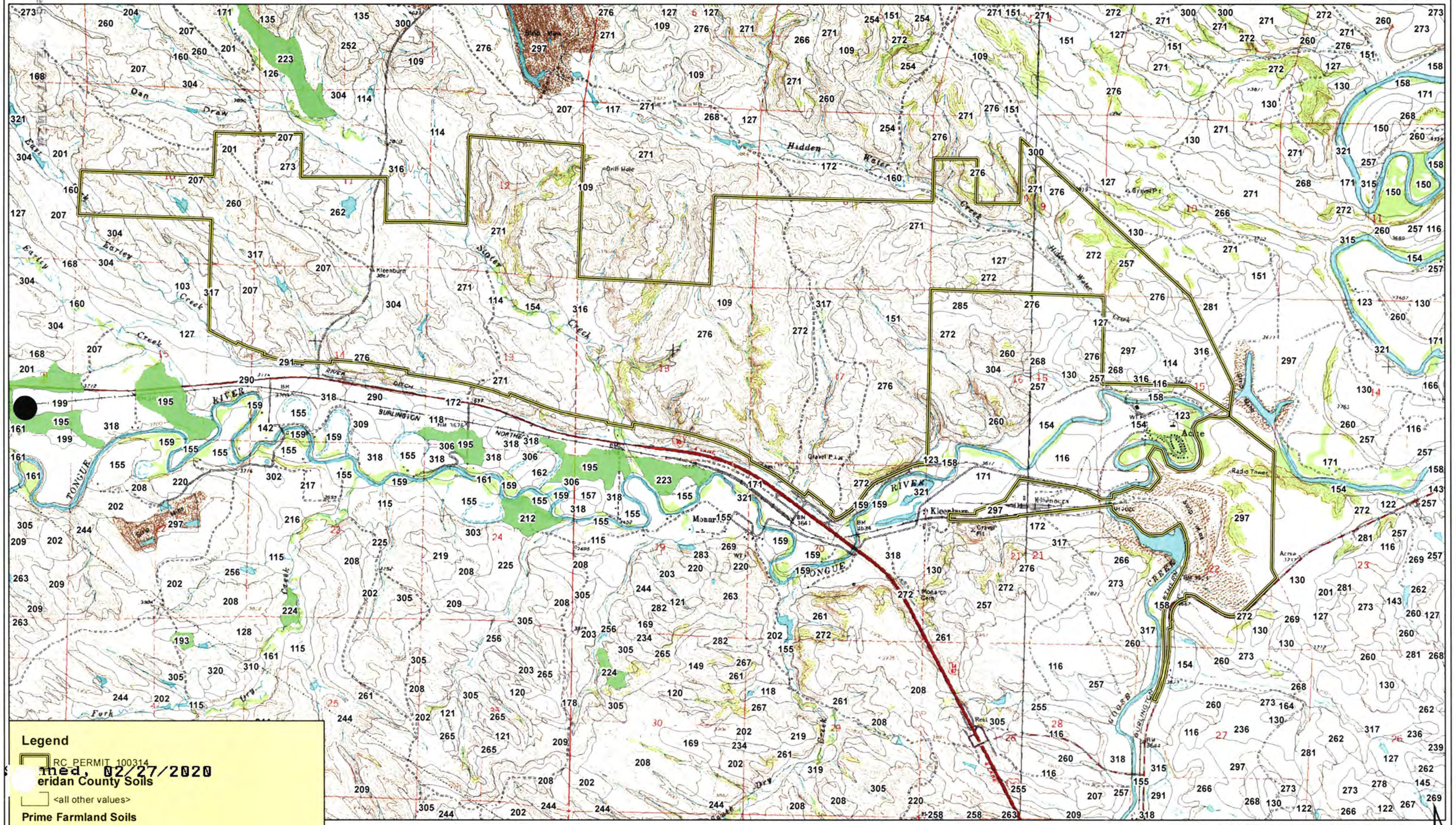
WWC Engineering
RC Permit Map

TFN 6 2/025
RECD NOV 14, 2014

USDA--NRCS
Sheridan Field Office
Prepared by: A. Cassiday
October 2014

RAMACO

Brook Mine



ined, 02/27/2020

October 2014

D7-F4

DEQ Ex. 4-045

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Prime and Other Important Farmlands

Sheridan County Area, Wyoming

Map symbol	Map unit name	Farmland classification
175	Moskee sandy loam, 0 to 3 percent slopes	Prime farmland if irrigated
176	Moskee sandy loam, 3 to 6 percent slopes	Prime farmland if irrigated
181	Moskee-Nuncho complex, 0 to 3 percent slopes	Prime farmland if irrigated
182	Moskee-Nuncho complex, 3 to 6 percent slopes	Prime farmland if irrigated
192	Nuncho loam, 0 to 3 percent slopes	Prime farmland if irrigated
193	Nuncho loam, 3 to 6 percent slopes	Prime farmland if irrigated
195	Nuncho clay loam, 0 to 3 percent slopes	Prime farmland if irrigated
196	Nuncho clay loam, 3 to 6 percent slopes	Prime farmland if irrigated
212	Platmak loam, 0 to 3 percent slopes	Prime farmland if irrigated
213	Platmak loam, 3 to 6 percent slopes	Prime farmland if irrigated
223	Recluse loam, 0 to 3 percent slopes	Prime farmland if irrigated
224	Recluse loam, 3 to 6 percent slopes	Prime farmland if irrigated

TFN 6 2/025
RECD NOV 14, 2014

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APPENDIX D7

Exhibit D7.2-1 Soil Sampling Protocol, RAMACO, TFN 6 2/025

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

October 2014 RAMACO

From: David Schellinger <david.schellinger@wyo.gov>
To: Jim Nyenhuis <jameshnyenhuis@aol.com>; jbarron <jbarron@wwcengineering.com>; Bj Kristiansen <bj.kristiansen@wyo.gov>
Subject: Soil Sampling Protocol, RAMACO, TFN 6 2/025
Date: Wed, Jun 4, 2014 10:31 am
Attachments: 6_2_025MM060414ds.doc (34K)

In order to properly document the LQD accepted sampling protocol for the proposed RAMACO permit, I have prepared the attached Memorandum summarizing the LQD District 3 soil sampling requirements for this project. Please let me know if you have further questions.

-
David Schellinger
Natural Resources Analyst
WDEQ/LQD District III
2100 W. 5th Street
Sheridan, WY 82801
Phone: (307)675-5611

E-Mail to and from me, in connection with the transaction of public business, is subject to the Wyoming Public Records Act and may be disclosed to third parties.

TFN 6 2/025
RECD NOV 14, 2014

D7-E2 Brook Mine

DEQ Ex. 4-048

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MEMORANDUM

To: File, RAMACO Preliminary Permit Correspondence, TFN 6 2/025

From: David Schellinger, Soils Specialist

Date: June 14, 2014

RE: Soil Baseline Requirements on Potential Subsidence Permit Areas

In a telephone message received on May 22, 2014 Mr. James Nyenhuis, a soils consultant collecting the RAMACO project soils baseline data, asked for clarification about sampling of soils on potential subsidence areas of the proposed permit acreage. After consultation with LQD in other District Offices, we concluded that only those areas proposed to have surface disturbance require sampling and analysis for suitability characterization. Soils on surfaces underlain by mining without surface disturbance (potential subsidence areas) require a minimum Class 3 mapping. If additional disturbance not currently planned is to occur in the future, additional sampling and analysis for suitability characterization will be required.

/DS
cc: Cheyenne File

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RECD NOV 14, 2014

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APPENDIX D7

Exhibit D7.3-1 Brook Mine Area Soils Map (Two Sheets)

TFN 6 2/025
RECD NOV 14, 2014

R.85 W. R.84 W.

T. 58 N.

T. 57 N.

HIDDEN WATER CREEK

SLATER CREEK

E. 1370000 E. 1380000 E. 1390000 E. 1400000

N. 1650000 N. 1640000 N. 1630000 N. 1620000 N. 1610000

R.85 W. R.84 W.

LEGEND

- BROOK MINE PERMIT BOUNDARY
- SOIL BOUNDARY
- SOIL COLLECTION POINT
- R11

MAP UNIT A: CAMBRIA LOAM, 2 TO 8% SLOPES
MAP UNIT B: ZIGWEID LOAM, IRRIGATED, 0 TO 3% SLOPES
MAP UNIT C: FORKWOOD LOAM, 4 TO 25% SLOPES
MAP UNIT D: SHINGLE CHANNERY LOAM, 2 TO 25% SLOPES
MAP UNIT E: SAMDAY CLAY LOAM, 2 TO 25% SLOPES
MAP UNIT F: SAMDAY-ROCK OUTCROP COMPLEX
MAP UNIT G: BAUXSON LOAM, 4 TO 25% SLOPES
MAP UNIT H: HAVERDAD LOAM, 2 TO 15% SLOPES
MAP UNIT U: ULM CLAY LOAM, IRRIGATED, 0 TO 3% SLOPES
MAP UNIT WO: WORTHENTON CLAY LOAM, 0 TO 3% SLOPES
MAP UNIT WX: WIBAUX CHANNERY LOAM, 2 TO 25% SLOPES
MAP UNIT WX-RO: WIBAUX-ROCK OUTCROP COMPLEX, STEEP
MAP UNIT RL: RECLAIMED LAND
MAP UNIT RO: ROCK OUTCROP
MAP UNIT W: WATER
MAP UNIT DL: DISTURBED LAND
MAP UNIT XXX: UNCLASSIFIED SOIL TYPE

N

0 500 1,000 1,500 2,000
GRAPHIC SCALE (FEET)

DEQ Ex. 4-051

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

EXHIBIT D7.3-1 TFN 6 2/025 RECD NOV 14, 2014 SHEET 1 OF 2

SUPERSEDED BROOK MINE AREA SOILS MAP

Drawn By: DCJ
Checked By: JGB
Date: 10/28/14

FILE: D7_3-1_SOILS.dwg

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K:\Sheridan\RAMA\2013\39\ACAD_WRI\EDDMGE_D7\D7_3-1_SOILS.dwg 10/28/2014 3:38:26 PM dave johnson

R. 85 W. R. 84 W.

T. 57 N.

T. 57 N.

R. 85 W. R. 84 W.

LEGEND

- BROOK MINE PERMIT BOUNDARY
- SOIL BOUNDARY
- R11 SOIL COLLECTION POINT
- AREA OF DISTURBANCE

MAP UNIT A: CAMBRIA LOAM, 2 TO 9% SLOPES
MAP UNIT B: ZIGWEID LOAM, IRRIGATED, 0 TO 3% SLOPES
MAP UNIT C: FORKWOOD LOAM, 4 TO 25% SLOPES
MAP UNIT D: SHINGLE CHANNERY LOAM, 2 TO 25% SLOPES
MAP UNIT E: SAMDAY CLAY LOAM, 2 TO 25% SLOPES
MAP UNIT F: SAMDAY-ROCK OUTCROP COMPLEX
MAP UNIT G: BAUKSON LOAM, 4 TO 25% SLOPES
MAP UNIT H: HAVERSKAD LOAM, 2 TO 15% SLOPES
MAP UNIT U: ULM CLAY LOAM, IRRIGATED, 0 TO 3% SLOPES
MAP UNIT WO: WORTHINGTON CLAY LOAM, 0 TO 3% SLOPES
MAP UNIT WX: WIBAUX CHANNERY LOAM, 2 TO 25% SLOPES
MAP UNIT WX-RO: WIBAUX-ROCK OUTCROP COMPLEX, STEEP
MAP UNIT RL: RECLAIMED LAND
MAP UNIT RO: ROCK OUTCROP
MAP UNIT W: WATER
MAP UNIT DL: DISTURBED LAND
MAP UNIT XXX: UNCLASSIFIED SOIL TYPE

GRAPHIC SCALE (FEET)
0 500 1,000 1,400
1 in. = 20

DEQ Ex. 4-052

RAMACO
BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR., STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
09/15	ROUND 1 COMMENTS
03/19	ROUND 5 COMMENTS

EXHIBIT D7.3-1 SHEET 2 OF 2
TFWR 2/025
RECD MAR 04, 2019
15

BROOK MINE AREA
SOILS MAP

Drawn By: DCJ
Checked By: JGB
Date: 10/28/14

WWC ENGINEERING
www.wwcengineering.com

File: ADD_D7.3-1_SOILS.dwg

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ADDENDUM D7-1
SOIL PROFILE DESCRIPTIONS

- **R1 Reclaimed Land, Map Unit RL**
- **R2 Reclaimed land, Map Unit RL**
- **R3 Reclaimed Land, Map Unit RL**
- **R4 Reclaimed Land, Map Unit RL**
- **R5 Cambria, Map Unit A**
- **R6 Cambria, Map Unit A**
- **R7 Haverdad, Map Unit H**
- **R8 Shingle, Map Unit D**
- **R9 Forkwood, Map Unit C,**
- **R10 Cambria, Map Unit A**
- **R11 Wibaux, Map Unit Wx**
- **R12 Forkwood, Map Unit C**
- **R13 Wibaux, Map Unit Wx**
- **R14 Forkwood, Map Unit C**
- **R15 Samday, Map Unit E**
- **R16 Shingle, Map Unit D**
- **R17 Bauxson, Map Unit G**
- **R18 Wibaux, Map Unit Wx-RO**
- **R19 Bauxson, Map Unit G**
- **R20 Haverdad, Map Unit H**
- **R21 Wibaux, Map Unit Wx**
- **R22 Bauxson, Map Unit G**
- **R23 Haverdad, Map Unit H**
- **R24 Samday, Map Unit E**
- **R25 Ulm, Map Unit U**
- **R26 Zigweid, Map Unit B**
- **R27 Samday, Map Unit E**

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R1

Soil type Reclaimed Land RL J. NYENHUIS, RN File No.

Area Ramaco Brook Mine, north of Sheridan WY Date 5-26-14 Stop No.

Classification SW¼, NW¼, NW¼ Sect 15 T 57N, R 84W

Location near "P4-3" (21" soil reapplied) 44°53'50"N, 106°59'17"W (iPhone 4S)

N. veg. (or crop) reclaimed grasses, very occ. wild big sage Climate mesic soil temp, ustic aridic soil moisture

Parent material mixed soil and spoil

Physiography regraded & reclaimed upland sideslope

Relief —	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 6%	Moisture sl. moist to 20"	
Aspect N15°	Root distrib. Major Rooting Depth "is 0-12"	% Clay *
Erosion none - slight spots	% Coarse fragments * see below 0-12" many F VF com M	% Coarser than V.F.S. *
Permeability mod slow		

Additional notes

Scattered prairie dog holes - active
Digital photos taken of sample site with sign and landscape
Sampled in "To Be Affected Area" Disturbance Area

4 Samples: 0-6, 6-12, 12-20, 20-32"

* Control section average

Horizon	Depth (Inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-6	10YR 5/3	10YR 4/3	Loam	MM GR	SO	FR	SS/SP	ES	GW		5%	mixed Frags
BC	6-12	10YR 5/3	10YR 4/3	Clay Loam	VM SBK, Mass.	SH	FR FI	S/P	ES	GW		25%	mixed Frags
C	12-20	10YR 5/2	10YR 4/2	Clay Loam	Massive	H	FI	S/P	ES+	GW		5%	mixed Frags
C/spoil	20-32	10YR 5/2	10YR 4/2	Clay Loam	Massive	H	FI	S/P	EV	GW		10%	mixed Frags
OB	32+	spoil (not sampled)											

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R2

Soil type Reclaimed Land RL J. NYENHUIS RN File No.

Area Ramaco Brook Mine, north of Sheridan WY Date 5-26-14 Stop No.

Classification

Location NE¼ of SW¼ of NW¼ Sec 15 T57N R84W 44°53'17" N 106°59'8" W

N. veg. (or crop) reclaimed grasses, acc. Wyo Big Sagebrush Climate mesic

Parent material mixed soil grading down to spoil

Physiography reclaimed sideslope

Relief — Drainage well Salt or alkali —

Elevation Gr. water deep Stoniness —

Slope 20% Moisture slt moist to

Aspect 42° NE Root distrib. mod 0-12" % Clay *

Erosion none % Coarse fragments * see below % Coarser than V.F.S. *

Permeability slow

Additional notes

Sampled in "To Be Affected Area" Disturbance Area
Digital photos taken of sample site with sign and landscape

4 Samples: 0-6, 6-12, 12-21, 21-30"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-6	10YR 5/3	10YR 4/3	Loam	MM GR	SH	FR	SS/SP	ES	GW		5%	mixed frags.
BC	6-12	10YR 5/4	10YR 4/4	Clay Loam	W M SBK	H	FR	S/P	ES+	GW		15%	mixed frags
C	12-21	10YR 6/4	10YR 5/4	Clay Loam	Massive	H	FI	S/P	ES+	GW		10%	"
C/spoil	21-30	10YR 5/4	10YR 4/4	Clay Loam	Massive	H	FI	S/P	EV	GW		10%	"
OB	30+	spoil (not sampled)											

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R3

Soil type Reclaimed RL — J. NYENHUIS, RN — File No.

Area RAMACO BROOK MINE, north of Sheridan WY — Date 5-28-14 — Stop No.

Classification

Location Big Horn Coal reclaimed area SE¼ of SW¼ of SE¼ Sect 15 T5N R84W 44° 54' 25" N, 106° 54' 39" W

N. veg. (or crop) reclamation grasses — Climate mesic

Parent material reapplied Topsoil

Physiography reclaimed area - gently sloping upland

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 3%	Moisture all moist	
Aspect 73° E	Root distrib. MRT 0-12" Common F VF 0-12"	% Clay *
Erosion none	% Coarse fragments * See below	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos taken of sample site with sign and landscape
Sampled in "To Be Affected Area" Disturbance Area

2 Samples: 0-6, 6-12"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %	
AC	0-6"	10YR 5/4	10YR 4/4	clay loam	mm SBK	SH	FR	S/P	ES	GW	5%	mixed frags
C	6-12	10YR 5/4	10YR 4/4	clay loam	mm SBK > mod	H	FR	S/P	ES+	GW	5%	mixed frags
OB	12+	regraded spoil (not sampled)										

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R4

Soil type Reclaimed Land RL — J NYENHUIS RN — File No.

Area Ramaco Brook Mine, north of Sheridan WY — Date 5-28-14 — Stop No.

Classification

Location Big Horn Coal Reclaimed Area NW 1/4 of NE 1/4 of NE 1/4 of Sect 22 T57N R84W 44°54'24"N 106°58'33"W

N. veg. (or crop) reclamation grasses — Climate mesic

Parent material reapplied topsoil

Physiography reclaimed area - gently sloping upland

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep	Stoniness —
Slope 2%	Moisture all moist	
Aspect 70° E	Root distrib. MLR 0-12" Com. F, VF	% Clay *
Erosion none	% Coarse fragments * few M 0-12"	% Coarser than V.F.S. *
Permeability moderate	see below	

Additional notes

Digital photos taken of sample site with sign and landscape
Sampled in "To be Affected Area" Disturbance Area

2 Samples: 0-6, 6-12"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %
AC	0-6	10YR 5/3	10YR 4/3	Clay Loam	MM SBK	SH	FR	S/P	EV	GW	15% mixed frags
C	6-12	10YR 5/4	10YR 4/4	Clay Loam	Massive	H	FR	S/P	EV	GW	20% mixed frags
OB	12+	regraded spoil (not sampled)									

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R5 File No.

Soil type Cambria Mag Unit A J. NYENHUIS, RN

Area Ramaco Brook Mine, north of Sheridan WYO | Date 5-27-14 | Stop No.

Classification Mod-deep, sandy Fine-loamy, mesic Ustic Haplargid

Location NW¼, SW¼, SW¼ T57N R85W 44°55'31" N, 107°4'10" W

N. veg. (or crop) prairie dog, mixed grasses | Climate mesic

Parent material mixed slopewash alluv. over residuum from scoria

Physiography valley side slope - alluvial fan

Relief	Drainage well	Salt or alkali –
Elevation	Gr. water deep (not encountered)	Stoniness –
Slope 5%	Moisture sl. moist to 10"	
Aspect 36° NE	Root distrib. MRD 0-22" Com F VF 22-36" Few M F	% Clay *
Erosion slight w mod spots	% Coarse fragments * see below	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos taken of sample site with sign and landscape
Sampled in "To Be Affected Area" Disturbance Area

4 Samples: 0-4, 4-10, 10-22, 22-36"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	10YR 6/3	10YR 5/3	Loam	WF GR	SH	VFR	SS/SP	EO	GS		5%	mixed frags
Bt	4-10	10YR 5/3	10YR 4/3	Loam	WM SBK	SH	FR	SS/SP	EO	GW		7%	"
C1	10-22	10YR 4/3	10YR 3/3	Clay Loam	Massive H	FI	S/SP		EO	GW		15%	"
C2	22-36	10YR 5/4	10YR 4/4	Clay Loam	Massive H	FI	SS/SP		SE	GW		20%	
	36+	stopped by scoria coarse fragments (probably not bedrock)											

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

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R6

Soil type Cambria Mgg Unit A — J. NYENHUIS, RN — File No.

Area RAMACO Brook Mine, north of Sheridan — Date 5-27-14 — Stop No.

Classification Deep, Fine-loamy, mesic Ustic Haplargid

Location SE¼ NE¼ NW¼ Sect 13 T5N R85W 44° 52' 40" N, 109° 1' 54" W

N. veg. (or crop) mixed grasses prairie dog — Climate mesic

Parent material slopewash alluvium

Physiography alluvial fan

Relief –	Drainage well	Salt or alkali –
Elevation	Gr. water deep	Stoniness –
Slope 4%	Moisture sl. moist 0-20" moist + 20-72"	
Aspect 76° East	Root distrib. MRE 0-20"	% Clay *
Erosion Slight w Mod spots	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability mod slow		

Additional notes: Common F, VF; Few M } 0-20"

Digital photos taken of sample site with sign and landscape
Sampled in "To Be Affected Area" Disturbance Area

6 Samples: 0-4, 4-12, 12-20, 20-36, 36-52, 52-72"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	10YR 6/3	10YR 5/3	Loam	MM PL	SO	VFR	SS/SP	E0	GS		27	small mixed Frags
Bt1	4-12	10YR 5/3	10YR 4/3	Loam	MM SBK	SH	FR	SS/SP	E0	GW		37	"
Bt2	12-20	10YR 5/4	10YR 4/4	Loam	MM SBK	H	FR	S/P	E0	GW		–	
C1	20-36	10YR 6/4	10YR 5/4	Loam	Mass.	H	FI	S/P	EM	GW		–	
C2 v. moist	36-52	10YR 6/4	10YR 5/4	Clay Loam	Mass.	H	FI	S/P	ES	GW		–	
C v. moist	52-72+	10YR 5/4	10YR 4/4	Clay Loam	Mass.	H	FI	S/P	ES	GW		–	

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R7

Soil type Haverdad Mapunit H INNENIHUS, RN File No.

Area RAMACO Brook Mine, north of Sheridan WY Date 5-27-14 Stop No.

Classification deep, fine-loamy, mesic (R55XW) Ustic Torrifluvent

Location NE¼ NE¼ NW¼ Sec 13 T57N ↓ 44° 55' 17" N, 107° 3' 44" W

N. veg. (or crop) Riparian Wooded: Cottonwood, big sage, grasses Climate mesic

Parent material stream lain alluvium

Physiography Slater Creek bottomland low terrace

Relief	Drainage well	Salt or alkali –
Elevation	Gr. water deep	Stoniness –
Slope 0%	Moisture moist to 30", dry 30-46, moist to 58", very moist below 58	
Aspect 140° SE	Root distrib. MRD 0-30"	% Clay *
Erosion none	% Coarse fragments * –	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos of sample site and landscape
Sampled in "To be Affected Area" Disturbance Area

6 Samples: 0-4, 4-16, 16-30, 30-46, 46-58, 58-72"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %		
A	0-4	10YR 4/3	10YR 3/3	Loam	sod cover	SO	VFR	SS/SP	SE	GS		–		
BC1	4-16	10YR 5/4	10YR 4/4	Loam	MM SBK	SH	FR	SS/SP	SE	GW		–		
BC2	16-30	10YR 6/3	10YR 5/3	Loam	WM SBK	SH	FR	SS/SP	EM	GW		–		
C1	30-46	10YR 6/4	10YR 5/4	Loam	Mass	H	FI	SS/SP	SE	GW		–		
C2	46-58	salts white 10YR 5/4	10YR 4/4	Loam	Mass	H	FI	SS/SP	SE	GW		–		
C3	58-72	10YR 5/3	10YR 4/3	Loam	Mass	SH	FR	S/P	SE	GW		<1% small frags		

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

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Soil type Shingle Map Unit D

J. NYENHUIS, RN

R8 File No.

Area RAMACO BROOK MINE north of Sheridan Date 5-28-14 Stop No.

Classification Shallow mesic Loamy Ustic TO R85W W4

Location SE¼ SE¼ NE¼ Section 13, T57N, 44°50'48"N, 106°59'8"W

N. veg. (or crop) Wyoming Big Sage, mixed grasses, forbs Climate mesic

Parent material thin residuum from sedimentary bedrock

Physiography upland

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 4%	Moisture dry	
Aspect 49° NE	Root distrib. MRD 0-20" Com M, F, VF few CO 0-20"	% Clay *
Erosion none	% Coarse fragments *	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos taken of sample site and landscape sampled in "To Be Affected Area" Disturbance Area

3 Samples: 0-3, 3-10, 10-20"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-3	10YR 5/3	10YR 4/3	Loam	mm GR	SH	FR	SS/SP	EO	GS		5%	small frags
Bw	3-10	10YR 4/3	10YR 3/3	Loam	mm SBK	H	FR	SS/SP	EO	GW		3%	small frags
Ck	10-20	10YR 6/4	10YR 5/4	Clay Loam	Mass.	H	FR	S/SP	EV	GW		10%	small frags
	20+	R Coarse Frags											

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R9

Soil type Forkwood Map Unit 5 J. NYENHUIS, RN File No.

Area RAMACO BROOK MINE, north of Sheridan WY Date 5-28-14 Stop No.

Classification Deep mesic Ustic Haplargid 44° 54' 31" N, 107° 8' 25"

Location NW¼ NW¼ NW¼ Sect 18 T57N, R84W

N. veg. (or crop) mixed grasses, W40 Big Sage - scattered Climate mesic

Parent material slopewash alluv.

Physiography valley sideslope - alluvial fan, bowl

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 7%	Moisture dry to 6", moist below	
Aspect 202° S	Root distrib. MAD 0-18"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *

Permeability mod slow

Additional notes

Digital photos taken of sample site and landscape

Sampled in "To be Affected Area" Disturbance Area

5 Samples: 0-4, 4-12, 12-23, 23-35, 35-46"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	10YR 5/3	10YR 4/3	Loam	MM GR	SH	VFR	SS/SP	EO	ES		5%	mixed frags
Bt	4-12	10YR 5/3 5/4	10YR 4/3 4/4	Loam	MM SBK	SH	FR	SS/SP	EO	GW		5%	"
Btk	12-23	7.5YR 6/4	7.5YR 4/4	Clay Loam	Massive	H	FR	S/P	EM	GW		15%	"
C1	23-35	7.5YR 6/4	7.5YR 4/4	Loam	Mass.	H	FI	S/P	ES	GW		18%	"
C2	35-46	7.5YR 6/6	7.5YR 5/6	Loam	Mass.	H	FI	S/P	EM	GW		20%	"
	46+	hard dense coarse	Gager fragments										

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R10

Soil type- Cambria Map Unit A J. NYENHUIS, RN File No.

Area RAMACO BROOK Mine northeast Sheridan WY. Date 5-29-14 Stop No.

Classification Deep Fine-loamy, mixed, superactive, mesic Ustic Haplargid

Location SE¼ NE¼ NW¼ Sec 17 T57N R84W 44° 40' 24" N, 106° 51' 59" W

N. veg. (or crop) mesh sheat grass forbs Climate mesic

Parent material slopewash alluvium

Physiography. upland valley

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 5%	Moisture dry	
Aspect 149° SE	Root distrib. MOD 0-18" FEW M com F, VF 0-18"	% Clay *
Erosion moderate	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderate		

Additional notes

Digital photos of sample site and landscape taken

Sampled in "To Be Affected Area" Disturbance Area

6 Samples: 0-4, 4-10, 10-18, 18-32, 32-48, 48-72"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4"	7.5YR 10YR 5/3	7.5YR 10YR 4/3	Loam	WM GR	SO	VFR	SS/SP	GS	E O		10%	mixed scoria gravels
Bt1	4-10	7.5YR 5/4	7.5YR 4/4	Clay Loam	WM SBK	SH	FR	SS/SP	GW	E O		15%	"
Bt2	10-18	7.5YR 5/4	7.5YR 4/4	Clay Loam	Massive	SH	FR	SS/SP	GW	SE		20%	"
C	18-32	7.5YR 6/4	7.5YR 4/4	Loam	Mass	H	FR	SS/SP	GW	EM		15%	"
C	32-48	7.5YR 6/4	7.5YR 4/4	SL	Mass	H	FR	SS/SP	GW	ES		45%	"
C	48-72+	7.5 YR 5/4	7.5YR 4/4	SL	Mass	H	FR	SS/SP	GW	ES		50%	

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R11

Soil type WIBAUX Map Unit Wx J. NYENHUIS, RN File No.

Area Ramaco Brook Mine, north of Sheridan WY Date 5-29-14 Stop No.

Classification shallow Loamy-skeletal over fragmental, mixed, nonacid, mesic, lovi orthent

Location NW¼ SW¼ SW¼ Sec 8 T57N R84W 44° 49' 2" N 106° 57' 47" W

N. veg. (or crop) Wyo. Big sage, mixed grasses, forbs, prickly Climate mesic

Parent material thin residuum from scoria bedrock plain

Physiography upland ridge crest

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness
Slope 4%	Moisture all dry to 4, then sl. moist	
Aspect 208° SW	Root distrib. MR 0-8" Many F, VF Few M, CO 0-8"	% Clay *
Erosion none to slight	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderately rapid		

Additional notes

Digital photos taken of sample site and landscape
Sampled in Potential Subsidence Area

3 Samples: 0-4, 4-8, 8-14"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	7.5YR 5/4	7.5YR 4/4	Channery Loam	MM GR	SO	VFR	SS/SP	EO	GS		15% 20%	scoria frags
Bw	4-8	7.5YR 5/4	7.5YR 4/4	Very Channery Loam	MM SBK	SH	FR	SS/SP	EO	GW		55%	scoria Channers
2C	8-14	7.5YR 6/4	7.5YR 5/4	EXT. CHANNERY Clay Loam	Mass. H	FR	FR	SS/SP	EO	GW		70%	scoria Frags

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R12

Soil type Forkwood Map Unit Co J. NYENHUIS, RN File No.

Area RAMACO Brook Mine north of Sheridan WYO. Date 5-29-14 Stop No.

Classification deep mesic Ustic Haplargid

Location SW¼ SE¼ SW¼ Sec 8 T57N R84W 44°55'23"N 107°1'35"W

N. veg. (or crop) WYO Big sage, mixed grasses, forbs, prickly pear Climate mesic

Parent material alluvium, colluvium from scoria

Physiography fan off ridge

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness channers surface
Slope 10%	Moisture	
Aspect 119°SE	Root distrib. MRD	% Clay *
Erosion none to slight	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderate		

Additional notes

Digital photos taken of sample site and landscape

Sampled in "To be Affected Area" Disturbance Area

6 Samples: 0-4, 4-13, 13-24, 24-40, 40-57, 57-72"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	7.5YR 5/4	7.5YR 4/4	Loam	WM GR	SO	VFR	SS/SP	EO	GS		15%	scoria channers
Bt1	4-13	7.5YR 5/4	7.5YR 4/4	Loam	WM SBK	SH	FR	SS/SP	SE	GW		20%	"
Btk	13-24	7.5YR 7/4	7.5YR 6/4	Loam	WM SBK	SH	FR	SS/SP	EV	GW		15%	"
C1	24-40	7.5YR 5/4	7.5YR 4/4	Loam	Mass	H	FR	SS/SP	ES	GW		10%	"
C2	40-57	7.5YR 5/4	7.5YR 4/4	Loam	Mass	H	FR	SS/SP	EM	GW		10%	"
C3	57-72+	10YR 6/4	10YR 4/4	Loam	Mass	H	FR	SS/SP	SE	GW		10%	"

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R13

Soil type WIBAUX Map Unit Wx J. NYENHUIS, RN File No.

Area RAMACO BROOK MINE north of Sheridan Date 5-29-14 Stop No.

Classification Shallow loamy-skeletal over fragmented, mixed, nonacid Ustic Torriorthent

Location SE¼ NW¼ NE¼ T57N, R84W 44°49'36" N, 106°58'17" W

N. veg. (or crop) Upland Grassland Climate mesic

Parent material thin residuum from scoria bedrock

Physiography upland

Relief	Drainage well	Salt or alkali –
Elevation	Gr. water deep (not encountered)	Stoniness –
Slope 6%	Moisture 8-15" sl. moist	
Aspect 91° E	Root distrib. MRR 0-8 COMF VF FEN 8-15"	% Clay *
Erosion slight	% Coarse fragments * 0-8"	% Coarser than V.F.S. *
Permeability moderate	see below	

Additional notes

Digital photos taken of sample site and landscape
Sampled in "To Be Affected Area" Disturbance Area

= Samples: 0-4, 4-8, 8-15"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF		
A	0-4	5YR 6/2	5YR 5/2	loam	MM GR	SH	FR	SS/SP	EO	GS		15%	scoria chunks	
B	4-8	7.5YR 5/3	7.5YR 4/3	clay	MS ABK	H	FI	S/P	EO	GW		10%	"	
BK	8-15	7.5YR 6/4	7.5YR 5/4	Very channery loam	Massive	H	FR	S/SP	EN+ ES	GW		30%	"	
2C	15+	Scoria (not sampled)										70+	"	

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R14

Soil type Forkwood Mag Unit C J. NYENHUIS RN File No.

Area Ramaco Brook Mine north of Sheridan Date 5-30-14 Stop No.

Classification deep Fine-loamy, mixed, superactive mesic Ustic Haplargid

Location SE¼ SE¼ NW¼ Sec 14, T5NR85W 44°55'2"N, 107°4'54"W

N. veg. (or crop) colluvium & Big sage, mixed grasses, cacti Climate mesic temp.

Parent material Mowry

Physiography sideslope

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 18%	Moisture moist to 36"	
Aspect 11° N	Root distrib. MR D 0-24"	% Clay *
Erosion none to slight	% Coarse fragments * see below	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos taken of sample site and landscape.

5 Samples: 0-4, 4-12, 12-24, 24-42, 42-55"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4"	10YR 5/3	10YR 4/3	SL	MM GR	SH	FR	S/SP	E0	GS		2%	some channers
Bt1	4-12	10YR 5/3	10YR 4/3	Loam	MM SBK	SH	FR	S/SP	E0	GW		5%	"
Bt2	12-24	7.5YR 5/4 10YR 5/4	7.5YR 4/4 10YR 4/4	SCL	MM SBK	H	FR	S/P	E0	GW		10%	"
Ck1	24-42	10YR 6/4	10YR 5/4	SCL	Mas.	H	FR	S/P	ES	GW		2%	"
Ck2	42-55	10YR	10YR	Loam	Mas.	H	FI	S/P	ES	GW		15%	frags
	stopped by rock												

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R15

Soil type SAMDAY Map Unit E J. NYENHUIS, RAJ File No.

Area RAMACO BROOK MINE, north of Sheridan WY Date 5-30-14 Stop No.

Classification shallow, clayey, smectitic, mesic Ustic Torriorthent

Location NE¼ SW¼ NW¼ Sec 14 T57N, R85W 44°53'51"N, 107°3'10"W

N. veg. (or crop) Big sage, mixed grasses, cactus, forbs Climate mesic temp

Parent material colluvium & slopewash over shale

Physiography side slope

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 20%	Moisture all moist	
Aspect 26° NE	Root distrib. MRD 0-5" ComF, VF	% Clay *
Erosion slight	% Coarse fragments * Few M, CO 0-8"	% Coarser than V.F.S. *
Permeability slow		

Additional notes

Digital photos taken of sample site and landscape

3 Samples: 0-3, 3-8, 8-13"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-3"	10YR 6/2	10YR 4/2	clay loam	mm GR	SH	FR	SS/SP	EO	GS		10%	frags
Bw	3-8	10YR 5/2	10YR 4/2	clay	mm SBK	H	FI	S/P	EO	GW		1%	"
C	8-13	10YR 3/2 w carbonaceous shale-coaly	10YR 2/2 material	Sandy Clay	w Modo	SH	FR	SS/SP	EO	GW		25%	carb. shale chips

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2

R16

Soil type Shingle Mag Unit D — J. NYENHUIS, RN — File No.

Area RAMACO BROOK Mine, north of Sheridan WY — Date 5-30-14 — Stop No.

Classification Shallow, Loamy, mesic Ustic Torriorthent

Location NW¼ SE¼ NW¼ Sect 13, T57N, R85W — 44° 51' 27" N 106° 59' 22" W

N. veg. (or crop) W4e Big sage, mixed grasses, cactus, forbs — Climate

Parent material slopewash alluv. over residuum

Physiography rolling upland sideslope

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 18%	Moisture dry 0-4, moist below	
Aspect 37° NE	Root distrib. MRD 0-12 com F, VF	% Clay *
Erosion none to slight	% Coarse fragments * see below: few m, co 0-12"	% Coarser than V.F.S. *
Permeability		

Additional notes

Digital photos taken of sample site and landscape.

3 Samples: 0-4, 4-12, 12-18"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4"	10YR 5/3	10YR 4/3	SL Loam	MM GR	SO	VFR	SS/SP	E0	GS		5%	scoria frags
Bw	4-12	10YR 5/4	10YR 4/3	SL Loam	MM SBK	SH	FR	SS/SP	E0	GW		10%	scoria frags
C	12-18	10YR 6/4	10YR 5/4	SL Loam	massive	H	FR	S/SP	EM	GW		15%	rock frags
	18+	stopped by rock											

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

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R17

Soil type Bauxson Mag Unit G J. NIENHUIS, RN File No.

Area RAMACO BROOK Mine, north of Sheridan WY Date 5-31-14 Stop No.

Classification deep Fine-loamy over fragmental, mixed superactive, mesic Aridic Argiustoll

Location NE/4 SW/4 SW/4 Sec 11 T57N R85W 44° 55' 29" N 107° 5' 9" W

N. veg. (or crop) upland Grassland mixed grasses cactus, sage shrubs Climate mesic temps

Parent material residuum from scoria bedrock

Physiography upland ridge crest - bench

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness
Slope 3%	Moisture all moist	
Aspect 79° E	Root distrib. MR	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *

Permeability moderate

Additional notes

Digital photos taken of sample-site and landscape

5 Samples: 0-4, 4-12, 12-23, 23-34, 34-42"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	10YR 4/3	10YR 3/3	Loam	MM GR	SO	VFR	SS/SP	EO	GS		2%	mixed frags
Bt	4-12	7.5YR 5/4 10YR	7.5YR 4/4 10YR	Clay Loam	MM SBK	SH	FR	SS/SP	EM	GW		10-15%	"
Bk	12-23	7.5YR 6/4 10YR	7.5YR 4/4 10YR	Cham. Loam	MM SBK	SH H	FR	SS/SP	EV	GW		20%	mixed/ scoria frags
ck	23-34	7.5YR 6/4	7.5YR 5/4	V. Cham. SL	Massive	H	FR	SS/SP	EV	GW		30%	"
c	34-42	7.5YR 5/4	7.5YR 4/4	V. Cham SL	Massive	H	FR	SS/SP	ES	GW		55%	"
2C	42+	stopped by rock (not sampled)										>70%	scoria frags

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R. 18.

Soil type WIBAUX Mag Unit Wx-RO J. NYENHUIS, RN File No.

Area RAMACO BROOK MINE, north of Sheridan WY Date 5-31-14 Stop No.

Classification Shallow Loamy-skeletal over Stratified mixed, nonacid, mesic Ustic Torriorthent

Location NW 1/4 SW 1/4 SW 1/4 Sect 11, T57N R85W 44° 55 24" N 107° 5' 19" W

N. veg. (or crop) weedy shrubs, mixed grasses rough broken Climate mesic temp

Parent material thin residuum from scoria bedrock (porcellanite)

Physiography upper scoria sideslope

Relief	Drainage well - somewhat excessive	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness channery surface
Slope 37%	Moisture all moist	
Aspect 194° S	Root distrib. MAD 0-8"	% Clay *
Erosion none to slight	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderately rapid		

Additional notes

Digital photos taken of sample site and landscape

3 Samples: 0-3, 3-8, 8-18"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-3	7.5YR 4/3	7.5YR 3/3	Chan. Loam	WM GR	SH	FR	SS/SP	EO	GS		20%	scoria Channers
BW	3-8	7.5YR 4/2	7.5YR 3/2	V. Chan. Loam	WM SBK	SH	FR	SS/SP	SE	GW		30%	"
C	8-18	7.5YR 4/2 skeletal	7.5YR 3/2	V. Chan. Loam	Massive	LO	LO	NS/NP	SE	GW		55%	"
	18-40+	fragmental (not sampled)											

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R19

Soil type Bawson Mag Unit G — J. NYENHUIS, RN — File No.

Area RAMACO Brook Mine, north of Sheridan WY — Date 5-31-14 — Stop No.

Classification Mod deep-deep Fine-loamy to Fine resin Aridic Argiustoll

Location NE¼ SE¼ NW¼ Sec 18 T57N R84W 44° 55' 6" N, 107° 2' 42" W

N. veg. (or crop) W40 big sage, mixed grasses, cactus — Climate mesic temp

Parent material slopewash alluv. and colluvium

Physiography Lower sideslope - upper bar

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness
Slope 18%	Moisture surface dry, moist	
Aspect 252° W	Root distrib. MRD 0-22"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability mod. slow		

Additional notes

Digital photos taken of sample site and landscape.

5 Samples: 0-4, 4-10, 10-22, 22-36, 36-48"

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-4	10YR 5/3	10YR 4/3	loam	mm GR	SH	FR	SS/SP	EO	GS		10%	mixed charcoal
Bt	4-10	5YR 5/3	5YR 4/3	clay loam	SM ABK	H	FR	S/P	SE	GW		10-15%	"
Btk	10-22	5YR 5/4	5YR 4/4	clay loam	MM SBK	H	FR	S/P	ES	GW		2%	
C	22-36	2.5YR 5/6 5YR	2.5YR 4/6 5YR	clay	Mass	VH	FI	S/P	EM	GW		20%	clay fx chips
C/Cs	36-48	2.5YR 5/6 5YR	2.5YR 4/6 5YR	clay	Mass	VH	FI	S/P	EO	GW		45% + gyp.	clay clots angular

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R20 File No.

Soil type Haverdad Map Unit H J. NYENHUIS, RN

Area RAMACO Brook Mine, north of Sheridan WY | Date 5-31-14 | Stop No.

Classification Deep Fine-loamy mixed superactive mesic Ustic Torrifluvent

Location NW¼ SE¼ NW¼ Sec 19 T57N R84W 44°54'46"N 107°6'6" W

N. veg. (or crop) Riparian woodland, mixed grasses | Climate mesic temp.

Parent material Fine-loamy streambain alluv.

Physiography Drainage Bottomland

Relief	Drainage well	Salt or alkali –
Elevation	Gr. water deep (not encountered)	Stoniness –
Slope 4%	Moisture all moist, very moist 42+	
Aspect 195° South	Root distrib. MAP 0-26"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderate		

Additional notes

Digital photos taken of sample site and landscape

6 Samples: 0-5, 5-14, 14-26, 26-42, 42-58, 58-72

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary		CF %	
A	0-5	10YR 5/3	10YR 4/3	Loam	MM GR	SO	FR	SS/SP	EO	GS		2%	mixed Acacia Frags
Bw	5-14	10YR 5/3	10YR 4/3	Loam	WM SBK	SH	FR	SS/SP	EO	GW		1%	"
BC	14-26	10YR 5/4	10YR 4/4	Loam	WM SBK	SH	FR	SS/SP	SE	GW		10-15%	
C1	26-42	10YR 4/2	10YR 3/2	Loam	Mass	H	FI	SS/SP	SE	GW		2%	mixed Frags
C2	42-58	10YR 4/2	10YR 3/2	Loam	Mass	SH	FR	SS/SP	SE+	GW		3%	"
C3	58-72+	10YR 4/3	10YR 3/3	Loam	Mass	SH	FR	SS/SP	EM	GW		3%	"
	did not hit bedrock												

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - Rev. 2 -

R21

Soil type WIBAUX Mapunit Wx J NYENHUIS File No.

Area RAMACO BROOK MINE, north of SHERIDAN WY Date 6-30-14 Stop No.

Classification shallow Lo-shal over fragmental mesic Ustic Torriorthent

Location NE¼ of SW¼ Sect. 18 T57N, R84W

N. veg. (or crop) wyo. big sage, mixed grasses, prickly pear cactus Climate mesic temp

Parent material thin residuum from interbedded sedimentary (volcanic) scoria Ustic-aridic precip

Physiography upland ridge crest

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness channery surface
Slope 8%	Moisture sl. moist 0-10"	
Aspect 220°SW	Root distrib. MOD 0-10" Many F VF	% Clay *
Erosion slight in spots	% Coarse fragments * see below Few M CO 0-10"	% Coarser than V.F.S. *
Permeability moderately rapid		

Additional notes

Digital photos taken of sample site and landscape
Located sample site in a "To Be Affected Area" Disturbance Area

2 Samples: 0-3, 3-10"

all samples screened No. 10 screen

* Control section average

Horizon	Depth IN.	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %
A	0-3	7.5YR 5/4	7.5YR 4/4	channery Loam	WF GR	SO	FR	SS/SP	SE	GS	20% scoria Channers
C	3-10	7.5YR 6/4	7.5YR 4/4	v. chan. Loam	WF SBK	SO	FR	SS/SP	SE	GW	35% scoria Fragments
2C	10-40+	"Fragmental" displaced scoria Fragments with many voids larger than 2 mm without any soil (NOT Sampled)									

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

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R22

Soil type Banxson Map Unit G — J. NYENHUIS — File No.

Area RAMACO BROOK MINE north of Sheridan WY — Date 6-30-14 — Stop No.

Classification see R17

Location SW¼ of NE¼ Sect. 18, T57N, R84W

N. veg. (or crop) Wyo. Big Sage, mixed grasses, prickly pear — Climate mosic soil temp ~~xeric aridic~~

Parent material local alluvium over residuum from scoria ~~Ppitp~~

Physiography upland Gowl

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 8%	Moisture Sl. moist to 14"	
Aspect 189° South	Root distrib. MRD 0-14"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *

Permeability moderately rapid

Additional notes

All samples screened No. 10 screen
Digital photos taken of sample site and landscape
Sample site located in "To be affected Area" Disturbance Area

3 Samples: 0-4, 4-14, 14-26"

* Control section average

Horizon	Depth IN.	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %		
A	0-4	10YR 4/3 7.5YR 4/2	10YR 3/3 7.5YR 3/2	Channery Loam	WM GR	SO	FR	SS/SP	SE	GS	15% scoria channers		
B	4-14	10YR 5/3 7.5YR 5/4	10YR 4/3 7.5YR 4/4	Loam	MM SBK	SO	FR	SS/SP	EM	GW +	20%	"	
C	14-26+	10YR 5/3 7.5YR 5/4	10YR 4/3 7.5YR 4/4	Loam	Mass.	SO	FR	SS/SP	EM	GW	25%	"	

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 7
Rev. 2 - 8

R23

Soil type HAVERDAD Map Unit H J. NYENHUIS File No.

Area RAMACO BROOK MINE, north of Sheridan WY Date 7-1-2014 Stop No.

Classification deep see R20 44° 55' 50" N, 106° 58' 55" W

Location SE¼ of SE¼ Sect 9 T57N, R84W

N. veg. (or crop) mixed grasses, silver sage Climate mesic temp aridic moist.

Parent material drainage and sheetwash alluvium

Physiography Hidden Waters Creek bottomland & low terraces

Relief	Drainage well	Salt or alkali –
Elevation	Gr. water deep (not encountered)	Stoniness –
Slope 2%	Moisture sl. moist to 14"	
Aspect 132° SE	Root distrib. MRD 0-14"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderate		

Additional notes

Digital photos taken of sample site and landscape located in "To be Affected Area" Disturbance Area

4 Samples: 0-4, 4-15, 15-26, 26-42"

* Control section average

Horizon	Depth IN	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %	
A	0-4	10YR 4/3	10YR 3/3	Loam	MM GR	SO	FR	SS/SP	SE	GS	–	
BC	4-15	10YR 5/3	10YR 4/3	Loam	WM SBK	SH	FR	SS/SP	EM	GW	–	
C1	15-26	10YR 6/3	10YR 5/3	Loam	Massive	SH	FR	SS/SP	EM	GW	34%	mixed channers
C2	26-42+	7.5YR 5/4	7.5YR 4/4	Loam	Massive	H	FR	SS/SP	EM	GW	34%	mixed channers

stopped by scoria channers - could not auger dig any deeper

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SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 2
Rev. 2 - 8

R24

Soil type Samday   Map Unit E   J. NYENHUIS   File No.

Area RAMACO BROOK Mine, north of Sheridan WY   Date 7-1-2014   Stop No.

Classification see R15   GPS: 44°54' 2" N, 106°59' 4?" N

Location SE¼ of SW¼ Sect. 9, T57N R84W

N. veg. (or crop) mixed grasses (no sage)   Climate ustic-aridic precip / mesic soil temp

Parent material slopewash alluvium over residuum from sedimentary beds

Physiography erosion surface - bench

Relief   Drainage well   Salt or alkali —

Elevation   Gr. water deep (not encountered)   Stoniness —

Slope 3%   Moisture 0-3" sl. moist

Aspect 357° N   Root distrib. MBD 0-10"   % Clay *

Erosion none   % Coarse fragments * see below   % Coarser than V.F.S. *

Permeability moderately slow

Additional notes

Digital photos taken of sample site and landscape
Located in "To be affected area" Disturbance Area
Screened 0-3"
not screened 3-10"
10-18" } 3 Samples: 0-3, 3-10, 10-18"

* Control section average

Horizon	Depth IN	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %
A	0-3	10YR 5/3	10YR 4/3	Silt Loam	mm GR	SO	FR	s/sp	SE-	GS	—
Bw	3-10	10YR 6/3	10YR 5/3	Clay Loam	wm SBK	SH	FR	s/p	SE-	GW	3% small scoria & shale chips
C	10-18	10YR 5/3	10YR 4/2	Clay Loam	Massive	VH	FR	s/p	SE-	GW	15% small hard shale chips
Cr	18+	weathered 10YR 7/3 clay shale (not sampled)									

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SOIL DESCRIPTION

SCS - SOI - 2
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R25
File No.

Soil type Ulm Map Unit 11 J. NYENHUIS

Area RAMACO BROOK MINE, north of Sheridan WY	Date 7-2-2014		Stop No.
Classification very deep Fine mesic Ustic Haplargid			
Location 44° 52' 52" N, 107° 4' 24" W			
N. veg. (or crop) Rangland mixed grasses		Climate mesic temp ustic aridic moisture	
Parent material local alluvium (fine Textured)			
Physiography irrigated hayfield Tongue River bottomland floodplain			
Relief	Drainage somewhat well		Salt or alkali —
Elevation	Gr. water deep		Stoniness —
Slope 0-2%	Moisture moist to 40" then very moist below		
Aspect 163° S	Root distrib. MB & 0-14"		% Clay *
Erosion none	% Coarse fragments * see below		% Coarser than V.F.S. *
Permeability moderately slow			

Additional notes

checked hole one day later - very moist - wet at 72" but No free water
Located in proposed Facilities Area
Digital photos taken of sample site and landscape

7 Samples 0-5, 5-14, 14-27, 27-40, 40-52, 52-62, 62-72"

* Control section average

Horizon	Depth IN.	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %			
Ap	0-5	10YR 5/2	10YR 4/2	clay	MM GR	SH	FR	S/P	SE-	GS	-			
Bt1	5-14	10YR 5/3	10YR 4/3	clay	MM SBK	H	FR	VS/VP	SE	GS	-			
Bt2	14-27	10YR 6/3	10YR 5/3	Silty clay	MM SBK	H	FI	VS/VR	SE	GW	-	few small black carb. stained chips		
C1	27-40	10YR 5/3	10YR 4/3	Silty clay	Massive	H	FI	VS/VP	SE	GW	-	"		
C2	40-52	10YR 6/4	10YR 5/4	clay	thin strata - VFS silty clay Massive	H	FR	S/SP	SE-	GW	-	5% small scoria chips and coaly chips start at		
C3	52-62	common red oxi morphic clays at 52"+ 10YR 5/3	10YR 4/3	Silty Clay	Massive	both	low	& high chroma	SE-	GW	-	42" 5%		
C4	62-72+	10YR 5/4	10YR 4/4	clay coats	stratified Massive	H	FR	S/SP	SE-	GW	-	5%		

TFN 6 2/025
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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 2
Rev. 2 - 8

R26

Soil type ZIGWEID Map Unit B loam J. NYENHUIS File No.

Area RAMACO BROOK MINE, north of Sheridan WY | Date 7-2-2014 | Stop No.

Classification deep fine loamy mesic Ustic Haplocambid (SW¼ of SW¼ of Sect 13 T57N, R85W)

Location Facilities Area bet road and RR tracks 44° 54' 58" N 107° 5' 52" W

N. veg. (or crop) Mixed grasses, hayland, including alfalfa | Climate mesic soil temp ustic aridic soil moist.

Parent material Qal local alluvium

Physiography irrigated hayfield terrace of Tongue River

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 0-2%	Moisture moist to	
Aspect 164° S	Root distrib. MRD 0-16"	% Clay *
Erosion none	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability moderate		

Additional notes

Digital photos taken of sample site and landscape

2" fine gravelly lense at 16-18", also grav. lense w scoria chips at 52-54"

7 Samples: 0-4, 4-16, 16-28, 28-40, 40-52, 52-62, 62-72"

* Control section average

Horizon	Depth IN	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %			
Ap	0-4	10YR 5/2	10YR 4/2	Loam	SCO GR	SH	FR	S/SP	EO	GS	—			
Bw	4-16	10YR 5/3	10YR 4/3	Loam	WM SBK	H	FR	S/P	EO	GW	—			
BC	16-28	10YR 6/3	10YR 5/3	Loam	Massive	H	FR	S/P	SE	GW	5%	small gravels and cobbles		
C1	28-40	10YR 5/3	10YR 4/3	Clay Loam	Mass.	H	FI	S/P	SE	GW	—			
C2	40-52	10YR 5/3	10YR 4/3	Clay Loam	Mass	SH	FR	SS/SP	SE EM-	GW	—			
C3	52-62	few light 2/1 chroma 6/1 redox 10YR 5/4	10YR 4/4	Loam	Mass.	SH	FR	SS/SP	EM	GW	5%	small gravels and scoria cobbles		
C4	62-72+	few light 2/1 chroma 6/1 redox 10YR 5/4	10YR 4/4	Loam	Mass.	H	FR	S/P	ES-	GW	"	"	"	
	did not hit bedrock													

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 2
Rev. 2 - 8

R27

Soil type Samday Map Unit E J. NYENHUIS File No.

Area RAMACO BROOK Mine, north of Sheridan WY. Date 7-2-2014 Stop No.

Classification Shallow see R15

Location SE¼ of NW¼ Sec 13 T57N R85W / 44° 54' 52" N, 107° 5' 12" W

N. veg. (or crop) Wyo big sage, mixed grasses, prickly pear Climate mesic soil temp ustic aridic moist

Parent material thin residuum from clay shale (no scoria)

Physiography upland hillslope

Relief	Drainage well	Salt or alkali —
Elevation	Gr. water deep (not encountered)	Stoniness —
Slope 5%	Moisture 9-18" sl. moist	
Aspect 209° SW	Root distrib. MRD 0-9"	% Clay *
Erosion slight	% Coarse fragments * —	% Coarser than V.F.S. *

Permeability moderately slow

Additional notes

Digital photos taken of sample site and landscape located in "To be affected area" Disturbance Area

3 Samples: 0-3, 3-9, 9-18"

* Control section average

Horizon	Depth IN.	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	CF %			
A	0-3	10YR 7/3	10YR 6/3	Clay Loam	mco PL	SH	FR	S/P	SE-	GW	2%	mixed channer		
B	3-9	10YR 7/3	10YR 5/3	Silty Clay Loam	SBK/ MBK/ MMGR	H	FR	S/P	SE	GW	—			
C	9-18	2.5Y 7/4 10YR 7/4	2.5Y 6/4 10YR 6/4	Silty Clay Loam	Mass	H	FR FI	S/P	EM	GW	—			
Cr	18+	weathered clay shale bedrock (not sampled)												

TFN 6 2/025
RECD NOV 14, 2014

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ADDENDUM D7-2
SOILS LABORATORY RESULTS
SOIL SAMPLE SITES R1 – R27

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Inter-Mountain Labs

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 6/18/2014

CLIENT: RAMACO
Project: Brook Mine Topsoil
Lab Order: S1405494

CASE NARRATIVE

Report ID: S1405494001

Samples R1, R2, R3, R4, R5, R6, R7, R8, and R9 were received on May 29, 2014.

Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, December 1994
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

TFN 6 2/025
RECD NOV 14, 2014

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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May 29, 2014

RAMACO, BROOK MINE, SHERIDAN WYO.

LIST OF SOIL SAMPLES: 36 Total Samples
sampled by JAMES NYENHUIS, CPSS-CPSC
Parameters: "Wyoming Topsoil"
pH, EC, sat%, OM, SAR, TEXTURE (hydrometer)
Boron & Selenium (hot water)
Coarse frags done in the field - don't do in the lab

R1	R2	R3	R4
0-6"	0-6"	0-6"	0-6"
6-12	6-12	6-12	6-12
12-20	12-21		
20-32	21-30		

R5	R6	R7	R8	R9
0-4"	0-4"	0-4"	0-3"	0-4"
4-10	4-12	4-16	3-10	4-12
10-22	12-20	16-30	10-20	12-23
22-36	20-36	30-46		23-35
	36-52	46-58		35-46
	52-72	58-72		

TFN 6 2/025
RECD NOV 14, 2014

Soil results in 15 business days.
On soil report, please have one blank line separating each sample set

5-29-14
Delivered J. Nyenhuis
Rec'd 5/29/14 Karen Saco

5140549

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1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Addendum D7-2-4

Brook Mine

Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1405494001

Project: Brook Mine Topsoil
Date Received: 5/29/2014

Date Reported: 6/18/2014
Work Order: S1405494

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1405494-001	R1	0-6	7.7	53.5	0.46	2.8	2.47	1.14	0.16	0.12
S1405494-002	R1	6-12	8.0	50.6	0.38	2.1	1.69	1.39	0.19	0.15
S1405494-003	R1	12-20	8.0	50.3	1.79	1.9	8.57	11.7	2.17	0.68
S1405494-004	R1	20-32	8.0	49.1	6.06	2.4	19.1	57.2	20.7	3.34
S1405494-005	R2	0-6	7.9	54.8	0.49	4.1	2.93	2.02	0.63	0.40
S1405494-006	R2	6-12	7.9	48.7	0.38	2.3	2.30	1.17	0.23	0.18
S1405494-007	R2	12-21	8.1	48.8	0.39	1.8	1.84	1.57	0.42	0.32
S1405494-008	R2	21-30	7.8	44.9	3.97	3.0	21.8	31.5	6.66	1.29
S1405494-009	R3	0-6	8.0	55.5	0.38	0.9	1.59	1.52	0.16	0.13
S1405494-010	R3	6-12	8.2	49.1	0.39	0.7	1.75	2.11	0.36	0.26
S1405494-011	R4	0-6	7.9	50.8	0.34	2.6	2.12	0.75	0.09	0.08
S1405494-012	R4	6-12	7.9	55.4	0.34	2.2	1.91	1.15	0.16	0.13
S1405494-013	R5	0-4	6.3	43.0	0.21	4.1	0.75	0.48	0.30	0.38
S1405494-014	R5	4-10	6.2	46.2	0.17	2.7	0.68	0.24	0.15	0.22
S1405494-015	R5	10-22	7.7	53.2	0.69	1.4	1.86	1.37	3.42	2.69
S1405494-016	R5	22-36	8.0	50.4	7.03	1.8	20.5	46.2	50.0	8.65
S1405494-017	R6	0-4	6.2	57.9	0.29	5.8	1.21	0.74	0.21	0.21
S1405494-018	R6	4-12	7.0	45.9	0.22	3.1	1.08	0.70	0.26	0.28
S1405494-019	R6	12-20	8.0	41.8	1.36	2.0	5.27	6.69	3.29	1.35
S1405494-020	R6	20-36	8.2	40.0	8.60	0.7	22.4	99.9	40.8	5.22

TFN 6 2/025
RECD NOV 14, 2014

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Soil Analysis Report

RAMACO
250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1405494001

Project: Brook Mine Topsoil
Date Received: 5/29/2014

Date Reported: 6/18/2014
Work Order: S1405494

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm
S1405494-001	R1	0-6	36.0	41.0	23.0	Loam	0.39	<0.02
S1405494-002	R1	6-12	28.0	45.0	27.0	Clay Loam	0.45	<0.02
S1405494-003	R1	12-20	34.0	39.0	27.0	Clay Loam	1.75	<0.02
S1405494-004	R1	20-32	28.0	44.0	28.0	Clay Loam	1.74	0.05
S1405494-005	R2	0-6	32.0	42.0	26.0	Loam	0.32	<0.02
S1405494-006	R2	6-12	33.0	39.0	28.0	Clay Loam	0.44	<0.02
S1405494-007	R2	12-21	36.0	35.0	29.0	Clay Loam	0.66	<0.02
S1405494-008	R2	21-30	24.0	50.0	26.0	Silty Loam	1.68	<0.02
S1405494-009	R3	0-6	24.0	46.0	30.0	Clay Loam	0.36	<0.02
S1405494-010	R3	6-12	30.0	42.0	28.0	Clay Loam	0.74	<0.02
S1405494-011	R4	0-6	34.0	35.0	31.0	Clay Loam	0.33	<0.02
S1405494-012	R4	6-12	28.0	40.0	32.0	Clay Loam	0.35	<0.02
S1405494-013	R5	0-4	40.0	47.0	13.0	Loam	0.28	<0.02
S1405494-014	R5	4-10	40.0	43.0	17.0	Loam	0.35	<0.02
S1405494-015	R5	10-22	30.0	41.0	29.0	Clay Loam	0.48	<0.02
S1405494-016	R5	22-36	34.0	32.0	34.0	Clay Loam	0.55	0.10
S1405494-017	R6	0-4	40.0	42.0	18.0	Loam	0.28	<0.02
S1405494-018	R6	4-12	29.0	46.0	25.0	Loam	0.30	<0.02
S1405494-019	R6	12-20	36.0	40.0	24.0	Loam	0.51	<0.02
S1405494-020	R6	20-36	32.0	44.0	24.0	Loam	0.43	0.20

TFN 6 2/025
RECD NOV 14, 2014

Addendum D7-2-5

Brook Mine

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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Your Environmental Monitoring Partner

October 2014

RAMACO

Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1405494001

Project: Brook Mine Topsoil
Date Received: 5/29/2014

Date Reported: 6/18/2014
Work Order: S1405494

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1405494-021	R6	36-52	8.4	45.0	9.49	1.5	19.4	110	54.8	6.81
S1405494-022	R6	52-72	8.4	46.7	8.78	1.1	15.7	82.8	58.6	8.35
S1405494-023	R7	0-4	6.5	70.3	0.33	5.5	1.16	1.08	0.59	0.56
S1405494-024	R7	4-16	8.0	43.2	0.42	2.3	1.58	1.06	0.47	0.41
S1405494-025	R7	16-30	7.9	53.3	3.65	3.2	10.8	23.3	10.0	2.43
S1405494-026	R7	30-46	8.0	49.1	6.41	2.2	22.5	35.8	28.3	5.24
S1405494-027	R7	46-58	8.2	52.9	6.66	2.3	22.8	50.0	38.8	6.43
S1405494-028	R7	58-72	8.2	49.2	6.21	1.8	20.2	46.8	34.7	6.00
S1405494-029	R8	0-3	6.4	53.9	0.26	3.2	1.26	0.61	0.20	0.21
S1405494-030	R8	3-10	6.3	57.4	0.14	1.6	0.82	0.28	0.12	0.16
S1405494-031	R8	10-20	7.8	56.2	0.32	1.9	2.01	0.90	0.23	0.19
S1405494-032	R9	0-4	6.2	51.0	0.21	4.0	0.77	0.59	0.15	0.19
S1405494-033	R9	4-12	6.7	39.1	0.17	1.6	0.54	0.55	0.18	0.24
S1405494-034	R9	12-23	8.0	48.1	0.32	0.8	1.14	1.32	0.38	0.34
S1405494-035	R9	23-35	8.0	44.6	4.92	1.3	19.6	34.2	16.1	3.11
S1405494-036	R9	35-46	8.3	39.1	10.6	<0.1	20.1	96.8	72.1	9.43

TFN 6 2/025
RECD NOV 14, 2014

Addendum D7-2-6

Brook Mine

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

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1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Brook Mine

Addendum D7-2-7

Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1405494001

Project: Brook Mine Topsoil
Date Received: 5/29/2014

Date Reported: 6/18/2014
Work Order: S1405494

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm
S1405494-021	R6	36-52	32.0	38.0	30.0	Clay Loam	0.66	0.20
S1405494-022	R6	52-72	36.0	36.0	28.0	Clay Loam	0.93	0.15
S1405494-023	R7	0-4	36.0	48.0	16.0	Loam	0.62	<0.02
S1405494-024	R7	4-16	36.0	44.0	20.0	Loam	0.52	<0.02
S1405494-025	R7	16-30	26.0	49.0	25.0	Loam	1.21	<0.02
S1405494-026	R7	30-46	28.0	48.0	24.0	Loam	0.71	0.16
S1405494-027	R7	46-58	26.0	48.0	26.0	Loam	0.61	0.13
S1405494-028	R7	58-72	42.0	37.0	21.0	Loam	0.70	0.06
S1405494-029	R8	0-3	48.0	34.0	18.0	Loam	0.29	<0.02
S1405494-030	R8	3-10	40.0	32.0	28.0	Clay Loam	0.18	<0.02
S1405494-031	R8	10-20	38.0	30.0	32.0	Clay Loam	0.19	<0.02
S1405494-032	R9	0-4	50.0	37.0	13.0	Loam	0.27	<0.02
S1405494-033	R9	4-12	44.0	37.0	19.0	Loam	0.21	<0.02
S1405494-034	R9	12-23	48.0	29.0	23.0	Loam	0.22	<0.02
S1405494-035	R9	23-35	40.0	39.0	21.0	Loam	1.56	0.11
S1405494-036	R9	35-46	38.0	41.0	21.0	Loam	2.44	0.37

TFN 6 2/025
RECD NOV 14, 2014

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

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Inter-Mountain Labs

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 6/18/2014

CLIENT: RAMACO
Project: Brook Mine Topsoil
Lab Order: S1406011

CASE NARRATIVE

Report ID: S1406011001

Samples R10, R11, R12, R13, R14, R15, and R16 were received on May 30, 2014.

Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, December 1994
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as ...dicated in this case narrative.

TFN 6 2/025
RECD NOV 14, 2014

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Scanned: 02/27/2015

May 30, 2014

RAMACO, BROOK MINE, SHERIDAN WYO.

LIST of Soil Samples: 2nd Set
same parameters as 1st Set

R10	R11	R12	R13
0-4"	0-4"	0-4"	0-4"
4-10	4-8	4-13	4-8
10-18	8-14	13-24	8-15
18-32		24-40	
32-48		40-57	
48-72		57-72	

R14	R15	R16
0-4"	0-3"	0-4"
4-12	3-8	4-12
12-24	8-13	12-18
24-42		
42-55		

TFN 6 2/025
RECD NOV 14, 2014

5-30-14

Delivered by Jim Nyenhuis
Rec'd 5/30/14 Kara Bea

S1406011

Scanned, 02/27/2020

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph. (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Brook Mine

Addendum D7-2-10

Soil Analysis Report

RAMACO
250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406011001
Date Reported: 6/18/2014
Work Order: S1406011

Project: Brook Mine Topsoil
Date Received: 5/30/2014

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1406011-001	R10	0-4	6.2	51.4	0.36	3.3	1.62	1.11	0.09	0.08
S1406011-002	R10	4-10	6.8	55.1	0.15	1.3	0.77	0.39	0.28	0.37
S1406011-003	R10	10-18	7.8	55.3	0.33	0.6	1.21	0.93	0.30	0.29
S1406011-004	R10	18-32	8.2	46.5	1.25	0.2	2.65	4.91	4.35	2.24
S1406011-005	R10	32-48	8.0	38.4	6.19	<0.1	19.7	46.9	22.9	3.97
S1406011-006	R10	48-72	8.0	39.6	6.81	0.1	17.4	56.2	27.8	4.58
S1406011-007	R11	0-4	6.1	59.3	0.27	4.8	1.11	1.08	0.53	0.50
S1406011-008	R11	4-8	6.3	51.5	0.12	2.3	0.58	0.33	0.24	0.35
S1406011-009	R11	8-14	6.6	57.1	0.19	2.4	0.73	0.40	0.11	0.15
S1406011-010	R12	0-4	6.6	53.5	0.18	2.6	0.68	0.41	0.07	0.10
S1406011-011	R12	4-13	7.8	56.0	0.20	1.5	1.08	0.43	0.07	0.08
S1406011-012	R12	13-24	8.1	50.9	0.23	1.1	0.96	0.70	0.14	0.16
S1406011-013	R12	24-40	8.4	40.7	0.23	0.6	0.50	0.83	0.83	1.02
S1406011-014	R12	40-57	8.2	46.6	0.57	0.4	0.52	0.73	4.05	5.12
S1406011-015	R12	57-72	8.0	51.5	1.88	0.2	3.50	4.26	10.3	5.25
S1406011-016	R13	0-4	6.4	47.1	0.51	4.2	0.48	0.60	3.11	4.23
S1406011-017	R13	4-8	7.6	71.2	1.23	1.7	0.84	1.59	8.06	7.31
S1406011-018	R13	8-15	8.2	71.3	12.8	1.3	20.1	62.6	111	17.3
S1406011-019	R14	0-4	6.9	40.5	0.49	1.9	2.17	1.29	0.28	0.21
S1406011-020	R14	4-12	6.7	37.1	0.17	0.6	0.53	0.44	0.14	0.21

TFN 6 2/025
RECD NOV 14, 2014

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

DEQ Ex. 4-090

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1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

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October 2014

RAMACO

Brook Mine

Addendum D7-2-11

Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406011001

Project: Brook Mine Topsoil

Date Received: 5/30/2014

Date Reported: 6/18/2014

Work Order: S1406011

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm
S1406011-001	R10	0-4	40.0	42.0	18.0	Loam	0.42	<0.02
S1406011-002	R10	4-10	34.0	38.0	28.0	Clay Loam	0.43	<0.02
S1406011-003	R10	10-18	26.0	44.0	30.0	Clay Loam	0.50	<0.02
S1406011-004	R10	18-32	42.0	34.0	24.0	Loam	0.61	<0.02
S1406011-005	R10	32-48	68.0	21.0	11.0	Sandy Loam	0.74	0.08
S1406011-006	R10	48-72	56.0	27.0	17.0	Sandy Loam	0.94	0.21
S1406011-007	R11	0-4	48.0	34.0	18.0	Loam	0.26	<0.02
S1406011-008	R11	4-8	38.0	38.0	24.0	Loam	0.34	<0.02
S1406011-009	R11	8-14	36.0	35.0	29.0	Clay Loam	0.28	<0.02
S1406011-010	R12	0-4	36.0	42.0	22.0	Loam	0.25	<0.02
S1406011-011	R12	4-13	38.0	36.0	26.0	Loam	0.32	<0.02
S1406011-012	R12	13-24	36.0	42.0	22.0	Loam	0.29	<0.02
S1406011-013	R12	24-40	40.0	44.0	16.0	Loam	0.27	<0.02
S1406011-014	R12	40-57	28.0	48.0	24.0	Loam	1.43	<0.02
S1406011-015	R12	57-72	28.0	50.0	22.0	Silty Loam	1.67	0.11
S1406011-016	R13	0-4	34.0	48.0	18.0	Loam	0.44	<0.02
S1406011-017	R13	4-8	26.0	34.0	40.0	Clay	1.37	0.02
S1406011-018	R13	8-15	44.0	44.0	12.0	Loam	1.81	0.09
S1406011-019	R14	0-4	64.0	24.0	12.0	Sandy Loam	0.20	<0.02
S1406011-020	R14	4-12	64.0	18.0	18.0	Sandy Loam	0.17	<0.02

TFN 6 2/025
RECD NOV 14, 2014

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

DEQ Ex. 4-091

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October 2014

RAMACO

Soil Analysis Report

RAMACO
250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406011001
Date Reported: 6/18/2014
Work Order: S1406011

Project: Brook Mine Topsoil
Date Received: 5/30/2014

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1406011-021	R14	12-24	8.2	41.9	0.26	0.2	1.01	1.05	0.21	0.20
S1406011-022	R14	24-42	8.4	32.0	0.73	0.8	1.35	4.65	1.31	0.75
S1406011-023	R14	42-55	8.0	40.9	5.56	0.9	7.59	77 7	11.8	1.81
S1406011-024	R15	0-3	7.1	54.9	0.30	6.1	1.27	0.99	0.18	0.17
S1406011-025	R15	3-8	7.3	51.0	0.14	2.6	0.58	0.71	0.29	0.37
S1406011-026	R15	8-13	5.9	86.6	0.18	6.5	1.31	1.11	0.33	0.30
S1406011-027	R16	0-4	6.5	50.9	0.25	3.1	0.84	0.61	0.25	0.29
S1406011-028	R16	4-12	6.9	41.4	0.16	1.2	0.66	0.37	0.08	0.12
S1406011-029	R16	12-18	8.0	39.1	0.24	0.8	1.07	0.72	0.30	0.31

TFN 6 2/025
RECD NOV 14, 2014

Addendum D7-2-12

Brook Mine

These results apply only to the samples tested.
Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by Karen A Secor
Karen Secor, Soil Lab Supervisor

Scanned, 02/27/2020

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph. (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406011001

Project: Brook Mine Topsoil
Date Received: 5/30/2014

Date Reported: 6/18/2014
Work Order: S1406011

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm
S1406011-021	R14	12-24	62.0	12.0	26.0	Sandy Clay Loam	0.17	<0.02
S1406011-022	R14	24-42	64.0	16.0	20.0	Sandy Clay Loam	0.22	<0.02
S1406011-023	R14	42-55	34.0	40.0	26.0	Loam	0.85	0.18
S1406011-024	R15	0-3	30.0	42.0	28.0	Clay Loam	0.44	<0.02
S1406011-025	R15	3-8	8.0	36.0	56.0	Silty Clay	0.39	<0.02
S1406011-026	R15	8-13	76.0	<0.1	49.0	Sandy Clay	0.49	<0.02
S1406011-027	R16	0-4	54.0	31.0	15.0	Sandy Loam	0.30	<0.02
S1406011-028	R16	4-12	52.0	30.0	18.0	Sandy Loam	0.27	<0.02
S1406011-029	R16	12-18	60.0	22.0	18.0	Sandy Loam	0.21	<0.02

TFN 6 2/025
RECD NOV 14, 2014

Addendum D7-2-13

Brook Mine

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

DEQ Ex. 4-093

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From: Karen Secor <ksecor@imlinc.com>
To: 'Jim Nyenhuis' <jameshnyenhuis@aol.com>
Subject: EC/SAR Rerun for Ramaco
Date: Thu, Jul 3, 2014 2:21 pm

Jim,

I re-analyzed sample R13 (8-15") for EC and SAR and obtained similar results. They are summarized below:

	Ca	Mg	Na	SAR
initial:	20.1	62.6	111	17.3
rerun:	20.5	74.6	150	21.8

Please call or email with any questions. Thanks,

Karen Secor

Soil Lab Manager

Inter-Mountain Labs

Phone 307-672-8945

Fax 307-672-6053

Email: ksecor@imlinc.com

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TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

From: Karen Secor <ksecor@imlinc.com>
To: 'Jim Nyenhuis' <jameshnyenhuis@aol.com>
Subject: FW: EC/SAR Rerun for Ramaco
Date: Thu, Jul 3, 2014 2:59 pm

Karen Secor

Soil Lab Manager

Inter-Mountain Labs

Phone 307-672-8945

Fax 307-672-6053

Email:

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From: Karen Secor [ ]
Sent: Thursday, July 03, 2014 2:22 PM
To: 'Jim Nyenhuis'
Subject: EC/SAR Rerun for Ramaco

Jim,

I re-analyzed sample R13 (8-15") for EC and SAR and obtained similar results. They are summarized below:

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Inter-Mountain Labs

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 6/18/2014

CLIENT: RAMACO
Project: Brook Mine Topsoil
Lab Order: S1406012

CASE NARRATIVE

Report ID: S1406012001

Samples R17, R18, R19, and R20 were received on June 2, 2014.

Samples were analyzed using the methods outlined in the following references.

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, December 1994
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

TFN 6 2/025
RECD NOV 14,2014

Reviewed by: Karen A Secor

Karen Secor, Soil Lab Supervisor

Scanned, 02/27/2020

5-31-14

RAMACO BROOK MINE
LIST OF SOIL SAMPLES 3rd Set (19 Samples)
Sampled by JIM NYENHUIS
970-204-9167

R17	R18	R19	R20
0-4"	0-3"	0-4"	0-5"
4-12	3-8	4-10	5-14
12-23	8-18	10-22	14-26
23-34		22-36	26-42
34-42		36-48	42-58
			58-72

Same paramaters as Sets 1 & 2

Delivered by Jim Nyenhuis 5-31-2014 3pm.

Rec'd 6/2/14 Kara Sleeper
S1406012

TFN 6 2/025
RECD NOV 14, 2014

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1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

October 2014

RAMACO

Brook Mine

Addendum D7-2-18

Soil Analysis Report

RAMACO
250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406012001
Date Reported: 6/18/2014
Work Order: S1406012

Project: Brook Mine Topsoil
Date Received: 6/2/2014

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1406012-001	R17	0-4	7.8	72.4	0.24	5.3	1.12	0.47	0.10	0.11
S1406012-002	R17	4-12	7.7	67.6	0.27	2.1	1.43	0.55	0.11	0.11
S1406012-003	R17	12-23	8.1	61.7	0.35	2.0	1.59	0.99	0.32	0.28
S1406012-004	R17	23-34	8.3	46.1	0.51	0.7	1.79	1.95	0.48	0.35
S1406012-005	R17	34-42	7.9	45.3	3.00	<0.1	25.8	15.6	1.86	0.41
S1406012-006	R18	0-3	6.6	69.8	0.37	5.0	2.33	0.92	0.34	0.27
S1406012-007	R18	3-8	6.8	70.3	0.24	3.1	1.49	0.63	0.32	0.31
S1406012-008	R18	8-18	7.6	63.5	0.26	0.6	1.76	0.62	0.36	0.33
S1406012-009	R19	0-4	6.5	50.1	0.25	3.7	1.29	0.99	0.39	0.37
S1406012-010	R19	4-10	7.7	48.7	0.30	1.5	0.86	1.03	0.51	0.52
S1406012-011	R19	10-22	8.3	47.5	0.33	1.6	0.89	1.03	1.39	1.42
S1406012-012	R19	22-36	8.1	61.6	6.31	0.6	15.0	60.7	25.1	4.09
S1406012-013	R19	36-48	8.0	53.9	7.50	<0.1	14.3	78.4	37.8	5.55
S1406012-014	R20	0-5	6.6	77.7	0.36	6.3	1.56	1.76	0.63	0.49
S1406012-015	R20	5-14	7.2	55.9	0.18	2.6	0.83	0.54	0.30	0.36
S1406012-016	R20	14-26	8.1	55.7	0.28	1.9	1.65	0.84	0.44	0.39
S1406012-017	R20	26-42	7.7	48.6	1.91	1.7	12.8	9.95	2.38	0.71
S1406012-018	R20	42-58	7.9	49.0	3.28	1.7	18.3	21.4	7.17	1.61
S1406012-019	R20	58-72	8.2	49.5	0.57	1.5	2.07	2.28	1.50	1.02

TFN 6 2/025
RECD NOV 14, 2014

These results apply only to the samples tested.
Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

DEQ Ex. 4-098

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Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

RAMACO

October 2014

Soil Analysis Report

RAMACO
250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1406012001
Date Reported: 6/18/2014
Work Order: S1406012

Project: Brook Mine Topsoil
Date Received: 6/2/2014

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Selenium ppm
S1406012-001	R17	0-4	40.0	41.0	19.0	Loam	0.26	<0.02
S1406012-002	R17	4-12	36.0	33.0	31.0	Clay Loam	0.23	<0.02
S1406012-003	R17	12-23	36.0	40.0	24.0	Loam	0.71	<0.02
S1406012-004	R17	23-34	62.0	28.0	10.0	Sandy Loam	0.53	<0.02
S1406012-005	R17	34-42	68.0	22.0	10.0	Sandy Loam	0.78	<0.02
S1406012-006	R18	0-3	46.0	36.0	18.0	Loam	0.49	<0.02
S1406012-007	R18	3-8	38.0	40.0	22.0	Loam	0.70	<0.02
S1406012-008	R18	8-18	38.0	40.0	22.0	Loam	0.57	<0.02
S1406012-009	R19	0-4	50.0	34.0	16.0	Loam	0.23	<0.02
S1406012-010	R19	4-10	38.0	30.0	32.0	Clay Loam	0.26	<0.02
S1406012-011	R19	10-22	18.0	46.0	36.0	Silty Clay Loam	0.61	<0.02
S1406012-012	R19	22-36	8.0	55.0	37.0	Silty Clay Loam	1.96	0.41
S1406012-013	R19	36-48	16.0	52.0	32.0	Silty Clay Loam	1.23	0.37
S1406012-014	R20	0-5	34.0	47.0	19.0	Loam	0.56	<0.02
S1406012-015	R20	5-14	36.0	44.0	20.0	Loam	0.50	<0.02
S1406012-016	R20	14-26	44.0	34.0	22.0	Loam	0.48	<0.02
S1406012-017	R20	26-42	36.0	39.0	25.0	Loam	0.56	<0.02
S1406012-018	R20	42-58	34.0	44.0	22.0	Loam	0.65	0.10
S1406012-019	R20	58-72	50.0	30.0	20.0	Loam	0.60	<0.02

TFN 6 2/025
RECD NOV 14, 2014

Addendum D7-2-19

These results apply only to the samples tested.
Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Brook Mine

DEQ Ex. 4-099

Scanned, 02/27/2020

RAMACO
Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 7/25/2014

CLIENT: RAMACO
Project: Brook Mine Topsoil
Lab Order: S1407102

CASE NARRATIVE

Report ID: S1407102001

Samples R21, R22, R23, R24, R25, R26, and R27 were received on July 3, 2014.

Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600/2-78-054 "Field and Laboratory Methods Applicable to Overburden and Mining Soils", 1978
American Society of Agronomy, Number 9, Part 2, 1982
USDA Handbook 60 "Diagnosis and Improvement of Saline and Alkali Soils", 1969
Wyoming Department of Environmental Quality, Land Quality Division, Guideline No. 1, 1984
New Mexico Overburden and Soils Inventory and Handling Guideline, March 1987
State of Utah, Division of Oil, Gas, and Mining: Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining, April 1988
Montana Department of State Lands, Reclamation Division: Soil, Overburden, and Regraded Spoil Guidelines, December 1994
State of Nevada Modified Sobek Procedure
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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RAMACO, BROOK MINE, SHERIDAN WYO.

LIST OF SOIL SAMPLES: 29 total Samples

Sampled by JAMES NYENHUIS, CPSS

Parameters: pH, EC, Sat %, OM, SAR, TEXTURE (hydrometer)
Boron & Selenium (hot water)
Coarse frags done in the field – don't do in the lab.
Keep remainder of sample material

R21	R22	R23	R24
0-3"	0-4"	0-4"	0-3"
3-10	4-14	4-15	3-10
	14-26	15-26	10-18
		26-42	

R25		R26	R27
0-5"	Add N-P-K per Jim Nyenhuis phone call 7/3/14 KS	0-4"	0-3"
5-14		4-16	3-9
14-27		16-28	9-18
27-40		28-40	
40-52		40-52	
52-62		52-62	
62-72		62-72	

S1407102

Recd by Kara Leco 7/3/14

Delivered by Jim Nyenhuis 7-3-14

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Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1407102001

Project: Brook Mine Topsoil
Date Received: 7/3/2014

Date Reported: 7/25/2014
Work Order: S1407102

Lab ID	Sample ID	Depths Inches	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Sodium meq/L	SAR
S1407102-001	R21	0-3	7.8	47.7	0.47	2.9	2.49	0.41	0.27	0.22
S1407102-002	R21	3-10	7.8	55.9	0.32	2.9	2.34	0.36	0.15	0.13
S1407102-003	R22	0-4	7.8	62.0	0.40	3.5	2.76	0.46	0.43	0.34
S1407102-004	R22	4-14	7.8	59.6	0.40	3.0	2.43	0.53	0.44	0.36
S1407102-005	R22	14-26	7.8	59.0	0.44	2.9	2.68	0.85	0.34	0.26
S1407102-006	R23	0-4	7.4	70.9	0.51	6.4	2.24	1.16	0.38	0.29
S1407102-007	R23	4-15	7.7	48.4	0.57	2.9	2.18	1.23	0.37	0.28
S1407102-008	R23	15-26	7.8	45.3	1.06	2.4	3.95	4.14	1.70	0.85
S1407102-009	R23	26-42	7.7	45.0	2.02	2.2	9.52	10.1	2.66	0.85
2-010	R24	0-3	6.2	56.2	0.26	3.3	0.37	0.47	0.82	1.27
2-011	R24	3-10	6.4	53.9	0.24	2.1	0.55	2.50	1.59	1.29
S1407102-012	R24	10-18	7.6	52.4	4.29	1.6	5.10	18.3	25.2	7.37
S1407102-013	R25	0-5	6.8	78.1	0.65	6.4	3.39	2.30	0.79	0.47
S1407102-014	R25	5-14	6.7	62.5	0.27	5.0	1.11	0.83	0.56	0.57
S1407102-015	R25	14-27	6.9	62.9	0.65	3.8	3.42	2.36	0.74	0.43
S1407102-016	R25	27-40	7.5	61.2	0.56	3.2	2.57	1.78	0.71	0.48
S1407102-017	R25	40-52	7.4	50.3	0.92	3.3	4.96	3.25	1.01	0.50
S1407102-018	R25	52-62	7.5	52.0	0.58	2.6	3.39	2.39	1.01	0.59
S1407102-019	R25	62-72	7.4	50.4	0.78	1.8	4.32	2.99	0.94	0.49
S1407102-020	R26	0-4	6.9	77.0	0.70	5.6	3.76	2.55	0.79	0.45

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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Soil Analysis Report

RAMACO

250 West Main Street, Suite 210
Lexington, KY 40507

Report ID: S1407102001

Project: Brook Mine Topsoil
Date Received: 7/3/2014

Date Reported: 7/25/2014
Work Order: S1407102

Lab ID	Sample ID	Depths	Sand	Silt	Clay	Texture	Boron	Nitrate(as N)	Available Phosphorus	Available Potassium	Selenium
		inches	%	%	%		ppm	ppm	ppm	ppm	ppm
S1407102-001	R21	0-3	52.0	35.0	13.0	Sandy Loam	0.29				<0.02
S1407102-002	R21	3-10	46.0	39.0	15.0	Loam	0.33				<0.02
S1407102-003	R22	0-4	40.0	45.0	15.0	Loam	0.29				<0.02
S1407102-004	R22	4-14	36.0	44.0	20.0	Loam	0.22				<0.02
S1407102-005	R22	14-26	36.0	43.0	21.0	Loam	0.28				<0.02
S1407102-006	R23	0-4	42.0	44.0	14.0	Loam	0.63				<0.02
S1407102-007	R23	4-15	46.0	37.0	17.0	Loam	0.61				<0.02
S1407102-008	R23	15-26	52.0	30.0	18.0	Sandy Loam	0.57				<0.02
S1407102-009	R23	26-42	52.0	29.0	19.0	Sandy Loam	0.56				<0.02
02-010	R24	0-3	24.0	53.0	23.0	Silty Loam	0.30				<0.02
2 011	R24	3-10	22.0	48.0	30.0	Clay Loam	0.31				<0.02
S1407102-012	R24	10-18	20.0	41.0	39.0	Clay Loam	0.44				<0.02
S1407102-013	R25	0-5	18.0	47.0	35.0	Silty Clay Loam	0.38	3.4	25.2	167	<0.02
S1407102-014	R25	5-14	16.0	47.0	37.0	Silty Clay Loam	0.28	4.7	13.6	148	<0.02
S1407102-015	R25	14-27	14.0	45.0	41.0	Silty Clay	0.48	4.2	11.4	157	<0.02
S1407102-016	R25	27-40	14.0	43.0	43.0	Silty Clay	0.42	1.1	9.2	161	<0.02
S1407102-017	R25	40-52	26.0	43.0	31.0	Clay Loam	0.25				<0.02
S1407102-018	R25	52-62	14.0	46.0	40.0	Silty Clay	0.28				<0.02
S1407102-019	R25	62-72	24.0	39.0	37.0	Clay Loam	0.49				<0.02
S1407102-020	R26	0-4	34.0	41.0	25.0	Loam	0.38	2.6	46.6	193	<0.02

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot. = Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Date Received: 7/3/2014

Date Reported: 7/25/2014
Work Order: S1407102

Lab ID	Sample ID	Depths	pH	Saturation	Electrical Conductivity	Organic Matter	PE Calcium	PE Magnesium	PE Sodium	SAR
		Inches	s.u.	%	dS/m	%	meq/L	meq/L	meq/L	
S1407102-021	R26	4-16	7.2	62.2	0.45	4.6	2.61	1.50	0.52	0.36
S1407102-022	R26	16-28	7.8	46.0	0.34	1.4	1.52	0.90	0.56	0.51
S1407102-023	R26	28-40	7.7	61.7	0.33	1.6	1.57	0.94	0.41	0.37
S1407102-024	R26	40-52	7.6	42.5	0.44	1.1	1.77	1.13	0.70	0.58
S1407102-025	R26	52-62	7.8	40.1	0.29	1.3	1.57	1.96	0.44	0.33
S1407102-026	R26	62-72	7.8	45.1	0.53	0.8	2.55	1.49	0.54	0.38
S1407102-027	R27	0-3	6.3	33.1	0.18	1.3	0.41	0.72	0.33	0.44
S1407102-028	R27	3-9	7.8	44.0	0.33	1.1	1.14	2.20	0.46	0.36
S1407102-029	R27	9-18	7.9	50.2	3.70	0.7	23.3	31.7	3.24	0.62

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Report ID: S1407102001

Project: Brook Mine Topsoil
Date Received: 7/3/2014

Date Reported: 7/25/2014
Work Order: S1407102

Lab ID	Sample ID	Depths Inches	Sand %	Silt %	Clay %	Texture	Boron ppm	Nitrate(as N) ppm	Available Phosphorus ppm	Available Potassium ppm	Selenium ppm
S1407102-021	R26	4-16	36.0	41.0	23.0	Loam	0.19	4.6	16.4	92	<0.02
S1407102-022	R26	16-28	42.0	37.0	21.0	Loam	0.15	1.3	6.4	65	<0.02
S1407102-023	R26	28-40	23.0	52.0	25.0	Silty Loam	0.16	0.9	6.1	70	<0.02
S1407102-024	R26	40-52	28.0	42.0	30.0	Clay Loam	0.24				<0.02
S1407102-025	R26	52-62	32.0	42.0	26.0	Loam	0.22				<0.02
S1407102-026	R26	62-72	30.0	45.0	25.0	Loam	0.17				<0.02
S1407102-027	R27	0-3	32.0	46.0	22.0	Loam	0.20				<0.02
S1407102-028	R27	3-9	16.0	47.0	37.0	Silty Clay Loam	0.25				<0.02
S1407102-029	R27	9-18	14.0	52.0	34.0	Silty Clay Loam	0.84				<0.02

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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Exhibit D8.2-1 Vegetation Summary

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Addendum D8-1 Baseline Vegetation Assessment

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VEGETATION INVENTORY

Appendix D8

Prepared by:
WWC Engineering

July 2015

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D8 VEGETATION INVENTORY

A vegetation assessment of RAMACO's Brook Mine was conducted by BKS Environmental Associates, Inc. (BKS) of Gillette, Wyoming in 2013. The vegetation assessment by BKS is reported in Addendum D8-1 (Baseline Vegetation Assessment).

D8.1 Survey Methodology

D8.1.1 General

All sampling procedures were designed according to the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) Rules and Regulations for Coal Permitting, Chapter 2 (WDEQ/LQD, 2012), and multiple consultations with the WDEQ/LQD. Baseline vegetation assessment sampling methodology derived by BKS was approved by WDEQ/LQD prior to fieldwork. All sampling procedures outlined in the approved WDEQ baseline vegetation sampling methodology were executed as approved.

D8.1.2 Vegetation Community Mapping

Vegetation communities were mapped using 2011 U.S. Department of Agriculture National Agricultural Imagery Program (NAIP) True Color aerial imagery, and were later verified through field surveys. All areas within a ½-mile buffer boundary were mapped, but field verification of the vegetation communities within the ½-mile buffer was not necessary, and vegetation sampling was not conducted within the buffer.

D8.1.3 Selection of Sample Point Locations

A computerized systematic grid (through ArcGIS) was used to randomly locate the maximum number of sample points within each vegetation community occurring within the Brook Mine Study Area as defined in Addendum D8-1. These computer generated random locations were uploaded to a hand-held Global Positioning System (GPS) for location in the field. Samples were taken in numerical order until the minimum sample size was

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attained, and then until either sample adequacy was met or the required maximum number of samples had been collected. The Rabbitbrush Shrubland (less than two acres in size) and disturbed areas were excluded from quantitative vegetation sampling.

D8.1.4 Cover Sampling of Vegetation Communities

Line-transect point-intercept methods were used to collect percent absolute cover data within the vegetation communities. Percent cover measurements were taken from point-intercepts at 1-meter intervals along a 50-meter cover transect using a laser point device at each sample location. Each 50-meter cover transect began at its specified random origin point and extended in a random compass direction. Transects that exceeded the boundaries of the vegetation community being sampled were redirected back into its vegetation community at a 90-degree angle from the original transect direction at the point of intercept. In instances where a 90-degree angle of reflection did not place the transect within the sampled vegetation community, a 45-degree angle of reflection was used.

Each 50-meter cover transect represented a single sample point within the given vegetation community. Each point-intercept represented 2% of the cover measurement. Percent cover measurements recorded "first-hit" point-intercepts by live foliar vegetation species, litter, rock, or bare ground. "Second-hits" on vegetation were recorded, but used only for the purpose of constructing a plant species list for each vegetation community.

Percent vegetation cover is the vertical projection of the general outline of plants to the ground surface. All "first-hit" point-intercepts of living vegetation and growth, produced during the current growing season, were counted toward total vegetation cover. Lichen and moss were not included in total vegetation cover. Total vegetation cover data was summarized by computing absolute (mean) cover, relative cover (% of total vegetation cover), frequency, and relative frequency (% of total plot occurrences for each plant species).

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Total ground cover equals the sum of cover values for percent vegetation, percent litter, and percent rock. Litter included all non-living organic material that was recognizable. Rock fragments were recorded when equal to or greater than two centimeters in size (i.e., sheet flow, minimum non-erodible particle size). Total ground cover measurements were expressed in absolute percentages for each sample point.

D8.1.5 Shrub and Tree Density

Shrub density data was collected in conjunction with the randomly selected cover sampling, wherever possible. Shrub density sampling was accomplished by counting each individual full, half-, and sub-shrub species within a 1-meter wide belt transect centered over the 50-meter cover transect, yielding a 100-m^2 belt transect. Shrub density belt transects were sampled until either sample adequacy was achieved or the maximum number of samples were reached for a given vegetation community. General approximations of shrub heights were recorded; however, shrub height measurements were not summarized for purposes of this report.

Tree counts were conducted using 2011 NAIP True Color aerial imagery. Trees counts were only conducted within vegetation communities which had trees present.

D8.1.6 Species Diversity and Composition

Species diversity was assessed by recording all plant species observed within the same 100-m^2 belt transect used for determining shrub density. These observations provide a measurement of the total species diversity for each vegetation community.

D8.1.7 Sample Adequacy

Sample adequacy for absolute total vegetation ground cover was tested for each of the sampled vegetation communities using the formula and confidence levels outlined in Addendum D8-1 Section D8-1.2.9.

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D8.1.8 Extended Reference Area

For the purposes of this permit, Extended Reference Area (EXREFA) is a native land unit that will be used to evaluate revegetation success for each of the same native vegetation communities affected by the proposed activities. The EXREFA is all of the unaffected area for each native vegetation community.

D8.1.9 Cropland and Pastureland Productivity

No prime cropland or pastureland lands of state-wide importance are within the Brook Mine Permit Area.

D8.2 Vegetation Survey Results

Table D8.2-1 presents the vegetation unit mapping acreages for the Brook Mine. Exhibit D8.2-1 provides the vegetation polygons on a photo base for the Brook Mine. Addendum D8-1 gives the detailed report by BKS of the vegetation assessment for the Brook Mine.

D8.3 References

Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD). (2012, December). *Chapter 2: Permit Application Requirements*. Retrieved 2014, from http://soswy.state.wy.us/Rules/RULES/8881.pdf

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Table D8.2-1. Vegetation Survey Summary

Vegetation Community	Brook Mine Permit Area	
	Acres	% of Area
Agricultural Land	4.5	0.1
Big Sagebrush Shrubland	913.7	20.1
Bottomland Sagebrush Grassland	50.6	1.1
Pine and Juniper Woodland	67.7	1.5
Prairie Dog Modified Grassland	436.7	9.6
Rabbitbrush Shrubland	1.3	<0.1
Reclaimed Grassland	596.7	13.1
Riparian Woodland	57.2	1.3
Rough Breaks Mixed Shrubland	576.0	12.7
Scoria Grassland	726.0	16.0
Upland Grassland	995.9	21.9
Disturbance	109.7	2.4
Water	12.8	0.3
Total	**4,548.8**	**100.1**

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TWN57N, RNG85W TWN57N, RNG84W

TWN57N, RNG85W TWN57N, RNG84W

Coordinate System: NAD 1983 UTM Zone 13N FEET, 2012 NAIP True Color imagery
Scale: 1 in = 1,000 ft

0 1,500 3,000 6,000 Feet

0 0.25 0.5 1 Kilometers

Legend

- Cover, Density Sample Location
- Cover, Density, Production Sample Location
- Density Sample Location
- Production Sample Location
- Density, Production Sample Location
- Sheridan County Declared Weed Location
- Wyoming Designated Weed Location
- Vegetation Communities
- Disturbed Land
- Permit Boundary
- Study Area
- Half-Mile Buffer
- Section Boundary
- Township/Range Boundary

Vegetation Communities

Map Symbol	Name
AG	Agricultural Land
BSG	Bottomland Sagebrush Grassland
BSS	Big Sagebrush Shrubland
D	Disturbed
PDMG	Prairie Dog Modified Grassland
PJW	Pine and Juniper Woodland
RBMS	Rough Breaks Mixed Shrubland
RG	Reclaimed Grassland
RS	Rabbitbrush Shrubland
RW	Riparian Woodland
SG	Scorta Grassland
UG	Upland Grassland
W	Water

General Location Map

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
7/30/15	BKS/JB
1/22/14	BKS/JB
7/31/14	BKS/TS
10/28/14	BKS/JB
6/15	Round 1 Comments
12/15	Round 3 Comments

EXHIBIT D8.2-1

TFN 6 2/2025
RECD DEC 18, 2015

VEGETATION SUMMARY

Drawn By: BKS/TS
Checked By: BKS/GG
Date: 12/4/2015

FILE: EX_D8-2-1_VEG_SUMMARY

RJH Environmental Associates, Inc.

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ADDENDUM D8-1

Baseline Vegetation Assessment

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D8-1 BASELINE VEGETATION ASSESSMENT

D8-1.1 Introduction

RAMACO proposes to open-pit mine coal in north central Sheridan County, Wyoming, at the Brook Mine. The proposed Brook Mine is located approximately 15 miles northwest of Sheridan, Wyoming, between Ranchester and Acme, Wyoming.

At the time of 2013 quantitative baseline vegetation assessments, the proposed Brook Mine Permit Area encompassed approximately 5,994.7 acres. However, the Brook Mine Permit Area proposed by RAMACO for the Wyoming Mine Permit Application only includes approximately 4,548.8 acres of the 5,994.7 acre permit area (referenced within this report as the proposed Brook Mine Permit Area). As a result, the entire 5,994.7 acre permit area was evaluated during baseline vegetation assessments (referenced within this report as the Brook Mine Study Area). Attachment D8-1-G contains a map of the Brook Mine Study Area and proposed Brook Mine Permit Area evaluated during 2013 baseline vegetation assessments. Attachment D8-1-K contains the sampling plan as approved by WDEQ/LQD on August 28, 2013.

The Brook Mine Study Area is located in all or portions of:

- Sections 10, 11, 12, 13, 14, 15, 21, 22, 23, 24, 26, 27, and 28 T57N R85W
- Sections 7, 8, 9, 10, 15, 17, 18, 19, 20, and 22 T57N R84W

The proposed Brook Mine Permit Area is located in all or portions of:

- Sections 10, 11, 12, 13, 14, and 15 T57N R85W
- Sections 7, 8, 9, 10, 15, 17, 18, 19, 20, 21, 22, and 27 T57N R84W

This report presents baseline information on the vegetation communities occurring within the approximately 5,994.7 acre Brook Mine Study Area which includes the majority of the 4,548.8 acre proposed Brook Mine Permit Area.

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Portions of the proposed Brook Mine Permit Area not included in the Brook Mine Study Area were added during an October 2014 permit boundary change following completion of the baseline vegetation study.

D8-1.2 Methodology

All sampling procedures were designed according to the Wyoming Department of Environmental Quality – Land Quality Division (WDEQ) Rules and Regulations for Coal Permitting, Chapter 2 (December 2012) and multiple consultation with the WDEQ from April 2013 to May 2014. Baseline vegetation sampling methods for the Brook Mine Study Area were derived by BKS Environmental Associates, Inc. (BKS), of Gillette, Wyoming, in April 2013, prior to the on-site visit with WDEQ and was revised in May 2013, prior to grazing enclosure placement. A final revision was submitted in June 2013, prior to baseline vegetation sampling, due to an extension in the permit area from the time grazing enclosure placement occurred till quantitative baseline vegetation sampling occurred. WDEQ approved the baseline vegetation sampling methodologies and subsequent revisions derived by BKS in May, June, and July 2013.

All sampling procedures outlined in the approved WDEQ baseline vegetation sampling methodologies were executed as approved with the following exceptions:

- Maximum number of production plots sampled in the Riparian Woodland vegetation community was 48 vs 50,
- Maximum number of shrub density belt transects sampled in the Riparian Woodland was 46 vs 50, and
- Maximum number of shrub density belt transects sampled in the Rough Breaks Mixed Shrubland was 49 vs 50.

WDEQ was consulted immediately following completion of baseline vegetation field sampling to gain approval of the above exceptions to the approved baseline vegetation sampling methodology. In addition, the WDEQ

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was consulted to determining if additional shrub density or production sampling was required due to sample adequacy not being attained after maximum sample numbers were sampled for all other vegetation communities. WDEQ approved the exceptions to the approved baseline vegetation sampling methodology and determined additional sampling to acquire sample adequacy was not required.

D8-1.2.1 Timing of Baseline Vegetation Assessments

BKS conducted:

- Vegetation community mapping in April and June 2013,
- Grazing enclosure placement April 30-May 2, 2013,
- Blowout penstemon (*Penstemon haydenii*) surveys June 4, 2013,
- Baseline vegetation sampling July 1-12, 2013, and
- Ute ladies'-tresses (*Spiranthes diluvialis*) surveys July 31, 2013.

D8-1.2.2 Vegetation Community Mapping

Eleven vegetation communities were identified within the Brook Mine Study Area: Agricultural Land, Big Sagebrush Shrubland, Bottomland Sagebrush Grassland, Pine and Juniper Woodland, Prairie Dog Modified Grassland, Rabbitbrush Shrubland, Reclaimed Grassland, Riparian Woodland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland. Vegetation communities were mapped using 2011 National Agricultural Imagery Program (NAIP) True Color aerial imagery and verified through field surveys in April and June 2013. Extent and number of vegetation communities throughout the Brook Mine Study Area were agreed upon by WDEQ, RAMACO, and BKS personnel during the on-site visit in April 2013, and additional consultation with the WDEQ following an extension of the permit area in June 2013.

Disturbed areas within the Brook Mine Study Area were identified and mapped, based on the scale of the available mapping. All areas within a half-mile of the Brook Mine Study Area and proposed Brook Mine Permit Area were

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mapped based on review of 2011 NAIP True Color ortho aerial imagery image and known expressions of the aerial imagery within the Brook Mine Study Area. Field verification of the vegetation communities within the half-mile buffer was not necessary, and vegetation sampling was not conducted within the half-mile buffer.

D8-1.2.3 Selection of Sample Point Location

A computerized systematic grid (through ArcGIS) was used to randomly locate the maximum number of sample points, as outlined in the WDEQ approved baseline vegetation sampling methodology, within the 10 vegetation community which were quantitatively sampled within the Brook Mine Study Area, prior to grazing enclosure placement: Agricultural Lands (n=20); Bottomland Sagebrush Grassland (n=25); Pine and Juniper Woodland (n=15); Reclaimed Grassland (n=10); and Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Rough Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, and Upland Grassland (n=50).

Due to an extension in the permit area between grazing enclosure placement and quantitative vegetation sampling, additional sample point locations were generated, through the same manner described above, in all vegetation communities except the Pine and Juniper Woodland and Scoria Grassland to ensure cover, production, and shrub density sampling were conducted in all portions of these vegetation communities.

These computer generated random locations were uploaded to a hand-held Global Positioning System (GPS) unit for actual location in the field. Sample point locations were sampled in numerical order until the minimum sample size was attained and then, until either sample adequacy was met or the required maximum number of samples had been collected.

The Rabbitbrush Shrubland (less than two acres in size) and disturbed areas were excluded from quantitative vegetation sampling.

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D8-1.2.4 Sample Intensity

Where possible, cover, production, and shrub density sampling was conducted at the same sample point location. Therefore, a total of 457 locations were sampled within 10 vegetation communities within the Brook Mine Study Area (Table D8-1): Agricultural Lands and Bottomland Sagebrush Grassland (n=25); Big Sagebrush Shrubland (n=90); Pine and Juniper Woodland (n=15); Prairie Dog Modified Grassland (n=40); Reclaimed Grassland (n=10); Riparian Woodland (n=49); Rough Breaks Mixed Shrubland (n=69); Scoria Grassland (n=50); and Upland Grassland (n=84).

Of the 457 locations sampled within the Brook Mine Study Area, 358 locations occurred within the proposed Brook Mine Permit Area (Table D8-1): Big Sagebrush Shrubland (n=74); Bottomland Sagebrush Grassland (n=17); Prairie Dog Modified (n=34); Riparian Woodland (n=25); Rough Breaks Mixed Shrubland (n=53); Reclaimed Grassland (n=8); and Upland Grassland (n=81). All Pine and Juniper Woodland (n=15) and Scoria Grassland (n=50) sample locations occurred within both the Brook Mine Study and proposed Brook Mine Permit Areas. No Agricultural Land sample locations occurred within the Brook Mine Permit Area.

D8-1.2.5 Cover Sampling of Vegetation Communities

Line-transect point-intercept methods were used to collect percent absolute cover data within all vegetation communities (Table D8-1). Percent cover measurements were taken from point-intercepts at 1-meter intervals along a 50-meter cover transect using a laser point device at each sample location. Each 50-meter cover transect began at its specified random origin point and extended in a random compass direction. Transects that exceed the boundaries of the vegetation community being sampled were redirected back into its vegetation community at a 90 degree angle from the original transect direction at the point of intercept. In instances where a 90 degree angle of

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reflection did not place the transect within the sampled vegetation community, a 45 degree angle of reflection was used.

Each 50-meter cover transect represented a single sample point within the given vegetation community. Each point-intercept represented 2% of the cover measurement. Percent cover measurements recorded "first-hit" point-intercepts by live foliar vegetation species, litter, rock, or bare ground. "Second-hits" on vegetation were recorded, but used only for the purpose of constructing a plant species list for each vegetation community.

Percent vegetation cover is the vertical projection of the general outline of plants to the ground surface. All "first-hit" point-intercepts of living vegetation and growth, produced during the current growing season, were counted toward total vegetation cover. Lichen and moss were not included in total vegetation cover. Total vegetation cover data was summarized by computing absolute (mean) cover, relative cover (% of total vegetation cover), frequency, and relative frequency (% of total plot occurrences for each plant species).

Total ground cover equals the sum of cover values for percent vegetation, percent litter, percent cryptograms, and percent rock. Litter included all non-living organic material that was recognizable. Rock fragments were recorded when equal to or greater than 2-centimeters in size (i.e., sheet flow, minimum non-erodible particle size). Total ground cover measurements were expressed in absolute percentages for each sample point.

D8-1.2.6 Production Sampling of Vegetation Communities

Annual herbaceous production was quantitatively sampled within each vegetation community except (Table D8-1): Agricultural Land, Prairie Dog Modified Grassland, Pine and Juniper Woodland, and Reclaimed Grassland. Each production quadrat covered an area of 1-square meter. All 2013 aboveground biomass was clipped, as close to the ground as possible, and placed in paper bags. Major species (contributing greater than 2% relative

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cover) were collected and bagged by species. Minor species (contributing less than 2% relative cover) were collected by life form, and relative percent contribution was estimated by species. Species lacking creditable value (SLCV), full shrubs, succulents, *Yucca* species, cushion plants, mosses, lichens, and trees were not clipped. Although clipping annual forbs is not required, annual forbs were collected in the field.

Clipped biomass was dried in a forced air oven at 105° C for 24 hours and weighed on an electronic balance scale to the nearest 0.10 gram. Clipped samples contributing less than 0.10 gram of matter were considered trace samples and calculated at 0.03 grams of weight. The bag weight was calculated and subtracted from the sample weight to yield only the dry weight of the vegetative matter. The final results were reported in grams/m^2, pounds/acre, and relative production (% of total production).

All production quadrats, in the proposed Brook Mine Permit Area, were sampled within grazing enclosures. Each enclosure exceeded the quadrat size to accommodate the production quadrat and a buffer area. Permanent fences used to control livestock grazing were considered a type of grazing enclosure. Grazing enclosures were not utilized in the southern portion of the Brook Mine Study Area, due to cattle grazing occurring prior to the extension of the permit area. Although cattle grazing occurred within the southern portion of the Brook Mine Study Area prior to quantitative production sampling, regrowth between grazing and quantitative sampling negated the early season grazing effects on herbaceous production in the affected vegetation communities: Big Sagebrush Shrubland, Bottomland Sagebrush Grassland, Riparian Woodland, and Rough Breaks Mixed Shrubland.

Production within the Agricultural Land vegetation community was not quantitatively sampled, but an 11 year county-wide productivity mean (2003-2013) based on National Agriculture Statistics Service (NASS) yield data for Sheridan County, Wyoming, was calculated.

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D8-1.2.7 Shrub and Tree Density Sampling of Vegetation Communities

Shrub density was collected in conjunction with randomly selected cover transects, wherever possible. Shrub density sampling was accomplished by counting each individual full, half-, and sub-shrub species within a 1-meter wide belt transect centered over the 50-meter cover transect, yielding a 100-square meter belt transect. Shrub density belt transects were sampled until either sample adequacy was achieved or the maximum number of samples were reached for a given vegetation community. General approximations of shrub heights were recorded; however, shrub height measurements were not summarized for purposes of this report.

Tree counts were conducted using 2011 NAIP True Color aerial imagery. Trees counts were only conducted within vegetation communities which had trees present: Pine and Juniper Woodland, Rough Breaks Mixed Shrubland, and Riparian Woodland.

D8-1.2.8 Species Diversity and Composition

Species diversity was assessed by recording all plant species observed within the same 100-square meter belt transect used for shrub density. These observations provide a measurement of the total species diversity for each vegetation community. Species diversity data was reported as the average number of species per 100-square meter belt transect and total number of species within each vegetation community, based on the comprehensive list of sampled and observed plant species. Species diversity calculations did not include SLCV: halogeton (*Halogeton glomeratus*), Japanese brome (*Bromus japonicus*), cheatgrass (*Bromus tectorum*), summercypress (*Bassia sieversiana*), Russian thistle (*Salsola tragus*), State Designated Noxious Weeds, or Sheridan County Declared Weeds. The number of species diversity belt transects equaled the number of 50-meter cover transects within each vegetation community. Sample adequacy was not required for species diversity and composition.

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Based on the cover transect data, the total number of plant species and the total number of plant species with greater than 2% relative vegetation cover, by life form, was determined for each vegetation community.

A comprehensive plant species list of all plant species encountered during 2013 quantitative vegetation assessment was compiled. Plant species encountered during other on-site vegetation assessments conducted in April, May, June, July, and late October 2013, were also included in the comprehensive plant species list. Plant species were compiled by life form and vegetation community. Scientific nomenclature follows the Rocky Mountain Vascular Plants of Wyoming (Dorn 2001).

D8-1.2.9 Sample Adequacy

Sample adequacy for absolute total vegetation cover, total ground cover, production, and shrub density was evaluated for each of the sampled vegetation communities, using the following formula:

$$n_{min} = \frac{2(sz)^2}{(dx)^2}$$

Where n_{min} = the number of sample points needed in a given vegetation community

s = sample standard deviation
z = 1.28 for cover, shrub density, and grassland production, or
z = 0.84 for shrubland production
d = 0.1 for cover, shrub density, and grassland production, or
d = 0.2 for shrubland production
x = sample mean

Confidence levels were determined when sample adequacy was not attained.

D8-1.2.10 Extended Reference Area

For the purposes of this permit Extended Reference Area (EXREFA) means a native land unit which will be used to evaluate revegetation success

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for each of the same vegetation communities which were affected by the proposed activities. All Agricultural Land, Bottomland Sagebrush Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Pine and Juniper Woodland, Reclaimed Grassland, Riparian Woodland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland vegetation communities unaffected by the proposed activities within the proposed Brook Mine Permit Area will serve as the EXREFA. The EXREFA will remain unaffected over the course of the project and will be as large as practical, at least two acres, considering land ownership patterns and land management history.

D8-1.2.11 Cropland and Pastureland Productivity

Cropland and pastureland were identified within the Brook Mine Study Area. However, the Natural Resource Service, Web Soil Survey, indicates areas of prime farmland or pastureland only exist within the Brook Mine Study Area with the application of irrigation. Prime cropland or pastureland, if the application of irrigation is present, occur in Sections 13, 23, and 24 T57N R85W and Sections 18 and 19 T57N R84W. No prime cropland or pastureland of statewide importance were indicated as occurring within the proposed Brook Mine Permit Area (NRCS 2014).

D8-1.3 Results

Tables are located in Attachment D8-1-A. Refer to Attachment D8-1-B for the comprehensive plant species list. Refer to Attachment D8-1-C for the cover summaries, Attachment D8-1-D for production summaries, and Attachment D8-1-E for shrub density summaries. Refer to Attachment D8-1-F for photographs. Refer to Attachment D8-1-G for a map illustrating the vegetation communities, sample locations, and weeds present within the Brook Mine Study and proposed Brook Mine Permit Areas. Cover, production, and shrub density raw data are presented in Attachments D8-1-H, D8-1-I, and D8-1-J, respectively. Table D8-3 and the raw summaries in Attachments D8-1-H, D8-1-I, and D8-J provide mean data for the proposed

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Brook Mine Permit Area. The following results are based on 2013 baseline vegetation assessments for the Brook Mine Study Area.

D8-1.3.1 Vegetation Community Mapping

The Brook Mine Study Area was approximately 5,994.7 acres (Table D8-2). The following 11 vegetation communities were present at the following approximate acreages: Agricultural Land 409.9 acres (6.8%), Big Sagebrush Shrubland 1,185.8 acres (19.8%), Bottomland Sagebrush Grassland 132.5 acres (2.2%), Pine and Juniper Woodland 66.8 acres (1.1%), Prairie Dog Modified Grassland 597.6 acres (10.0%), Rabbitbrush Shrubland 0.7 acres (<0.1%), Reclaimed Grassland 713.5 acres (11.9%), Riparian Woodland 143.4 acres (2.4%), Rough Breaks Mixed Shrubland 794.9 acres (13.3%), Scoria Grassland 726.1 acres (12.1%), and Upland Grassland 1,025.8 acres (17.1%). Disturbed areas, defined as lands disturbed by human activities, encompassed approximately 181.1 acres (3.0%), and water covered approximately 16.6 acres (0.3%).

The proposed Brook Mine Permit Area was approximately 4,548.8 acres (Table D8-2). The following 11 vegetation communities were present at the following approximate acreages: Agricultural Land 4.5 acres (0.1%), Big Sagebrush Shrubland 913.7 acres (20.1%), Bottomland Sagebrush Grassland 50.6 acres (1.1%), Pine and Juniper Woodland 67.7 acres (1.5%), Prairie Dog Modified Grassland 436.7 acres (9.6%), Rabbitbrush Shrubland 1.3 acres (<0.1%), Reclaimed Grassland 596.7 acres (13.1%), Riparian Woodland 57.2 acres (1.3%), Rough Breaks Mixed Shrubland 576.0 acres (12.7%), Scoria Grassland 726.0 acres (16.0%), and Upland Grassland vegetation communities occupied approximately 995.9 acres (21.9%). Disturbed areas encompassed approximately 109.7 acres (2.4%), and water covered approximately 12.8 acres (0.3%). Note: Acreages for the Pine and Juniper Woodland, Rabbitbrush Shrubland, and Scoria Grassland were the same in both the Brook Mine and proposed Brook Mine Permit Area; however, percentages were different.

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D8-1.3.2 Agricultural Land

This vegetation community comprised 409.9 of the 5,994.7 acre (6.8%) Brook Mine Study Area and 4.5 of the 4,548.8 acre (0.1%) proposed Brook Mine Permit Area (Table D8-2). The Agricultural Land vegetation community was primarily located along the Tongue River in the southern portion of the Brook Mine Study and proposed Brook Mine Permit Areas. Alfalfa (*Medicago sativa*) and forage grasses were dominant in the multiple fields that comprised this vegetation community. Evidence of regular harvest and irrigation were observed within this vegetation community.

D8-1.3.2.1 Cover

Twenty-five, 50-meter cover transects were sampled within the Agricultural Land vegetation community (Table D8-1). Absolute total vegetation cover was 83.8%. Absolute total ground cover was 97.5% (Table D8-3). Absolute bare soil and litter/rock percentages were 2.5% and 13.7%, respectively. Cryptograms were not observed within this vegetation community (Table D8-5). Introduced biennial/perennial forbs were the dominant life form with 36.2% relative vegetation cover, followed by native cool season perennial grasses with 30.5% relative vegetation cover (Table D8-4). Alfalfa provided the highest relative vegetation cover at 32.7%, while slender wheatgrass (*Elymus trachycaulus*) provided the next highest relative vegetation cover at 18.6% (Table D8-5).

D8-1.3.2.2 Production

Production within the Agricultural Land vegetation community was not quantitatively sampled. The 11 year county-wide productivity mean (2003-2013), based on NASS yield data, was hay including alfalfa averaged 2.5 tons per acre and hay excluding alfalfa averaged 1.59 tons per acre within Sheridan County (NASS 2014).

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D8-1.3.2.3 Shrub and Tree Density

A few shrubs were observed along unmowed field edges. No trees were observed within the Agricultural Land vegetation community.

D8-1.3.2.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 43 plant species were sampled or observed within the Agricultural Land vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=25) was 8.7 (Attachment D8-1-H). Native cool season perennial grasses were the most common life form encountered with 10 plant species sampled or observed. Native perennial forbs were the second most common life form with eight plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: native cool season perennial grasses, introduced perennial grasses, and introduced biennial/perennial forbs (Table D8-8).

D8-1.3.3 Big Sagebrush Shrubland

This vegetation community comprised 1,185.8 of the 5,994.7 acre (19.8%) Brook Mine Study Area and 913.7 of the 4,548.8 acre (20.1%) proposed Brook Mine Permit Area (Table D8-2). The Big Sagebrush Shrubland vegetation community was characterized by greater than 20% big sagebrush (*Artemisia tridentata*) cover. This vegetation community was found on alluvial aprons, hills, ridges, and terraces. Topography of these sites captures snow during the winter months, creating persistent drifts resulting in different vegetation types than adjacent sites where snow blows free.

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D8-1.3.3.1 Cover

Twenty-three, 50-meter cover transects were sampled within the Big Sagebrush Shrubland vegetation community (Table D8-1). Absolute total vegetation cover was 57.8%. Absolute total ground cover was 88.3%

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(Table D8-3). Absolute bare soil and litter/rock percentages were 11.7% and 29.1%, respectively. Cryptograms provided 1.4% absolute cover (Table D8-5). Native full shrubs were the dominant life form with 44.1% relative vegetation cover, followed by native cool season perennial grasses with 23.7% relative vegetation cover (Table D8-4). Big sagebrush provided the highest relative vegetation cover at 42.2%, while western wheatgrass (*Elymus smithii*) provided the next highest relative vegetation cover at 6.4% (Table D8-5).

D8-1.3.3.2 Production

Fifty, 1-square meter quadrats were sampled within the Big Sagebrush Shrubland vegetation community (Table D8-1). Total production was 37.5 g/m^2 or 663.0 pounds/acre. Native cool season perennial grasses was the dominant life form and contributed 57.6% of the relative production at 21.6 g/m^2. Introduced annual grasses was the second most dominant life form and contributed 16.8% of the relative production at 6.3 g/m^2 (Table D8-6). Bluebunch wheatgrass (*Elymus spicatus*) was the dominant plant species and contributed 23.7% of the relative production at 8.9 g/m^2 (Attachment D8-1-D).

D8-1.3.3.3 Shrub and Tree Density

Fifty, 100-square meter belt transects were sampled within the Big Sagebrush Shrubland vegetation community (Table D8-1). Shrub density was 1.2 shrubs/m^2 or 4,926.0 shrubs/acre. Big sagebrush contributed 74.5% of the relative density at 0.9 shrubs/m^2 (Table D8-7). No trees were observed in the Big Sagebrush Shrubland vegetation community.

D8-1.3.3.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 77 plant species were sampled or observed within the Big Sagebrush Shrubland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=23) was 14.4 (Attachment D8-1-H). Native perennial forbs

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were the most common life form encountered with 32 plant species sampled or observed. Native cool season perennial grasses were the second most common life form with eight plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, introduced annual forbs, native perennial forbs, and native full shrubs (Table D8-8).

D8-1.3.4 Bottomland Sagebrush Grassland

This vegetation community comprised 132.5 of the 5,994.7 acre (2.2%) Brook Mine Study Area and 50.6 of the 4,548.8 acre (1.1%) proposed Brook Mine Permit Area (Table D8-2). The Bottomland Sagebrush Grassland was characterized by highly productive grasses and grasslike plant species. Sagebrush and other shrubs were, but composed less than 20% of the canopy cover. This vegetation community occurred primarily on the eastern and southern portions of the proposed Brook Mine Study Area on deeper, fine-textured soils in low-lying areas occurring in drainage floodplains primarily along Hidden Water Creek.

D8-1.3.4.1 Cover

Twenty-five, 50-meter cover transects were sampled within the Bottomland Sagebrush Grassland vegetation community (Table D8-1). Absolute total vegetation cover was 72.8%. Absolute total ground cover was 95.5% (Table D8-3). Absolute bare soil and litter/rock percentages were 4.5% and 22.7%, respectively. Cryptograms were not observed within this vegetation community (Table D8-5). Native cool season perennial grasses were the dominant life form with 31.7% relative vegetation cover, followed by native grasslikes and introduced perennial grasses with 15.0% relative vegetation cover, each (Table D8-4). Western wheatgrass provided the highest relative

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vegetation cover at 18.3%, while crested wheatgrass (*Agropyron cristatum*) provided the next highest relative vegetation cover at 9.9% (Table D8-5).

D8-1.3.4.2 Production

Twenty-five, 1-square meter quadrats were sampled within the Bottomland Sagebrush Grassland vegetation community (Table D8-1). Total production was 120.0 g/m^2 or 2,139.7 pounds/acre. Native cool season perennial grasses was the dominant life form and contributed 33.5% of the relative production at 40.2 g/m^2. Introduced perennial grasses was the second most dominant life form and contributed 24.0% of the relative production at 28.8 g/m^2 (Table D8-6). Western wheatgrass was the dominant plant species and contributed 28.3% of the relative production at 34.0 g/m^2 (Attachment D8-1-D).

D8-1.3.4.3 Shrub and Tree Density

Twenty-five, 100-square meter belt transects were sampled within the Bottomland Sagebrush Grassland vegetation community (Table D8-1). Shrub density was 0.5 shrubs/m^2 or 2,216.1 shrubs/acre. White sagebrush (*Artemisia ludoviciana*) contributed 57.3% of the relative density at 0.3 shrubs/m^2 (Table D8-7). No trees were observed within the Bottomland Sagebrush Grassland vegetation community.

D8-1.3.4.4 Species Diversity and Composition

Excluding SLCV, 13 life forms and 92 plant species were sampled or observed within the Bottomland Sagebrush Grassland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=25) was 12.5 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 14 plant species sampled or observed. Native cool season perennial grasses were the second most common life forms with 13 plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life

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forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, introduced perennial grasses, native grasslikes, introduced annual forbs (Table D8-8).

D8-1.3.5 Pine and Juniper Woodland

This vegetation community comprised 66.8 of the 5,994.7 acre (1.1%) Brook Mine Study Area and 4,548.8 acre (1.5%) proposed Brook Mine Permit Area (Table D8-2). The Pine and Juniper Woodland vegetation community was occurred in areas with diverse topography, generally on higher-elevation slopes. The presence of Rocky Mountain juniper (*Juniperus scopulorum*) and ponderosa pine (*Pinus ponderosa*) distinguish this vegetation community from the Rough Breaks Mixed Shrubland vegetation community.

D8-1.3.5.1 Cover

Fifteen, 50-meter cover transects were sampled within the Pine and Juniper Woodland vegetation community (Table D8-1). Absolute total vegetation cover was 43.6%. Absolute total ground cover was 89.0% (Table D8-3). Absolute bare soil and litter/rock percentages were 11.0% and 44.1%, respectively. Cryptograms provided 1.3% absolute cover (Table D8-5). Native cool season perennial grasses were the dominant life form with 46.3% relative vegetation cover, followed by native trees with 18.3% relative vegetation cover (Table D8-4). Bluebunch wheatgrass provided the highest relative vegetation cover at 32.8%, while cheatgrass provided the next highest relative vegetation cover at 13.1% (Table D8-5).

D8-1.3.5.2 Production

Production was not measured within the Pine and Juniper Woodland vegetation community.

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D8-1.3.5.3 Shrub and Tree Density

Fifteen, 100-square meter cover transects were sampled within the Pine and Juniper Woodland vegetation community (Table D8-1). Shrub density was 0.6 shrubs/m^2 or 2,320.3 shrubs/acre. Broom snakeweed (*Gutierrezia sarothrae*) contributed 24.6% of the relative density at 0.1 shrubs/m^2 (Table D8-7). Rocky Mountain juniper and ponderosa pine were both observed in this vegetation community. Approximately 405 trees were counted within the Pine and Juniper Woodland vegetation community.

D8-1.3.5.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 56 plant species were sampled or observed within the Pine and Juniper Woodland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=15) was 14.2 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 18 plant species sampled or observed. Native cool season perennial grasses and native full shrubs were the second most common life forms with six plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, native perennial forbs, and native trees (Table D8-8).

D8-1.3.6 Prairie Dog Modified Grassland

This vegetation community comprised 597.6 of the 5,994.7 acre (10.0%) Brook Mine Study Area and 436.7 of the 4,548.8 acre (9.6%) proposed Brook Mine Permit Area (Table D8-2). The Prairie Dog Modified Grassland vegetation community was naturally disturbed by prairie dogs. As a result, this vegetation community had high bare soil, low vegetation height and cover, and a high percentage of introduced annual grasses. This vegetation community occurred throughout the Brook Mine Study Area in relatively flat areas.

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D8-1.3.6.1 Cover

Forty, 50-meter cover transects were sampled within the Prairie Dog Modified Grassland vegetation community (Table D8-1). Absolute total vegetation cover was 48.9%. Absolute total ground cover was 72.5% (Table D8-3). Absolute bare soil and litter/rock percentages were 27.5% and 23.5%, respectively. Cryptograms provided 0.1% absolute cover (Table D8-5). Introduced annual grasses were the dominant life form with 28.6% relative vegetation cover, followed by native cool season perennial grasses with 23.5% relative vegetation cover (Table D8-4). Cheatgrass provided the highest relative vegetation cover at 25.6%, while western wheatgrass provided the next highest relative vegetation cover at 19.9% (Table D8-5).

D8-1.3.6.2 Production

Production was not measured within the Prairie Dog Modified Grassland vegetation community.

D8-1.3.6.3 Shrub and Tree Density

Forty, 100-square meter belt transects were sampled within the Prairie Dog Modified Grassland vegetation community (Table D8-1). Shrub density was 0.4 shrubs/m^2 or 1,561.1 shrubs/acre. Fringed sagewort (*Artemisia frigida*) contributed 67.3% of the relative density at 0.3 shrubs/m^2 (Table D8-7). No trees were observed in the Prairie Dog Modified Grassland vegetation community.

D8-1.3.6.4 Species Diversity and Composition

Excluding SLCV, 13 life forms and 74 plant species were sampled or observed within the Prairie Dog Modified Grassland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=40) was 10.0 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 20 plant species sampled or observed. Introduced annual forbs were the second most common life form

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with 11 plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, native warm season perennial grasses, introduced perennial grasses, native annual forbs, introduced annual forbs, native perennial forbs, and introduced biennial/perennial forbs (Table D8-8).

D8-1.3.7 Reclaimed Grassland

This vegetation community comprised 713.5 of the 5,994.7 acre (11.9%) Brook Mine Study Area and 596.7 of the 4,548.8 acre (13.1%) proposed Brook Mine Permit Area (Table D8-2). The Reclaimed Grassland vegetation community was located in the eastern and southern portions of the Brook Mine Study Area on reclaimed coal mines.

D8-1.3.7.1 Cover

Ten, 50-meter cover transects were sampled within the Reclaimed Grassland vegetation community (Table D8-1). Absolute total vegetation cover was 63.6%. Absolute total ground cover was 90.4% (Table D8-3). Absolute bare soil and litter/rock percentages were 9.6% and 26.8%, respectively. Cryptograms were not observed within this vegetation community (Table D8-5). Native cool season perennial grasses were the dominant life form with 45.3% relative vegetation cover, followed by introduced perennial grasses with 27.7% relative vegetation cover (Table D8-4). Western wheatgrass provided the highest relative vegetation cover at 39.3%, while smooth brome (*Bromus inermis*) provided the next highest relative vegetation cover at 24.8% (Table D8-5).

D8-1.3.7.2 Production

Production was not measured within the Reclaimed Grassland vegetation community.

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D8-1.3.7.3 Shrub and Tree Density

Ten, 100-square meter belt transects were sampled within the Reclaimed Grassland vegetation community (Table D8-1). Shrub density was less than 0.1 shrubs/m^2 or 194.3 shrubs/acre. Four-wing saltbush (*Atriplex canescens*) contributed 79.2% of the relative density at less than 0.1 shrubs/m^2 (Table D8-7). No trees were observed within the Reclaimed Grassland vegetation community.

D8-1.3.7.4 Species Diversity and Composition

Excluding SLCV, 10 life forms and 26 plant species were sampled or observed within the Reclaimed Grassland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=10) was 7.2 (Attachment D8-1-H). Native cool season perennial grasses were the most common life form encountered with five plant species sampled or observed. Introduced annual forbs, native perennial forbs, and native full shrubs were the second most common life forms with four plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, introduced perennial grasses, introduced annual forbs, and introduced biennial/perennial forbs (Table D8-8).

D8-1.3.8 Riparian Woodland

This vegetation community comprised 143.4 of the 5,994.7 acre (2.4%) Brook Mine Study Area and 57.2 of the 4,548.8 acre (1.3%) proposed Brook Mine Permit Area (Table D8-2). The Riparian Woodland vegetation community occurs primarily along the Tongue River and Slater Creek in alluvial floodplains and stream terraces. Soils in these areas are typically very deep and well drained. Multiple trees and shrub species were present and abundant in the Riparian Woodland vegetation community due to the presence and proximity of water.

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D8-1.3.8.1 Cover

Twenty-five, 50-meter cover transects were sampled within the Riparian Woodland vegetation community (Table D8-1). Absolute total vegetation cover was 82.0%. Absolute total ground cover was 97.9% (Table D8-3). Absolute bare soil and litter/rock percentages were 2.1% and 15.9%, respectively. Cryptograms were not observed within this vegetation community (Table D8-5). Native cool season perennial grasses were the dominant life form with 23.8% relative vegetation cover, followed by native full shrubs with 17.6% relative vegetation cover (Table D8-4). Common snowberry (*Symphoricarpos albus*) provided the highest relative vegetation cover at 14. 0%, while western wheatgrass provided the next highest relative vegetation cover at 12.0% (Table D8-5).

D8-1.3.8.2 Production

Forty-eight, 1-square meter quadrats were sampled within the Riparian Woodland vegetation community (Table D8-1). Total production was 143.3 g/m^2 or 2,556.9 pounds/acre. Introduced perennial grasses was the dominant life form and contributed 30.9% of the relative production at 44.3 g/m^2. Native cool season perennial grasses was the second most dominant life form and contributed 27.8% of the relative production at 39.8 g/m^2 (Table D8-6). Crested wheatgrass was the dominant plant species and contributed 21.7% of the relative production at 31.1 g/m^2 (Attachment D8-1-D).

D8-1.3.8.3 Shrub and Tree Density

Forty-six, 100-square meter belt transects were sampled within the Riparian Woodland vegetation community (Table D8-1). Shrub density was 1.8 shrubs/m^2 or 7,298.7 shrubs/acre. Common snowberry contributed 70.0% of the relative density at 1.3 shrubs/m^2 (Table D8-7). Native trees eastern cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*), Greene's mountain ash (*Sorbus scopulina*), and peachleaf willow (*Salix amygdaloides*) as well as the introduced tree Russian olive (*Elaeagnus angustifolia*) were present.

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Approximately 820 trees were counted within the Riparian Woodland vegetation community.

D8-1.3.8.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 103 plant species were sampled or observed within the Riparian Woodland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=25) was 13.1 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 23 plant species sampled or observed. Native full shrubs were the second most common life form with 14 plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, native warm season perennial grasses, introduced perennial grasses, native grasslikes, native perennial forbs, introduced biennial/perennial forbs, native full shrubs, and native trees (Table D8-8).

D8-1.3.9 Rough Breaks Mixed Shrubland

This vegetation community comprised 794.9 of the 5,994.7 acre (13.3%) Brook Mine Study Area and 576.0 of the 4,548.8 acre (12.7%) proposed Brook Mine Permit Area (Table D8-2). The Rough Breaks Mixed Shrubland vegetation community was characterized by greater than 20% shrub cover of a high diversity of full, half- and sub-shrub species. The vegetation community was located along the edges of Big Sagebrush Shrubland and Upland Grassland vegetation communities throughout the Brook Mine Study Area, typically, in shallower soils and on greater topographic reliefs.

D8-1.3.9.1 Cover

Thirty, 50-meter cover transects were sampled within the Rough Breaks Mixed Shrubland vegetation community (Table D8-1). Absolute total vegetation

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cover was 41.8%. Absolute total ground cover was 69.7% (Table D8-3). Absolute bare soil and litter/rock percentages were 30.3% and 26.5%, respectively. Cryptograms provided 1.4% absolute cover (Table D8-5). Native cool season perennial grasses were the dominant life form with 35.4% relative vegetation cover, followed by native full shrubs with 29.9% relative vegetation cover (Table D8-4). Big sagebrush provided the highest relative vegetation cover at 22.7%, while bluebunch wheatgrass provided the next highest relative vegetation cover at 16.7% (Table D8-5).

D8-1.3.9.2 Production

Fifty, 1-square meter quadrats were sampled within the Rough Breaks Mixed Shrubland vegetation community (Table D8-1). Total production was 37.7 g/m^2 or 673.5 pounds/acre. Native cool season perennial grasses was the dominant life form and contributed 53.3% of the relative production at 20.1 g/m^2. Native perennial forbs was the second most dominant life form and contributed 24.9% of the relative production at 9.4 g/m^2 (Table D8-6). Bluebunch wheatgrass was the dominant plant species and contributed 35.0% of the relative production at 13.2 g/m^2 (Attachment D8-1-D).

D8-1.3.9.3 Shrub and Tree Density

Forty-nine, 100-square meter belt transects were sampled within the Rough Breaks Mixed Shrubland vegetation community (Table D8-1). Shrub density was 1.6 shrubs/m^2 or 6,434.7 shrubs/acre. Big sagebrush contributed 39.3% of the relative density at 0.6 shrubs/m^2 (Table D8-7). Rocky Mountain juniper was observed in the Rough Breaks Mixed Shrubland vegetation community. Approximately 60 trees were counted within the Rough Breaks Mixed Shrubland vegetation community.

D8-1.3.9.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 97 plant species were sampled or observed within the Rough Breaks Mixed Shrubland vegetation community

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(Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=30) was 15.5 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 38 plant species sampled or observed. Native full shrubs were the second most common life form with 11 plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, native perennial forbs, native full shrubs, and native half- and sub-shrubs (Table D8-8).

D8-1.3.10 Scoria Grassland

This vegetation community comprised 726.1 of the 5,994.7 acre (12.1%) Brook Mine Study Area and 4,548.8 acre (16.0%) proposed Brook Mine Permit Area (Table D8-2). The Scoria Grassland vegetation community was located on hill slopes and ridges throughout the Brook Mine Study Area with a high percentage of scoria derived soils. Vegetation within the Scoria Grassland vegetation community was predominantly composed of bunchgrasses and less than 20% canopy cover of low growing shrubs such as skunkbush sumac (*Rhus aromatica*). Burned areas within this vegetation community were included in the Upland Grassland vegetation community due to the absence of low growing shrubs. Areas within this vegetation community with greater than 20% shrub cover were included in the Rough Breaks Mixed Shrubland vegetation community due to the density and diversity of shrubs.

D8-1.3.10.1 Cover

Twenty-eight, 50-meter cover transects were sampled within the Scoria Grassland vegetation community (Table D8-1). Absolute total vegetation cover was 58.1%. Absolute total ground cover was 89.2% (Table D8-3). Absolute bare soil and litter/rock percentages were 10.8% and 30.7%, respectively. Cryptograms provided 0.4% absolute cover (Table D8-5). Introduced annual grasses were the dominant life form with 37.3% relative vegetation cover,

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followed by native cool season perennial grasses with 27.9% relative vegetation cover (Table D8-4). Cheatgrass provided the highest relative vegetation cover at 32.4%, while bluebunch wheatgrass provided the next highest relative vegetation cover at 11.0% (Table D8-5).

D8-1.3.10.2 Production

Fifty, 1-square meter quadrats were sampled within the Scoria Grassland vegetation community (Table D8-1). Total production was 60.8 g/m^2 or 1,083.7 pounds/acre. Native cool season perennial grasses was the dominant life form and contributed 40.1% of the relative production at 24.4 g/m^2. Introduced annual grasses was the second most dominant life form and contributed 35.0% of the relative production at 21.3 g/m^2 (Table D8-6). Cheatgrass was the dominant plant species and contributed 32.4% of the relative production at 19.7 g/m^2 (Attachment D8-1-D).

D8-1.3.10.3 Shrub and Tree Density

Fifty, 100-square meter belt transects were sampled within the Scoria Grassland vegetation community (Table D8-1). Shrub density was 0.5 shrubs/m^2 or 1,849.5 shrubs/acre. Big Sagebrush contributed 40.2% of the relative density at 0.2 shrubs/m^2 (Table D8-7). No trees were observed within this vegetation community.

D8-1.3.10.4 Species Diversity and Composition

Excluding SLCV, 13 life forms and 93 plant species were sampled or observed within the Scoria Grassland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=28) was 13.8 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 34 plant species sampled or observed. Native full shrubs were the second most common life form with nine plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one

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plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, introduced biennial/perennial forbs, and native full shrubs (Table D8-8).

D8-1.3.11 Upland Grassland

This vegetation community comprised 1,025.8 of the 5,994.7 acre (17.1%) Brook Mine Study Area and 995.9 of the 4,548.8 acre (21.9%) proposed Brook Mine Permit Area (Table D8-2). The Upland Grassland vegetation community was characterized by a predominance of native cool season perennial grasses and less than 20% shrub cover. This vegetation community occurred throughout the Brook Mine Study Area primarily in areas with deep soils.

D8-1.3.11.1 Cover

Twenty-eight, 50-meter cover transects were sampled within the Upland Grassland vegetation community (Table D8-1). Absolute total vegetation cover was 58.0%. Absolute total ground cover was 90.7% (Table D8-3). Absolute bare soil and litter/rock percentages were 9.3% and 32.5%, respectively. Cryptograms provided 0.2% absolute cover (Table D8-5). Native cool season perennial grasses were the dominant life form with 42.1% relative vegetation cover, followed by introduced annual grasses with 30.9% relative vegetation cover (Table D8-4). Cheatgrass provided the highest relative vegetation cover at 22.6%, while western wheatgrass provided the next highest relative vegetation cover at 17.9% (Table D8-5).

D8-1.3.11.2 Production

Fifty, 1-square meter quadrats were sampled within the Upland Grassland vegetation community (Table D8-1). Total production was 64.4 g/m^2 or 1,150.5 pounds/acre. Native cool season perennial grasses was the dominant life form and contributed 57.5% of the relative production at 37.0 g/m^2. Introduced annual grasses was the second most dominant life form and

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contributed 24.4% of the relative production at 15.7 g/m^2 (Table D8-6). Western wheatgrass was the dominant plant species and contributed 31.5% of the relative production at 20.3 g/m^2 (Attachment D8-1-D).

D8-1.3.11.3 Shrub and Tree Density

Fifty-two, 50-meter cover transects were sampled within the Upland Grassland vegetation community (Table D8-1). Shrub density was 0.3 shrubs/m^2 or 1,412.6 shrubs/acre. Fringed sagewort contributed 62.8% of the relative density at 0.2 shrubs/m^2 (Table D8-7). No trees were observed within this vegetation community.

D8-1.3.11.4 Species Diversity and Composition

Excluding SLCV, 12 life forms and 96 plant species were sampled or observed within the Upland Grassland vegetation community (Attachment D8-1-B). The mean number of plant species sampled or observed per belt transect (n=28) was 15.0 (Attachment D8-1-H). Native perennial forbs were the most common life form encountered with 32 plant species sampled or observed. Native full shrubs were the second most common life form with 10 plant species sampled or observed (Attachment D8-1-B). Based on all plant species sampled on the cover transects, the following life forms had at least one plant species with greater than 2% relative vegetation cover: introduced annual grasses, native cool season perennial grasses, introduced annual forbs, and introduced biennial/perennial forbs (Table D8-8).

D8-1.3.12 Rabbitbrush Shrubland

This vegetation community comprised 0.7 of the 5,994.7 acre (<0.1%) Brook Mine Study Area and 4,548.8 acre (<0.1%) proposed Brook Mine Permit Area (Table D8-2). The Rabbitbrush Shrubland vegetation community had greater than 20% rubber rabbitbrush (*Chrysothamnus viscidiflorus)* and yellow rabbitbrush (*Ericameria nauseosa*) canopy cover. The understory was similar to the Upland Grassland vegetation community which surrounded it. No

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quantitative vegetation sampling was conducted within this vegetation community due to its limited size.

D8-1.3.13 Sample Adequacy

Sample adequacy was met for total vegetation cover in all 10 vegetation communities quantitatively sampled except the Pine and Juniper Woodland (Confidence Level = 67.7%) (Table D8-9). Sample adequacy for total ground cover was met in all 10 of the vegetation communities quantitatively sampled. Sample adequacy for production was met in the two shrubland vegetation communities sampled: Big Sagebrush Shrubland and Rough Breaks Mixed Shrubland. Sample adequacy for production was not met in the three grassland and one woodland vegetation communities quantitatively sampled: Bottomland Sagebrush Grassland (Confidence Level = 63.7%), Scoria Grassland (Confidence Level = 73.9%), Upland Grassland (Confidence Level = 77.9%), and Riparian Woodland (Confidence Level = 72.6%). Sample adequacy for shrub density was not met in all vegetation communities quantitatively sampled. Shrub density confidence levels ranged from 52.8% to 74.9%.

D8-1.4 Threatened and Endangered Habitat and Species Surveys

Refer to Table D8-10 for a tabular summary of potential occurrence determinations for Threatened and Endangered plant species within the proposed Brook Mine Permit Area.

D8-1.4.1 Ute ladies'-tresses (*Spiranthes diluvialis*)

Habitat suitability for Ute ladies'-tresses (*Spiranthes diluvialis*), within the Brook Mine Permit Area, was evaluated based on the presence of the following characteristics: late season perennial water source, associated vegetation species, sandy or loamy textured soils, gradual transitions between uplands and water bodies or drainages, vegetation density between 75% and 90%, vegetation height less than 18 inches, and non-alkaline soils. Based on late July field evaluations, late season perennial water sources were present within the Brook Mine Permit Area. However, where late season perennial

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water sources were present, associated vegetation species, appropriate soil textures, gradual transitions, vegetation cover and density, and non-alkaline sandy or loamy textured soils were not present or not present in sufficient combination to provide suitable habitat. No individuals or populations of Ute ladies'-tresses were found during field surveys, and based on the lack of suitable habitat characteristics, local habitat was confirmed unsuitable for Ute ladies'-tresses.

D8-1.4.2 Blowout Penstemon (Penstemon Haydenii)

Habitat suitability for blowout penstemon (*Penstemon haydenii*), within the Brook Mine Permit Area, was evaluated based on the presence of the following characteristics: eolian sand deposits or sand deposits greater than three feet in depth, fine sandy textured soils absent of rocks and coarse fragments, wind or gravity erosion versus water erosion, slopes greater than 25%, slope elevation changes of 60 to 120 feet, vegetation cover of less than 40%, and associated plant species. No individuals or populations of blowout penstemon were found during late June field surveys, and based on the lack of suitable habitat characteristics, local habitat was confirmed unsuitable for blowout penstemon.

D8-1.5 Other Special Status Plant Species

WYNDD reports no special status plant species within the Brook Mine Study Area (WYNDD 2013).

D8-1.6 Selenium Indicators

One selenium indicator, two-grooved milkvetch (*Astragalus bisulcatus*), was observed within the Pine and Juniper Woodland and Scoria Grassland vegetation communities.

D8-1.7 Noxious Weeds

Surveys for Wyoming State Designated Noxious Weeds (Wyoming Weed and Pest Council 2013a) and Sheridan County Declared Weeds (Wyoming Weed

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and Pest Council 2013b) were conducted in conjunction with baseline vegetation mapping, sampling, and threatened and endangered plant species surveys. All State Designated Noxious Weeds and Sheridan County Declared Weeds observed during these surveys were GPS located and mapped. Refer to Attachment D8-1-G for a map illustrating weed location within the Brook Mine Study Area and proposed Brook Mine Permit Area.

Eight Wyoming State Designated Noxious Weeds were encountered: skeletonleaf bur ragweed, (*Ambrosia tomentosa*), whitetop (*Cardaria draba*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), western houndstongue (*Cynoglossum officinale*), perennial pepperweed (*Lepidium latifolium*), common tansy (*Tanacetum vulgare*), and Russian olive (Attachment D8-1-B). Skeletonleaf bur ragweed was present within the Bottomland Sagebrush Grassland, Scoria Grassland, and Upland Grassland vegetation communities. Canada thistle was present within the Agricultural Land, Bottomland Sagebrush Grassland, Riparian Woodland, Rough Breaks Mixed Shrubland, and Upland Grassland vegetation communities. Field bindweed was present within the Agricultural Land, Bottomland Sagebrush Grassland, Prairie Dog Modified Grassland, Reclaimed Grassland, Riparian Woodland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland vegetation communities. Western houndstongue was present within the Prairie Dog Modified Grassland and Riparian Woodland vegetation communities. Common tansy was present within the Bottomland Sagebrush Grassland vegetation community. Whitetop, perennial pepperweed, and Russian olive were present within the Riparian Woodland vegetation community.

Five Sheridan County Declared Weeds were encountered: showy milkweed (*Asclepias speciosa*), wild licorice (*Glycyrrhiza lepidota*), plains pricklypear (*Opuntia polyacantha*), curly dock (*Rumex crispus*), and common cocklebur (*Xanthium strumarium*) (Attachment D8-1-B). Showy milkweed was

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present within the Bottomland Sagebrush Grassland and Riparian Woodland vegetation communities. Wild licorice was present within the Agricultural Land, Bottomland Sagebrush Grassland, Pine and Juniper Woodland, Riparian Woodland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland vegetation communities. Plains pricklypear was present within the Agricultural Land, Big Sagebrush Shrubland, Bottomland Sagebrush Grassland, Prairie Dog Modified Grassland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland vegetation communities. Curly dock was present within the Agricultural Land, Bottomland Sagebrush Grassland, Prairie Dog Modified Grassland, Riparian Woodland, and Upland Grassland vegetation communities. Common cocklebur was present within the Bottomland Sagebrush Grassland, Riparian Woodland, and Scoria Grassland vegetation communities.

Five other SLCV were encountered: cheatgrass, Japanese brome, summercypress, halogeton, and Russian thistle (Attachment D8-1-B). Cheatgrass and Japanese brome were present in all vegetation communities. Summercypress was present within the Agricultural Land, Bottomland Sagebrush Grassland, Prairie Dog Modified Grassland, Reclaimed Grassland, Riparian Woodland, and Upland Grassland vegetation communities. Halogeton was present within the Reclaimed Grassland and Riparian Woodland vegetation communities. Russian thistle was present within the Bottomland Sagebrush Shrubland, Prairie Dog Modified Grassland, and Upland Grassland vegetation communities.

Over weeds were observed in small isolated patches or as isolated individuals. However, large patches of cheatgrass and Japanese brome were observed.

D8-1.8 Summary of Vegetation Surveys

The approximately 5,994.7 acre Brook Mine Study Area and 4,548.8 acre proposed Brook Mine Permit Area consisted of 11 vegetation communities:

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Agricultural Land, Big Sagebrush Shrubland, Bottomland Sagebrush Grassland, Pine and Juniper Woodland, Prairie Dog Modified Grassland, Rabbitbrush Shrubland, Reclaimed Grassland, Riparian Woodland, Rough Breaks Mixed Shrubland, Scoria Grassland, and Upland Grassland. Shrubland vegetation communities covered approximately 35.3% and 32.8% of the Brook Mine Study Area and proposed Brook Mine Permit Area, respectively (Table D8-2). Big Sagebrush Shrubland was the dominant shrubland vegetation community. Native grassland vegetation communities covered approximately 39.2% and 48.6% of the Brook Mine Study Area and proposed Brook Mine Permit Area, respectively. Upland Grassland was the dominant grassland vegetation community. Woodland vegetation communities covered 3.5% and 2.7% of the Brook Mine Study Area and proposed Brook Mine Permit Area, respectively. Riparian Woodland was the dominant woodland vegetation. Reclaimed areas occupied approximately 11.9% and 13.1% of the Brook Mine Study Area and proposed Brook Mine Permit Area, respectively. Agricultural lands occupied approximately 6.8% and 0.1% of the Brook Mine Study Area and proposed Brook Mine Permit Area, respectively.

Within the Brook Mine Study Area, total vegetation cover ranged from 41.8% to 83.8%. Total ground cover ranged from 69.7% to 97.9%. Excluding SLCV, species diversity ranged from 26 to 103 plant species sampled or observed, with a total of 187 plant species sampled or observed. Western wheatgrass, green needlegrass (*Nassella viridula*), Sandberg bluegrass (*Poa secunda*), crested wheatgrass, and smooth brome were the most common perennial grasses. The most common perennial forb species were western yarrow (*Achillea millefolium*) and American vetch (*Vicia americana*). Big sagebrush, silver sagebrush (*Artemisia cana*), and skunkbrush were the most common native shrub species. Fringed sagewort and broom snakeweed were the most common native half- and sub-shrubs.

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No special status plant species or suitable habitats were encountered within the proposed Brook Mine Permit Area. Eight Wyoming State Designated Noxious Weeds, five Sheridan County Declared Weeds, and five other SLCV were observed throughout the Brook Mine Study Area.

D8-1.9 References

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ATTACHMENT D8-1-A

Tables

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Table D8-1. Summary of Sample Points within Each Vegetation Community for the Brook Mine Study Area and Proposed Brook Mine Permit Area

Vegetation Communities	Brook Mine Study Area			Proposed Brook Mine Permit Area		
	Cover	Production	Shrub Density	Cover	Production	Shrub Density
Agricultural Land	25	--	25	--	--	--
Big Sagebrush Shrubland	23	50	50	19	43	38
Bottomland Sagebrush Grassland	25	25	25	17	17	17
Pine and Juniper Woodland	15	--	15	15	--	15
Prairie Dog Modified Grassland	40	--	40	34	--	34
Reclaimed Grassland	10	--	10	8	--	8
Riparian Woodland	25	48	46	14	24	23
Rough Breaks Mixed Shrubland	30	50	49	23	38	35
Scoria Grassland	28	50	50	28	50	50
Upland Grassland	28	50	52	28	50	50
Total	**249**	**273**	**362**	**186**	**222**	**270**

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Table D8-2. Summary of Acreages and Percent of the Brook Mine Study Area, Proposed Brook Mine Permit Area, and Half-Mile Buffer Composed of Each Vegetation Community

Vegetation Community	Brook Mine Study Area		Proposed Brook Mine Permit Area		Half-Mile Buffer	
	Acres	% of Area	Acres	% of Area	Acres	% of Area
Agricultural Land	409.9	6.8	4.5	0.1	1,575.3	13.6
Big Sagebrush Shrubland	1,185.8	19.8	913.7	20.1	1,931.8	16.7
Bottomland Sagebrush Grassland	132.5	2.2	50.6	1.1	500.0	4.3
Pine and Juniper Woodland	66.8	1.1	67.7	1.5	295.0	2.5
Prairie Dog Modified Grassland	597.6	10.0	436.7	9.6	1,059.2	9.1
Rabbitbrush Shrubland	0.7	<0.1	1.3	<0.1	--	--
Reclaimed Grassland	713.5	11.9	596.7	13.1	1,221.4	10.5
Riparian Woodland	143.4	2.4	57.2	1.3	1,083.9	9.4
Rough Breaks Mixed Shrubland	794.9	13.3	576.0	12.7	1,678.8	14.5
Scoria Grassland	726.1	12.1	726.0	16.0	792.4	6.8
Upland Grassland	1,025.8	17.1	995.9	21.9	787.8	6.8
Disturbance	181.1	3.0	109.7	2.4	549.2	4.7
Water	16.6	0.3	12.8	0.3	105.4	0.9
Total	**5,994.7**	**100.0**	**4,548.8**	**100.1**	**11,580.2**	**99.8**

NOTE: % of Area Totals shown in this table do not sum to 100.0 due to rounding errors.

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Table D8-3. Summary of 2013 Major Vegetation Parameters for the Brook Mine Study Area and Proposed Brook Mine Permit Area

Vegetation Community	Total Vegetation Cover (Absolute %)		Total Ground Cover (Absolute %)		Production (g/m²)		Shrub Density (#/m²)	
	Permit Area	Study Area	Permit Area	Study Area	Permit Area	Study Area	Permit Area	Study Area
Agricultural Land	--	83.8	--	97.5	--	--	--	0.0
Big Sagebrush Shrubland	54.1	57.8	88.0	88.3	34.4	37.5	1.1	1.2
Bottomland Sagebrush Grassland	67.1	72.8	95.3	95.5	93.3	120.0	0.7	0.5
Pine and Juniper Woodland	43.6	43.6	89.0	89.0	--	--	0.6	0.6
Prairie Dog Modified Grassland	46.7	48.9	72.6	72.5	--	--	0.4	0.4
Reclaimed Grassland	64.8	63.6	95.0	90.4	--	--	0.1	<0.1
Riparian Woodland	80.3	82.0	97.6	97.9	159.9	143.3	2.6	1.8
Rough Breaks Mixed Shrubland	40.7	41.8	71.0	69.7	41.3	37.7	1.6	1.6
Scoria Grassland	58.1	58.1	89.2	89.2	60.8	60.8	0.5	0.5
Upland Grassland	58.0	58.0	90.7	90.7	64.4	64.4	0.3	0.3

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Table D8-4. Summary of 2013 Mean Vegetation Cover Data, by Life Form, for the Brook Mine Study Area

Life Form	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Annual Grasses	--	--	0.9	1.6	--	--	--	--	0.2	0.4
Introduced Annual Grasses	1.3	1.6	4.9	8.5	6.0	8.2	6.9	15.8	14.0	28.6
Native Cool Season Perennial Grasses[1]	25.6	30.5	13.7	23.7	23.1	31.7	20.2	46.3	11.5	23.5
Native Warm Season Perennial Grasses	0.3	0.4	1.2	2.1	0.9	1.2	0.3	0.7	2.2	4.5
Introduced Perennial Grasses	21.5	25.7	0.8	1.4	10.9	15.0	--	--	2.7	5.5
Native Grasslikes	0.5	0.6	0.3	0.5	10.9	15.0	0.8	1.8	--	--
Native Annual Forbs	0.3	0.4	0.1	0.2	0.4	0.5	0.1	0.2	2.4	4.9
Introduced Annual Forbs	1.4	1.7	3.0	5.2	2.7	3.7	1.1	2.5	4.4	9.0
Native Perennial Forbs[2]	0.7	0.8	5.5	9.5	6.1	8.4	4.0	9.2	4.8	9.8
Introduced Biennial/Perennial Forbs	30.3	36.2	0.1	0.2	7.7	10.6	0.2	0.5	5.3	10.8
Native Half- and Sub-Shrubs	0.7	0.8	1.6	2.8	1.3	1.8	0.4	0.9	0.9	1.8
Native Full Shrubs	1.2	1.4	25.5	44.1	2.8	3.8	1.6	3.7	0.4	0.8
Native Trees	--	--	--	--	--	--	8.0	18.3	--	--
Introduced Trees	--	--	--	--	--	--	--	--	--	--
Native Succulents	--	--	0.2	0.3	--	--	--	--	0.1	0.2
Total	**83.8**	**100.1**	**57.8**	**100.1**	**72.8**	**99.9**	**43.6**	**99.9**	**48.9**	**99.8**

[1] Native Cool Season Perennial Grasses' and Unknown Grasses' absolute percentages have been combined.
[2] Native Perennial Forbs' and Unknown Forb Species' absolute percentages have been combined.
NOTE: Relative percentages shown in this table do not sum to 100.0 due to rounding errors.

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Table D8-4. Summary of 2013 Mean Vegetation Cover Data, by Life Form, for the Brook Mine Study Area (Cont.)

Life Form	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Annual Grasses	--	--	--	--	--	--	0.2	0.3	0.8	1.4
Introduced Annual Grasses	5.2	8.2	2.7	3.3	2.7	6.5	21.7	37.3	17.9	30.9
Native Cool Season Perennial Grasses[1]	28.8	45.3	19.5	23.8	14.8	35.4	16.2	27.9	24.4	42.1
Native Warm Season Perennial Grasses	--	--	3.2	3.9	0.3	0.7	1.1	1.9	1.0	1.7
Introduced Perennial Grasses	17.6	27.7	8.3	10.1	0.3	0.7	0.5	0.9	0.4	0.7
Native Grasslikes	0.4	0.6	5.0	6.1	0.1	0.2	0.1	0.2	0.1	0.2
Native Annual Forbs	0.2	0.3	0.2	0.2	1.1	2.6	0.2	0.3	0.8	1.4
Introduced Annual Forbs	2.4	3.8	1.4	1.7	0.5	1.2	2.2	3.8	1.9	3.3
Native Perennial Forbs[2]	1.6	2.5	8.4	10.2	6.0	14.4	6.2	10.7	4.8	8.3
Introduced Biennial/Perennial Forbs	7.0	11.0	5.6	6.8	0.9	2.2	1.6	2.8	2.9	5.0
Native Half- and Sub-Shrubs	--	--	--	--	2.5	6.0	0.7	1.2	1.2	2.1
Native Full Shrubs	0.4	0.6	14.4	17.6	12.5	29.9	7.4	12.7	1.7	2.9
Native Trees	--	--	12.7	15.5	0.1	0.2	--	--	--	--
Introduced Trees	--	--	0.6	0.7	--	--	--	--	--	--
Native Succulents	--	--	--	--	--	--	--	--	0.1	0.2
Total	**63.6**	**100.0**	**82.0**	**99.9**	**41.8**	**100.0**	**58.1**	**100.0**	**58.0**	**100.2**

[1] Native Cool Season Perennial Grasses' and Unknown Grasses' absolute percentages have been combined.
[2] Native Perennial Forbs' and Unknown Forb Species' absolute percentages have been combined.
NOTE: Relative percentages shown in this table do not sum to 100.0 due to rounding errors.

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area

Life Form/ Scientific Name	Common Name	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Annual Grasses											
Echinochloa muricata	Rough barnyardgrass	--	--	0.9	1.6	--	--	--	--	--	--
Vulpia octoflora	Sixweeks fescue	--	--	--	--	--	--	--	--	0.2	0.4
Subtotal		--	--	0.9	1.6	--	--	--	--	0.2	0.4
Introduced Annual Grasses											
Bromus japonicus	Japanese brome	1.0	1.2	3.2	5.5	2.5	3.4	1.2	2.8	1.5	3.1
Bromus tectorum	Cheatgrass	0.2	0.2	1.7	2.9	3.5	4.8	5.7	13.1	12.5	25.6
Triticum aestivum	Common wheat	0.1	0.1	--	--	--	--	--	--	--	--
Subtotal		1.3	1.6	4.9	8.5	6.0	8.2	6.9	15.8	14.0	28.6
Native Cool Season Perennial Grasses											
Elymus elymoides	Bottlebrush squirreltail	--	--	--	--	0.2	0.3	--	--	--	--
Elymus lanceolatus	Thickspike wheatgrass	0.7	0.8	--	--	0.7	1.0	--	--	--	--
Elymus smithii	Western wheatgrass	4.2	5.0	3.7	6.4	13.3	18.3	3.3	7.6	9.7	19.9
Elymus spicatus	Bluebunch wheatgrass	0.2	0.2	3.5	6.1	0.2	0.3	14.3	32.8	0.4	0.8
Elymus trachycaulus	Slender wheatgrass	15.6	18.6	--	--	0.6	0.8	--	--	--	--
Festuca spp.	Fescue	2.3	2.7	--	--	--	--	--	--	--	--
Glyceria grandis	American mannagrass	0.2	0.2	--	--	--	--	--	--	--	--
Hesperostipa comata	Needleandthread	0.2	0.2	3.7	6.4	0.6	0.8	0.5	1.1	0.4	0.8
Hordeum jubatum	Foxtail barley	0.6	0.7	--	--	4.4	6.0	--	--	--	--
Nassella viridula	Green needlegrass	0.1	0.1	1.5	2.6	2.3	3.2	0.5	1.1	0.2	0.4
Phalaris arundinacea	Reed canarygrass	0.1	0.1	--	--	0.2	0.3	--	--	--	--
Poa secunda	Sandberg bluegrass	1.4	1.7	1.3	2.2	0.6	0.8	1.6	3.7	0.8	1.6
Subtotal		25.6	30.5	13.7	23.7	23.1	31.7	20.2	46.3	11.5	23.5
Native Warm Season Perennial Grasses											
Aristida purpurea	Purple threeawn	--	--	0.2	0.3	--	--	--	--	0.9	1.8
Bouteloua gracilis	Blue grama	0.2	0.2	1.0	1.7	0.2	0.3	0.3	0.7	1.0	2.0
Buchloe dactyloides	Buffalograss	--	--	--	--	0.2	0.3	--	--	--	--
Spartina pectinata	Prairie cordgrass	0.1	0.1	--	--	0.5	0.7	--	--	--	--
Sporobolus cryptandrus	Sand dropseed	--	--	--	--	--	--	--	--	0.3	0.6
Subtotal		0.3	0.4	1.2	2.1	0.9	1.2	0.3	0.7	2.2	4.5
Introduced Perennial Grasses											
Agropyron cristatum	Crested wheatgrass	8.1	9.7	0.3	0.5	7.2	9.9	--	--	2.6	5.3
Bromus inermis	Smooth brome	9.4	11.2	--	--	2.0	2.7	--	--	0.1	0.2
Dactylis glomerata	Orchardgrass	2.0	2.4	--	--	--	--	--	--	--	--

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Introduced Perennial Grasses (Cont.)											
Elymus junceus	Russian wildrye	--	--	--	--	0.2	0.3	--	--	--	--
Festuca ovina	Sheep fescue	--	--	0.5	0.9	--	--	--	--	--	--
Phleum pratensis	Timothy	0.6	0.7	--	--	0.3	0.4	--	--	--	--
Poa pratensis	Kentucky bluegrass	1.4	1.7	--	--	1.2	1.6	--	--	--	--
Subtotal		21.5	25.7	0.8	1.4	10.9	15.0	--	--	2.7	5.5
Native Grasslikes											
Carex filifolia	Threadleaf sedge	--	--	0.3	0.5	--	--	0.8	1.8	--	--
Carex nebrascensis	Nebraska sedge	0.5	0.6	--	--	6.8	9.3	--	--	--	--
Carex praegracilis	Clustered field sedge	--	--	--	--	1.2	1.6	--	--	--	--
Juncus balticus	Baltic rush	--	--	--	--	0.5	0.7	--	--	--	--
Schoenoplectus pungens	Common threesquare	--	--	--	--	2.4	3.3	--	--	--	--
Subtotal		0.5	0.6	0.3	0.5	10.9	15.0	0.8	1.8	--	--
Native Annual Forbs											
Chamaesyce glyptosperma	Ribseed sandmat	--	--	--	--	--	--	--	--	0.1	0.2
Chenopodium berlandieri	Pitseed goosefoot	0.1	0.1	--	--	0.1	0.1	--	--	--	--
Descurainia pinnata	Western tansymustard	0.1	0.1	--	--	--	--	--	--	--	--
Logfia arvensis	Field cottonrose	--	--	--	--	--	--	--	--	0.2	0.4
Lappula redowskii	Bluebur stickseed	--	--	--	--	0.1	0.1	--	--	0.7	1.4
Plantago patagonica	Pursh's plantain	0.1	0.1	0.1	0.2	0.2	0.3	0.1	0.2	1.3	2.7
Solanum triflorum	Cutleaf nightshade	--	--	--	--	--	--	--	--	0.1	0.2
Subtotal		0.3	0.4	0.1	0.2	0.4	0.5	0.1	0.2	2.4	4.9
Introduced Annual Forbs											
Alyssum desertorum	Desert alyssum	0.3	0.4	2.9	5.0	1.6	2.2	0.4	0.9	2.4	4.9
Amaranthus albus	Prostrate pigweed	--	--	--	--	--	--	--	--	0.3	0.6
Bassia sieversiana	Summercypress	0.9	1.1	--	--	0.2	0.3	--	--	0.1	0.2
Brassica juncea	Brown mustard	--	--	--	--	--	--	--	--	0.1	0.2
Camelina microcarpa	Littleseed falseflax	--	--	--	--	0.2	0.3	0.3	0.7	--	--
Descurainia sophia	Flixweed	--	--	--	--	0.2	0.3	--	--	--	--
Halogeton glomeratus	Halogeton	--	--	--	--	--	--	--	--	--	--
Lepidium perfoliatum	Shieldcress	--	--	--	--	--	--	--	--	--	--
Medicago lupulina	Black medic	--	--	0.1	0.2	--	--	--	--	0.5	1.0

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Introduced Annual Forbs (Cont.)											
Polygonum argyrocoleon	Silversheath knotweed	--	--	--	--	--	--	--	--	0.1	0.2
Polygonum aviculare	Prostrate knotweed	--	--	--	--	--	--	--	--	0.6	1.2
Polygonum convolvulus	Black bindweed	0.2	0.2	--	--	--	--	--	--	0.2	0.4
Sisymbrium altissimum	Tumble mustard	--	--	--	--	0.2	0.3	--	--	0.1	0.2
Thlaspi arvense	Field pennycress	--	--	--	--	0.3	0.4	0.4	0.9	--	--
	Subtotal	1.4	1.7	3.0	5.2	2.7	3.7	1.1	2.5	4.4	9.0
Native Perennial Forbs											
Achillea millefolium	Western yarrow	0.1	0.1	0.2	0.3	0.8	1.1	0.7	1.6	0.2	0.4
Allium textile	Textile onion	--	--	0.1	0.2	--	--	--	--	--	--
Ambrosia psilostachya	Western ragweed	--	--	--	--	0.3	0.4	--	--	0.1	0.2
Ambrosia tomentosa	Skeletonleaf bur ragweed	--	--	--	--	0.7	1.0	--	--	--	--
Antennaria microphylla	Littleleaf pussytoes	--	--	--	--	--	--	--	--	0.2	0.4
Asclepias speciosa	Showy milkweed	--	--	--	--	0.2	0.3	--	--	--	--
Astragalus spp.	Milkvetch	--	--	--	--	0.1	0.1	--	--	0.2	0.4
Cirsium spp.	Thistle	--	--	--	--	--	--	--	--	0.1	0.2
Comandra umbellata	Bastard toadflax	--	--	0.7	1.2	--	--	--	--	--	--
Dalea purpurea	Purple prairie clover	--	--	0.4	0.7	--	--	0.3	0.7	0.1	0.2
Echinacea angustifolia	Purple coneflower	--	--	--	--	0.1	0.1	--	--	--	--
Equisetum laevigatum	Smooth horsetail	--	--	--	--	0.4	0.5	--	--	--	--
Eriogonum ovalifolium	Cushion wild buckwheat	--	--	0.1	0.2	--	--	--	--	--	--
Eriogonum pauciflorum	Fewflower buckwheat	--	--	0.1	0.2	--	--	--	--	--	--
Evolvulus nuttallianus	Shaggy dwarf morning-glory	--	--	0.1	0.2	--	--	--	--	0.2	0.4
Gaura coccinea	Scarlet gaura	--	--	0.1	0.2	--	--	--	--	0.1	0.2
Glycyrrhiza lepidota	Wild licorice	--	--	--	--	0.6	0.8	--	--	--	--
Grindelia squarrosa	Curlycup gumweed	--	--	--	--	--	--	--	--	0.1	0.2
Heterotheca villosa	Hairy golden aster	--	--	--	--	--	--	--	--	0.3	0.6
Linum lewisii	Blue flax	--	--	--	--	--	--	--	--	0.1	0.2
Lygodesmia juncea	Rush skeletonplant	--	--	--	--	--	--	--	--	0.3	0.6
Pediomelum argophyllum	Silverleaf Indian breadroot	--	--	0.6	1.0	--	--	--	--	0.1	0.2
Penstemon spp.	Penstemon	--	--	--	--	--	--	--	--	0.1	0.2
Phlox hoodii	Hoods phlox	0.2	0.2	1.4	2.4	--	--	1.6	3.7	0.7	1.4
Polygonum spp.	Knotweed	--	--	--	--	1.0	1.4	--	--	--	--
Psoralidium tenuiflorum	Slimflower scurfpea	0.1	0.1	0.5	0.9	0.1	0.1	0.5	1.1	0.1	0.2

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Perennial Forbs (Cont.)											
Rumex spp.	Dock	--	--	--	--	0.1	0.1	--	--	0.1	0.2
Sonchus spp.	Sowthistle	--	--	--	--	0.4	0.5	--	--	--	--
Sphaeralcea coccinea	Scarlet globemallow	--	--	--	--	1.2	1.6	0.4	0.9	1.4	2.9
Symphyotrichum falcatum	White prairie aster	0.2	0.2	0.1	0.2	--	--	--	--	0.2	0.4
Vicia americana	American vetch	0.1	0.1	1.1	1.9	0.1	0.1	0.5	1.1	0.1	0.2
Subtotal		0.7	0.8	5.5	9.5	6.1	8.4	4.0	9.2	4.8	9.8
Introduced Biennial/Perennial Forbs											
Cirsium arvense	Canada thistle	--	--	--	--	1.0	1.4	--	--	--	--
Cerastium arvense	Field chickweed	--	--	--	--	--	--	0.1	0.2	--	--
Convolvulus arvensis	Field bindweed	1.0	1.2	--	--	3.8	5.2	--	--	5.1	10.4
*Lactuca serriola**	Prickly lettuce	--	--	--	--	0.2	0.3	--	--	--	--
Medicago sativa	Alfalfa	27.4	32.7	--	--	0.2	0.3	--	--	--	--
*Melilotus officinalis**	Yellow sweetclover	0.2	0.2	--	--	0.6	0.8	--	--	0.2	0.4
Rumex crispus	Curly dock	0.1	0.1	--	--	0.3	0.4	--	--	--	--
Taraxacum officinale	Common dandelion	0.6	0.7	--	--	1.4	1.9	--	--	--	--
*Tragopogon dubius**	Western salsify	0.4	0.5	0.1	0.2	0.2	0.3	0.1	0.2	--	--
Trifolium pratense	Red clover	0.6	0.7	--	--	--	--	--	--	--	--
Subtotal		30.3	36.2	0.1	0.2	7.7	10.6	0.2	0.5	5.3	10.8
Native Half- and Sub-Shrubs											
Artemisia frigida	Fringed sagewort	0.7	0.8	1.1	1.9	0.2	0.3	0.3	0.7	0.8	1.6
Artemisia ludoviciana	White sagebrush	--	--	--	--	1.1	1.5	--	--	0.1	0.2
Gutierrezia sarothrae	Broom snakeweed	--	--	0.4	0.7	--	--	0.1	0.2	--	--
Yucca glauca	Yucca	--	--	0.1	0.2	--	--	--	--	--	--
Subtotal		0.7	0.8	1.6	2.8	1.3	1.8	0.4	0.9	0.9	1.8
Native Full Shrubs											
Artemisia cana	Silver sagebrush	--	--	--	--	1.1	1.5	--	--	--	--
Artemisia tridentata	Big sagebrush	1.0	1.2	24.4	42.2	--		0.7	1.6	0.2	0.4
Chrysothamnus viscidiflorus	Yellow rabbitbrush	0.2	0.2	0.3	0.5	--	--	0.1	0.2	0.2	0.4
Ericameria nauseosa	Rubber rabbitbrush	--	--	0.2	0.3	--	--	0.4	0.9	--	--
Rhus aromatica	Skunkbush sumac	--	--	0.6	1.0	0.2	0.3	0.4	0.9	--	--
Symphoricarpos albus	Common snowberry	--	--	--	--	0.2	0.3	--	--	--	--
Symphoricarpos occidentalis	Western snowberry	--	--	--	--	0.3	0.4	--	--	--	--

*Introduced Biennial Forbs

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Full Shrubs (Cont.)											
Symphoricarpos spp.	Snowberry	--	--	--	--	1.0	1.4	--	--	--	--
	Subtotal	1.2	1.4	25.5	44.1	2.8	3.8	1.6	3.7	0.4	0.8
Native Succulents											
Opuntia polycantha	Plains pricklypear	--	--	0.2	0.3	--	--	--	--	0.1	0.2
	Subtotal	--	--	0.2	0.3	--	--	--	--	0.1	0.2
Native Trees											
Juniperus scopulorum	Rocky Mountain juniper	--	--	--	--	--	--	3.3	7.6	--	--
Pinus ponderosa	Ponderosa pine	--	--	--	--	--	--	4.7	10.8	--	--
	Subtotal	--	--	--	--	--	--	8.0	18.3	--	--
	Total Vegetation Cover	**83.8**	**--**	**57.8**	**--**	**72.8**	**--**	**43.6**	**--**	**48.9**	**--**
	Cryptograms	**0.0**	**--**	**1.4**	**--**	**0.0**	**--**	**1.3**	**--**	**0.1**	**--**
	Litter	**13.0**	**--**	**21.9**	**--**	**22.1**	**--**	**17.8**	**--**	**19.8**	**--**
	Rock	**0.7**	**--**	**7.2**	**--**	**0.6**	**--**	**26.3**	**--**	**3.7**	**--**
	Total Ground Cover	**97.5**	**--**	**88.3**	**--**	**95.5**	**--**	**89.0**	**--**	**72.5**	**--**
	Bare Ground	**2.5**	**--**	**11.7**	**--**	**4.5**	**--**	**11.0**	**--**	**27.5**	**--**

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Annual Grasses											
Cenchrus longispinus	Mat sandbar	--	--	--	--	--		--	--	0.1	0.2
Echinochloa muricata	Rough barnyardgrass	--	--	--	--	--	--	0.1	0.2	0.6	1.0
Vulpia octoflora	Sixweeks fescue	--	--	--	--	--	--	0.1	0.2	0.1	0.2
Subtotal		--	--	--	--	--	--	0.2	0.3	0.8	1.4
Introduced Annual Grasses											
Bromus japonicus	Japanese brome	3.8	6.0	1.7	2.1	2.4	5.7	2.9	5.0	4.8	8.3
Bromus tectorum	Cheatgrass	1.4	2.2	1.0	1.2	0.3	0.7	18.8	32.4	13.1	22.6
Triticum aestivum	Common wheat	--	--	--	--	--	--	--	--	--	--
Subtotal		5.2	8.2	2.7	3.3	2.7	6.5	21.7	37.3	17.9	30.9
Native Cool Season Perennial Grasses											
Achnatherum hymenoides	Indian ricegrass	--	--	--	--	0.1	0.2	--	--	--	--
Elymus cinereus	Basin wildrye	--	--	0.2	0.2	--	--	--	--	--	--
Elymus lanceolatus	Thickspike wheatgrass	1.8	2.8	1.3	1.6	0.5	1.2	0.1	0.2	0.6	1.0
Elymus smithii	Western wheatgrass	25.0	39.3	9.8	12.0	4.1	9.8	2.8	4.8	10.4	17.9
Elymus spicatus	Bluebunch wheatgrass	--	--	--	--	7.0	16.7	6.4	11.0	3.9	6.7
Elymus trachycaulus	Slender wheatgrass	1.4	2.2	1.8	2.2	--	--	--	--	0.1	0.2
Festuca spp.	Fescue	--	--	0.2	0.2	--	--	--	--	--	--
Hesperostipa comata	Needleandthread	--	--	--	--	0.7	1.7	4.4	7.6	5.4	9.3
Hordeum jubatum	Foxtail barley	--	--	4.6	5.6	--	--	--	--	--	--
Koeleria macrantha	Prairie junegrass	--	--	--	--	0.1	0.2	0.1	0.2	--	--
Nassella viridula	Green needlegrass	0.4	0.6	1.0	1.2	1.4	3.3	0.9	1.5	1.1	1.9
Poa secunda	Sandberg bluegrass	0.2	0.3	0.6	0.7	0.9	2.2	1.5	2.6	2.9	5.0
Subtotal		28.8	45.3	19.5	23.8	14.8	35.4	16.2	27.9	24.4	42.1
Native Warm Season Perennial Grasses											
Aristida purpurea	Purple threeawn	--	--	--	--	0.1	0.2	0.4	0.7	0.1	0.2
Bouteloua gracilis	Blue grama	--	--	0.2	0.2	0.1	0.2	0.7	1.2	0.5	0.9
Distichlis stricta	Inland saltgrass	--	--	--	--	--	--	--	--	0.4	0.7
Schizachyrium scoparium	Little bluestem	--	--	--	--	0.1	0.2	--	--	--	--
Spartina pectinata	Prairie cordgrass	--	--	3.0	3.7	--	--	--	--	--	--
Subtotal		--	--	3.2	3.9	0.3	0.7	1.1	1.9	1.0	1.7
Introduced Perennial Grasses											
Agropyron cristatum	Crested wheatgrass	1.8	2.8	2.7	3.3	0.1	0.2	--	--	0.3	0.5
Bromus inermis	Smooth brome	15.8	24.8	3.1	3.8	0.1	0.2	0.1	0.2	--	--

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Introduced Perennial Grasses (Cont.)											
Dactylis glomerata	Orchardgrass	--	--	0.3	0.4	--	--	--	--	--	--
Festuca ovina	Sheep fescue	--	--	--	--	--	--	0.4	0.7	--	--
Phleum pratensis	Timothy	--	--	0.4	0.5	--	--	--	--	--	--
Poa bulbosa	Bulbous bluegrass	--	--	--	--	0.1	0.2	--	--	0.1	0.2
Poa pratensis	Kentucky bluegrass	--	--	1.8	2.2	--	--	--	--	--	--
Subtotal		17.6	27.7	8.3	10.1	0.3	0.7	0.5	0.9	0.4	0.7
Native Grasslikes											
Carex filifolia	Threadleaf sedge	0.4	0.6	0.4	0.5	0.1	0.2	0.1	0.2	0.1	0.2
Carex nebrascensis	Nebraska sedge	--	--	3.5	4.3	--	--	--	--	--	--
Juncus balticus	Baltic rush	--	--	1.0	1.2	--	--	--	--	--	--
Schoenoplectus pungens	Common threesquare	--	--	0.1	0.1	--	--	--	--	--	--
Subtotal		0.4	0.6	5.0	6.1	0.1	0.2	0.1	0.2	0.1	0.2
Native Annual Forbs											
Atriplex suckleyi	Suckley's endolepis	--	--	--	--	0.7	1.7	--	--	--	--
Chenopodium berlandieri	Pitseed goosefoot	--	--	0.1	0.1	0.1	0.2	--	--	--	--
Erigeron strigosus	Rough fleabane	--	--	--	--	--	--	--	--	0.1	0.2
Galium aparine	Stickywilly	--	--	0.1	0.1	--	--	--	--	--	--
Helianthus annuus	Annual sunflower	--	--	--	--	--	--	0.1	0.2		
Lappula redowskii	Bluebur stickseed	--	--	--	--	--	--	0.1	0.2	0.1	0.2
Plantago patagonica	Pursh's plantain	0.2	0.3	--	--	0.3	0.7	--	--	0.6	1.0
Subtotal		0.2	0.3	0.2	0.2	1.1	2.6	0.2	0.3	0.8	1.4
Introduced Annual Forbs											
Alyssum desertorum	Desert alyssum	1.4	2.2	0.4	0.5	0.4	1.0	0.7	1.2	1.3	2.2
Bassia sieverisana	Summercypress	--	--	0.3	0.4	--	--	--	--	--	--
Camelina microcarpa	Littleseed falseflax	0.6	0.9	--	--	--	--	0.9	1.5	0.1	0.2
Descurainia sophia	Flixweed	--	--	--	--	--	--	0.1	0.2	--	--
Halogeton glomeratus	Halogeton	0.2	0.3	--	--	--	--	--	--	--	--
Lepidium perfoliatum	Shieldcress	--	--	0.2	0.2	--	--	0.1	0.2	--	--
Medicago lupulina	Black medic	0.2	0.3	0.3	0.4	--	--	0.1	0.2	--	--
Sisymbrium altissimum	Tumble mustard	--	--	--	--	--	--	0.3	0.5	0.4	0.7
Thlaspi arvense	Field pennycress	--	--	0.2	0.2	0.1	0.2	--	--	0.1	0.2
Subtotal		2.4	3.8	1.4	1.7	0.5	1.2	2.2	3.8	1.9	3.3

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Perennial Forbs											
Achillea millefolium	Western yarrow	--	--	1.8	2.2	0.4	1.0	0.1	0.2	0.6	1.0
Ambrosia tomentosa	Skeletonleaf bur ragweed	--	--	--	--	--	--	0.1	0.2	--	--
Asclepias speciosa	Showy milkweed	--	--	0.2	0.2	--	--	--	--	--	--
Asteraceae spp.	Asteraceae	--	--	1.0	1.2	--	--	--	--	--	--
Astragalus spp.	Milkvetch	--	--	0.8	1.0	--	--	0.1	0.2	0.2	0.3
Cirsium spp.	Thistle	--	--	--	--	0.1	0.2	--	--	0.1	0.2
Comandra umbellata	Bastard toadflax	0.2	0.3	0.3	0.4	0.3	0.7	0.1	0.2	--	--
Dalea candida	White prairie clover	--	--	--	--	0.2	0.5	--	--	--	--
Dalea purpurea	Purple prairie clover	--	--	--	--	0.1	0.2	1.0	1.7	--	--
Equisetum laevigatum	Smooth horsetail	--	--	0.2	0.2	--	--	--	--	--	--
Eriogonum pauciflorum	Fewflower buckwheat	--	--	--	--	0.1	0.2	--	--	--	--
Evolvulus nuttallianus	Shaggy dwarf morning-glory	--	--	0.1	0.1	0.2	0.5	0.3	0.5	0.1	0.2
Galium boreale	Northern bedstraw	--	--	0.1	0.1	--	--	0.1	0.2	--	--
Gaura coccinea	Scarlet gaura	--	--	--	--	0.2	0.5	0.1	0.2	0.1	0.2
Glycyrrhiza lepidota	Wild licorice	--	--	0.2	0.2	--	--	0.1	0.2	--	--
Grindelia squarrosa	Curlycup gumweed	1.0	1.6	1.5	1.8	0.1	0.2	--	--	0.1	0.2
Heterotheca villosa	Hairy golden aster	--	--	--	--	0.1	0.2	0.2	0.3	--	--
Lactuca oblongifolia	Blue lettuce	--	--	--	--	--	--	0.4	0.7	0.1	0.2
Lappula spp.	Stickseed	--	--	--	--	--	--	--	--	0.1	0.2
Lygodesmia juncea	Rush skeletonplant	--	--	--	--	--	--	--	--	0.1	0.2
Machaeranthera tanacetifolia	Tansyleaf tansy aster	--	--	--	--	0.1	0.2	--	--	--	--
Musineon divaricatum	Leafy wildparsely	--	--	--	--	0.1	0.2	--	--	0.1	0.2
Pediomelum argophyllum	Silverleaf Indian breadroot	--	--	--	--	0.1	0.2	0.3	0.5	0.2	0.3
Pediomelum esculentum	Large Indian breadroot	--	--	--	--	0.2	0.5	0.2	0.3	--	--
Phlox hoodii	Hoods phlox	--	--	--	--	1.3	3.1	0.1	0.2	0.9	1.6
Polygonum spp.	Knotweed	--	--	--	--	--	--	--	--	0.1	0.2
Psoralidium tenuiflorum	Slimflower scurfpea	--	--	--	--	1.1	2.6	1.1	1.9	0.5	0.9
Ratibida columnifera	Prairie coneflower	--	--	--	--	0.1	0.2	0.1	0.2	--	--
Sonchus spp.	Sowthistle	--	--	1.8	2.2	--	--	--	--	--	--
Sphaeralcea coccinea	Scarlet globemallow	--	--	0.2	0.2	0.5	1.2	1.1	1.9	0.8	1.4
Symphyotrichum falcatum	White prairie aster	--	--	--	--	--	--	--	--	0.1	0.2
Thermopsis rhombifolia	Golden banner	--	--	--	--	0.2	0.5	0.1	0.2	--	--
Vicia americana	American vetch	0.4	0.6	0.2	0.2	0.5	1.2	0.6	1.0	0.5	0.9

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Perennial Forbs (Cont.)											
Zigadenus venenosus	Death camas	--	--	--	--	--	--	--	--	0.1	0.2
Subtotal		1.6	2.5	8.4	10.2	6.0	14.4	6.2	10.7	4.8	8.3
Introduced Biennial/Perennial Forbs											
Cardaria draba	Whitetop	--	--	0.1	0.1	--	--	--	--	--	--
Cirsium arvense	Canada thistle	--	--	0.4	0.5	0.1	0.2	--	--	--	--
Cerastium arvense	Field chickweed	--	--	--	--	--	--	--	--	--	--
Convolvulus arvensis	Field bindweed	1.0	1.6	1.1	1.3	0.5	1.2	1.2	2.1	1.7	2.9
*Cynoglossum officinale**	Western houndstongue	--	--	0.1	0.1	--	--	--	--	--	--
*Lactuca serriola**	Prickly lettuce	--	--	1.0	1.2	--	--	--	--	--	--
Medicago sativa	Alfalfa	0.2	0.3	0.1	0.1	--	--	--	--	--	--
*Melilotus officinalis**	Yellow sweetclover	2.8	4.4	0.2	0.2	--	--	0.1	0.2	0.2	0.3
Taraxacum officinale	Common dandelion	2.4	3.8	2.3	2.8	--	--	--	--	0.6	1.0
*Tragopogon dubius**	Western salsify	0.6	0.9	0.2	0.2	0.3	0.7	0.3	0.5	0.4	0.7
Trifolium repens	White clover	--	--	0.1	0.1	--	--	--	--	--	--
Subtotal		7.0	11.0	5.6	6.8	0.9	2.2	1.6	2.8	2.9	5.0
Native Half- and Sub-Shrubs											
Artemisia frigida	Fringed sagewort	--	--	--	--	1.1	2.6	0.2	0.3	0.8	1.4
Artemisia ludoviciana	White sagebrush	--	--	--	--	0.1	0.2	--	--	--	--
Artemisia pedatifida	Birdfoot sagebrush	--	--	--	--	0.1	0.2	--	--	--	--
Atriplex gardneri	Gardner saltbush	--	--	--	--	0.1	0.2	--	--	--	--
Gutierrezia sarothrae	Broom snakeweed	--	--	--	--	1.1	2.6	0.2	0.3	0.4	0.7
Linanthus pungens	Granite pricklygila	--	--	--	--	--	--	0.1	0.2	--	--
Yucca glauca	Yucca	--	--	--	--	--	--	0.2	0.3	--	--
Subtotal		--	--	--	--	2.5	6.0	0.7	1.2	1.2	2.1
Native Full Shrubs											
Artemisia cana	Silver sagebrush	0.2	0.3	2.3	2.8	0.3	0.7	0.3	0.5	0.3	0.5
Artemisia tridentata	Big sagebrush	--	--	0.2	0.2	9.5	22.7	4.1	7.1	0.9	1.6
Atriplex canescens	Four-wing saltbush	--	--	0.2	0.2	0.1	0.2	--	--	--	--
Ericameria nauseosa	Rubber rabbitbrush	0.2	0.3	--	--	0.6	1.4	--	--	--	--
Rhus aromatica	Skunkbrush sumac	--	--	--	--	0.3	0.7	3.0	5.2	0.2	0.3
Ribes cereum	Wax currant	--	--	--	--	0.1	0.2	--	--	0.1	0.2
Rosa woodsii	Woods rose	--	--	0.2	0.2	0.7	1.7	--	--	--	--
Sarcobatus vermiculatus	Greasewood	--	--	--	--	0.9	2.2	--	--	0.1	0.2

*Introduced Biennial Forbs

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Table D8-5. Summary of 2013 Mean Vegetation Cover Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %	Absolute %	Relative %
Native Full Shrubs (Cont.)											
Symphoricarpos albus	Common snowberry	--	--	11.5	14.0	--	--	--	--	--	--
Symphoricarpos spp.	Snowberry	--	--	--	--	--	--	--	--	0.1	0.2
Subtotal		0.4	0.6	14.4	17.6	12.5	29.9	7.4	12.7	1.7	2.9
Native Succulents											
Opuntia polycantha	Plains pricklypear	--	--	--	--	--	--	--	--	0.1	0.2
Subtotal		--	--	--	--	--	--	--	--	0.1	0.2
Native Trees											
Fraxinus pennsylvanica	Green ash	--	--	1.3	1.6	--	--	--	--	--	--
Juniperus scopulorum	Rocky Mountain juniper			--	--	0.1	0.2	--	--	--	--
Populus deltoids	Eastern cottonwood	--	--	6.6	8.0	--	--	--	--	--	--
Pinus ponderosa	Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Salix amygdaloides	Peachleaf willow	--	--	0.2	0.2	--	--	--	--	--	--
Sorbus scopulina	Greene's mountain ash	--	--	4.6	5.6	--	--	--	--	--	--
Subtotal		--	--	12.7	15.5	0.1	0.2	--	--	--	--
Introduced Trees											
Elaeagnus angustifolia	Russian olive	--	--	0.6	0.7	--	--	--	--	--	--
Subtotal		--	--	0.6	0.7	--	--	--	--	--	--
Total Vegetation Cover		**63.6**	--	**82.0**	--	**41.8**	--	**58.1**	--	**58.0**	--
Cryptograms		**0.0**	--	**0.0**	--	**1.4**	--	**0.4**	--	**0.2**	--
Litter		**25.4**	--	**15.0**	--	**15.7**	--	**19.7**	--	**28.2**	--
Rock		**1.4**	--	**0.9**	--	**10.8**	--	**11.0**	--	**4.3**	--
Total Ground Cover		**90.4**	--	**97.9**	--	**69.7**	--	**89.2**	--	**90.7**	--
Bare Ground		**9.6**	--	**2.1**	--	**30.3**	--	**10.8**	--	**9.3**	--

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Table D8-6. Summary of 2013 Mean Herbaceous Production Data, by Life Form, for the Brook Mine Study Area

Life Form	Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
	Mean (g/m^2)	Relative %	Mean (g/m^2)	Relative %	Mean (g/m^2)	Relative %	Mean (g/m^2)	Relative %	Mean (g/m^2)	Relative %	Mean (g/m^2)	Relative %
Native Annual Grasses	0.3	0.8	--	--	--	--	--	--	<0.1	<0.1	--	--
Introduced Annual Grasses	6.3	16.8	5.1	4.3	7.8	5.4	4.7	12.5	21.3	35.0	15.7	24.4
Native Cool Season Perennial Grasses[1]	21.6	57.6	40.2	33.5	39.8	27.8	20.1	53.3	24.4	40.1	37.0	57.5
Native Warm Season Perennial Grasses	0.4	1.1	1.7	1.4	7.8	5.4	0.2	0.5	0.4	0.7	1.0	1.6
Introduced Perennial Grasses	1.0	2.7	28.8	24.0	44.3	30.9	--	--	<0.1	<0.1	0.7	1.1
Native Grasslikes[2]	0.2	0.5	16.8	14.0	12.3	8.6	0.1	0.3	--	--	0.5	0.8
Native Annual Forbs	0.4	1.1	0.1	0.1	1.0	0.7	0.1	0.3	1.5	2.5	1.5	2.3
Introduced Annual Forbs	2.0	5.3	2.0	1.7	4.9	3.4	0.5	1.3	2.9	4.8	0.4	0.6
Native Perennial Forbs[3]	4.9	13.1	10.8	9.0	10.5	7.3	9.4	24.9	9.5	15.6	6.4	9.9
Introduced Biennial/Perennial Forbs	0.4	1.1	14.5	12.1	14.9	10.4	2.6	6.9	0.8	1.3	1.2	1.9
Total	**37.5**	**100.1**	**120.0**	**100.1**	**143.3**	**99.9**	**37.7**	**100.0**	**60.8**	**100.0**	**64.4**	**100.1**
Total (pounds/acre)	**663.0**	--	**2,139.7**	--	**2,556.9**	--	**673.5**	--	**1,083.7**	--	**1,150.5**	--

[1] Native Cool Season Grasses' and Unknown Grass Species' absolute percents have been combined
[2] Native Grasslike Species' and Unknown Grasslike Species' absolute percents have been combined.
[3] Native Perennial Fobs' and Unknown Forb Species' absolute percents have been combined.
NOTE: Relative percentages shown in this table do not sum to 100.0 due to rounding errors.

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Table D8-7. Summary of 2013 Mean Shrub Density Data, by Species, for the Brook Mine Study Area

Life Form/ Scientific Name	Common Name	Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland		Prairie Dog Modified Grassland	
		Mean (#/m²)	Relative %	Mean (#/m²)	Relative %	Mean (#/m²)	Relative %	Mean (#/m²)	Relative %
Native Half- and Sub-Shrubs									
Artemisia frigida	Fringed sagewort	0.2	12.5	<0.1	3.5	0.1	24.2	0.3	67.3
Artemisia ludoviciana	White sagebrush	--	--	0.3	57.3	0.1	15.7	<0.1	8.0
Artemisia pedatifida	Birdfoot sagebrush	--	--	--	--	--	--	--	--
Atriplex gardneri	Gardner saltbush	--	--	--	--	--	--	--	--
Gutierrezia sarothrae	Broom snakeweed	0.1	8.1	--	--	0.1	24.6	<0.1	6.4
Juniperus horizontalis	Creeping juniper	--	--	--	--	--	--	--	--
Linanthus pungens	Granite pricklygila	--	--	--	--	--	--	--	--
Yucca glauca	Yucca	<0.1	<0.1	--	--	--	--	--	--
Subtotal		0.3	20.6	0.3	60.8	0.4	64.5	0.3	81.7
Native Full Shrubs[1]									
Artemisia cana	Silver sagebrush	<0.1	2.7	0.1	21.9	--	--	<0.1	0.1
Artemisia tridentata	Big sagebrush	0.9	74.5	--	--	0.1	14.1	<0.1	8.5
Atriplex canescens	Four-wing saltbush	--	--	--	--	--	--	--	--
Chrysothamnus viscidiflorus	Yellow rabbitbrush	<0.1	0.9	--	--	<0.1	1.9	<0.1	5.2
Ericameria nauseosa	Rubber rabbitbrush	<0.1	0.9	--	--	<0.1	5.7	<0.1	3.9
Rhus aromatica	Skunkbrush sumac	<0.1	0.2	<0.1	0.4	<0.1	5.7	<0.1	0.1
Ribes cereum	Wax currant	<0.1	<0.1	--	--	<0.1	3.3	--	--
Rosa woodsii	Woods rose	--	--	<0.1	0.2	<0.1	4.7	--	--
Sarcobatus vermiculatus	Greasewood	--	--	--	--	--	--	--	--
Symphoricarpos albus	Common snowberry	<0.1	0.1	<0.1	2.0	--	--	<0.1	0.5
Symphoricarpos occidentalis	Western snowberry	--	--	0.1	14.1	--	--	--	--
Symphoricarpos spp.	Snowberry	--	--	<0.1	0.7	--	--	--	--
Subtotal		1.0	79.4	0.2	39.2	0.2	35.5	0.1	18.3
Total		**1.2**	**100.0**	**0.5**	**100.0**	**0.6**	**100.0**	**0.4**	**100.0**
Total (#/acre)		**4,926.0**	**--**	**2,216.1**	**--**	**2,320.3**	**--**	**1,561.1**	**--**

[1] Native Full Shrubs' and Unknown Native Full Shrub's mean number per square meter values have been combined.
NOTE: #/m² values do not always equal the subtotals and totals shown due to rounding errors generated from the conversion of #/100m² to #/m².

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Table D8-7. Summary of 2013 Mean Shrub Density Data, by Species, for the Brook Mine Study Area (Cont.)

Life Form/ Scientific Name	Common Name	Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland		Scoria Grassland		Upland Grassland	
		Mean (#/m²)	Relative %	Mean (#/m²)	Relative %	Mean (#/m²)	Relative %	Mean (#/m²)	Relative %	Mean (#/m²)	Relative %
Native Half- and Sub-Shrubs											
Artemisia frigida	Fringed sagewort	<0.1	2.1	<0.1	1.1	0.2	12.8	0.1	22.4	0.2	62.8
Artemisia ludoviciana	White sagebrush	--	--	0.1	4.1	<0.1	0.4	<0.1	2.9	--	--
Artemisia pedatifida	Birdfoot sagebrush	--	--	--	--	<0.1	0.1	--	--	<0.1	0.1
Atriplex gardneri	Gardner saltbush					<0.1	0.2	--	--	--	--
Gutierrezia sarothrae	Broom snakeweed	--	--	<0.1	<0.1	0.3	16.9	<0.1	8.1	<0.1	4.9
Juniperus horizontalis	Creeping juniper					<0.1	<0.1	--	--	--	--
Krascheninnikovia lanata	Winterfat	--	--	--	--	--	--	<0.1	0.1	<0.1	2.6
Lianthus pungens	Granite pricklygila					<0.1	0.1	--	--	--	--
Yucca glauca	Yucca	--	--	--	--	<0.1	0.2	<0.1	1.1	<0.1	1.1
Subtotal		<0.1	2.1	0.1	5.2	0.5	30.6	0.2	34.5	0.2	71.3
Native Full Shrubs[1]											
Artemisia cana	Silver sagebrush	<0.1	8.3	0.2	11.6	<0.1	0.9	<0.1	5.9	<0.1	3.7
Artemisia tridentata	Big sagebrush	<0.1	2.1	<0.1	0.5	0.6	39.3	0.2	40.2	<0.1	11.7
Atriplex canescens	Four-wing saltbush	<0.1	79.2	--	--	<0.1	<0.1	--	--	--	--
Chrysothamnus viscidiflorus	Yellow rabbitbrush	--	--	--	--	<0.1	0.3	<0.1	0.2	<0.1	4.6
Ericameria nauseosa	Rubber rabbitbrush	<0.1	8.3	<0.1	0.1	0.2	11.2	<0.1	2.0	<0.1	1.7
Rhus aromatica	Skunkbrush sumac	--	--	<0.1	<0.1	<0.1	0.6	0.1	13.4	<0.1	1.1
Ribes cereum	Wax currant	--	--	<0.1	0.1	--	--	<0.1	0.1	<0.1	0.3
Rosa woodsii	Woods rose	--	--	0.1	4.5	0.2	15.3	<0.1	3.3	<0.1	1.1
Sarcobatus vermiculatus	Greasewood	--	--	--	--	<0.1	1.6	--	--	<0.1	0.9
Shepherdia canadensis	Russet buffaloberry	--	--	<0.1	0.2	--	--	--	--	--	--
Symphoricarpos albus	Common snowberry	--	--	1.3	70.0	<0.1	0.1	<0.1	0.2	<0.1	3.4
Symphoricarpos occidentalis	Western snowberry	--	--	0.1	7.9	<0.1	0.1	<0.1	<0.1	--	--
Subtotal		<0.1	97.9	1.7	94.8	1.1	69.4	0.3	65.5	0.1	28.7
Total		**<0.1**	**100.0**	**1.8**	**100.0**	**1.6**	**100.0**	**0.5**	**100.0**	**0.3**	**100.0**
Total (#/acre)		**194.3**	--	**7,298.7**	--	**6,434.7**	--	**1,849.5**	--	**1,412.6**	--

[1] Native Full Shrubs' and Unknown Native Full Shrub's mean number per square meter values have been combined.
NOTE: #/m² values do not always equal the subtotals and totals shown due to rounding errors generated from the conversion of #/100m² to #/m².

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Table D8-8. Number of Species Sampled and Number of Species Sampled with Greater Than 2% Relative Vegetation Cover, on the Cover Transects, within the Brook Mine Study Area

Life Form	Agricultural Land		Big Sagebrush Shrubland		Bottomland Sagebrush Grassland		Pine and Juniper Woodland	
	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%
Native Annual Grasses	--	--	1	--	--	--	--	--
Introduced Annual Grasses*	3	--	2	2	2	2	2	2
Native Cool Season Perennial Grasses[1]	11	3	5	5	10	3	5	3
Native Warm Season Perennial Grasses	2	--	2	--	3	--	1	--
Introduced Perennial Grasses	5	3	2	--	5	2	--	--
Native Grasslike Species	1	--	1	--	4	2	1	--
Native Annual Forbs	3	--	1	--	3	--	1	--
Introduced Annual Forbs*	3	--	2	1	6	1	3	--
Native Perennial Forbs[2]	5	--	13	1	14	--	6	1
Introduced Biennial/Perennial Forbs*	7	1	1	--	8	1	2	--
Native Half- and Sub-Shrubs	1	--	3	--	2	--	2	--
Native Full Shrubs[3]	2	--	4	1	4	--	4	--
Native Succulents	--	--	1	--	--	--	--	--
Native Trees	--	--	--	--	--	--	2	2
Introduced Trees	--	--	--	--	--	--	--	--
Total	**43**	**7**	**38**	**10**	**61**	**11**	**29**	**8**

[1] Native Cool Season Perennial Grasses and Unknown Grasses have been combined.
[2] Native Perennial Forbs and Unknown Forbs have been combined.
[3] Does not include *Symphoricarpos* spp. when *Symphoricarpos albus* and *Symphoricarpos occidentalis* are both present.
* Includes Species Lacking Creditable Value.

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Table D8-8. Number of Species Sampled and Number of Species Sampled with Greater Than 2% Relative Vegetation Cover, on the Cover Transects, within the Brook Mine Study Area (Cont.)

Life Form	Prairie Dog Modified Grassland		Reclaimed Grassland		Riparian Woodland		Rough Breaks Mixed Shrubland	
	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%	Total # of Species Sampled	# of Species ≥ 2%
Native Annual Grasses	1	--	--	--	--	--	--	--
Introduced Annual Grasses*	2	2	2	2	2	1	2	1
Native Cool Season Perennial Grasses[1]	5	1	5	3	8	3	8	4
Native Warm Season Perennial Grasses	3	1	--	--	2	1	3	--
Introduced Perennial Grasses	2	1	2	2	5	3	3	--
Native Grasslike Species	--	--	1	--	4	1	1	--
Native Annual Forbs	5	1	1	--	2	--	3	--
Introduced Annual Forbs*	9	1	4	1	5	--	2	--
Native Perennial Forbs[2]	20	1	3	--	13	2	20	2
Introduced Biennial/Perennial Forbs*	2	1	5	2	10	1	3	--
Native Full Shrubs[3]	2	--	2	--	5	2	8	2
Native Half- and Sub-Shrubs	2	--	--	--	--	--	5	2
Native Succulents	1	--	--	--	--	--	--	--
Native Trees	--	--	--	--	4	2	1	--
Introduced Trees	--	--	--	--	1	--	--	--
Total	**54**	**9**	**25**	**10**	**61**	**16**	**59**	**11**

[1] Native Cool Season Perennial Grasses and Unknown Grasses have been combined.
[2] Native Perennial Forbs and Unknown Forbs have been combined.
[3] Does not include *Symphoricarpos* spp. when *Symphoricarpos albus* and *Symphoricarpos occidentalis* are both present.
* Includes Species Lacking Creditable Value.

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Table D8-8. Number of Species Sampled and Number of Species Sampled with Greater Than 2% Relative Vegetation Cover, on the Cover Transects, within the Brook Mine Study Area (Cont.)

Life Form	Scoria Grassland		Upland Grassland	
	Total # of Species Sampled	**# of Species ≥ 2%**	**Total # of Species Sampled**	**# of Species ≥ 2%**
Native Annual Grasses	2	--	3	--
Introduced Annual Grasses*	2	2	2	2
Native Cool Season Perennial Grasses[1]	7	4	7	4
Native Warm Season Perennial Grasses	2	--	3	--
Introduced Perennial Grasses	2	--	2	--
Native Grasslike Species	1	--	1	--
Native Annual Forbs	2	--	3	--
Introduced Annual Forbs*	6	--	4	1
Native Perennial Forbs[2]	19	--	18	--
Introduced Biennial/Perennial Forbs*	3	1	4	1
Native Half- and Sub-Shrubs	4	--	2	--
Native Full Shrubs[3]	3	2	6	--
Native Succulents	--	--	1	--
Native Trees	--	--	--	--
Introduced Trees	--	--	--	--
Total	**53**	**9**	**56**	**8**

[1] Native Cool Season Perennial Grasses and Unknown Grasses have been combined.
[2] Native Perennial Forbs and Unknown Forbs have been combined.
[3] Does not include *Symphoricarpos* spp. when *Symphoricarpos albus* and *Symphoricarpos occidentalis* are both present.
* Includes Species Lacking Creditable Value.

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Table D8-9. Summary of 2013 Sample Adequacy Calculations for the Brook Mine Study Area

Vegetation Community	Mean	Standard Deviation	Actual Sample #	Computed Adequate Sample Size	Computed Z-Value	Confidence Level Achieved
Agricultural Land						
Total Vegetation Cover	83.8	22.6	25	24	0.93	N/A
Total Ground Cover	97.5	5.0	25	1	4.86	N/A
Density	0.0	0.0	25	N/A	N/A	N/A
Big Sagebrush Shrubland						
Total Vegetation Cover	57.8	10.5	23	11	1.33	N/A
Total Ground Cover	88.3	7.3	23	2	2.89	N/A
Production	37.5	23.7	50	14	1.12	N/A
Density	1.2	64.5	50	92	0.67	74.9
Bottomland Sagebrush Grassland						
Total Vegetation Cover	72.8	13.4	25	11	1.36	N/A
Total Ground Cover	95.5	5.0	25	1	4.79	N/A
Production	120.0	85.2	25	165	0.35	63.7
Density	0.5	68.3	25	509	0.20	57.9
Pine and Juniper Woodland						
Total Vegetation Cover	43.6	18.5	15	59	0.46	67.7
Total Ground Cover	89.0	12.1	15	6	1.42	N/A
Density	0.6	62.2	15	385	0.18	57.1
Prairie Dog Modified Grassland						
Total Vegetation Cover	48.9	16.2	40	36	0.95	N/A
Total Ground Cover	72.5	20.0	40	25	1.15	N/A
Density	0.4	73.0	40	1,172	0.17	56.8

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Table D8-9. Summary of 2013 Sample Adequacy Calculations for the Brook Mine Study Area (Cont.)

Vegetation Community	Mean	Standard Deviation	Actual Sample #	Computed Adequate Sample Size	Computed Z-Value	Confidence Level Achieved
Reclaimed Grassland						
Total Vegetation Cover	63.6	9.1	10	7	1.11	N/A
Total Ground Cover	90.4	10.8	10	5	1.33	N/A
Density	<0.1	10.8	10	1,662	0.07	52.8
Riparian Woodland						
Total Vegetation Cover	82.0	14.8	25	11	1.38	N/A
Total Ground Cover	97.9	3.5	25	0	6.93	N/A
Production	143.3	78.1	48	109	0.60	72.6
Density	1.8	179.3	46	324	0.34	63.3
Rough Breaks Mixed Shrubland						
Total Vegetation Cover	41.8	12.0	30	27	0.95	N/A
Total Ground Cover	69.7	17.4	30	21	1.09	N/A
Production	37.7	24.0	50	14	1.13	N/A
Density	1.6	83.1	49	89	0.67	74.9
Scoria Grassland						
Total Vegetation Cover	58.1	9.3	28	8	1.65	N/A
Total Ground Cover	89.2	7.1	28	2	3.33	N/A
Production	60.8	33.8	50	101	0.64	73.9
Density	0.5	42.0	50	277	0.38	64.8
Upland Grassland						
Total Vegetation Cover	58.0	12.7	28	16	1.21	N/A
Total Ground Cover	90.7	9.2	28	3	2.62	N/A
Production	65.4	27.9	50	69	0.77	77.9
Density	0.3	36.7	52	362	0.34	63.3

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Table D8-10. Threatened and Endangered Plant Species Surveyed for and Potential Occurrence within the Brook Mine Study Area

Common Name	Scientific Name	Status	Habitat	Potential Occurrence within the Proposed Brook Mine Permit Area
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	Seasonally moist soils and wet meadows of drainages below 7,000ft. in elevation	Habitat Confirmed Unsuitable
Blowout penstemon	*Penstemon haydenii*	Endangered	Sand blowouts or dunes	Habitat Confirmed Unsuitable

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ATTACHMENT D8-1-B

Comprehensive Plant Species List

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Acronym	Current Nomenclature	Common Name	Agricultural Land	Big Sagebrush Shrubland	Bottomland Sagebrush Grassland	Pine and Juniper Woodland	Prairie Dog Modified Grassland	Reclaimed Grassland	Riparian Woodland	Rough Breaks Mixed Shrubland	Scoria Grassland	Upland Grassland
Native Annual Grasses												
CENLON	*Cenchrus longispinus*	Mat sandbur										X
ECHMUR	*Echinochloa muricata*	Rough barnyardgrass		X							X	X
VULOCT	*Vulpia octoflora*	Sixweeks fescue		X			X				X	X
Introduced Annual Grasses												
BROJAP*	*Bromus japonicus*	Japanese brome	X	X	X	X	X	X	X	X	X	X
BROTEC*	*Bromus tectorum*	Cheatgrass	X	X	X	X	X	X	X	X	X	X
POLMON	*Polypogon monspeliensis*	Annual rabbitfoot grass										
TRIAES	*Triticum aestivum*	Common wheat	X									
Native Cool Season Perennial Grasses												
ACHHYM	*Achnatherum hymenoides*	Indian ricegrass		X	X					X		
ELYCIN	*Elymus cinereus*	Basin wildrye							X			
ELYELY	*Elymus elymoides*	Bottlebrush squirreltail			X							
ELYHIS	*Elymus hispidus*	Intermediate wheatgrass										
ELYLAN	*Elymus lanceolatus*	Thickspike wheatgrass	X		X			X	X	X	X	X
ELYSMI	*Elymus smithii*	Western wheatgrass	X	X	X	X	X	X	X	X	X	X
ELYSPI	*Elymus spicatus*	Bluebunch wheatgrass	X	X	X	X	X			X	X	X
ELYTRA	*Elymus trachycaulus*	Slender wheatgrass	X		X			X	X			X
FESIDA	*Festuca idahoensis*	Idaho fescue		X							X	
GLYGRA	*Glyceria grandis*	American mannagrass	X									
HESCOM	*Hesperostipa comata*	Needleandthread	X	X	X	X	X			X	X	X
HORJUB	*Hordeum jubatum*	Foxtail barley	X		X				X			
KOEMAC	*Koeleria macrantha*	Prairie junegrass								X	X	
NASVIR	*Nassella viridula*	Green needlegrass	X	X	X	X	X	X	X	X	X	X
PHAARU	*Phalaris arundinacea*	Reed canarygrass	X		X							
POASEC	*Poa secunda*	Sandberg bluegrass	X	X	X	X	X	X	X	X	X	X
Native Warm Season Perennial Grasses												
ARIPUR	*Aristida purpurea*	Purple threeawn		X			X			X	X	X
BOUGRA	*Bouteloua gracilis*	Blue grama	X	X	X	X	X		X	X	X	X
BUCDAC	*Buchloe dactyloides*	Buffalograss			X						X	
DISSTR	*Distichlis stricta*	Inland saltgrass										X
SCHSCO	*Schizachyrium scoparium*	Little bluestem								X		
SPAPEC	*Spartina pectinata*	Prairie cordgrass	X		X				X			
SPOAIR	*Sporobolus airoides*	Alkali sacaton										
SPOCRY	*Sporobolus cryptandrus*	Sand dropseed					X					X

X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.
	Species observed, but not sampled.

*** Species Lacking Credible Value (SLCV)**

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Acronym	Current Nomenclature	Common Name	Agricultural Land	Big Sagebrush Shrubland	Bottomland Sagebrush Grassland	Pine and Juniper Woodland	Prairie Dog Modified Grassland	Reclaimed Grassland	Riparian Woodland	Rough Breaks Mixed Shrubland	Scoria Grassland	Upland Grassland
Introduced Perennial Grasses												
AGRCRI	*Agropyron cristatum*	Crested wheatgrass	X	X	X		X	X	X	X		X
AGRCAP	*Agrostis capillaris*	Colonial bentgrass							X			
BROINE	*Bromus inermis*	Smooth brome	X	X	X		X	X	X	X	X	X
DACGLO	*Dactylis glomerata*	Orchardgrass	X						X			
ELYJUN	*Elymus junceus*	Russian wildrye			X							
FESOVI	*Festuca ovina*	Sheep fescue		X							X	X
PHLPRA	*Phleum pratense*	Timothy	X		X				X			
POABUL	*Poa bulbosa*	Bulbous bluegrass		X	X					X		X
POAPRA	*Poa pratensis*	Kentucky bluegrass	X		X				X			
Perennial Grass Species Unknown Origin												
FESSPP	*Festuca* spp.	Fescue	X						X			
Native Grasslike Species												
CARFIL	*Carex filifolia*	Threadleaf sedge		X		X		X	X	X	X	X
CARNEB	*Carex nebrascensis*	Nebraska sedge	X		X				X			
CARPRA	*Carex praegracilis*	Clustered field sedge			X							
CARPRA	*Carex prairea*	Prairie sedge										
CARSPP	*Carex* spp.	Sedge			X							
JUNBAL	*Juncus balticus*	Baltic rush			X				X			
JUNINT	*Juncus interior*	Inland rush										
SCHACU	*Schoenoplectus acutus*	Hardstem clubrush										
SCHMAR	*Schoenoplectus maritimus*	Cosmopolitan bulrush										
SCHPUN	*Schoenoplectus pungens*	Common threesquare			X				X			
SCHTAB	*Schoenoplectus tabernaemontani*	Softstem bulrush										
SCIPAL	*Scirpus pallidus*	Greenscale bulrush										
Native Annual Forbs												
ATRSUC	*Atriplex suckleyi*	Suckley's endolepis								X		
CHAGLY	*Chamaesyce glyptosperma*	Ribseed sandmat					X					
CHEBER	*Chenopodium berlandieri*	Pitseed goosefoot	X		X				X	X		
CHELEP	*Chenopodium leptophyllum*	Narrowleaf goosefoot										
CLESER	*Cleome serrulata*	Rocky mountain beeplant										
DESPIN	*Descurainia pinnata*	Western tansymustard	X						X	X	X	X
ERISTR	*Erigeron strigosus*	Rough fleabane										X
GALAPA	*Galium aparine*	Stickywilly							X			
LOGARV	*Logfia arvensis*	Field cottonrose		X			X			X	X	X

X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.
	Species observed, but not sampled.

*** Species Lacking Credible Value (SLCV)**

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Acronym	Current Nomenclature	Common Name	Agricultural Land	Big Sagebrush Shrubland	Bottomland Sagebrush Grassland	Pine and Juniper Woodland	Prairie Dog Modified Grassland	Reclaimed Grassland	Riparian Woodland	Rough Breaks Mixed Shrubland	Scoria Grassland	Upland Grassland
Native Annual Forbs (Cont.)												
HELANN	*Helianthus annuus*	Annual sunflower							X		X	
LAPRED	*Lappula redowskii*	Bluebur stickseed		X	X		X				X	X
PLAPAT	*Plantago patagonica*	Pursh's plantain	X	X	X	X	X	X		X		X
SOLTRI	*Solanum triflorum*	Cutleaf nightshade					X					
XANSTR*	*Xanthium strumarium*	Common cocklebur									X	
Introduced Annual Forbs												
ALYDES	*Alyssum desertorum*	Desert alyssum	X	X	X	X	X	X	X	X	X	X
AMAALB	*Amaranthus albus*	Prostrate pigweed					X					
ATRHET	*Atriplex heterosperma*	Twoscale saltbush							X			
BASSIE*	*Bassia sieversiana*	Summercypress	X		X		X		X			X
BRAJUN	*Brassica juncea*	Brown mustard					X					
CAMMIC	*Camelina microcarpa*	Littleseed falseflax		X	X	X		X	X		X	X
CHEALB	*Chenopodium album*	Common lambsquarter								X		
DESSOP	*Descurainia sophia*	Flixweed		X	X				X		X	
HALGLO*	*Halogeton glomeratus*	Halogeton						X				
LEPCAM	*Lepidium campestre*	Field pepperweed										
LEPPER	*Lepidium perfoliatum*	Shieldcress			X				X		X	
LOGARV	*Logfia arvensis*	Fluffweed		X								
MEDLUP	*Medicago lupulina*	Black medic		X			X	X	X	X	X	
POLARG	*Polygonum argyrocoleon*	Silversheath knotweed					X					
POLAVI	*Polygonum aviculare*	Prostrate knotweed					X					
POLCON	*Polygonum convolvulus*	Black bindweed	X				X		X			
SALTRA*	*Salsola tragus*	Russian thistle										
SISALT	*Sisymbrium altissimum*	Tumble mustard			X		X				X	X
THLARV	*Thlaspi arvense*	Field pennycress		X	X	X			X	X		X
Native Biennial Forbs												
LACLUD	*Lactuca ludoviciana*	Wild lettuce										
Introduced Biennial Forbs												
CIRVUL	*Cirsium vulgare*	Bull thistle										
CYNOFF*	*Cynoglossum officinale*	Western houndstongue							X			
LACSER	*Lactuca serriola*	Prickly lettuce			X				X	X		
MELOFF	*Melilotus officinalis*	Yellow sweetclover	X	X	X		X	X	X	X	X	X
TRADUB	*Tragopogon dubius*	Western salsify	X	X	X	X		X	X	X	X	X
X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.											
	Species observed, but not sampled.											

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Native Perennial Forbs												
ACHMIL	*Achillea millefolium*	Western yarrow	X	X	X	X	X		X	X	X	X
AGOAUR	*Agoseris aurantiaca*	Orange agoseris							X			
AGOGLA	*Agoseris glauca*	Pale agoseris								X		X
ALLTEX	*Allium textile*	Textile onion		X						X		
AMBPSI	*Ambrosia psilostachya*	Western ragweed			X		X				X	X
AMBTOM*	*Ambrosia tomentosa*	Skeletonleaf bur ragweed			X						X	X
ANTMIC	*Antennaria microphylla*	Littleleaf pussytoes		X			X			X		X
APOCAN	*Apocynum cannabinum*	Indianhemp							X			
ASCSPE*	*Asclepias speciosa*	Showy milkweed			X				X			
ASTSP1	*Asteraceae* spp.	Asteraceae							X			
ASTADS	*Astragalus adsurgens*	Prairie milkvetch										
ASTBAR	*Astragalus barrii*	Barr's milkvetch										
ASTBIS	*Astragalus bisulcatus*	Twogrooved milkvetch										
ASTMIS	*Astragalus miser*	Weedy milkvetch										
ASTSPA	*Astragalus spatulatus*	Spoonleaf milkvetch										X
BALSAG	*Balsamorhiza sagittata*	Arrowleaf balsamroot										
BRIEUP	*Brickellia eupatorioides*	Thoroughwort		X					X		X	
CALNUT	*Calochortus nuttallii*	Sego lily		X						X		
CIRFLO	*Cirsium flodmanii*	Flodman thistle										X
CIRUND	*Cirsium undulatum*	Wavyleaf thistle										
COMUMB	*Comandra umbellata*	Bastard toadflax		X				X	X	X	X	
DALCAN	*Dalea candida*	White prarie clover								X		
DALPUR	*Dalea purpurea*	Purple prarie clover		X		X	X			X	X	X
DODPUL	*Dodecatheon pulchellum*	Darkthroat shootingstar										
ECHANG	*Echinacea angustifolia*	Purple coneflower			X							
EQULAE	*Equisetum laevigatum*	Smooth horsetail			X				X			
ERIFLA	*Eriogonum flavum*	Alpine golden buckwheat										
ERIOVA	*Eriogonum ovalifolium*	Cushion wild buckwheat		X								
ERIPAU	*Eriogonum pauciflorum*	Fewflower buckwheat		X						X	X	
EVONUT	*Evolvulus nuttallianus*	Shaggy dwarf morning-glory		X			X		X	X	X	X
GALBOR	*Galium boreale*	Northern bedstraw							X		X	
GAUCOC	*Gaura coccinea*	Scarlet gaura		X			X			X	X	X
GLYLEP*	*Glycyrrhiza lepidota*	Wild licorice			X				X	X	X	
GRISQU	*Grindelia squarrosa*	Curlycup gumweed					X	X	X	X		X

X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.
	Species observed, but not sampled.

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Native Perennial Forbs (Cont.)												
HETVIL	*Heterotheca villosa*	Hairy golden aster		X			X			X	X	
HYMRIC	*Hymenoxys richardsonii*	Pingue rubberweed										
LACOBL	*Lactuca oblongifolia*	Blue lettuce							X		X	X
LEPFRE	*Lepidium fremontii*	Desert pepperweed							X			
LEUMON	*Leucocrinum montanum*	Sand lily										
LIAPUN	*Liatris punctata*	Dotted blazing star										
LINLEW	*Linum lewisii*	Blue flax					X		X			
LOMFOE	*Lomatium foeniculaceum*	Desert biscuitroot									X	
LYGJUN	*Lygodesmia juncea*	Rush skeletonplant		X	X		X				X	X
MACGRI	*Machaeranthera grindelioides*	Nutall's goldenweed								X		
MACTAN	*Machaeranthera tanacetifolia*	Tansyleaf tansy aster								X		
MERCIL	*Mertensia ciliata*	Mountain bluebells		X								
MUSDIV	*Musineon divaricatum*	Leafy wildparsley								X	X	X
OXYCAM	*Oxytropis campestris*	Field locoweed										
OXYLAM	*Oxytropis lambertii*	Lambert crazyweed								X		
OXYSER	*Oxytropis sericea*	White locoweed								X	X	
PACCAN	*Packera cana*	Woolly groundsel								X		
PEDARG	*Pediomelum argophyllum*	Silverleaf Indian breadroot		X			X			X	X	X
PEDESC	*Pediomelum esculentum*	Large Indian breadroot		X						X	X	X
PENALB	*Penstemon albidus*	White beardtongue										
PHLHOO	*Phlox hoodii*	Hoods phlox	X	X		X	X			X	X	X
PSOLAN	*Psoralidium lanceolatum*	Narrowleaf scurfpea								X		
PSOTEN	*Psoralidium tenuiflorum*	Slimflower scurfpea	X	X	X	X	X			X	X	X
RATCOL	*Ratibida columnifera*	Prairie coneflower								X	X	
SOLMIS	*Solidago missouriensis*	Missouri goldenrod										
SPHCOC	*Sphaeralcea coccinea*	Scarlet globemallow		X	X	X	X		X	X	X	X
STEARM	*Stenotus armerioides*	Thrifty goldenweed								X		
SYMFAL	*Symphyotrichum falcatum*	White prairie aster	X	X			X		X	X	X	X
THERHO	*Thermopsis rhombifolia*	Golden banner		X						X	X	X
TYPLAT	*Typha latifolia*	Common cattail							X			
VICAME	*Vicia americana*	American vetch	X	X	X	X	X	X	X	X	X	X
VIONUT	*Viola nuttallii*	Nuttall's violet										
WYEAMP	*Wyethia amplexicaulis*	Mulesears wyethia							X			
ZIGVEN	*Zigadenus venenosus*	Death camas										X
X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.											
	Species observed, but not sampled.											

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Introduced Perennial Forbs												
ASTCIC	*Astragalus cicer*	Cicer milkvetch								X	X	
CARDRA*	*Cardaria draba*	Whitetop							X			
CERARV	*Cerastium arvense*	Field chickweed				X						
CIRARV*	*Cirsium arvense*	Canada thistle	X		X				X	X		X
CONARV*	*Convolvulus arvensis*	Field bindweed	X		X		X	X	X	X	X	X
LEPLAT*	*Lepidium latifolium*	Perennial pepperweed										
MEDSAT	*Medicago sativa*	Alfalfa	X		X			X	X		X	
POTREC	*Potentilla recta*	Sulphur cinquefoil										
RUMCRI*	*Rumex crispus*	Curly dock	X		X				X			
TANVUL*	*Tanacetum vulgare*	Common tansy										
TAROFF	*Taraxacum officinale*	Common dandelion	X	X	X			X	X	X	X	X
TRIPRA	*Trifolium pratense*	Red clover	X									
TRIREP	*Trifolium repens*	White clover							X			
Unknown Forb Species												
ARESPP	*Arenaria* spp.	Sandwort										
ASTSPP	*Astragalus* spp.	Milkvetch			X		X		X		X	X
CASSPP	*Castilleja* spp.	Indian paintbrush										
CHESPP	*Chenopodium* spp.	Goosefoot							X			
CIRSPP	*Cirsium* spp.	Thistle					X			X		X
CRYSPP	*Cryptantha* spp.	Cryptantha									X	
DELSPP	*Delphinium* spp.	Larkspur										
ERISPP	*Eriogonum* spp.	Buckwheat								X	X	X
GEUSPP	*Geum* spp.	Avens										
LACSPP	*Lactuca* spp.	Lettuce										
LAPSPP	*Lappula* spp.	Stickseed										X
OXYSPP	*Oxytropis* spp.	Locoweed										
PENSPP	*Penstemon* spp.	Penstemon					X			X		X
PHYSPP	*Physaria* spp.	Twinpod										
POLSPP	*Polygonum* spp.	Knotweed			X					X		X
PSOSPP	*Psoralidium* spp.	Scurfpea										
RUMSPP	*Rumex* spp.	Dock			X		X					
SONSPP	*Sonchus* spp.	Sowthistle			X				X			
TRISPP	*Trifolium* spp.	Clover			X							
VIOSPP	*Viola* spp.	Violet										

X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.
	Species observed, but not sampled.

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Native Full Shrubs												
ARTCAN	*Artemisia cana*	Silver sagebrush		X	X		X	X	X	X	X	X
ARTTRI	*Artemisia tridentata*	Big sagebrush	X	X		X	X	X	X	X	X	X
ATRCAN	*Atriplex canescens*	Four-wing saltbush						X	X	X		
CHRVIS	*Chrysothamnus viscidiflorus*	Yellow rabbitbrush	X	X		X	X			X	X	X
ERINAU	*Ericameria nauseosa*	Rubber rabbitbrush		X		X	X	X	X	X	X	X
PRUVIR	*Prunus virginiana*	Chokecherry									X	
RHUARO	*Rhus aromatica*	Skunkbush sumac		X	X	X	X		X	X	X	X
RIBCER	*Ribes cereum*	Wax currant		X		X			X	X		X
RIBLAC	*Ribes lacustre*	Prickly currant										
ROSWOO	*Rosa woodsii*	Woods rose			X	X			X	X	X	X
SARVER	*Sarcobatus vermiculatus*	Greasewood								X		X
SHECAN	*Shepherdia canadensis*	Russet buffaloberry							X			
SYMALB	*Symphoricarpos albus*	Common snowberry		X	X		X		X	X	X	X
SYMOCC	*Symphoricarpos occidentalis*	Western snowberry			X				X	X	X	
SYMSPP	*Symphoricarpos spp.*	Snowberry			X				X			X
Native Half- and Sub-Shrubs												
ARTFRI	*Artemisia frigida*	Fringed sagewort	X	X	X	X	X	X	X	X	X	X
ARTLUD	*Artemisia ludoviciana*	White sagebrush			X	X	X		X	X	X	
ARTPED	*Artemisia pedatifida*	Birdfoot sagebrush								X		X
ATRGAR	*Atriplex gardneri*	Gardner saltbush								X		
GUTSAR	*Gutierrezia sarothrae*	Broom snakeweed		X		X	X		X	X	X	X
JUNHOR	*Juniperus horizontalis*	Creeping juniper								X		
KRALAN	*Krascheninnikovia lanata*	Winterfat									X	X
LINPUN	*Linanthus pungens*	Granite pricklygila								X	X	
YUCGLA	*Yucca glauca*	Yucca		X						X	X	X
Native Trees												
ACENEG	*Acer negundo*	Boxelder										
FRAPEN	*Fraxinus pennsylvanica*	Green ash							X			
JUNMON	*Juniperus monosperma*	One seeded juniper										
JUNSCO	*Juniperus scopulorum*	Rocky Mountain juniper				X				X	X	
PINPON	*Pinus ponderosa*	Ponderosa pine				X						
POPDEL	*Populus deltoides*	Eastern cottonwood							X			
X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.											
	Species observed, but not sampled.											

*** Species Lacking Credible Value (SLCV)**
NOTE: For species diversity calculations: (1) unknown plant species shown in this table were counted toward the total number of species observed or sampled, but were not counted toward the total number of life forms observed or sampled and (2) species lacking credible value (SLCV) were not counted toward the total number of species or the total number of life forms observed or sampled

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Acronym	Current Nomenclature	Common Name	Agricultural Land	Big Sagebrush Shrubland	Bottomland Sagebrush Grassland	Pine and Juniper Woodland	Prairie Dog Modified Grassland	Reclaimed Grassland	Riparian Woodland	Rough Breaks Mixed Shrubland	Scoria Grassland	Upland Grassland
Native Trees (Cont.)												
SALAMY	*Salix amygdaliodes*	Peachleaf willow							X			
SALEXI	*Salix exigua*	Narrowleaf willow										
SORSCO	*Sorbus scopulina*	Greene's mountain ash							X			
Introduced Trees												
ELAANG*	*Elaeagnus angustifolia*	Russian olive							X			
Native Succulents												
OPUPOL*	*Opuntia polyacantha*	Plains pricklypear		X			X					X
X	Species sampled on cover transects, shrub density belt transects, and/or in production plots.											
	Species observed, but not sampled.											

*** Species Lacking Credible Value (SLCV)**
NOTE: For species diversity calculations: (1) unknown plant species shown in this table were counted toward the total number of species observed or sampled, but were not counted toward the total number of life forms observed or sampled and (2) species lacking credible value (SLCV) were not counted toward the total number of species or the total number of life forms observed or sampled

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Cover Summaries

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	AG	**Sample Size:**	1
Community Type:	Agricultural Land	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	1.0	1.2	2.6	16.0	2.5	3.8	12
Bromus tectorum	0.2	0.2	0.9	8.0	1.3	1.5	21
Triticum aestivum	0.1	0.1	0.4	4.0	0.6	0.7	25
Sub-Total	**1.3**	**1.6**	**2.6**				
Native Cool Season Perennial Grasses							
Elymus lanceolatus	0.7	0.8	3.2	8.0	1.3	2.1	18
Elymus smithii	4.2	5.0	5.5	44.0	7.0	12.0	5
Elymus spicatus	0.2	0.2	0.7	12.0	1.9	2.1	18
Elymus trachycaulus	15.6	18.6	17.6	64.0	10.2	28.8	2
Glyceria grandis	0.2	0.2	1.2	4.0	0.6	0.8	24
Hesperostipa comata	0.2	0.2	0.6	8.0	1.3	1.5	21
Hordeum jubatum	0.6	0.7	2.8	4.0	0.6	1.3	22
Nassella viridula	0.1	0.1	0.4	4.0	0.6	0.7	25
Phalaris arundinacea	0.1	0.1	0.4	4.0	0.6	0.7	25
Poa secunda	1.4	1.7	4.2	16.0	2.5	4.2	10
Sub-Total	**23.3**	**27.8**	**19.5**				
Native Warm Season Perennial Grasses							
Bouteloua gracilis	0.2	0.2	0.9	8.0	1.3	1.5	21
Spartina pectinata	0.1	0.1	0.4	4.0	0.6	0.7	25
Sub-Total	**0.3**	**0.4**	**0.9**				
Introduced Perennial Grasses							
Agropyron cristatum	8.1	9.7	13.5	40.0	6.4	16.1	4
Bromus inermis	9.4	11.2	15.4	52.0	8.3	19.5	3
Dactylis glomerata	2.0	2.4	4.0	28.0	4.5	6.9	6
Phleum pratense	0.6	0.7	2.0	12.0	1.9	2.6	17
Poa pratensis	1.4	1.7	4.6	20.0	3.2	4.9	8
Sub-Total	**21.5**	**25.7**	**21.8**				
Unknown Grass Species							
Festuca spp.	2.3	2.7	7.2	20.0	3.2	5.9	7
Sub-Total	**2.3**	**2.7**	**7.2**				
Native Grasslike Species							
Carex nebrascensis	0.5	0.6	2.4	4.0	0.6	1.2	23
Sub-Total	**0.5**	**0.6**	**2.4**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	AG	**Sample Size:**	1
Community Type:	Agricultural Land	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover Mean Absolute	Cover Relative (%)	Cover Std. Dev. (n-1)	Frequency Absolute	Frequency Relative (%)	I.V*	Rank
Native Annual Forbs							
Chenopodium berlandieri	0.1	0.1	0.4	4.0	0.6	0.7	25
Descurainia pinnata	0.1	0.1	0.4	4.0	0.6	0.7	25
Plantago patagonica	0.1	0.1	0.4	4.0	0.6	0.7	25
Sub-Total	**0.3**	**0.4**	**0.7**				
Introduced Annual Forbs							
Alyssum desertorum	0.3	0.4	0.7	16.0	2.5	2.9	16
Bassia sieversiana	0.9	1.1	4.4	4.0	0.6	1.7	20
Polygonum convolvulus	0.2	0.2	1.2	4.0	0.6	0.8	24
Sub-Total	**1.4**	**1.7**	**5.6**				
Introduced Biennial Forbs							
Melilotus officinalis	0.2	0.2	0.6	8.0	1.3	1.5	21
Tragopogon dubius	0.4	0.5	1.0	16.0	2.5	3.0	15
Sub-Total	**0.6**	**0.7**	**1.4**				
Native Perennial Forbs							
Achillea millefolium	0.1	0.1	0.4	4.0	0.6	0.7	25
Phlox hoodii	0.2	0.2	0.8	4.0	0.6	0.8	24
Psoralidium tenuiflorum	0.1	0.1	0.4	4.0	0.6	0.7	25
Symphyotrichum falcatum	0.2	0.2	0.9	8.0	1.3	1.5	21
Vicia americana	0.1	0.1	0.4	4.0	0.6	0.7	25
Sub-Total	**0.7**	**0.8**	**1.5**				
Introduced Perennial Forbs							
Convolvulus arvensis	1.0	1.2	3.0	20.0	3.2	4.4	9
Medicago sativa	27.4	32.7	30.8	72.0	11.5	44.2	1
Rumex crispus	0.1	0.1	0.4	4.0	0.6	0.7	25
Taraxacum officinale	0.6	0.7	1.2	20.0	3.2	3.9	11
Trifolium pratense	0.6	0.7	2.8	8.0	1.3	2.0	19
Sub-Total	**29.7**	**35.4**	**30.2**				
Native Full Shrubs							
Artemisia tridentata	1.0	1.2	3.4	12.0	1.9	3.1	14
Chrysothamnus viscidiflorus	0.2	0.2	0.6	8.0	1.3	1.5	21
Sub-Total	**1.2**	**1.4**	**3.9**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.7	0.8	2.2	16.0	2.5	3.3	13
Sub-Total	**0.7**	**0.8**	**2.2**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	AG	**Sample Size:**	1
Community Type:	Agricultural Land	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover Mean Absolute	Cover Relative (%)	Cover Std. Dev. (n-1)	Frequency Absolute	Frequency Relative (%)	I.V*	Rank
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	26
Lichen	0.0	0.0	0.0	0.0	0.0	0.0	26
Algae	0.0	0.0	0.0	0.0	0.0	0.0	26
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	26
Sub-Total	**0.0**	**0.0**	**0.0**				

Totals		Std. Dev.
Total Vegetation	83.8	22.6
Total Vegetation w/Cryptograms	83.8	22.6
Total Vegetation excluding SLCV	80.3	23.4
Litter	13.0	20.8
Rock	0.7	2.1
Total Ground Cover	97.5	5.0
Total Ground Cover excluding SLCV	94.0	8.1
Bare Soil	2.5	5.0

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSS	**Sample Size:**	1
Community Type:	Big Sagebrush Shrubland	**Number of Samples:**	23
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Annual Grasses							
Echinochloa muricata	0.9	1.6	0.4	4.3	0.5	2.1	18
Sub-Total	**0.9**	**1.6**	**0.4**				
Introduced Annual Grasses							
Bromus japonicus	3.2	5.5	4.3	47.8	5.7	11.2	6
Bromus tectorum	1.7	2.9	3.3	34.8	4.2	7.1	8
Sub-Total	**4.9**	**8.5**	**5.5**				
Native Cool Season Perennial Grasses							
Elymus smithii	3.7	6.4	5.7	52.2	6.3	12.7	5
Elymus spicatus	3.5	6.1	3.8	60.9	7.3	13.4	4
Hesperostipa comata	3.7	6.4	3.7	60.9	7.3	13.7	3
Nassella viridula	1.5	2.6	3.5	21.7	2.6	5.2	12
Poa secunda	1.3	2.2	2.2	34.8	4.2	6.4	10
Sub-Total	**13.7**	**23.7**	**5.6**				
Native Warm Season Perennial Grasses							
Aristida purpurea	0.2	0.3	0.8	4.3	0.5	0.8	23
Bouteloua gracilis	1.0	1.7	1.8	30.4	3.6	5.3	11
Sub-Total	**1.2**	**2.1**	**1.9**				
Introduced Perennial Grasses							
Agropyron cristatum	0.3	0.5	1.0	13.0	1.6	2.1	18
Festuca ovina	0.5	0.9	1.8	8.7	1.0	1.9	20
Sub-Total	**0.8**	**1.4**	**2.0**				
Native Grasslike Species							
Carex filifolia	0.3	0.5	1.2	8.7	1.0	1.5	21
Sub-Total	**0.3**	**0.5**	**1.2**				
Native Annual Forbs							
Plantago patagonica	0.1	0.2	0.4	4.3	0.5	0.7	24
Sub-Total	**0.1**	**0.2**	**0.4**				
Introduced Annual Forbs							
Alyssum desertorum	2.9	5.0	2.5	78.3	9.4	14.4	2
Medicago lupulina	0.1	0.2	0.4	4.3	0.5	0.7	24
Sub-Total	**3.0**	**5.2**	**2.8**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSS	**Sample Size:**	1
Community Type:	Big Sagebrush Shrubland	**Number of Samples:**	23
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Biennial Forbs							
Tragopogon dubius	0.1	0.2	0.4	4.3	0.5	0.7	29
Sub-Total	**0.1**	**0.2**	**0.4**				
Native Perennial Forbs							
Achillea millefolium	0.2	0.3	0.6	8.7	1.0	1.3	22
Allium textile	0.1	0.2	0.4	4.3	0.5	0.7	24
Comandra umbellata	0.7	1.2	2.0	13.0	1.6	2.8	18
Dalea purpurea	0.4	0.7	1.0	17.4	2.1	2.8	16
Eriogonum ovalifolium	0.1	0.2	0.4	4.3	0.5	0.7	24
Eriogonum pauciflorum	0.1	0.2	0.4	4.3	0.5	0.7	24
Evolvulus nuttallianus	0.1	0.2	0.4	4.3	0.5	0.7	24
Gaura coccinea	0.1	0.2	0.4	4.3	0.5	0.7	24
Phlox hoodii	1.4	2.4	2.1	43.5	5.2	7.6	7
Pediomelum argophyllum	0.6	1.0	1.5	17.4	2.1	3.2	15
Psoralidium tenuiflorum	0.5	0.9	1.1	21.7	2.6	3.5	14
Symphyotrichum falcatum	0.1	0.2	0.4	4.3	0.5	0.7	24
Vicia americana	1.1	1.9	3.4	21.7	2.6	4.5	13
Sub-Total	**5.5**	**9.5**	**4.8**				
Native Full Shrubs							
Artemisia tridentata	24.4	42.2	10.2	100.0	12.0	54.2	1
Chrysothamnus viscidiflorus	0.3	0.5	0.9	8.7	1.0	1.5	21
Ericameria nauseosa	0.2	0.3	0.6	8.7	1.0	1.3	22
Rhus aromatica	0.6	1.0	2.5	8.7	1.0	2.0	19
Sub-Total	**25.5**	**44.1**	**10.8**				
Native Half &Sub-Shrubs							
Artemisia frigida	1.1	1.9	1.7	39.1	4.7	6.6	9
Gutierrezia sarothrae	0.4	0.7	1.3	13.0	1.6	2.3	17
Yucca glauca	0.1	0.2	0.4	4.3	0.5	0.7	24
Sub-Total	**1.6**	**2.8**	**2.0**				
Native Succulents							
Opuntia polyacantha	0.2	0.3	0.6	8.7	1.0	1.3	22
Sub-Total	**0.2**	**0.3**	**0.6**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSS	**Sample Size:**	1
Community Type:	Big Sagebrush Shrubland	**Number of Samples:**	23
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	25
Lichen	1.4	2.4	2.4	39.1	4.7	7.1	8
Algae	0.0	0.0	0.0	0.0	0.0	0.0	25
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	25
Sub-Total	**1.4**	**2.4**	**2.4**				

Totals		Std. Dev.
Total Vegetation	57.8	10.5
Total Vegetation w/Cryptograms	59.2	10.0
Total Vegetation excluding SLCV	52.0	9.9
Litter	21.9	8.2
Rock	7.2	6.9
Total Ground Cover	88.3	7.3
Total Ground Cover excluding SLCV	82.5	7.4
Bare Soil	11.7	7.3

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSG	**Sample Size:**	1
Community Type:	Bottomland Sagebrush Grassland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	2.5	3.4	2.8	52.0	5.6	9.0	7
Bromus tectorum	3.5	4.8	5.5	44.0	4.8	9.6	6
Sub-Total	**6.0**	**8.2**	**6.6**				
Native Cool Season Perennial Grasses							
Elymus elymoides	0.2	0.3	0.8	4.0	0.4	0.7	30
Elymus lanceolatus	0.7	1.0	3.2	8.0	0.9	1.9	22
Elymus smithii	13.3	18.3	10.5	76.0	8.2	26.5	1
Elymus spicatus	0.2	0.3	0.8	4.0	0.4	0.7	30
Elymus trachycaulus	0.6	0.8	2.5	8.0	0.9	1.7	24
Hesperostipa comata	0.6	0.8	2.1	8.0	0.9	1.7	24
Hordeum jubatum	4.4	6.0	8.5	36.0	3.9	9.9	5
Nassella viridula	2.3	3.2	3.9	44.0	4.8	8.0	8
Phalaris arundinacea	0.2	0.3	1.2	4.0	0.4	0.7	30
Poa secunda	0.6	0.8	1.5	20.0	2.2	3.0	17
Sub-Total	**23.1**	**31.7**	**16.4**				
Native Warm Season Perennial Grasses							
Bouteloua gracilis	0.2	0.3	1.2	4.0	0.4	0.7	30
Buchloe dactyloides	0.2	0.3	1.2	4.0	0.4	0.7	30
Spartina pectinata	0.5	0.7	1.8	8.0	0.9	1.6	25
Sub-Total	**0.9**	**1.2**	**2.3**				
Introduced Perennial Grasses							
Agropyron cristatum	7.2	9.9	11.4	44.0	4.8	14.7	2
Bromus inermis	2.0	2.7	5.5	24.0	2.6	5.3	11
Elymus junceus	0.2	0.3	0.9	8.0	0.9	1.2	27
Phleum pratense	0.3	0.4	1.6	4.0	0.4	0.8	29
Poa pratensis	1.2	1.6	2.2	28.0	3.0	4.6	13
Sub-Total	**10.9**	**15.0**	**12.1**				
Native Grasslike Species							
Carex nebrascensis	6.8	9.3	14.7	24.0	2.6	11.9	3
Carex praegracilis	1.2	1.6	6.0	4.0	0.4	2.0	21
Juncus balticus	0.5	0.7	1.3	12.0	1.3	2.0	21
Schoenoplectus pungens	2.4	3.3	12.0	4.0	0.4	3.7	14
Sub-Total	**10.9**	**15.0**	**22.5**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSG	**Sample Size:**	1
Community Type:	Bottomland Sagebrush Grassland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Annual Forbs							
Chenopodium berlandieri	0.1	0.1	0.4	4.0	0.4	0.5	31
Lappula redowskii	0.1	0.1	0.4	4.0	0.4	0.5	31
Plantago patagonica	0.2	0.3	1.2	4.0	0.4	0.7	30
Sub-Total	**0.4**	**0.5**	**1.3**				
Introduced Annual Forbs							
Alyssum desertorum	1.6	2.2	2.9	32.0	3.5	5.7	10
Bassia sieversiana	0.2	0.3	0.8	4.0	0.4	0.7	30
Camelina microcarpa	0.2	0.3	0.6	8.0	0.9	1.2	27
Descurainia sophia	0.2	0.3	0.6	8.0	0.9	1.2	27
Sisymbrium altissimum	0.2	0.3	0.6	8.0	0.9	1.2	27
Thlaspi arvense	0.3	0.4	0.9	12.0	1.3	1.7	24
Sub-Total	**2.7**	**3.7**	**3.1**				
Introduced Biennial Forbs							
Lactuca serriola	0.2	0.3	0.9	8.0	0.9	1.2	27
Melilotus officinalis	0.6	0.8	1.8	16.0	1.7	2.5	18
Tragopogon dubius	0.2	0.3	0.6	8.0	0.9	1.2	27
Sub-Total	**1.0**	**1.4**	**2.4**				
Native Perennial Forbs							
Achillea millefolium	0.8	1.1	1.6	24.0	2.6	3.7	14
Ambrosia psilostachya	0.3	0.4	0.9	12.0	1.3	1.7	24
Ambrosia tomentosa	0.7	1.0	2.5	12.0	1.3	2.3	19
Asclepias speciosa	0.2	0.3	0.8	4.0	0.4	0.7	30
Echinacea angustifolia	0.1	0.1	0.4	4.0	0.4	0.5	31
Equisetum laevigatum	0.4	0.5	1.6	8.0	0.9	1.4	26
Glycyrrhiza lepidota	0.6	0.8	2.8	4.0	0.4	1.2	27
Psoralidium tenuiflorum	0.1	0.1	0.4	4.0	0.4	0.5	31
Sphaeralcea coccinea	1.2	1.6	2.2	32.0	3.5	5.1	12
Vicia americana	0.1	0.1	0.4	4.0	0.4	0.5	31
Sub-Total	**4.5**	**6.2**	**5.1**				
Introduced Perennial Forbs							
Cirsium arvense	1.0	1.4	3.4	16.0	1.7	3.1	16
Convolvulus arvensis	3.8	5.2	5.9	48.0	5.2	10.4	4
Medicago sativa	0.2	0.3	0.8	4.0	0.4	0.7	30
Rumex crispus	0.3	0.4	0.7	16.0	1.7	2.1	20
Taraxacum officinale	1.4	1.9	5.6	16.0	1.7	3.6	15
Sub-Total	**6.7**	**9.2**	**8.9**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	BSG	**Sample Size:**	1
Community Type:	Bottomland Sagebrush Grassland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Unknown Forb Species							
Astragalus spp.	0.1	0.1	0.4	4.0	0.4	0.5	31
Polygonum spp.	1.0	1.4	4.8	4.0	0.4	1.8	23
Rumex spp.	0.1	0.1	0.4	4.0	0.4	0.5	31
Sonchus spp.	0.4	0.5	2.0	4.0	0.4	0.9	28
Sub-Total	**1.6**	**2.2**	**5.3**				
Native Full Shrubs							
Artemisia cana	1.1	1.5	2.9	20.0	2.2	3.7	14
Rhus aromatica	0.2	0.3	0.8	4.0	0.4	0.7	30
Symphoricarpos albus	0.2	0.3	0.6	8.0	0.9	1.2	27
Symphoricarpos occidentalis	0.3	0.4	1.6	4.0	0.4	0.8	29
Symphoricarpos spp.	1.0	1.4	3.2	16.0	1.7	3.1	16
Sub-Total	**2.8**	**3.8**	**4.4**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.2	0.3	0.7	12.0	1.3	1.6	25
Artemisia ludoviciana	1.1	1.5	1.5	44.0	4.8	6.3	9
Sub-Total	**1.3**	**1.8**	**1.8**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	32
Lichen	0.0	0.0	0.0	0.0	0.0	0.0	32
Algae	0.0	0.0	0.0	0.0	0.0	0.0	32
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	32
Sub-Total	**0.0**	**0.0**	**0.0**				

Totals		**Std. Dev.**
Total Vegetation	72.8	13.4
Total Vegetation w/Cryptograms	72.8	13.4
Total Vegetation excluding SLCV	60.7	17.9
Litter	22.1	13.2
Rock	0.6	1.4
Total Ground Cover	95.5	5.0
Total Ground Cover excluding SLCV	83.4	11.0
Bare Soil	4.5	5.0

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	PJW	**Sample Size:**	1
Community Type:	Pine and Juniper Woodland	**Number of Samples:**	15
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	1.2	2.8	2.6	33.3	5.0	7.8	9
Bromus tectorum	5.7	13.1	9.5	46.7	7.0	20.1	2
Sub-Total	**6.9**	**15.8**	**10.2**				
Native Cool Season Perennial Grasses							
Elymus smithii	3.3	7.6	5.8	46.7	7.0	14.6	4
Elymus spicatus	14.3	32.8	8.1	100.0	15.0	47.8	1
Hesperostipa comata	0.5	1.1	1.2	20.0	3.0	4.1	13
Nassella viridula	0.5	1.1	1.2	20.0	3.0	4.1	13
Poa secunda	1.6	3.7	2.8	33.3	5.0	8.7	8
Sub-Total	**20.2**	**46.3**	**8.6**				
Native Warm Season Perennial Grasses							
Bouteloua gracilis	0.3	0.7	0.7	13.3	2.0	2.7	17
Sub-Total	**0.3**	**0.7**	**0.7**				
Native Grasslike Species							
Carex filifolia	0.8	1.8	1.8	20.0	3.0	4.8	12
Sub-Total	**0.8**	**1.8**	**1.8**				
Native Annual Forbs							
Plantago patagonica	0.1	0.2	0.5	6.7	1.0	1.2	19
Sub-Total	**0.1**	**0.2**	**0.5**				
Introduced Annual Forbs							
Alyssum desertorum	0.4	0.9	0.8	20.0	3.0	3.9	14
Camelina microcarpa	0.3	0.7	0.7	13.3	2.0	2.7	17
Thlaspi arvense	0.4	0.9	1.1	13.3	2.0	2.9	16
Sub-Total	**1.1**	**2.5**	**2.1**				
Introduced Biennial Forbs							
Tragopogon dubius	0.1	0.2	0.5	6.7	1.0	1.2	19
Sub-Total	**0.1**	**0.2**	**0.5**				
Native Perennial Forbs							
Achillea millefolium	0.7	1.6	1.2	26.7	4.0	5.6	10
Dalea purpurea	0.3	0.7	1.0	6.7	1.0	1.7	18
Phlox hoodii	1.6	3.7	2.7	40.0	6.0	9.7	6
Psoralidium tenuiflorum	0.5	1.1	0.9	26.7	4.0	5.1	11
Sphaeralcea coccinea	0.4	0.9	1.1	13.3	2.0	2.9	16
Vicia americana	0.5	1.1	1.2	20.0	3.0	4.1	13.0
Sub-Total	**4.0**	**9.2**	**3.5**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	PJW	**Sample Size:**	1
Community Type:	Pine and Juniper Woodland	**Number of Samples:**	15
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Perennial Forbs							
Cerastium arvense	0.1	0.2	0.5	6.7	1.0	1.2	19
Sub-Total	**0.1**	**0.2**	**0.5**				
Native Full Shrubs							
Artemisia tridentata	0.7	1.6	1.8	13.3	2.0	3.6	15
Chrysothamnus viscidiflorus	0.1	0.2	0.5	6.7	1.0	1.2	19
Ericameria nauseosa	0.4	0.9	1.1	13.3	2.0	2.9	16
Rhus aromatica	0.4	0.9	0.8	20.0	3.0	3.9	14
Sub-Total	**1.6**	**3.7**	**1.9**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.3	0.7	0.7	13.3	2.0	2.7	17
Gutierrezia sarothrae	0.1	0.2	0.5	6.7	1.0	1.2	19
Sub-Total	**0.4**	**0.9**	**0.8**				
Native Trees							
Juniperus scopulorum	3.3	7.6	5.6	33.3	5.0	12.6	5
Pinus ponderosa	4.7	10.8	8.2	26.7	4.0	14.8	3
Sub-Total	**8.0**	**18.3**	**8.1**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	20
Lichen	1.3	3.0	1.8	40.0	6.0	9.0	7
Algae	0.0	0.0	0.0	0.0	0.0	0.0	20
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	20
Sub-Total	**1.3**	**3.0**	**1.8**				

Totals		**Std. Dev.**
Total Vegetation	43.6	18.5
Total Vegetation w/Cryptograms	44.9	17.5
Total Vegetation excluding SLCV	37.7	13.0
Litter	17.8	10.8
Rock	26.3	21.6
Total Ground Cover	89.0	12.1
Total Ground Cover excluding SLCV	83.1	12.5
Bare Soil	11.0	12.1

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	PDMG	**Sample Size:**	1
Community Type:	Prairie Dog Modified Grassland	**Number of Samples:**	40
Date:	7/1/2014	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Annual Grasses							
Vulpia octoflora	0.2	0.4	1.0	5.0	0.8	1.2	22
Sub-Total	**0.2**	**0.4**	**1.0**				
Introduced Annual Grasses							
Bromus japonicus	1.5	3.1	3.6	22.5	3.4	6.5	7
Bromus tectorum	12.5	25.6	15.1	60.0	9.1	34.7	1
Sub-Total	**14.0**	**28.6**	**14.7**				
Native Cool Season Perennial Grasses							
Elymus smithii	9.7	19.9	8.1	82.5	12.5	32.4	2
Elymus spicatus	0.4	0.8	1.0	12.5	1.9	2.7	16
Hesperostipa comata	0.4	0.8	1.0	12.5	1.9	2.7	16
Nassella viridula	0.2	0.4	1.0	5.0	0.8	1.6	19
Poa secunda	0.8	1.6	1.6	25.0	3.8	5.4	11
Sub-Total	**11.5**	**23.5**	**8.6**				
Native Warm Season Perennial Grasses							
Aristida purpurea	0.9	1.8	1.9	25.0	3.8	5.6	10
Bouteloua gracilis	1.0	2.0	2.2	25.0	3.8	5.8	9
Sporobolus cryptandrus	0.3	0.6	1.2	7.5	1.1	1.7	18
Sub-Total	**2.2**	**4.5**	**3.2**				
Introduced Perennial Grasses							
Agropyron cristatum	2.6	5.3	5.9	20.0	3.0	8.3	5
Bromus inermis	0.1	0.2	0.3	2.5	0.4	0.6	25
Sub-Total	**2.7**	**5.5**	**5.9**				
Native Annual Forbs							
Chamaesyce glyptosperma	0.1	0.2	0.6	2.5	0.4	0.6	25
Logfia arvensis	0.2	0.4	0.7	5.0	0.8	1.2	28
Lappula redowskii	0.7	1.4	1.9	15.0	2.3	3.7	22
Plantago patagonica	1.3	2.7	3.0	22.5	3.4	6.1	8
Solanum triflorum	0.1	0.2	0.4	5.0	0.8	1.0	23
Sub-Total	**2.4**	**4.9**	**4.0**				
Introduced Annual Forbs							
Alyssum desertorum	2.4	4.9	3.0	55.0	8.3	13.2	4
Amaranthus albus	0.3	0.6	1.9	2.5	0.4	1.0	23
Bassia sieversiana	0.1	0.2	0.3	2.5	0.4	0.6	25
Brassica juncea	0.1	0.2	0.6	2.5	0.4	0.6	25
Medicago lupulina	0.5	1.0	3.2	2.5	0.4	1.4	21
Polygonum argyrocoleon	0.1	0.2	0.3	2.5	0.4	0.6	25

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	PDMG	**Sample Size:**	1
Community Type:	Prairie Dog Modified Grassland	**Number of Samples:**	40
Date:	7/1/2014	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Polygonum aviculare	0.6	1.2	1.8	17.5	2.6	3.8	14
Polygonum convolvulus	0.2	0.4	1.3	2.5	0.4	0.8	24
Sisymbrium altissimum	0.1	0.2	0.4	5.0	0.8	1.0	23
Sub-Total	**4.4**	**9.0**	**6.8**				
Introduced Biennial Forbs							
Melilotus officinalis	0.2	0.4	0.5	7.5	1.1	1.4	22
Sub-Total	**0.2**	**0.4**	**0.5**				
Native Perennial Forbs							
Achillea millefolium	0.2	0.4	0.5	7.5	1.1	1.5	20
Ambrosia psilostachya	0.1	0.2	0.6	2.5	0.4	0.6	25
Antennaria microphylla	0.2	0.4	0.7	5.0	0.8	1.2	22
Dalea purpurea	0.1	0.2	0.3	2.5	0.4	0.6	25
Evolvulus nuttallianus	0.2	0.4	0.7	5.0	0.8	1.2	22
Gaura coccinea	0.1	0.2	0.3	2.5	0.4	0.6	25
Grindelia squarrosa	0.1	0.2	0.3	2.5	0.4	0.6	25
Heterotheca villosa	0.3	0.6	0.9	7.5	1.1	1.7	18
Linum lewisii	0.1	0.2	0.3	2.5	0.4	0.6	25
Lygodesmia juncea	0.3	0.6	0.9	12.5	1.9	2.5	17
Pediomelum argophyllum	0.1	0.2	0.3	2.5	0.4	0.6	25
Phlox hoodii	0.7	1.4	1.7	17.5	2.6	4.0	13
Psoralidium tenuiflorum	0.1	0.2	0.4	5.0	0.8	1.0	23
Sphaeralcea coccinea	1.4	2.9	2.8	35.0	5.3	8.2	6
Symphyotrichum falcatum	0.2	0.4	0.7	5.0	0.8	1.2	22
Vicia americana	0.1	0.2	0.6	2.5	0.4	0.6	25
Sub-Total	**4.3**	**8.8**	**4.1**				
Introduced Perennial Forbs							
Convolvulus arvensis	5.1	10.4	8.6	35.0	5.3	15.8	3
Sub-Total	**5.1**	**10.4**	**8.6**				
Unknown Forb Species							
Astragalus spp.	0.2	0.4	0.5	7.5	1.1	1.5	20
Cirsium spp.	0.1	0.2	0.3	2.5	0.4	0.6	25
Penstemon spp.	0.1	0.2	0.3	2.5	0.4	0.6	25
Rumex spp.	0.1	0.2	0.3	2.5	0.4	0.6	25
Sub-Total	**0.5**	**1.0**	**0.9**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	PDMG	**Sample Size:**	1
Community Type:	Prairie Dog Modified Grassland	**Number of Samples:**	40
Date:	7/1/2014	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Full Shrubs							
Artemisia tridentata	0.2	0.4	0.7	5.0	0.8	1.2	22
Chrysothamnus viscidiflorus	0.2	0.4	0.8	7.5	1.1	1.5	20
Sub-Total	**0.4**	**0.8**	**1.0**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.8	1.6	1.6	22.5	3.4	5.0	12
Artemisia ludoviciana	0.1	0.2	0.6	2.5	0.4	0.6	25
Sub-Total	**0.9**	**1.8**	**1.8**				
Native Succulents							
Opuntia polyacantha	0.1	0.2	0.3	2.5	0.4	0.6	25
Sub-Total	**0.1**	**0.2**	**0.3**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	26
Lichen	0.1	0.2	0.3	2.5	0.4	0.6	25
Algae	0.0	0.0	0.0	0.0	0.0	0.0	26
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	26
Sub-Total	**0.1**	**0.1**	**0.3**				

Totals		Std. Dev.
Total Vegetation	48.9	16.2
Total Vegetation w/Cryptograms	49.0	16.2
Total Vegetation excluding SLCV	29.8	12.9
Litter	19.8	11.4
Rock	3.7	7.3
Total Ground Cover	72.5	20.0
Total Ground Cover excluding SLCV	53.4	21.3
Bare Soil	27.5	20.0

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RG	**Sample Size:**	1
Community Type:	Reclaimed Grassland	**Number of Samples:**	10
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	3.8	6.0	5.6	60.0	9.8	15.8	3
Bromus tectorum	1.4	2.2	3.1	30.0	4.9	7.1	8
Sub-Total	**5.2**	**8.2**	**7.6**				
Native Cool Season Perennial Grasses							
Elymus lanceolatus	1.8	2.8	5.7	10.0	1.6	4.4	11
Elymus smithii	25.0	39.3	21.3	80.0	13.1	52.4	1
Elymus trachycaulus	1.4	2.2	4.4	10.0	1.6	3.8	14
Nassella viridula	0.4	0.6	1.3	10.0	1.6	2.2	15
Poa secunda	0.2	0.3	0.6	10.0	1.6	1.9	16
Sub-Total	**28.8**	**45.3**	**21.8**				
Introduced Perennial Grasses							
Agropyron cristatum	1.8	2.8	2.7	40.0	6.6	9.4	5
Bromus inermis	15.8	24.8	21.4	60.0	9.8	34.6	2
Sub-Total	**17.6**	**27.7**	**20.9**				
Native Grasslike Species							
Carex filifolia	0.4	0.6	1.3	10.0	1.6	2.2	15
Sub-Total	**0.4**	**0.6**	**1.3**				
Native Annual Forbs							
Plantago patagonica	0.2	0.3	0.6	10.0	1.6	1.9	16
Sub-Total	**0.2**	**0.3**	**0.6**				
Introduced Annual Forbs							
Alyssum desertorum	1.4	2.2	1.9	50.0	8.2	10.4	4
Camelina microcarpa	0.6	0.9	1.3	20.0	3.3	4.2	12
Halogeton glomeratus	0.2	0.3	0.6	10.0	1.6	1.9	16
Medicago lupulina	0.2	0.3	0.6	10.0	1.6	1.9	16
Sub-Total	**2.4**	**3.8**	**1.8**				
Introduced Biennial Forbs							
Melilotus officinalis	2.8	4.4	5.9	30.0	4.9	9.3	6
Tragopogon dubius	0.6	0.9	1.0	30.0	4.9	5.8	9
Sub-Total	**3.4**	**5.3**	**5.7**				
Native Perennial Forbs							
Comandra umbellata	0.2	0.3	0.6	10.0	1.6	1.9	16
Grindelia squarrosa	1.0	1.6	2.2	20.0	3.3	4.9	10
Vicia americana	0.4	0.6	0.8	20.0	3.3	3.9	13
Sub-Total	**1.6**	**2.5**	**2.5**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RG	**Sample Size:**	1
Community Type:	Reclaimed Grassland	**Number of Samples:**	10
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Perennial Forbs							
Convolvulus arvensis	1.0	1.6	2.2	20.0	3.3	4.9	10
Medicago sativa	0.2	0.3	0.6	10.0	1.6	1.9	16
Taraxacum officinale	2.4	3.8	5.6	30.0	4.9	8.7	7
Sub-Total	**3.6**	**5.7**	**5.6**				
Native Full Shrubs							
Artemisia cana	0.2	0.3	0.6	10.0	1.6	1.9	16
Ericameria nauseosa	0.2	0.3	0.6	10.0	1.6	1.9	16
Sub-Total	**0.4**	**0.6**	**0.8**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	17
Lichen	0.0	0.0	0.0	0.0	0.0	0.0	17
Algae	0.0	0.0	0.0	0.0	0.0	0.0	17
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	17
Sub-Total	**0.0**	**0.0**	**0.0**				

Totals		Std. Dev.
Total Vegetation	63.6	9.1
Total Vegetation w/Cryptograms	63.6	9.1
Total Vegetation excluding SLCV	57.2	7.7
Litter	25.4	11.0
Rock	1.4	2.1
Total Ground Cover	90.4	10.8
Total Ground Cover excluding SLCV	84.0	14.9
Bare Soil	9.6	10.8

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RW	**Sample Size:**	1
Community Type:	Riparian Woodland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	1.7	2.1	2.9	32.0	3.5	5.6	12
Bromus tectorum	1.0	1.2	3.1	16.0	1.7	2.9	19
Sub-Total	**2.7**	**3.3**	**5.4**				
Native Cool Season Perennial Grasses							
Elymus cinereus	0.2	0.2	0.7	12.0	1.3	1.5	29
Elymus lanceolatus	1.3	1.6	5.6	8.0	0.9	2.5	20
Elymus smithii	9.8	12.0	9.5	68.0	7.4	19.4	2
Elymus trachycaulus	1.8	2.2	4.4	24.0	2.6	4.8	15
Hordeum jubatum	4.6	5.6	9.8	28.0	3.1	8.7	4
Nassella viridula	1.0	1.2	3.4	8.0	0.9	2.1	24
Poa secunda	0.6	0.7	2.0	12.0	1.3	2.0	25
Sub-Total	**19.3**	**23.5**	**12.1**				
Native Warm Season Perennial Grasses							
Bouteloua gracilis	0.2	0.2	0.8	4.0	0.4	0.6	33
Spartina pectinata	3.0	3.7	7.6	16.0	1.7	5.4	13
Sub-Total	**3.2**	**3.9**	**7.5**				
Introduced Perennial Grasses							
Agropyron cristatum	2.7	3.3	6.5	44.0	4.8	8.1	6
Bromus inermis	3.1	3.8	5.1	44.0	4.8	8.6	5
Dactylis glomerata	0.3	0.4	1.2	8.0	0.9	1.3	30
Phleum pratense	0.4	0.5	1.3	12.0	1.3	1.8	26
Poa pratensis	1.8	2.2	3.3	28.0	3.1	5.3	14
Sub-Total	**8.3**	**10.1**	**9.9**				
Unknown Grass Species							
Festuca spp.	0.2	0.2	0.8	4.0	0.4	0.6	33
Sub-Total	**0.2**	**0.2**	**0.8**				
Native Grasslike Species							
Carex filifolia	0.4	0.5	2.0	4.0	0.4	0.9	32
Carex nebrascensis	3.5	4.3	8.1	28.0	3.1	7.4	8
Juncus balticus	1.0	1.2	2.9	12.0	1.3	2.5	20
Schoenoplectus pungens	0.1	0.1	0.4	4.0	0.4	0.5	34
Sub-Total	**5.0**	**6.1**	**9.8**				
Native Annual Forbs							
Chenopodium berlandieri	0.1	0.1	0.4	4.0	0.4	0.5	34
Galium aparine	0.1	0.1	0.4	4.0	0.4	0.5	34
Sub-Total	**0.2**	**0.2**	**0.6**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RW	**Sample Size:**	1
Community Type:	Riparian Woodland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Forbs							
Alyssum desertorum	0.4	0.5	1.0	16.0	1.7	2.2	23
Bassia sieversiana	0.3	0.4	1.2	8.0	0.9	1.3	30
Lepidium perfoliatum	0.2	0.2	0.6	8.0	0.9	1.1	31
Medicago lupulina	0.3	0.4	1.2	8.0	0.9	1.3	30
Thlaspi arvense	0.2	0.2	0.7	12.0	1.3	1.5	29
Sub-Total	**1.4**	**1.7**	**2.0**				
Introduced Biennial Forbs							
Cynoglossum officinale	0.1	0.1	0.4	4.0	0.4	0.5	34
Lactuca serriola	1.0	1.2	3.2	16.0	1.7	2.9	19
Melilotus officinalis	0.2	0.2	0.7	12.0	1.3	1.5	29
Tragopogon dubius	0.2	0.2	0.6	8.0	0.9	1.1	31
Sub-Total	**1.5**	**1.8**	**3.5**				
Native Perennial Forbs							
Achillea millefolium	1.8	2.2	4.5	36.0	3.9	6.1	10
Asclepias speciosa	0.2	0.2	0.6	8.0	0.9	1.1	31
Asteraceae spp.	1.0	1.2	2.5	16.0	1.7	2.9	19
Comandra umbellata	0.3	0.4	0.9	12.0	1.3	1.7	27
Equisetum laevigatum	0.2	0.2	0.8	4.0	0.4	0.6	33
Evolvulus nuttallianus	0.1	0.1	0.4	4.0	0.4	0.5	34
Galium boreale	0.1	0.1	0.4	4.0	0.4	0.5	34
Glycyrrhiza lepidota	0.2	0.2	1.2	4.0	0.4	0.6	33
Grindelia squarrosa	1.5	1.8	4.4	12.0	1.3	3.1	18
Sphaeralcea coccinea	0.2	0.2	0.8	4.0	0.4	0.6	33
Vicia americana	0.2	0.2	0.8	4.0	0.4	0.6	32
Sub-Total	**5.8**	**7.1**	**7.6**				
Introduced Perennial Forbs							
Cardaria draba	0.1	0.1	0.4	4.0	0.4	0.5	34
Cirsium arvense	0.4	0.5	1.0	16.0	1.7	2.2	23
Convolvulus arvensis	1.1	1.3	2.3	24.0	2.6	3.9	16
Medicago sativa	0.1	0.1	0.4	4.0	0.4	0.5	34
Taraxacum officinale	2.3	2.8	3.5	44.0	4.8	7.6	7
Trifolium repens	0.1	0.1	0.4	4.0	0.4	0.5	34
Sub-Total	**4.1**	**5.0**	**5.1**				
Unknown Forb Species							
Astragalus spp.	0.8	1.0	2.5	12.0	1.3	2.3	22
Sonchus spp.	1.8	2.2	5.1	12.0	1.3	3.5	17
Sub-Total	**2.6**	**3.2**	**6.4**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RW	**Sample Size:**	1
Community Type:	Riparian Woodland	**Number of Samples:**	25
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover Mean Absolute	Cover Relative (%)	Cover Std. Dev. (n-1)	Frequency Absolute	Frequency Relative (%)	I.V*	Rank
Native Full Shrubs							
Artemisia cana	2.3	2.8	4.7	28.0	3.1	5.9	11
Artemisia tridentata	0.2	0.2	0.8	4.0	0.4	0.6	33
Atriplex canescens	0.2	0.2	1.2	4.0	0.4	0.6	33
Rosa woodsii	0.2	0.2	0.6	8.0	0.9	1.1	31
Symphoricarpos albus	11.5	14.0	14.4	76.0	8.3	22.3	1
Sub-Total	**14.4**	**17.6**	**15.7**				
Native Trees							
Fraxinus pennsylvanica	1.3	1.6	6.0	8.0	0.9	2.4	21
Populus deltoides	6.6	8.0	16.8	24.0	2.6	10.6	3
Salix amygdaloides	0.2	0.2	0.8	4.0	0.4	0.6	33
Sorbus scopulina	4.6	5.6	15.8	8.0	0.9	6.5	9
Sub-Total	**12.7**	**15.5**	**22.2**				
Introduced Trees							
Elaeagnus angustifolia	0.6	0.7	2.8	8.0	0.9	1.6	28
Sub-Total	**0.6**	**0.7**	**2.8**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	35
Lichen	0.0	0.0	0.0	0.0	0.0	0.0	35
Algae	0.0	0.0	0.0	0.0	0.0	0.0	35
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	35
Sub-Total	**0.0**	**0.0**	**0.0**				

Totals		Std. Dev.
Total Vegetation	82.0	14.8
Total Vegetation w/Cryptograms	82.0	14.8
Total Vegetation excluding SLCV	76.3	14.3
Litter	15.0	14.3
Rock	0.9	4.4
Total Ground Cover	97.9	3.5
Total Ground Cover excluding SLCV	92.2	7.3
Bare Soil	2.1	3.5

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RBMS	**Sample Size:**	1
Community Type:	Rough Breaks Mixed Shrubland	**Number of Samples:**	30
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Annual Grasses							
Bromus japonicus	2.4	5.7	3.3	56.7	6.7	12.4	4
Bromus tectorum	0.3	0.7	0.9	13.3	1.6	2.3	21
Sub-Total	**2.7**	**6.5**	**3.5**				
Native Cool Season Perennial Grasses							
Achnatherum hymenoides	0.1	0.2	0.5	6.7	0.8	1.0	27
Elymus lanceolatus	0.5	1.2	1.4	16.7	2.0	3.2	16
Elymus smithii	4.1	9.8	5.7	56.7	6.7	16.5	3
Elymus spicatus	7.0	16.7	6.9	73.3	8.7	25.4	2
Hesperostipa comata	0.7	1.7	2.1	13.3	1.6	3.3	15
Koeleria macrantha	0.1	0.2	0.4	3.3	0.4	0.6	29
Nassella viridula	1.4	3.3	2.2	43.3	5.2	8.5	5
Poa secunda	0.9	2.2	2.1	23.3	2.8	5.0	11
Sub-Total	**14.8**	**35.4**	**8.4**				
Native Warm Season Perennial Grasses							
Aristida purpurea	0.1	0.2	0.4	3.3	0.4	0.6	29
Bouteloua gracilis	0.1	0.2	0.4	3.3	0.4	0.6	29
Schizachyrium scoparium	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.3**	**0.7**	**0.6**				
Introduced Perennial Grasses							
Agropyron cristatum	0.1	0.2	0.4	3.3	0.4	0.6	29
Bromus inermis	0.1	0.2	0.4	3.3	0.4	0.6	29
Poa bulbosa	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.3**	**0.7**	**0.8**				
Native Grasslike Species							
Carex filifolia	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.1**	**0.2**	**0.4**				
Native Annual Forbs							
Atriplex suckleyi	0.7	1.7	2.9	10.0	1.2	2.9	18
Chenopodium berlandieri	0.1	0.2	0.4	3.3	0.4	0.6	29
Plantago patagonica	0.3	0.7	0.9	10.0	1.2	1.9	23
Sub-Total	**1.1**	**2.6**	**3.0**				
Introduced Annual Forbs							
Alyssum desertorum	0.4	1.0	1.5	10.0	1.2	2.2	22
Thlaspi arvense	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.5**	**1.2**	**1.5**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RBMS	**Sample Size:**	1
Community Type:	Rough Breaks Mixed Shrubland	**Number of Samples:**	30
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Introduced Biennial Forbs							
Tragopogon dubius	0.3	0.7	0.8	16.7	2.0	2.7	19
Sub-Total	**0.3**	**0.7**	**0.8**				
Native Perennial Forbs							
Achillea millefolium	0.4	1.0	1.0	16.7	2.0	3.0	17
Comandra umbellata	0.3	0.7	0.9	10.0	1.2	1.9	23
Dalea candida	0.2	0.5	0.8	6.7	0.8	1.3	27
Dalea purpurea	0.1	0.2	0.5	6.7	0.8	1.0	28
Eriogonum pauciflorum	0.1	0.2	0.7	3.3	0.4	0.6	29
Evolvulus nuttallianus	0.2	0.5	1.1	3.3	0.4	0.9	28
Gaura coccinea	0.2	0.5	0.6	10.0	1.2	1.7	24
Grindelia squarrosa	0.1	0.2	0.5	6.7	0.8	1.0	27
Heterotheca villosa	0.1	0.2	0.4	3.3	0.4	0.6	31
Machaeranthera tanacetifolia	0.1	0.2	0.4	3.3	0.4	0.6	29
Musineon divaricatum	0.1	0.2	0.5	6.7	0.8	1.0	27
Pediomelum argophyllum	0.1	0.2	0.5	6.7	0.8	1.0	27
Pediomelum esculentum	0.2	0.5	1.1	3.3	0.4	0.9	28
Phlox hoodii	1.3	3.1	2.1	36.7	4.4	7.5	6
Psoralidium tenuiflorum	1.1	2.6	2.4	26.7	3.2	5.8	10
Ratibida columnifera	0.1	0.2	0.5	6.7	0.8	1.0	27
Sphaeralcea coccinea	0.5	1.2	0.9	23.3	2.8	4.0	13
Thermopsis rhombifolia	0.2	0.5	0.6	10.0	1.2	1.7	24
Vicia americana	0.5	1.2	1.0	23.3	2.8	4.0	13
Sub-Total	**5.9**	**14.1**	**4.5**				
Introduced Perennial Forbs							
Cirsium arvense	0.1	0.2	0.7	3.3	0.4	0.6	29
Convolvulus arvensis	0.5	1.2	1.9	10.0	1.2	2.4	20
Sub-Total	**0.6**	**1.4**	**2.0**				
Unknown Forb Species							
Cirsium spp.	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.1**	**0.2**	**0.4**				
Native Full Shrubs							
Artemisia cana	0.3	0.7	1.1	10.0	1.2	1.9	23
Artemisia tridentata	9.5	22.7	9.4	76.7	9.1	31.8	1
Atriplex canescens	0.1	0.2	0.4	3.3	0.4	0.6	29
Ericameria nauseosa	0.6	1.4	1.5	16.7	2.0	3.4	14
Rhus aromatica	0.3	0.7	1.5	6.7	0.8	1.5	25
Ribes cereum	0.1	0.2	0.4	3.3	0.4	0.6	29
Rosa woodsii	0.7	1.7	1.7	20.0	2.4	4.1	12

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	RBMS	**Sample Size:**	1
Community Type:	Rough Breaks Mixed Shrubland	**Number of Samples:**	30
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Sarcobatus vermiculatus	0.9	2.2	2.4	13.3	1.6	3.8	14
Sub-Total	**12.5**	**29.9**	**10.0**				
Native Half &Sub-Shrubs							
Artemisia frigida	1.1	2.6	2.5	30.0	3.6	6.2	9
Artemisia ludoviciana	0.1	0.2	0.7	3.3	0.4	0.6	29
Artemisia pedatifida	0.1	0.2	0.4	3.3	0.4	0.6	29
Atriplex gardneri	0.1	0.2	0.4	3.3	0.4	0.6	29
Gutierrezia sarothrae	1.1	2.6	1.9	33.3	4.0	6.6	8
Sub-Total	**2.5**	**6.0**	**4.0**				
Native Trees							
Juniperus scopulorum	0.1	0.2	0.4	3.3	0.4	0.6	29
Sub-Total	**0.1**	**0.2**	**0.4**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	30
Lichen	1.4	3.3	2.6	33.3	4.0	7.3	7
Algae	0.0	0.0	0.0	0.0	0.0	0.0	30
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	30
Sub-Total	**1.4**	**3.8**	**2.6**				

Totals		Std. Dev.
Total Vegetation	41.8	12.0
Total Vegetation w/Cryptograms	43.2	12.3
Total Vegetation excluding SLCV	38.1	10.9
Litter	15.7	8.9
Rock	10.8	8.4
Total Ground Cover	69.7	17.4
Total Ground Cover excluding SLCV	66.0	17.3
Bare Soil	30.3	17.4

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	SG	**Sample Size:**	1
Community Type:	Scoria Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Annual Grasses							
Echinochloa muricata	0.1	0.2	0.8	3.6	0.4	0.6	27
Vulpia octoflora	0.1	0.2	0.4	3.6	0.4	0.6	27
Sub-Total	**0.2**	**0.3**	**0.8**				
Introduced Annual Grasses							
Bromus japonicus	2.9	5.0	4.5	42.9	5.3	10.3	6
Bromus tectorum	18.8	32.4	13.8	89.3	11.0	43.4	1
Sub-Total	**21.7**	**37.3**	**13.9**				
Native Cool Season Perennial Grasses							
Elymus lanceolatus	0.1	0.2	0.8	3.6	0.4	0.6	27
Elymus smithii	2.8	4.8	4.6	50.0	6.1	10.9	5
Elymus spicatus	6.4	11.0	6.3	71.4	8.8	19.8	2
Hesperostipa comata	4.4	7.6	5.7	60.7	7.5	15.1	3
Koeleria macrantha	0.1	0.2	0.4	3.6	0.4	0.6	27
Nassella viridula	0.9	1.5	2.9	17.9	2.2	3.7	15
Poa secunda	1.5	2.6	2.3	35.7	4.4	7.0	8
Sub-Total	**16.2**	**27.9**	**11.1**				
Native Warm Season Perennial Grasses							
Aristida purpurea	0.4	0.7	1.0	17.9	2.2	2.9	17
Bouteloua gracilis	0.7	1.2	1.6	21.4	2.6	3.8	14
Sub-Total	**1.1**	**1.9**	**2.0**				
Introduced Perennial Grasses							
Bromus inermis	0.1	0.2	0.4	3.6	0.4	0.6	27
Festuca ovina	0.4	0.7	1.9	7.1	0.9	1.6	22
Sub-Total	**0.5**	**0.9**	**1.9**				
Native Grasslike Species							
Carex filifolia	0.1	0.2	0.5	7.1	0.9	1.1	25
Sub-Total	**0.1**	**0.2**	**0.5**				
Native Annual Forbs							
Helianthus annuus	0.1	0.2	0.4	3.6	0.4	0.6	27
Lappula redowskii	0.1	0.2	0.4	3.6	0.4	0.6	27
Sub-Total	**0.2**	**0.3**	**0.5**				
Introduced Annual Forbs							
Alyssum desertorum	0.7	1.2	1.2	28.6	3.5	4.7	11
Camelina microcarpa	0.9	1.5	1.8	21.4	2.6	4.1	12
Descurainia sophia	0.1	0.2	0.5	7.1	0.9	1.1	25

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	SG	**Sample Size:**	1
Community Type:	Scoria Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Lepidium perfoliatum	0.1	0.2	0.4	3.6	0.4	0.6	27
Medicago lupulina	0.1	0.2	0.5	7.1	0.9	1.1	25
Sisymbrium altissimum	0.3	0.5	1.2	7.1	0.9	1.4	23
Sub-Total	**2.2**	**3.8**	**3.2**				
Introduced Biennial Forbs							
Melilotus officinalis	0.1	0.2	0.4	3.6	0.4	0.6	27
Tragopogon dubius	0.3	0.5	0.9	10.7	1.3	1.8	20
Sub-Total	**0.4**	**0.7**	**1.0**				
Native Perennial Forbs							
Achillea millefolium	0.1	0.2	0.4	3.6	0.4	0.6	27
Ambrosia tomentosa	0.1	0.2	0.4	3.6	0.4	0.6	27
Comandra umbellata	0.1	0.2	0.4	3.6	0.4	0.6	27
Dalea purpurea	1.0	1.7	2.5	17.9	2.2	3.9	13
Evolvulus nuttallianus	0.3	0.5	0.9	10.7	1.3	1.8	20
Galium boreale	0.1	0.2	0.4	3.6	0.4	0.6	27
Gaura coccinea	0.1	0.2	0.4	3.6	0.4	0.6	27
Glycyrrhiza lepidota	0.1	0.2	0.4	3.6	0.4	0.6	27
Heterotheca villosa	0.2	0.3	0.8	7.1	0.9	1.2	24
Lactuca oblongifolia	0.4	0.7	1.1	10.7	1.3	2.0	19
Pediomelum argophyllum	0.3	0.5	1.2	7.1	0.9	1.4	23
Pediomelum esculentum	0.2	0.3	0.8	7.1	0.9	1.2	24
Phlox hoodii	0.1	0.2	0.5	7.1	0.9	1.1	25
Psoralidium tenuiflorum	1.1	1.9	1.6	35.7	4.4	6.3	9
Ratibida columnifera	0.1	0.2	0.4	3.6	0.4	0.6	27
Sphaeralcea coccinea	1.1	1.9	2.2	28.6	3.5	5.4	10
Thermopsis rhombifolia	0.1	0.2	0.4	3.6	0.4	0.6	27
Vicia americana	0.6	1.0	1.4	17.9	2.2	3.2	16
Sub-Total	**6.1**	**10.5**	**5.9**				
Introduced Perennial Forbs							
Convolvulus arvensis	1.2	2.1	6.4	3.6	0.4	2.5	18
Sub-Total	**1.2**	**2.1**	**6.4**				
Unknown Forb Species							
Astragalus spp.	0.1	0.2	0.4	3.6	0.4	0.6	27
Sub-Total	**0.1**	**0.2**	**0.4**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	SG	**Sample Size:**	1
Community Type:	Scoria Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Full Shrubs							
Artemisia cana	0.3	0.5	1.5	3.6	0.4	0.9	26
Artemisia tridentata	4.1	7.1	6.9	50.0	6.1	13.2	4
Rhus aromatica	3.0	5.2	5.8	39.3	4.8	10.0	7
Sub-Total	**7.4**	**12.7**	**7.9**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.2	0.3	0.6	10.7	1.3	1.6	22
Gutierrezia sarothrae	0.2	0.3	0.8	7.1	0.9	1.2	24
Linanthus pungens	0.1	0.2	0.4	3.6	0.4	0.6	27
Yucca glauca	0.2	0.3	0.8	7.1	0.9	1.2	24
Sub-Total	**0.7**	**1.2**	**1.7**				
Cryptograms							
Moss	0.1	0.1	0.4	3.6	0.4	0.5	28
Lichen	0.3	0.5	0.9	10.7	1.3	1.8	20
Algae	0.0	0.0	0.0	0.0	0.0	0.0	29
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	29
Sub-Total	**0.4**	**0.6**	**1.0**				

Totals		Std. Dev.
Total Vegetation	58.1	9.3
Total Vegetation w/Cryptograms	58.5	8.9
Total Vegetation excluding SLCV	34.8	12.2
Litter	19.7	9.6
Rock	11.0	9.2
Total Ground Cover	89.2	7.1
Total Ground Cover excluding SLCV	65.9	15.9
Bare Soil	10.8	7.1

* I.V. Stands for Importance Value

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	UG	**Sample Size:**	1
Community Type:	Upland Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Annual Grasses							
Cenchrus longispinus	0.1	0.2	0.8	3.6	0.4	0.6	40
Echinochloa muricata	0.6	1.0	1.3	17.9	2.0	3.0	16
Vulpia octoflora	0.1	0.2	0.4	3.6	0.4	0.6	42
Sub-Total	**0.8**	**1.4**	**1.7**				
Introduced Annual Grasses							
Bromus japonicus	4.8	8.3	6.5	67.9	7.5	15.8	3
Bromus tectorum	13.1	22.6	16.6	60.7	6.7	29.3	1
Sub-Total	**17.9**	**30.9**	**17.6**				
Native Cool Season Perennial Grasses							
Elymus lanceolatus	0.6	1.0	1.6	17.9	2.0	3.0	16
Elymus smithii	10.4	17.9	12.0	82.1	9.1	27.0	2
Elymus spicatus	3.9	6.7	5.8	50.0	5.5	12.2	5
Elymus trachycaulus	0.1	0.2	0.4	3.6	0.4	0.6	42
Hesperostipa comata	5.4	9.3	6.0	53.6	5.9	15.2	4
Nassella viridula	1.1	1.9	2.1	28.6	3.2	5.1	10
Poa secunda	2.9	5.0	5.5	32.1	3.6	8.6	6
Sub-Total	**24.4**	**42.1**	**11.1**				
Native Warm Season Perennial Grasses							
Aristida purpurea	0.1	0.2	0.5	7.1	0.8	1.0	33
Bouteloua gracilis	0.5	0.9	1.2	17.9	2.0	2.9	18
Distichlis stricta	0.4	0.7	1.7	7.1	0.8	1.5	29
Sub-Total	**1.0**	**1.7**	**2.0**				
Introduced Perennial Grasses							
Agropyron cristatum	0.3	0.5	0.9	10.7	1.2	1.7	25
Poa bulbosa	0.1	0.2	0.4	3.6	0.4	0.6	42
Sub-Total	**0.4**	**0.7**	**1.1**				
Native Grasslike Species							
Carex filifolia	0.1	0.2	0.4	3.6	0.4	0.6	42
Sub-Total	**0.1**	**0.2**	**0.4**				
Native Annual Forbs							
Erigeron strigosus	0.1	0.2	0.4	3.6	0.4	0.6	42
Lappula redowskii	0.1	0.2	0.5	7.1	0.8	1.0	33
Plantago patagonica	0.6	1.0	1.7	14.3	1.6	2.6	20
Sub-Total	**0.8**	**1.4**	**2.1**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	UG	**Sample Size:**	1
Community Type:	Upland Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover Mean Absolute	Cover Relative (%)	Cover Std. Dev. (n-1)	Frequency Absolute	Frequency Relative (%)	I.V*	Rank
Introduced Annual Forbs							
Alyssum desertorum	1.3	2.2	2.1	39.3	4.3	6.5	1
Camelina microcarpa	0.1	0.2	0.5	7.1	0.8	1.0	17
Sisymbrium altissimum	0.4	0.7	1.2	10.7	1.2	1.9	12
Thlaspi arvense	0.1	0.2	0.5	7.1	0.8	1.0	17
Sub-Total	**1.9**	**3.3**	**2.5**				
Introduced Biennial Forbs							
Melilotus officinalis	0.2	0.3	0.6	10.7	1.2	1.5	13
Tragopogon dubius	0.4	0.7	1.0	14.3	1.6	2.3	11
Sub-Total	**0.6**	**1.0**	**1.1**				
Native Perennial Forbs							
Achillea millefolium	0.6	1.0	1.4	21.4	2.4	3.4	7
Evolvulus nuttallianus	0.1	0.2	0.4	3.6	0.4	0.6	18
Gaura coccinea	0.1	0.2	0.4	3.6	0.4	0.6	18
Grindelia squarrosa	0.1	0.2	0.5	7.1	0.8	1.0	17
Lactuca oblongifolia	0.1	0.2	0.4	3.6	0.4	0.6	18
Lygodesmia juncea	0.1	0.2	0.4	3.6	0.4	0.6	18
Musineon divaricatum	0.1	0.2	0.8	3.6	0.4	0.6	18
Pediomelum argophyllum	0.2	0.3	0.6	10.7	1.2	1.5	13
Phlox hoodii	0.9	1.6	1.6	32.1	3.6	5.2	3
Psoralidium tenuiflorum	0.5	0.9	1.3	17.9	2.0	2.9	10
Sphaeralcea coccinea	0.8	1.4	1.8	21.4	2.4	3.8	5
Symphyotrichum falcatum	0.1	0.2	0.5	7.1	0.8	1.0	17
Vicia americana	0.5	0.9	1.0	21.4	2.4	3.3	8
Zigadenus venenosus	0.1	0.2	0.4	3.6	0.4	0.6	18
Sub-Total	**4.3**	**7.4**	**3.1**				
Introduced Perennial Forbs							
Convolvulus arvensis	1.7	2.9	3.8	28.6	3.2	6.1	2
Taraxacum officinale	0.6	1.0	1.5	14.3	1.6	2.6	10
Sub-Total	**2.3**	**4.0**	**4.9**				
Unknown Forb Species							
Astragalus spp.	0.2	0.3	0.8	7.1	0.8	1.1	16
Cirsium spp.	0.1	0.2	0.4	3.6	0.4	0.6	18
Lappula spp.	0.1	0.2	0.4	3.6	0.4	0.6	18
Polygonum spp.	0.1	0.2	0.4	3.6	0.4	0.6	18
Sub-Total	**0.5**	**0.9**	**1.1**				

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RAMACO
Report: Cover Summary

Project Name:	2013 RAMACO	**Sampling Method:**	Point Line Intercept
Polygon Name:	UG	**Sample Size:**	1
Community Type:	Upland Grassland	**Number of Samples:**	28
Date:	7/1/2013	**Report Date:**	12/31/2013

Species	Cover			Frequency			
	Mean Absolute	Relative (%)	Std. Dev. (n-1)	Absolute	Relative (%)	I.V*	Rank
Native Full Shrubs							
Artemisia cana	0.3	0.5	1.0	7.1	0.8	1.3	14
Artemisia tridentata	0.9	1.6	2.3	17.9	2.0	3.6	6
Rhus aromatica	0.2	0.3	0.6	10.7	1.2	1.5	13
Ribes cereum	0.1	0.2	0.4	3.6	0.4	0.6	18
Sarcobatus vermiculatus	0.1	0.2	0.4	3.6	0.4	0.6	18
Symphoricarpos spp.	0.1	0.2	0.5	7.1	0.8	1.0	17
Sub-Total	**1.7**	**2.9**	**2.9**				
Native Half &Sub-Shrubs							
Artemisia frigida	0.8	1.4	1.4	32.1	3.6	5.0	4
Gutierrezia sarothrae	0.4	0.7	1.2	10.7	1.2	1.9	12
Sub-Total	**1.2**	**2.1**	**1.7**				
Native Succulents							
Opuntia polyacantha	0.1	0.2	0.4	3.6	0.4	0.6	18
Sub-Total	**0.1**	**0.2**	**0.4**				
Cryptograms							
Moss	0.0	0.0	0.0	0.0	0.0	0.0	19
Lichen	0.2	0.4	0.8	7.1	0.8	1.2	15
Algae	0.0	0.0	0.0	0.0	0.0	0.0	19
Fungi	0.0	0.0	0.0	0.0	0.0	0.0	19
Sub-Total	**0.2**	**0.4**	**0.8**				

Totals		Std. Dev.
Total Vegetation	58.0	12.7
Total Vegetation w/Cryptograms	58.2	12.5
Total Vegetation excluding SLCV	38.1	13.0
Litter	28.2	9.6
Rock	4.3	4.8
Total Ground Cover	90.7	9.2
Total Ground Cover excluding SLCV	70.8	15.5
Bare Soil	9.3	9.2

* I.V. Stands for Importance Value

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Production Summaries

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: BSS
Community Type: Big Sagebrush Shrubland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Vulpia octoflora	0.3	5.8	0.8	1.8
Total Native Annual Grasses	**0.3**	**5.8**	**0.8**	**1.8**
Bromus japonicus	3.7	65.8	9.9	8.9
Bromus tectorum	2.6	45.9	6.9	6.8
Total Introduced Annual Grasses	**6.3**	**111.7**	**16.8**	**11.2**
Achnatherum hymenoides	0.1	1.8	0.3	0.7
Elymus smithii	4.4	77.7	11.7	10.0
Elymus spicatus	8.9	158.0	23.7	10.9
Festuca idahoensis	0.2	4.4	0.5	1.8
Hesperostipa comata	5.6	100.1	14.9	9.0
Nassella viridula	1.5	26.3	4.0	4.0
Poa secunda	0.9	15.9	2.4	1.9
Total Native Cool Season Perennial Grasses	**21.6**	**384.2**	**57.6**	**14.8**
Aristida purpurea	0.2	3.1	0.5	1.2
Bouteloua gracilis	0.2	3.2	0.5	0.8
Total Native Warm Season Perennial Grasses	**0.4**	**6.3**	**1.1**	**1.4**
Agropyron cristatum	0.4	7.5	1.1	1.9
Bromus inermis	0.4	7.4	1.1	3.0
Festuca ovina	0.2	2.7	0.5	1.1
Poa bulbosa	<0.1	0.2	<0.1	0.1
Total Introduced Perennial Grasses	**1.0**	**17.8**	**2.7**	**3.6**
Carex filifolia	0.2	3.8	0.5	0.9
Total Native Grasslike Species	**0.2**	**3.8**	**0.5**	**0.9**
Lappula redowskii	0.1	0.9	0.3	0.4
Logfia arvensis	<0.1	0.5	0.1	0.2
Plantago patagonica	0.3	6.0	0.8	1.2
Total Native Annual Forbs	**0.4**	**7.4**	**1.1**	**1.3**
Alyssum desertorum	1.7	29.6	4.5	2.7
Camelina microcarpa	<0.1	0.2	<0.1	0.1
Descurainia sophia	0.3	4.7	0.8	1.8
Total Introduced Annual Forbs	**2.0**	**34.5**	**5.3**	**3.2**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: BSS
Community Type: Big Sagebrush Shrubland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Melilotus officinalis	<0.1	0.6	0.1	0.2
Tragopogon dubius	0.3	5.0	0.8	0.6
Total Introduced Biennial Forbs	**0.3**	**5.6**	**0.8**	**0.7**
Achillea millefolium	0.2	2.8	0.5	0.5
Brickellia eupatorioides	0.1	1.5	0.3	0.6
Calochortus nuttallii	0.1	2.0	0.3	0.6
Comandra umbellata	0.1	1.7	0.3	0.7
Dalea purpurea	0.6	10.1	1.6	2.0
Evolvulus nuttallianus	0.1	1.2	0.3	0.5
Gaura coccinea	0.1	1.2	0.3	0.4
Heterotheca villosa	0.1	1.7	0.3	0.7
Lygodesmia juncea	<0.1	0.8	0.1	0.3
Mertensia ciliata	<0.1	0.2	<0.1	0.1
Pediomelum argophyllum	0.1	2.5	0.3	0.6
Pediomelum esculentum	0.3	4.9	0.8	0.9
Phlox hoodii	0.1	2.0	0.3	0.4
Psoralidium tenuiflorum	1.0	17.5	2.7	4.3
Sphaeralcea coccinea	0.5	8.8	1.3	2.2
Thermopsis rhombifolia	0.1	1.0	0.3	0.4
Vicia americana	1.3	24.0	3.5	4.8
Total Native Perennial Forbs	**4.9**	**83.9**	**13.1**	**7.1**
Taraxacum officinale	0.1	2.0	0.3	0.8
Total Introduced Perennial Forbs	**0.1**	**2.0**	**0.3**	**0.8**
Total Production	**37.5**	**663.0**	**100.1**	**23.7**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: BSG
Community Type: Bottomland Sagebrush Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 25
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Bromus japonicus	2.6	46.0	2.2	4.7
Bromus tectorum	2.5	45.3	2.1	8.0
Total Introduced Annual Grasses	**5.1**	**91.3**	**4.3**	**8.7**
Achnatherum hymenoides	0.2	3.3	0.2	0.9
Elymus lanceolatus	0.4	7.2	0.3	2.0
Elymus smithii	34.0	607.5	28.3	55.4
Elymus trachycaulus	0.8	14.2	0.7	2.8
Hordeum jubatum	2.8	49.6	2.3	11.4
Nassella viridula	2.0	36.3	1.7	6.1
Total Native Cool Season Perennial Grasses	**40.2**	**718.1**	**33.5**	**57.4**
Spartina pectinata	1.7	29.6	1.4	8.3
Total Native Warm Season Perennial Grasses	**1.7**	**29.6**	**1.4**	**8.3**
Agropyron cristatum	18.0	321.4	15.0	41.7
Bromus inermis	9.4	167.6	7.8	42.5
Phleum pratense	0.7	12.9	0.6	3.6
Poa bulbosa	0.5	9.4	0.4	2.6
Poa pratensis	0.2	3.6	0.2	1.0
Total Introduced Perennial Grasses	**28.8**	**514.9**	**24.0**	**56.9**
Carex nebrascensis	15.8	281.3	13.2	65.6
Total Native Grasslike Species	**15.8**	**281.3**	**13.2**	**65.6**
Carex spp.	1.0	18.4	0.8	5.2
Total Unknown Grasslike Species	**1.0**	**18.4**	**0.8**	**5.2**
Lappula redowskii	0.1	1.9	0.1	0.5
Total Native Annual Forbs	**0.1**	**1.9**	**0.1**	**0.5**
Alyssum desertorum	1.4	25.1	1.2	4.4
Camelina microcarpa	0.1	1.6	0.1	0.4
Lepidium perfoliatum	0.1	1.6	0.1	0.5
Thlaspi arvense	0.4	7.8	0.3	2.0
Total Introduced Annual Forbs	**2.0**	**36.1**	**1.7**	**4.8**
Lactuca serriola	6.4	113.9	5.3	31.5
Tragopogon dubius	0.5	8.6	0.4	2.0
Total Introduced Biennial Forbs	**6.9**	**122.5**	**5.8**	**31.5**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: BSG
Community Type: Bottomland Sagebrush Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 25
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Achillea millefolium	2.4	42.3	2.0	10.9
Ambrosia psilostachya	4.2	74.1	3.5	16.3
Lygodesmia juncea	0.4	6.6	0.3	1.8
Sphaeralcea coccinea	0.5	8.2	0.4	1.4
Total Native Perennial Forbs	**7.5**	**131.2**	**6.3**	**19.1**
Cirsium arvense	1.0	17.0	0.8	2.3
Convolvulus arvensis	5.8	103.7	4.8	12.6
Rumex crispus	0.7	12.0	0.6	2.7
Taraxacum officinale	0.1	1.9	0.1	0.5
Total Introduced Perennial Forbs	**7.6**	**134.6**	**6.3**	**13.5**
Astragalus spp.	0.2	4.4	0.2	1.2
Chenopodium spp.	0.5	8.9	0.4	1.7
Polygonum spp.	0.8	14.2	0.7	4.0
Sonchus spp.	1.4	24.5	1.2	6.9
Trifolium spp.	0.4	7.8	0.3	2.2
Total Unknown Forb Species	**3.3**	**59.8**	**2.8**	**8.0**
Total Production	**120.0**	**2,139.7**	**100.2**	**85.2**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: RW
Community Type: Riparian Woodland
Date: 7/1/2013
Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 48
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Bromus japonicus	5.7	102.2	4.0	15.5
Bromus tectorum	2.1	38.1	1.5	7.5
Total Introduced Annual Grasses	**7.8**	**140.3**	**5.4**	**19.4**
Elymus lanceolatus	0.4	7.8	0.3	2.1
Elymus smithii	13.1	233.7	9.1	30.0
Elymus trachycaulus	16.4	292.2	11.4	63.2
Hordeum jubatum	5.0	88.3	3.5	17.8
Nassella viridula	1.7	30.3	1.2	7.3
Poa secunda	1.0	17.8	0.7	4.2
Total Native Cool Season Perennial Grasses	**37.6**	**670.1**	**26.2**	**68.3**
Spartina pectinata	7.8	139.3	5.4	28.5
Total Native Warm Season Perennial Grasses	**7.8**	**139.3**	**5.4**	**28.5**
Agropyron cristatum	31.1	554.7	21.7	82.3
Agrostis capillaris	<0.1	0.6	<0.1	0.2
Bromus inermis	10.3	183.9	7.2	33.7
Poa pratensis	2.9	51.4	2.0	7.6
Total Introduced Perennial Grasses	**44.3**	**790.6**	**30.9**	**85.0**
Festuca spp.	2.2	39.5	1.5	10.9
Total Unknown Grass Species	**2.2**	**39.5**	**1.5**	**10.9**
Carex nebrascensis	12.2	217.9	8.5	36.9
Schoenoplectus pungens	0.1	1.0	0.1	0.3
Total Native Grasslike Species	**12.3**	**218.9**	**8.6**	**36.9**
Chenopodium berlandieri	0.2	3.9	0.1	1.5
Descurainia pinnata	0.3	5.4	0.2	1.4
Galium aparine	0.1	1.4	0.1	0.5
Helianthus annuus	0.4	7.6	0.3	2.9
Total Native Annual Forbs	**1.0**	**18.3**	**0.7**	**4.1**
Alyssum desertorum	0.4	7.9	0.3	1.4
Atriplex heterosperma	0.7	11.9	0.5	4.6
Camelina microcarpa	0.8	13.8	0.6	2.2
Descurainia sophia	0.2	3.8	0.1	1.5
Lepidium perfoliatum	1.0	18.7	0.7	6.7
Medicago lupulina	0.8	14.2	0.6	4.2
Polygonum convolvulus	0.1	1.3	0.1	0.5

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: RW
Community Type: Riparian Woodland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 48
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Thlaspi arvense	0.9	16.5	0.6	4.5
Total Introduced Annual Forbs	**4.9**	**88.1**	**3.4**	**13.7**
Cynoglossum officinale	0.2	3.1	0.1	1.2
Lactuca serriola	1.2	20.8	0.8	5.7
Melilotus officinalis	<0.1	0.3	<0.1	0.1
Tragopogon dubius	0.2	3.2	0.1	0.9
Total Introduced Biennial Forbs	**1.6**	**27.4**	**1.1**	**5.8**
Achillea millefolium	2.6	46.0	1.8	7.4
Agoseris aurantiaca	<0.1	0.7	<0.1	0.3
Apocynum cannabinum	0.1	2.5	0.1	1.0
Asclepias speciosa	0.3	4.8	0.2	1.9
Brickellia eupatorioides	0.7	12.3	0.5	4.8
Comandra umbellata	0.1	2.1	0.1	0.8
Equisetum laevigatum	0.7	12.9	0.5	3.3
Evolvulus nuttallianus	0.8	14.4	0.6	5.6
Galium boreale	0.1	2.3	0.1	0.9
Glycyrrhiza lepidota	0.1	1.8	0.1	0.7
Grindelia squarrosa	1.9	33.9	1.3	10.9
Lactuca oblongifolia	0.2	3.3	0.1	1.3
Lepidium fremontii	<0.1	0.4	<0.1	0.2
Linum lewisii	<0.1	0.4	<0.1	0.2
Symphyotrichum falcatum	0.5	8.6	0.3	1.9
Typha latifolia	<0.1	0.7	<0.1	0.3
Vicia americana	<0.1	0.4	<0.1	0.1
Wyethia amplexicaulis	<0.1	0.5	<0.1	0.2
Total Native Perennial Forbs	**8.3**	**148.0**	**5.8**	**15.4**
Cardaria draba	7.0	125.0	4.9	34.0
Cirsium arvense	1.5	26.6	1.0	6.7
Convolvulus arvensis	1.8	31.9	1.3	6.7
Medicago sativa	0.1	2.1	0.1	0.8
Rumex crispus	0.1	1.4	0.1	0.5
Taraxacum officinale	2.7	48.7	1.9	5.7
Trifolium repens	0.1	1.1	0.1	0.4
Total Introduced Perennial Forbs	**13.3**	**236.8**	**9.3**	**34.6**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: RW
Community Type: Riparian Woodland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 48
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Astragalus spp.	0.9	16.7	0.6	6.2
Asteraceae spp.	0.5	9.6	0.3	2.6
Chenopodium spp.	0.1	0.9	0.1	0.4
Sonchus spp.	0.7	12.4	0.5	4.4
Total Unknown Forb Species	**2.2**	**39.6**	**1.5**	**7.8**
Total Production	**143.3**	**2,556.9**	**99.8**	**78.1**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: RBMS
Community Type: Rough Breaks Mixed Shrubland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Bromus japonicus	3.6	63.4	9.5	13.1
Bromus tectorum	1.1	19.5	2.9	4.3
Total Introduced Annual Grasses	**4.7**	**82.9**	**12.5**	**16.3**
Elymus lanceolatus	1.2	22.0	3.2	3.5
Elymus smithii	2.6	45.7	6.9	4.2
Elymus spicatus	13.2	236.0	35.0	16.9
Hesperostipa comata	2.3	40.7	6.1	6.4
Koeleria macrantha	0.1	2.0	0.3	0.6
Nassella viridula	0.6	10.7	1.6	2.0
Poa secunda	0.1	1.9	0.3	0.5
Total Native Cool Season Perennial Grasses	**20.1**	**359.0**	**53.3**	**16.8**
Bouteloua gracilis	0.1	2.2	0.3	0.6
Schizachyrium scoparium	0.1	1.2	0.3	0.5
Total Native Warm Season Perennial Grasses	**0.2**	**3.4**	**0.5**	**0.7**
Carex filifolia	0.1	1.4	0.3	0.4
Total Native Grasslike Species	**0.1**	**1.4**	**0.3**	**0.4**
Atriplex suckleyi	<0.1	0.6	0.1	0.2
Descurainia pinnata	<0.1	0.3	0.1	0.1
Gnaphalium palustre	<0.1	0.3	0.1	0.1
Plantago patagonica	<0.1	0.6	0.1	0.2
Total Native Annual Forbs	**0.1**	**1.8**	**0.3**	**0.3**
Alyssum desertorum	0.3	5.9	0.8	0.9
Chenopodium album	<0.1	0.1	<0.1	<0.1
Medicago lupulina	0.2	2.7	0.5	0.7
Total Introduced Annual Forbs	**0.5**	**8.7**	**1.3**	**1.1**
Lactuca serriola	<0.1	0.4	0.1	0.2
Melilotus officinalis	0.1	1.7	0.3	0.6
Tragopogon dubius	0.3	5.9	0.8	1.2
Total Introduced Biennial Forbs	**0.4**	**8.0**	**1.1**	**1.3**
Achillea millefolium	0.2	4.2	0.5	0.7
Agoseris glauca	0.1	1.6	0.3	0.6
Allium textile	<0.1	1.8	0.1	0.3
Antennaria microphylla	0.2	2.9	0.5	1.1
Calochortus nuttallii	<0.1	0.2	<0.1	0.1
Comandra umbellata	0.7	12.9	1.9	2.1

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: RBMS
Community Type: Rough Breaks Mixed Shrubland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Dalea candida	0.3	4.9	0.8	1.2
Dalea purpurea	0.5	8.2	1.3	2.0
Evolvulus nuttallianus	<0.1	0.6	0.1	0.2
Gaura coccinea	1.1	20.0	2.9	2.9
Glycyrrhiza lepidota	0.2	4.2	0.5	1.7
Grindelia squarrosa	0.3	4.8	0.8	1.1
Machaeranthera grindelioides	<0.1	0.7	0.1	0.3
Musineon divaricatum	0.2	3.9	0.5	0.7
Oxytropis lambertii	<0.1	0.7	0.1	0.3
Oxytropis sericea	0.1	1.3	0.3	0.5
Packera cana	0.1	2.1	0.3	0.6
Pediomelum argophyllum	0.2	5.4	0.5	1.6
Pediomelum esculentum	<0.1	0.7	0.1	0.2
Phlox hoodii	1.3	23.0	3.4	2.9
Psoralidium lanceolatum	0.4	7.2	1.1	1.4
Psoralidium tenuiflorum	2.1	36.9	5.6	4.4
Ratibida columnifera	<0.1	0.6	0.1	0.2
Sphaeralcea coccinea	0.4	7.1	1.1	1.2
Stenotus armerioides	0.1	1.2	0.3	0.3
Symphyotrichum falcatum	0.2	3.2	0.5	1.0
Vicia americana	0.3	5.1	0.8	1.1
Total Native Perennial Forbs	**9.2**	**165.4**	**24.4**	**8.5**
Astragalus cicer	<0.1	0.6	0.1	0.3
Convolvulus arvensis	2.1	37.3	5.6	6.8
Taraxacum officinale	0.1	1.6	0.3	0.4
Total Introduced Perennial Forbs	**2.2**	**39.5**	**5.8**	**6.8**
Eriogonum spp.	0.1	1.8	0.3	0.5
Penstemon spp.	0.1	1.6	0.3	0.6
Total Unknown Forb Species	**0.2**	**3.4**	**0.5**	**0.8**
Total Production	**37.7**	**673.5**	**100.0**	**24.0**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: SG
Community Type: Scoria Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Echinochloa muricata	<0.1	0.3	<0.1	0.1
Total Native Annual Grasses	**<0.1**	**0.3**	**<0.1**	**0.1**
Bromus japonicus	1.6	28.5	2.6	2.8
Bromus tectorum	19.7	351.8	32.4	28.2
Total Introduced Annual Grasses	**21.3**	**380.3**	**35.0**	**28.9**
Elymus smithii	1.6	27.7	2.6	4.0
Elymus spicatus	15.9	284.3	26.2	21.9
Festuca idahoensis	0.1	1.0	0.2	0.4
Hesperostipa comata	5.5	97.7	9.0	13.0
Nassella viridula	1.0	18.7	1.6	4.1
Poa secunda	0.3	4.7	0.5	1.0
Total Native Cool Season Perennial Grasses	**24.4**	**434.1**	**40.1**	**22.3**
Aristida purpurea	0.1	1.6	0.2	0.4
Bouteloua gracilis	0.1	0.9	0.2	0.4
Buchloe dactyloides	<0.1	0.7	0.1	0.3
Calamagrostis purpurascens	0.2	3.5	0.3	1.4
Total Native Warm Season Perennial Grasses	**0.4**	**6.7**	**0.7**	**1.5**
Festuca ovina	<0.1	0.5	<0.1	0.2
Total Introduced Perennial Grasses	**<0.1**	**0.5**	**<0.1**	**0.2**
Descurainia pinnata	<0.1	0.7	0.1	0.3
Helianthus annuus	1.4	25.6	2.3	9.4
Logfia arvensis	<0.1	0.2	<0.1	0.1
Total Native Annual Forbs	**1.5**	**26.5**	**2.5**	**9.4**
Alyssum desertorum	1.2	20.7	2.0	3.0
Camelina microcarpa	1.4	24.5	2.3	7.2
Descurainia sophia	<0.1	0.8	0.1	0.3
Sisymbrium altissimum	0.3	5.8	0.5	1.6
Total Introduced Annual Forbs	**2.9**	**51.8**	**4.8**	**7.9**
Melilotus officinalis	0.1	1.2	0.2	0.5
Tragopogon dubius	0.5	8.7	0.8	1.7
Total Introduced Biennial Forbs	**0.6**	**9.9**	**1.0**	**1.7**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: SG
Community Type: Scoria Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Ambrosia psilostachya	0.1	1.4	0.2	0.5
Brickellia eupatorioides	0.2	4.0	0.3	1.6
Dalea purpurea	2.2	39.8	3.6	5.8
Eriogonum pauciflorum	0.2	3.3	0.3	1.0
Evolvulus nuttallianus	0.5	9.6	0.8	3.2
Galium boreale	<0.1	0.1	<0.1	0.1
Gaura coccinea	0.1	2.0	0.2	0.6
Lactuca tatarica	<0.1	0.5	<0.1	0.2
Lomatium foeniculaceum	0.2	3.4	0.3	1.3
Lygodesmia juncea	0.2	4.2	0.3	1.7
Musineon divaricatum	<0.1	0.3	<0.1	0.1
Oxytropis sericea	1.0	17.1	1.6	4.7
Pediomelum argophyllum	0.2	4.1	0.3	1.0
Pediomelum esculentum	0.1	1.7	0.2	0.5
Phlox hoodii	0.4	7.6	0.7	2.3
Psoralidium tenuiflorum	1.9	34.7	3.1	11.3
Sphaeralcea coccinea	1.6	29.1	2.6	3.8
Symphyotrichum falcatum	0.2	3.6	0.3	1.4
Vicia americana	0.2	3.3	0.3	0.7
Total Native Perennial Forbs	**9.4**	**169.8**	**15.5**	**17.9**
Astragalus cicer	<0.1	0.5	<0.1	0.2
Medicago sativa	0.1	1.1	0.2	0.4
Taraxacum officinale	<0.1	0.3	<0.1	0.1
Total Introduced Perennial Forbs	**0.2**	**1.9**	**0.3**	**0.5**
Cryptantha spp.	<0.1	0.4	<0.1	0.1
Eriogonum spp.	0.1	1.5	0.2	0.6
Total Unknown Forb Species	**0.1**	**1.9**	**0.2**	**0.6**
Total Production	**60.8**	**1,083.7**	**100.1**	**33.8**

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: UG
Community Type: Upland Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Bromus japonicus	4.8	85.6	7.5	7.7
Bromus tectorum	10.9	194.8	16.9	20.0
Total Introduced Annual Grasses	**15.7**	**280.4**	**24.4**	**23.8**
Elymus lanceolatus	1.4	24.9	2.2	4.6
Elymus smithii	20.3	362.3	31.5	24.5
Elymus spicatus	7.9	141.8	12.3	16.1
Hesperostipa comata	4.1	73.6	6.4	7.5
Nassella viridula	1.9	33.7	3.0	6.5
Poa secunda	1.4	24.7	2.2	3.2
Total Native Cool Season Perennial Grasses	**37.0**	**661.0**	**57.5**	**24.9**
Aristida purpurea	0.2	4.1	0.3	1.6
Bouteloua gracilis	0.6	10.3	0.9	1.7
Distichlis stricta	<0.1	0.8	0.1	0.3
Sporobolus cryptandrus	0.2	4.0	0.3	1.2
Total Native Warm Season Perennial Grasses	**1.0**	**19.2**	**1.6**	**2.9**
Agropyron cristatum	0.4	7.8	0.6	2.8
Festuca ovina	0.1	1.4	0.2	0.6
Poa bulbosa	0.2	3.0	0.3	0.7
Total Introduced Perennial Grasses	**0.7**	**12.2**	**1.1**	**2.9**
Carex filifolia	0.5	9.0	0.8	3.6
Total Native Grasslike Species	**0.5**	**9.0**	**0.8**	**3.6**
Lappula redowskii	1.1	19.4	1.7	7.7
Logfia arvensis	0.1	1.0	0.2	0.3
Plantago patagonica	0.3	5.6	0.5	1.0
Total Native Annual Forbs	**1.5**	**26.0**	**2.3**	**7.7**
Alyssum desertorum	0.4	7.6	0.6	1.1
Total Introduced Annual Forbs	**0.4**	**7.6**	**0.6**	**1.1**
Melilotus officinalis	0.1	1.1	0.2	0.3
Tragopogon dubius	0.5	9.8	0.8	1.2
Total Introduced Biennial Forbs	**0.6**	**10.9**	**0.9**	**1.2**
Achillea millefolium	0.7	11.6	1.1	2.0

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RAMACO
BASELINE ASSESSMENT
Report: Production Summary

Project Name: 2013 RAMACO
Polygon Name: UG
Community Type: Upland Grassland
Date: 7/1/2013

Plot Size: 1 Square Meter
Sample Size: 1
Number of Samples: 50
Report Date: 12/31/2013

Species	Mean g/m²	Mean lbs/acre	Relative (%)	Std. Dev n - 1 (gm/sq.m.)
Agoseris glauca	<0.1	0.1	<0.1	<0.1
Ambrosia psilostachya	0.2	2.9	0.3	0.7
Antennaria microphylla	<0.1	0.1	<0.1	<0.1
Cirsium flodmanii	0.2	2.8	0.3	1.1
Dalea purpurea	0.5	9.5	0.8	2.6
Evolvulus nuttallianus	0.5	8.9	0.8	3.4
Gaura coccinea	0.1	1.5	0.2	0.6
Grindelia squarrosa	0.1	1.4	0.2	0.6
Musineon divaricatum	<0.1	0.2	<0.1	0.1
Pediomelum argophyllum	0.1	2.3	0.2	0.7
Pediomelum esculentum	0.1	2.5	0.2	0.8
Phlox hoodii	0.3	5.3	0.5	1.3
Psoralidium tenuiflorum	1.3	23.1	2.0	3.8
Sphaeralcea coccinea	1.0	18.4	1.6	2.3
Thermopsis rhombifolia	0.2	4.5	0.3	1.3
Vicia americana	1.1	18.8	1.7	4.1
Total Native Perennial Forbs	**6.4**	**113.9**	**9.9**	**8.2**
Convolvulus arvensis	0.1	0.9	0.2	0.4
Taraxacum officinale	0.5	8.7	0.8	1.3
Total Introduced Perennial Forbs	**0.6**	**9.6**	**0.9**	**1.4**
Eriogonum spp.	<0.1	0.3	<0.1	0.1
Penstemon spp.	<0.1	0.4	<0.1	0.1
Total Unknown Forb Species	**<0.1**	**0.7**	**0.1**	**0.2**
Total Production	**64.4**	**1,150.5**	**100.1**	**27.9**

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ATTACHMENT D8-1-E

Shrub Density Summaries

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	BSS	**Sample Size**	1
Community Type	Big Sagebrush Shrubland	**Number of Samples**	50
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	3.3	2.7	10.7	<0.1	133.6
Artemisia tridentata	90.7	74.5	45.5	0.9	3,669.8
Chrysothamnus viscidiflorus	1.1	0.9	6.0	<0.1	46.1
Ericameria nauseosa	1.1	0.9	5.2	<0.1	44.5
Rhus aromatica	0.3	0.2	1.1	<0.1	11.3
Ribes cereum	<0.1	<0.1	<0.1	<0.1	<0.1
Symphoricarpos albus	0.1	0.1	0.6	<0.1	3.2
Total Native Full Shrubs	**96.6**	**79.4**	**52.3**	**1.0**	**3,908.6**
Artemisia frigida	15.2	12.5	18.4	0.2	613.5
Gutierrezia sarothrae	9.9	8.1	17.2	0.1	402.3
Yucca glauca	<0.1	<0.1	0.3	<0.1	1.6
Total Native Half &Sub-Shrubs	**25.1**	**20.6**	**26.4**	**0.3**	**1,017.4**
Total	**121.7**	**100.0**	**64.5**	**1.2**	**4,926.0**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	BSG	**Sample Size**	1
Community Type	Bottomland Sagebrush Grassland	**Number of Samples**	25
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	12.0	21.9	38.4	0.1	484.0
Rhus aromatica	0.2	0.4	0.7	<0.1	8.1
Rosa woodsii	0.1	0.2	0.4	<0.1	3.2
Symphoricarpos albus	1.1	2.0	5.0	<0.1	43.7
Symphoricarpos occidentalis	7.7	14.1	18.4	0.1	312.4
Symphoricarpos spp.	0.4	0.7	2.0	<0.1	16.2
Total Native Full Shrubs	**21.5**	**39.2**	**41.7**	**0.2**	**867.7**
Artemisia frigida	1.9	3.5	4.1	<0.1	76.1
Artemisia ludoviciana	31.4	57.3	54.2	0.3	1,272.4
Total Native Half &Sub-Shrubs	**33.3**	**60.8**	**53.5**	**0.3**	**1,348.5**
Total	**54.8**	**100.0**	**68.3**	**0.5**	**2,216.1**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	PJW	**Sample Size**	1
Community Type	Pine and Juniper Woodland	**Number of Samples**	15
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia tridentata	8.1	14.1	11.6	0.1	326.5
Chrysothamnus viscidiflorus	1.1	1.9	3.9	<0.1	45.9
Ericameria nauseosa	3.3	5.7	7.8	<0.1	132.2
Rhus aromatica	3.3	5.7	5.9	<0.1	132.2
Ribes cereum	1.9	3.3	4.1	<0.1	75.5
Rosa woodsii	2.7	4.7	10.0	<0.1	110.6
Total Native Full Shrubs	**20.4**	**35.5**	**22.9**	**0.2**	**822.9**
Artemisia frigida	13.9	24.2	19.3	0.1	563.9
Artemisia ludoviciana	9.0	15.7	34.9	0.1	364.2
Gutierrezia sarothrae	14.1	24.6	19.9	0.1	569.3
Total Native Half &Sub-Shrubs	**37.0**	**64.5**	**46.5**	**0.4**	**1,497.4**
Total	**57.4**	**100.0**	**62.2**	**0.6**	**2,320.3**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	PDMG	**Sample Size**	1
Community Type	Prairie Dog Modified Grassland	**Number of Samples**	40
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	<0.1	0.1	0.2	<0.1	1.0
Artemisia tridentata	3.3	8.5	9.2	<0.1	132.5
Chrysothamnus viscidiflorus	2.0	5.2	7.8	<0.1	79.9
Ericameria nauseosa	1.5	3.9	8.9	<0.1	58.7
Rhus aromatica	<0.1	0.1	0.2	<0.1	1.0
Symphoricarpos albus	0.2	0.5	1.3	<0.1	8.1
Total Native Full Shrubs	**7.1**	**18.3**	**14.4**	**0.1**	**281.3**
Artemisia frigida	26.1	67.3	67.7	0.3	1,057.3
Artemisia ludoviciana	3.1	8.0	18.2	<0.1	123.4
Gutierrezia sarothrae	2.5	6.4	11.4	<0.1	99.2
Total Native Half &Sub-Shrubs	**31.7**	**81.7**	**69.3**	**0.3**	**1,279.9**
Total	**38.8**	**100.0**	**73.0**	**0.4**	**1,561.1**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	RG	**Sample Size**	1
Community Type	Reclaimed Grassland	**Number of Samples**	10
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	0.4	8.3	1.3	<0.1	16.2
Artemisia tridentata	0.1	2.1	0.3	<0.1	4.0
Atriplex canescens	3.8	79.2	11.0	<0.1	153.8
Ericameria nauseosa	0.4	8.3	1.3	<0.1	16.2
Total Native Full Shrubs	**4.7**	**97.9**	**10.3**	**<0.1**	**190.2**
Artemisia frigida	0.1	2.1	0.3	<0.1	4.0
Total Native Half &Sub-Shrubs	**0.1**	**2.1**	**0.3**	**<0.1**	**4.0**
Total	**4.8**	**100.0**	**10.8**	**<0.1**	**194.3**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	RW	**Sample Size**	1
Community Type	Riparian Woodland	**Number of Samples**	46
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	20.9	11.6	36.3	0.2	846.4
Artemisia tridentata	0.9	0.5	2.9	<0.1	35.2
Ericameria nauseosa	0.2	0.1	0.6	<0.1	6.2
Rhus aromatica	<0.1	<0.1	0.1	<0.1	0.9
Ribes cereum	0.1	0.1	0.5	<0.1	5.3
Rosa woodsii	8.1	4.5	31.2	0.1	329.0
Shepherdia canadensis	0.3	0.2	2.4	<0.1	14.1
Symphoricarpos albus	126.1	70.0	175.6	1.3	5,104.5
Symphoricarpos occidentalis	14.2	7.9	51.6	0.1	576.3
Total Native Full Shrubs	**170.8**	**94.8**	**177.2**	**1.7**	**6,917.7**
Artemisia frigida	2.0	1.1	7.2	<0.1	80.9
Artemisia ludoviciana	7.4	4.1	17.1	0.1	298.2
Gutierrezia sarothrae	<0.1	<0.1	0.3	<0.1	1.8
Total Native Half &Sub-Shrubs	**9.4**	**5.2**	**18.3**	**0.1**	**380.9**
Total	**180.2**	**100.0**	**179.3**	**1.8**	**7,298.7**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	RBMS	**Sample Size**	1
Community Type	Rough Breaks Mixed Shrubland	**Number of Samples**	49
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	1.5	0.9	5.4	<0.1	60.3
Artemisia tridentata	62.5	39.3	53.6	0.6	2,529.0
Atriplex canescens	<0.1	<0.1	0.3	<0.1	1.7
Chrysothamnus viscidiflorus	0.4	0.3	2.0	<0.1	18.2
Ericameria nauseosa	17.8	11.2	28.8	0.2	718.5
Rhus aromatica	0.9	0.6	2.1	<0.1	34.7
Rosa woodsii	24.3	15.3	42.9	0.2	983.7
Sarcobatus vermiculatus	2.6	1.6	10.1	<0.1	104.1
Symphoricarpos albus	0.1	0.1	0.4	<0.1	2.5
Symphoricarpos occidentalis	0.2	0.1	1.6	<0.1	9.1
Total Native Full Shrubs	**110.3**	**69.4**	**81.6**	**1.1**	**4,461.6**
Artemisia frigida	20.3	12.8	23.2	0.2	821.8
Artemisia ludoviciana	0.6	0.4	2.9	<0.1	23.1
Artemisia pedatifida	0.2	0.1	1.6	<0.1	9.1
Atriplex gardneri	0.3	0.2	1.8	<0.1	13.2
Gutierrezia sarothrae	26.8	16.9	34.4	0.3	1,084.4
Juniperus horizontalis	<0.1	<0.1	0.1	<0.1	0.8
Linanthus pungens	0.2	0.1	1.1	<0.1	6.6
Yucca glauca	0.3	0.2	1.8	<0.1	14.0
Total Native Half &Sub-Shrubs	**48.7**	**30.6**	**49.0**	**0.5**	**1,973.1**
Total	**159.0**	**100.0**	**83.1**	**1.6**	**6,434.7**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	SG	**Sample Size**	1
Community Type	Scoria Grassland	**Number of Samples**	50
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	2.7	5.9	8.5	<0.1	109.3
Artemisia tridentata	18.3	40.2	23.9	0.2	742.2
Chrysothamnus viscidiflorus	0.1	0.2	0.5	<0.1	4.9
Ericameria nauseosa	0.9	2.0	5.3	<0.1	38.0
Rhus aromatica	6.1	13.4	6.7	0.1	248.5
Ribes cereum	<0.1	0.1	0.3	<0.1	1.6
Rosa woodsii	1.5	3.3	4.8	<0.1	62.3
Symphoricarpos albus	0.1	0.2	0.4	<0.1	3.2
Symphoricarpos occidentalis	<0.1	<0.1	0.1	<0.1	0.8
Total Native Full Shrubs	**29.8**	**65.5**	**26.2**	**0.3**	**1,210.9**
Artemisia frigida	10.2	22.4	17.7	0.1	414.4
Artemisia ludoviciana	1.3	2.9	8.9	<0.1	51.0
Gutierrezia sarothrae	3.7	8.1	6.7	<0.1	151.4
Krascheninnikovia lanata	<0.1	0.1	0.3	<0.1	1.6
Yucca glauca	0.5	1.1	3.4	<0.1	20.2
Total Native Half &Sub-Shrubs	**15.7**	**34.5**	**25.7**	**0.2**	**638.6**
Total	**45.5**	**100.0**	**42.0**	**0.5**	**1,849.5**

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RAMACO
BASELINE ASSESSMENT
Report: Density Summary

Project Name	2013 RAMACO	**Plot Size**	100 Square Meters
Polygon Name	UG	**Sample Size**	1
Community Type	Upland Grassland	**Number of Samples**	52
Date	7/1/2013	**Report Date**	12/31/2013

	Mean (Number/Plot)	Relative Density	Std. Dev. n-1 (Number/Plot)	Mean (Number/sq.m.)	Mean (Number/Acre)
Artemisia cana	1.3	3.7	6.0	<0.1	53.7
Artemisia tridentata	4.1	11.7	9.3	<0.1	166.5
Chrysothamnus viscidiflorus	1.6	4.6	4.9	<0.1	64.6
Ericameria nauseosa	0.6	1.7	2.9	<0.1	25.7
Rhus aromatica	0.4	1.1	1.2	<0.1	15.6
Ribes cereum	0.1	0.3	0.7	<0.1	5.4
Rosa woodsii	0.4	1.1	2.2	<0.1	15.6
Sarcobatus vermiculatus	0.3	0.9	1.8	<0.1	10.1
Symphoricarpos albus	1.2	3.4	8.3	<0.1	47.5
Total Native Full Shrubs	**10.0**	**28.7**	**17.2**	**0.1**	**404.7**
Artemisia frigida	21.9	62.8	30.5	0.2	888.0
Artemisia pedatifida	<0.1	0.1	0.1	<0.1	0.8
Gutierrezia sarothrae	1.7	4.9	5.2	<0.1	67.7
Krascheninnikovia lanata	0.9	2.6	6.2	<0.1	35.8
Yucca glauca	0.4	1.1	1.3	<0.1	15.6
Total Native Half &Sub-Shrubs	**24.9**	**71.3**	**32.1**	**0.2**	**1,007.9**
Total	**34.9**	**100.0**	**36.7**	**0.3**	**1,412.6**

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ATTACHMENT D8-1-F

Photographs

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Agricultural Land 1

Agricultural Land 2

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Agricultural Land 3

Agricultural Land 4

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Agricultural Land 6

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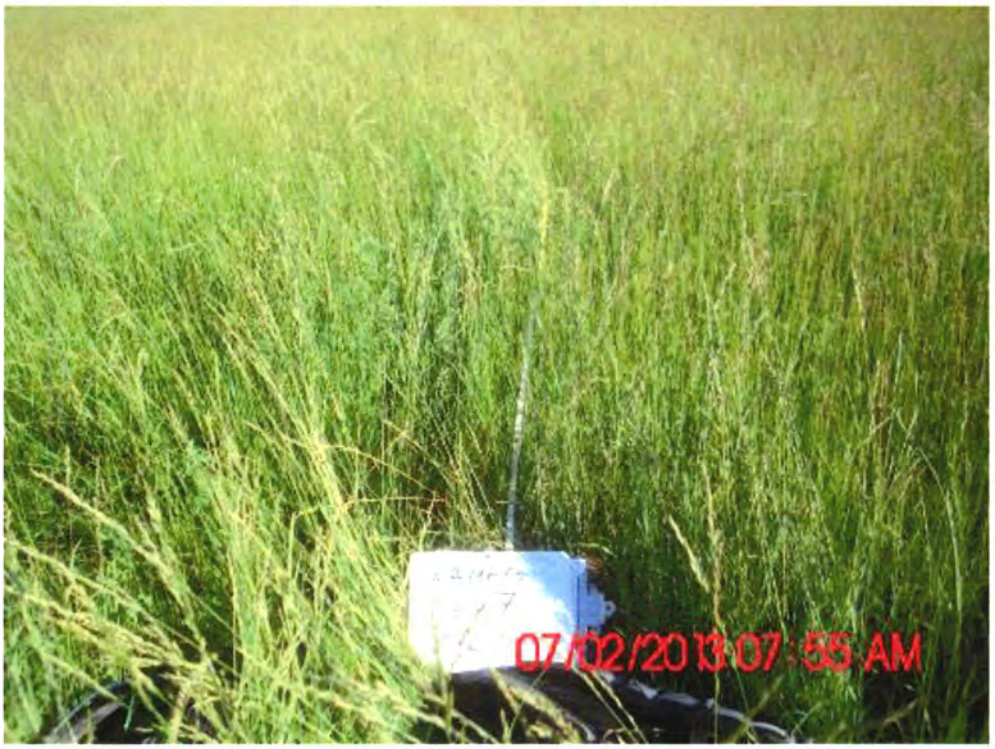

Agricultural Land 7

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Agricultural Land 9

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Agricultural Land 15

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Agricultural Land 17

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Agricultural Land 19

Agricultural Land 20

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Agricultural Land 21

Agricultural Land 22

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Agricultural Land 25

Bottomland Sagebrush Grassland 1

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Bottomland Sagebrush Grassland 2

Bottomland Sagebrush Grassland 3

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Bottomland Sagebrush Grassland 4

Bottomland Sagebrush Grassland 5

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Bottomland Sagebrush Grassland 6

Bottomland Sagebrush Grassland 7

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Bottomland Sagebrush Grassland 8

Bottomland Sagebrush Grassland 9

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Bottomland Sagebrush Grassland 10

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Bottomland Sagebrush Grassland 12

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Bottomland Sagebrush Grassland 14

Bottomland Sagebrush Grassland 15

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Bottomland Sagebrush Grassland 16

Bottomland Sagebrush Grassland 17

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Bottomland Sagebrush Grassland 18

Bottomland Sagebrush Grassland 19

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Bottomland Sagebrush Grassland 20

Bottomland Sagebrush Grassland 21

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Bottomland Sagebrush Grassland 22

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Bottomland Sagebrush Grassland 24

Bottomland Sagebrush Grassland 25

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Big Sagebrush Shrubland 1

Big Sagebrush Shrubland 2

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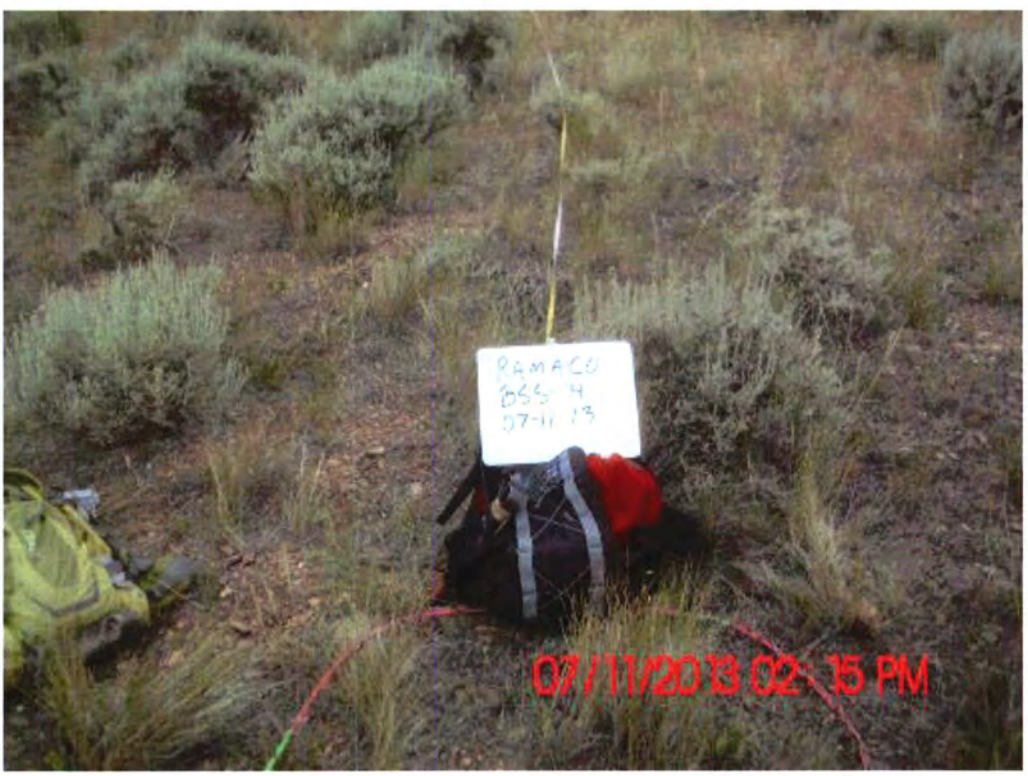
Big Sagebrush Shrubland 3



Big Sagebrush Shrubland 4

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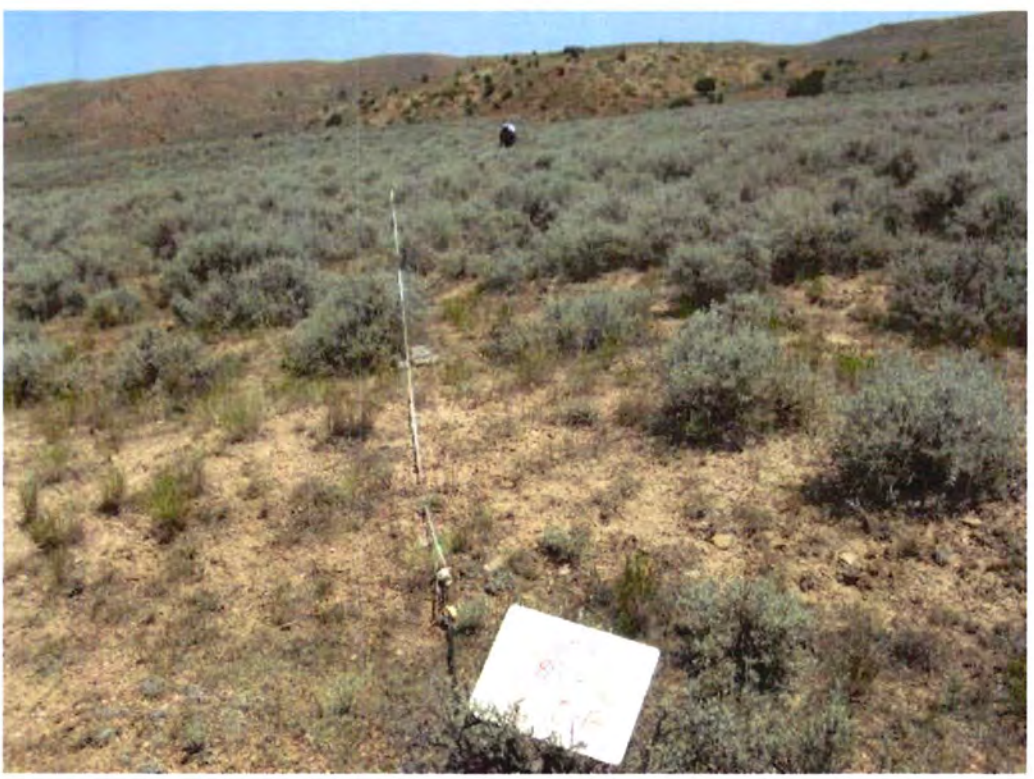
Big Sagebrush Shrubland 5



Big Sagebrush Shrubland 6

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Big Sagebrush Shrubland 7

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Big Sagebrush Shrubland 9

Big Sagebrush Shrubland 10

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Big Sagebrush Shrubland 11

Big Sagebrush Shrubland 12

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Big Sagebrush Shrubland 13

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Big Sagebrush Shrubland 15

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Big Sagebrush Shrubland 17

Big Sagebrush Shrubland 18

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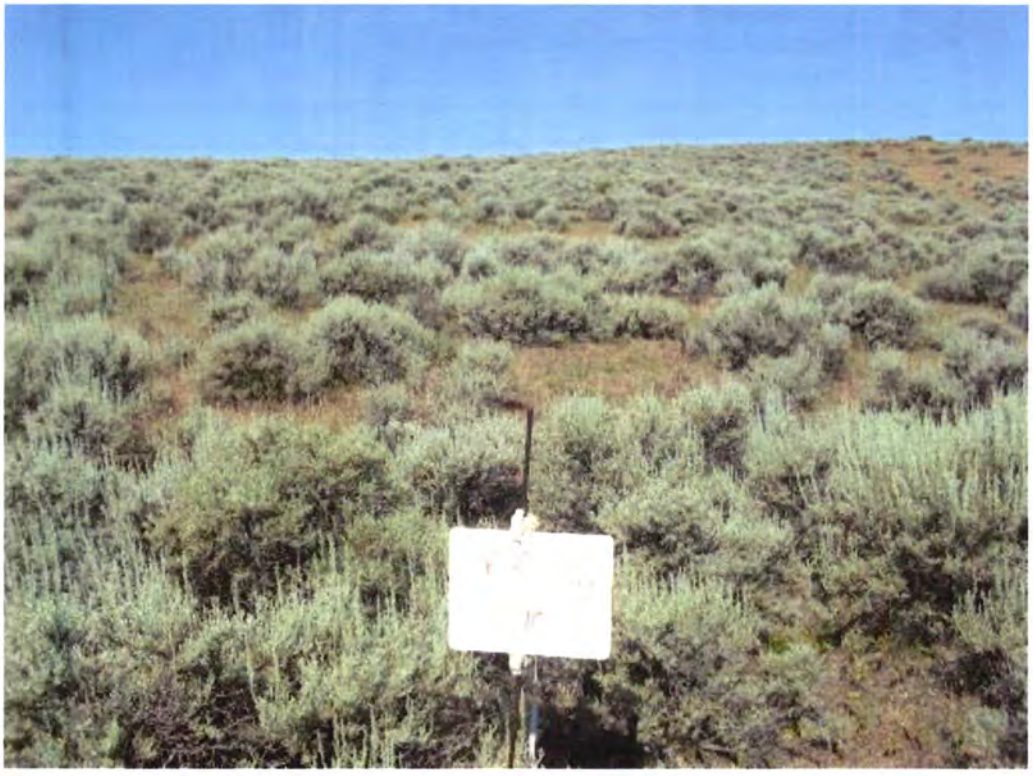

Big Sagebrush Shrubland 19

Big Sagebrush Shrubland 20

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PHOTO FOR BIG SAGEBRUSH SHRUBLAND 21 NOT AVAILABLE

Big Sagebrush Shrubland 22

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Big Sagebrush Shrubland 23

Big Sagebrush Shrubland 24

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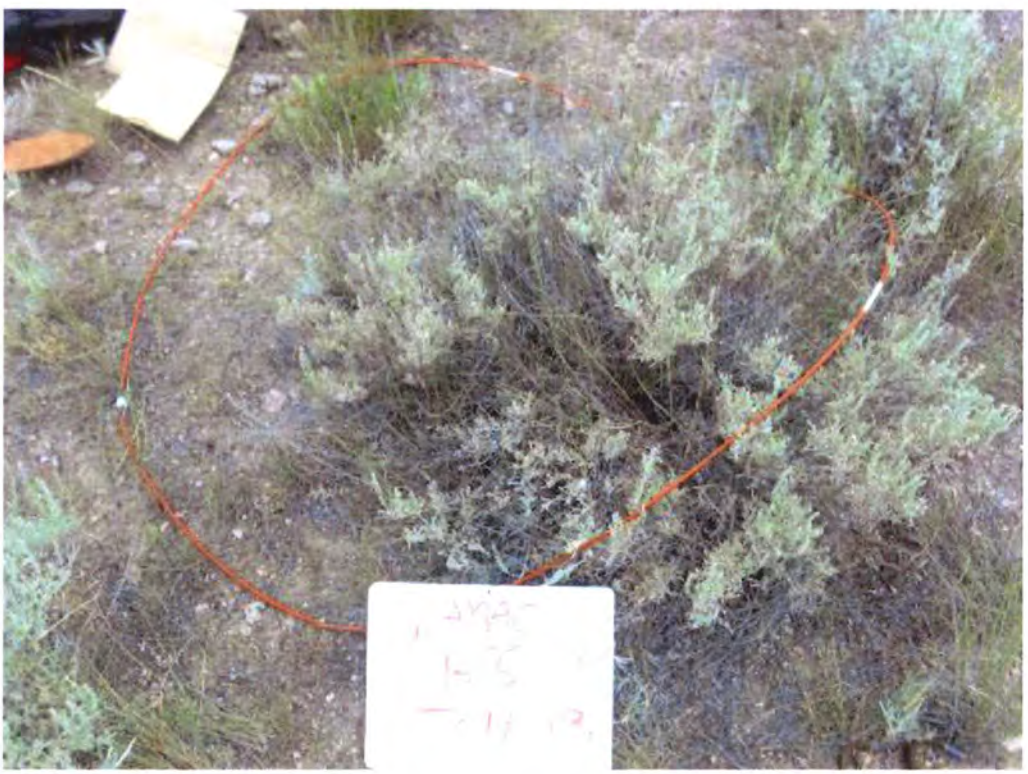
Big Sagebrush Shrubland 25



Big Sagebrush Shrubland 26

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Big Sagebrush Shrubland 27

Big Sagebrush Shrubland 28

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Big Sagebrush Shrubland 29

Big Sagebrush Shrubland 30

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Big Sagebrush Shrubland 31

PHOTO FOR BIG SAGEBRUSH SHRUBLAND 32 NOT AVAILABLE

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Big Sagebrush Shrubland 33

Big Sagebrush Shrubland 34

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Big Sagebrush Shrubland 35

Big Sagebrush Shrubland 36

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Big Sagebrush Shrubland 37

Big Sagebrush Shrubland 38

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Big Sagebrush Shrubland 39

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Big Sagebrush Shrubland 41

Big Sagebrush Shrubland 42

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Big Sagebrush Shrubland 43

Big Sagebrush Shrubland 44

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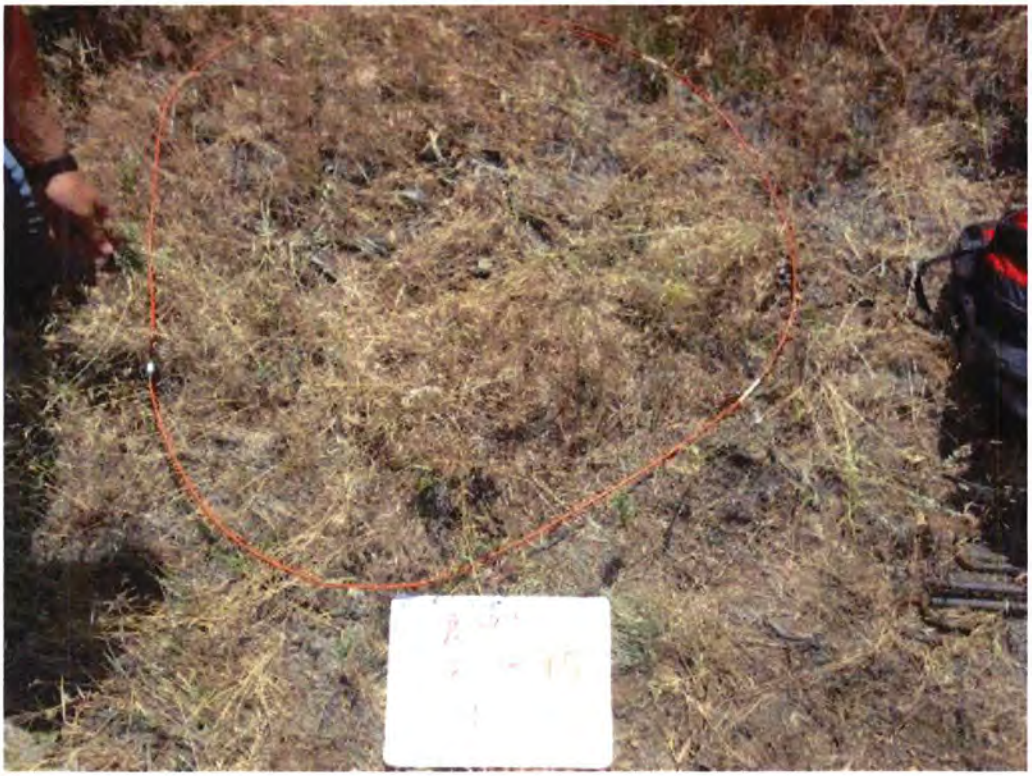

Big Sagebrush Shrubland 45

PHOTO FOR BIG SAGEBRUSH SHRUBLAND 46 NOT AVAILABLE

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Big Sagebrush Shrubland 47

Big Sagebrush Shrubland 48

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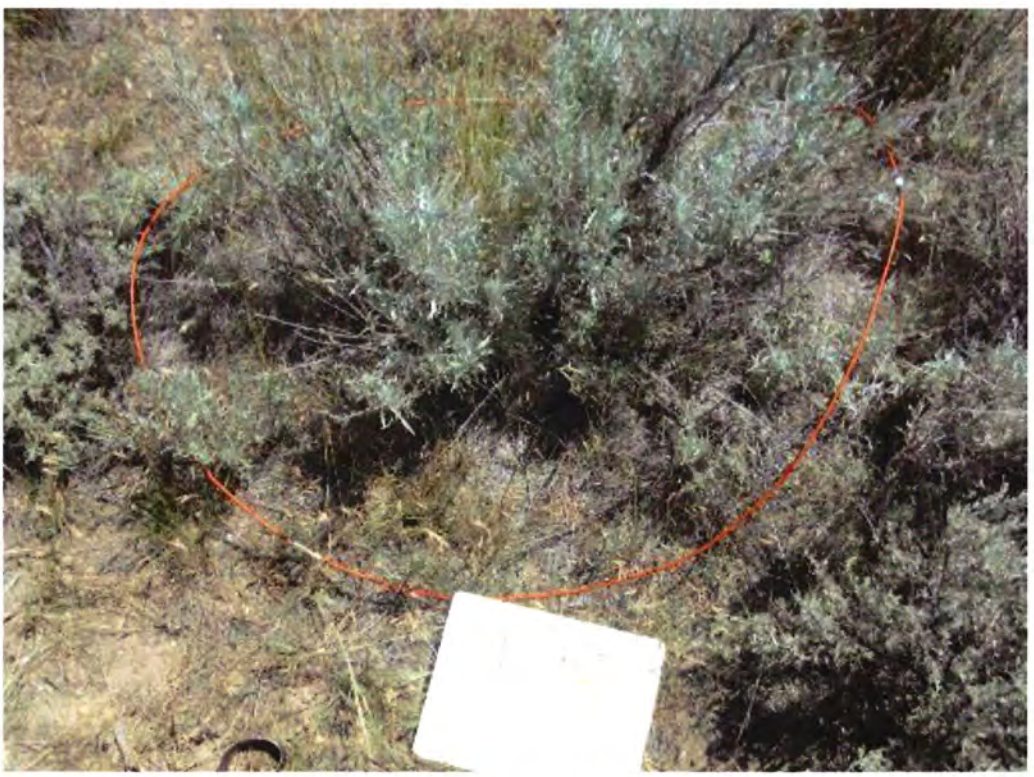
Big Sagebrush Shrubland 49



Big Sagebrush Shrubland 50

TFN 6 2/025
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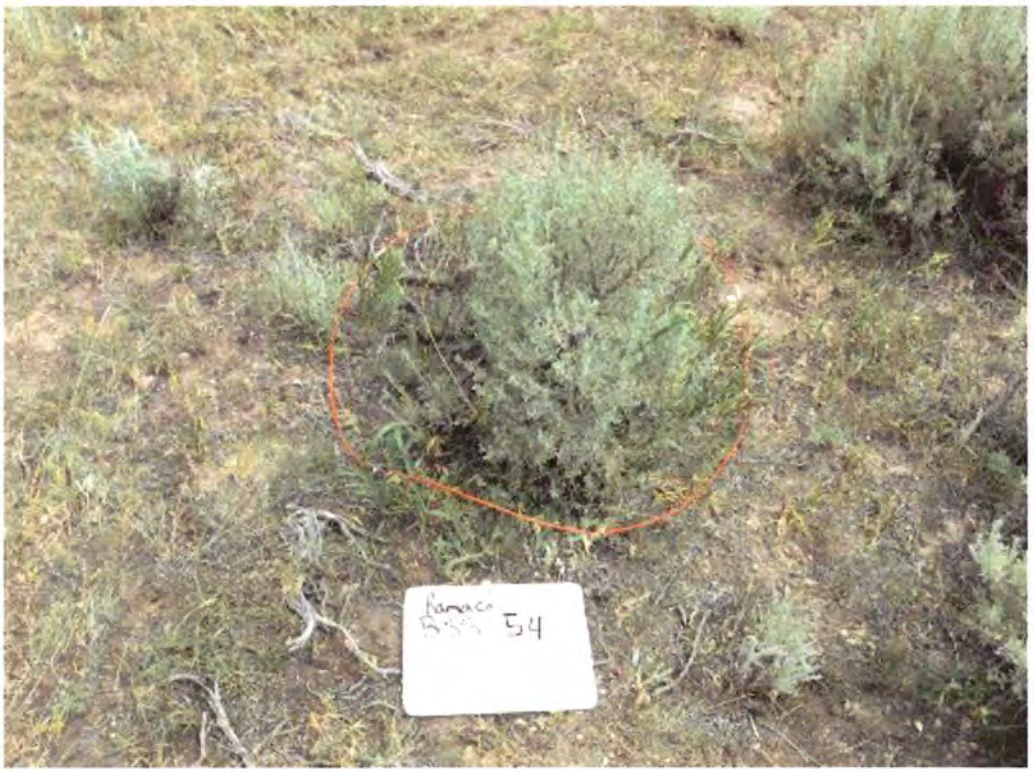
Big Sagebrush Shrubland 51

PHOTOS FOR BIG SAGEBRUSH SHRUBLAND 52-53 NOT AVAILABLE

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Big Sagebrush Shrubland 54

Big Sagebrush Shrubland 55

TFN 6 2/025
RECD NOV 14, 2014

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Big Sagebrush Shrubland 56

Big Sagebrush Shrubland 57

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Big Sagebrush Shrubland 58

Big Sagebrush Shrubland 59

TFN 6 2/025
RECD NOV 14, 2014

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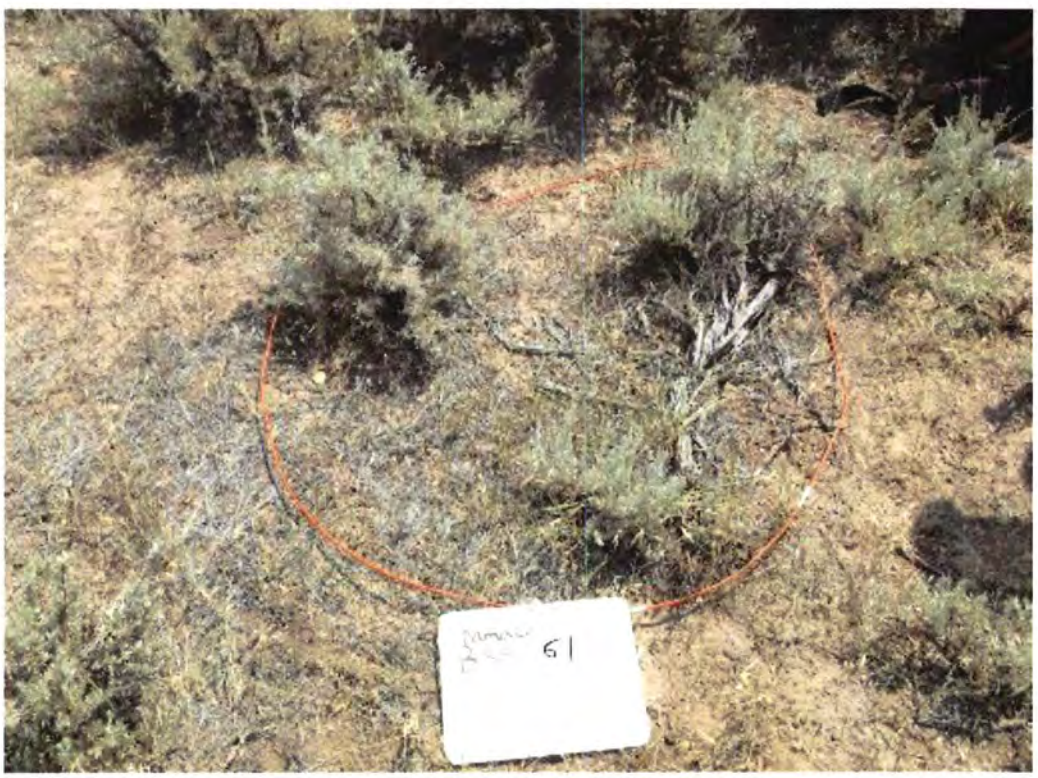
Big Sagebrush Shrubland 60



Big Sagebrush Shrubland 61

TFN 6 2/025
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Big Sagebrush Shrubland 62

Big Sagebrush Shrubland 63

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Big Sagebrush Shrubland 64

Big Sagebrush Shrubland 65

TFN 6 2/025
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Big Sagebrush Shrubland 66

Big Sagebrush Shrubland 67

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Big Sagebrush Shrubland 68

Big Sagebrush Shrubland 69

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Big Sagebrush Shrubland 70

Big Sagebrush Shrubland 71

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Big Sagebrush Shrubland 72

Big Sagebrush Shrubland 73

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RECD NOV 14, 2014

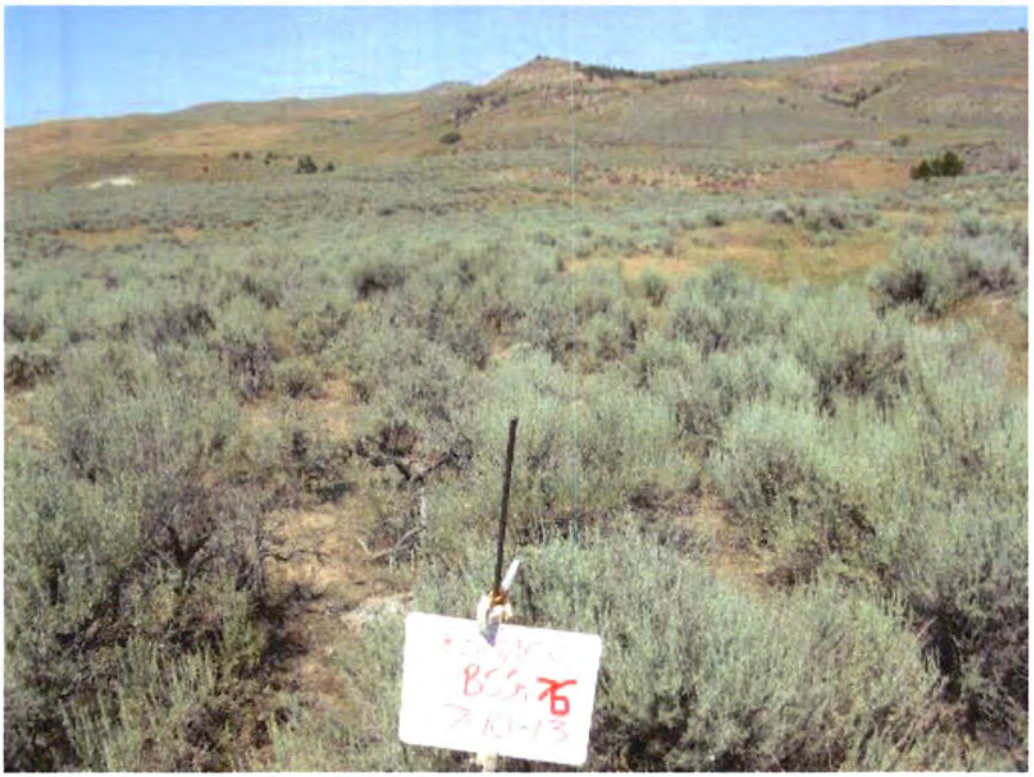
Scanned, 02/27/2020

Big Sagebrush Shrubland 74

Big Sagebrush Shrubland 75

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



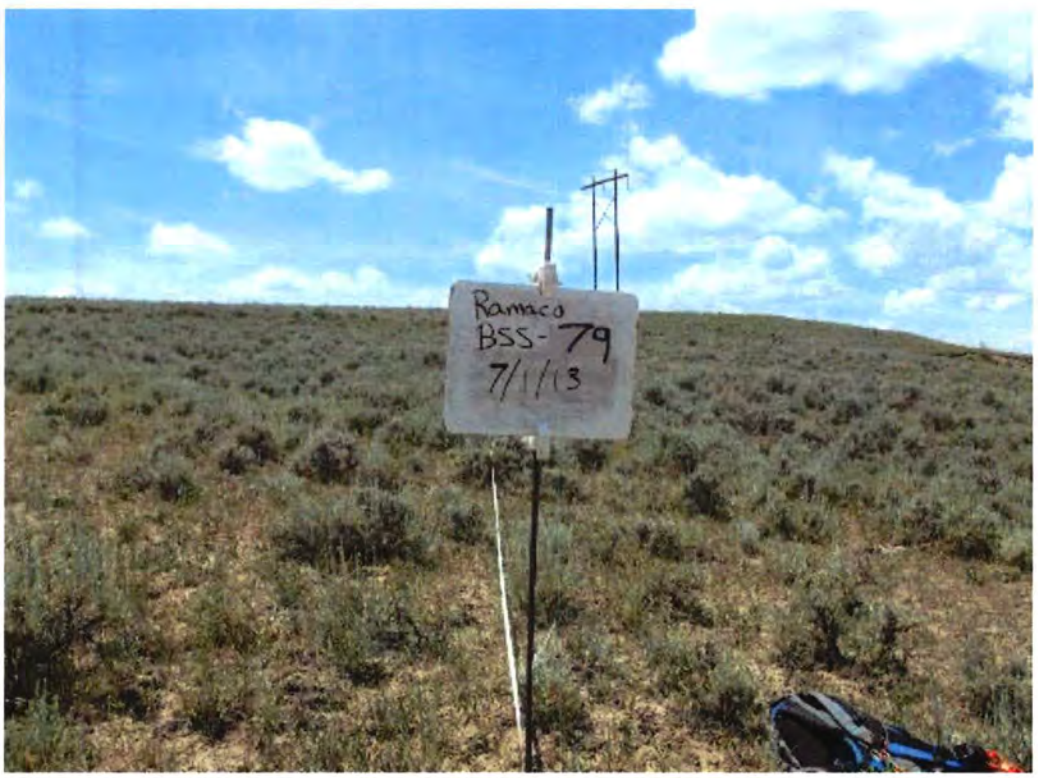
Big Sagebrush Shrubland 76

Big Sagebrush Shrubland 77

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Big Sagebrush Shrubland 78



Big Sagebrush Shrubland 79

TFN 6 2/025
RECD NOV 14, 2014

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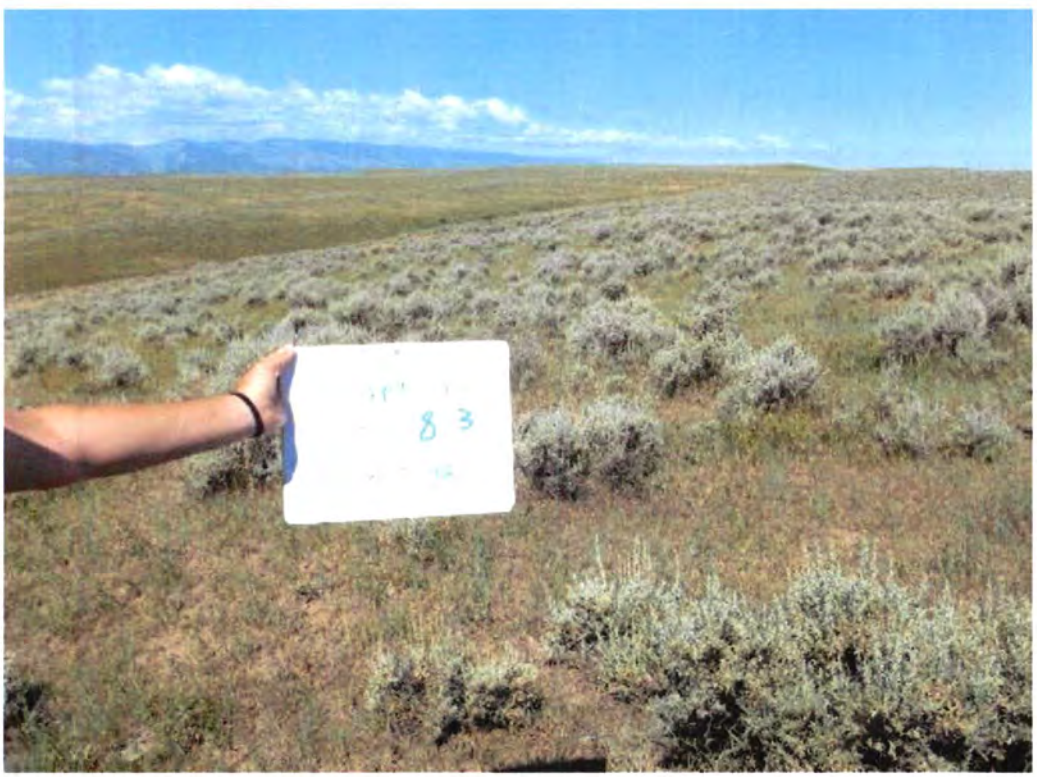
Big Sagebrush Shrubland 80

Big Sagebrush Shrubland 81

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Big Sagebrush Shrubland 82



Big Sagebrush Shrubland 83

TFN 6 2/025
RECD NOV 14, 2014

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Big Sagebrush Shrubland 84

Big Sagebrush Shrubland 85

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RECD NOV 14, 2014

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Big Sagebrush Shrubland 86

Big Sagebrush Shrubland 87

TFN 6 2/025
RECD NOV 14, 2014

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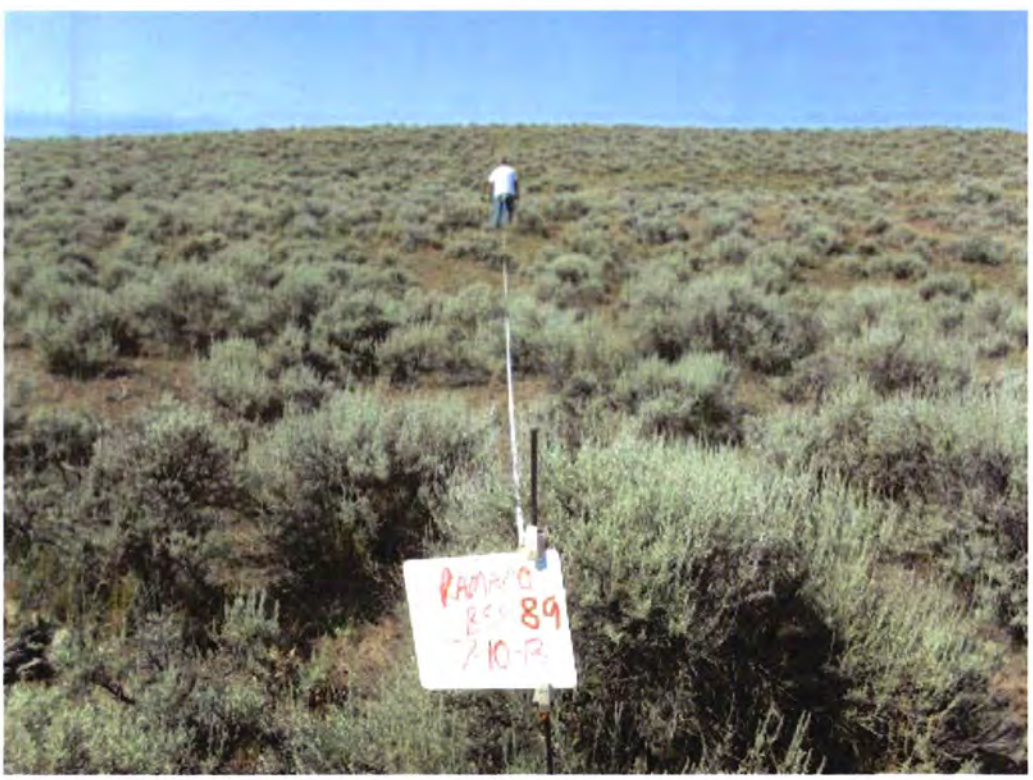
PHOTO FOR BIG SAGEBRUSH SHRUBLAND 88 NOT AVAILABLE



Big Sagebrush Shrubland 89

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Big Sagebrush Shrubland 90

Prairie Dog Modified Grassland 1

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 2

Prairie Dog Modified Grassland 3

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RECD NOV 14, 2014

Scanned, 02/27/2020

Prairie Dog Modified Grassland 4

Prairie Dog Modified Grassland 5

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Prairie Dog Modified Grassland 6

Prairie Dog Modified Grassland 7

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Prairie Dog Modified Grassland 8

Prairie Dog Modified Grassland 9

TFN 6 2/025
RECD NOV 14, 2014

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PHOTO FOR PRAIRIE DOG MODIFIED GRASSLAND 10 NOT AVAILABLE

Prairie Dog Modified Grassland 11

TFN 6 2/025
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Prairie Dog Modified Grassland 12

Prairie Dog Modified Grassland 13

TFN 6 2/025
RECD NOV 14, 2014

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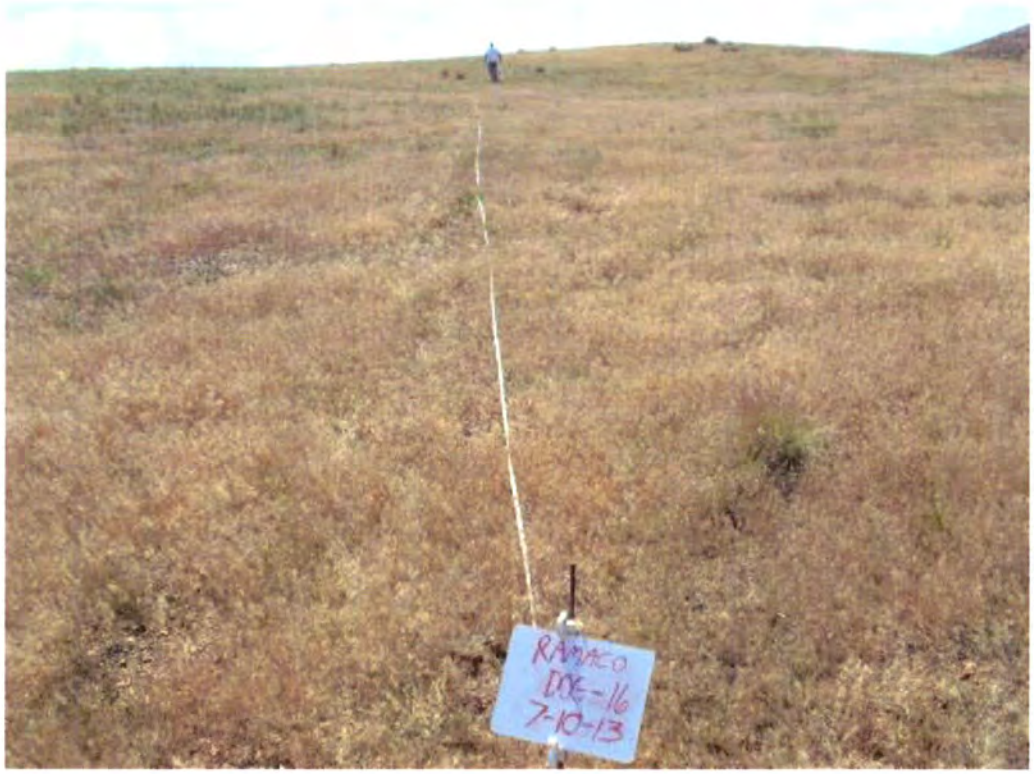
Prairie Dog Modified Grassland 14

PHOTO FOR PRAIRIE DOG MODIFIED GRASSLAND 15 NOT AVAILABLE

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



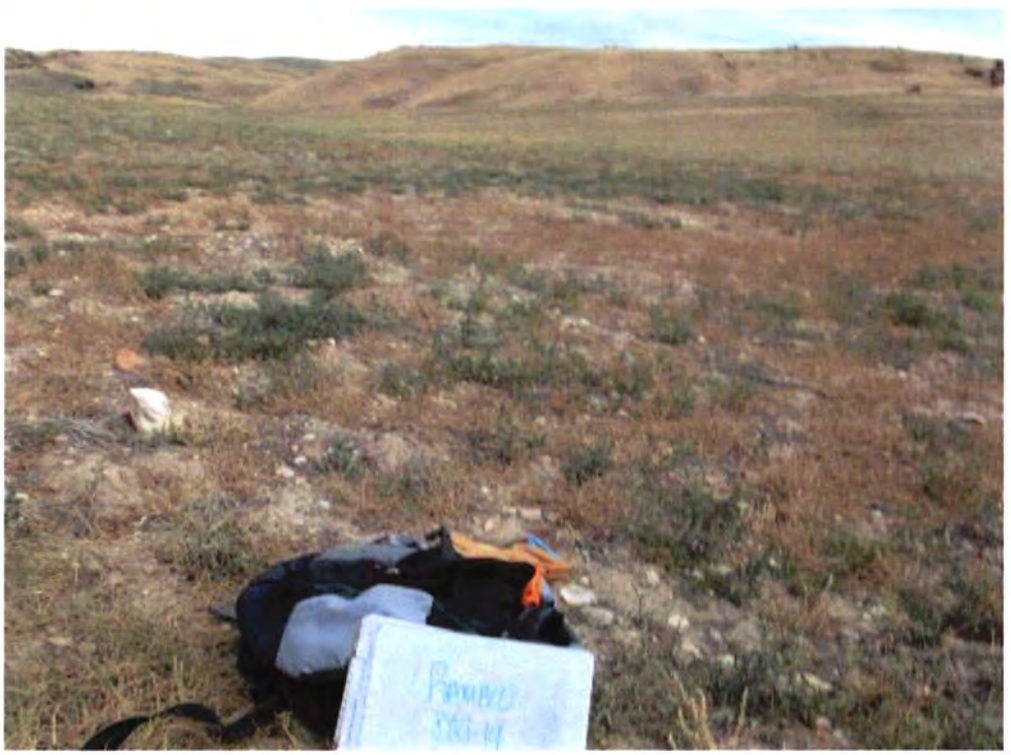
Prairie Dog Modified Grassland 16

Prairie Dog Modified Grassland 17

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Prairie Dog Modified Grassland 18



Prairie Dog Modified Grassland 19

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 20

Prairie Dog Modified Grassland 21

TFN 6 2/025
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Prairie Dog Modified Grassland 22

Prairie Dog Modified Grassland 23

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 24

Prairie Dog Modified Grassland 25

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 26

Prairie Dog Modified Grassland 27

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 28

Prairie Dog Modified Grassland 29

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Prairie Dog Modified Grassland 30

Prairie Dog Modified Grassland 31

TFN 6 2/025
RECD NOV 14, 2014

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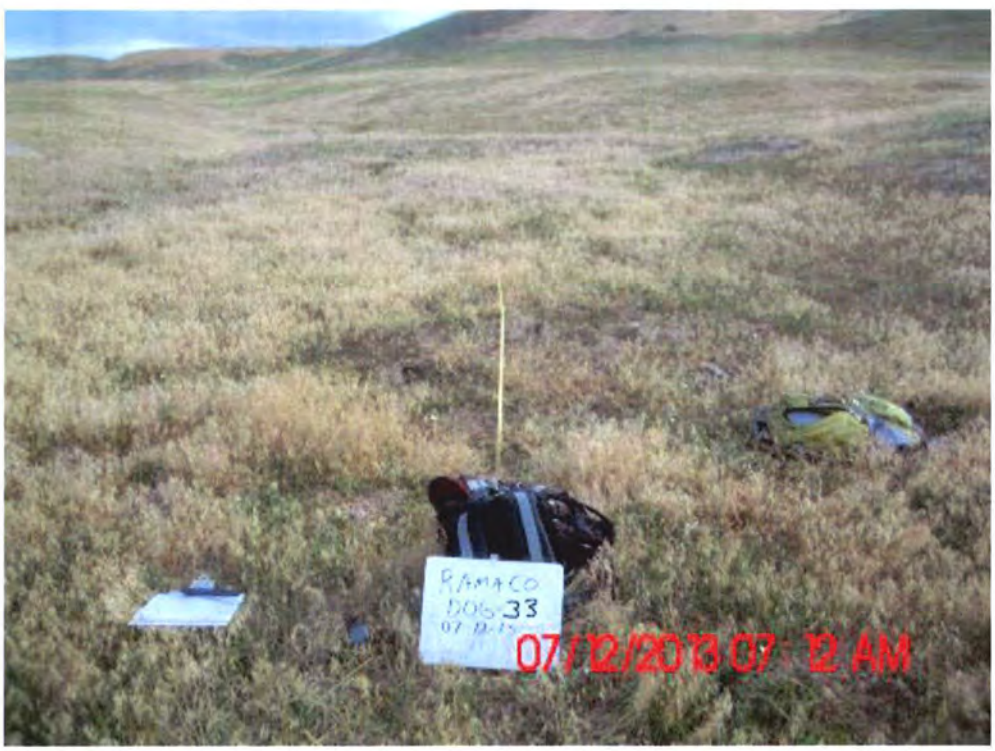
Prairie Dog Modified Grassland 32

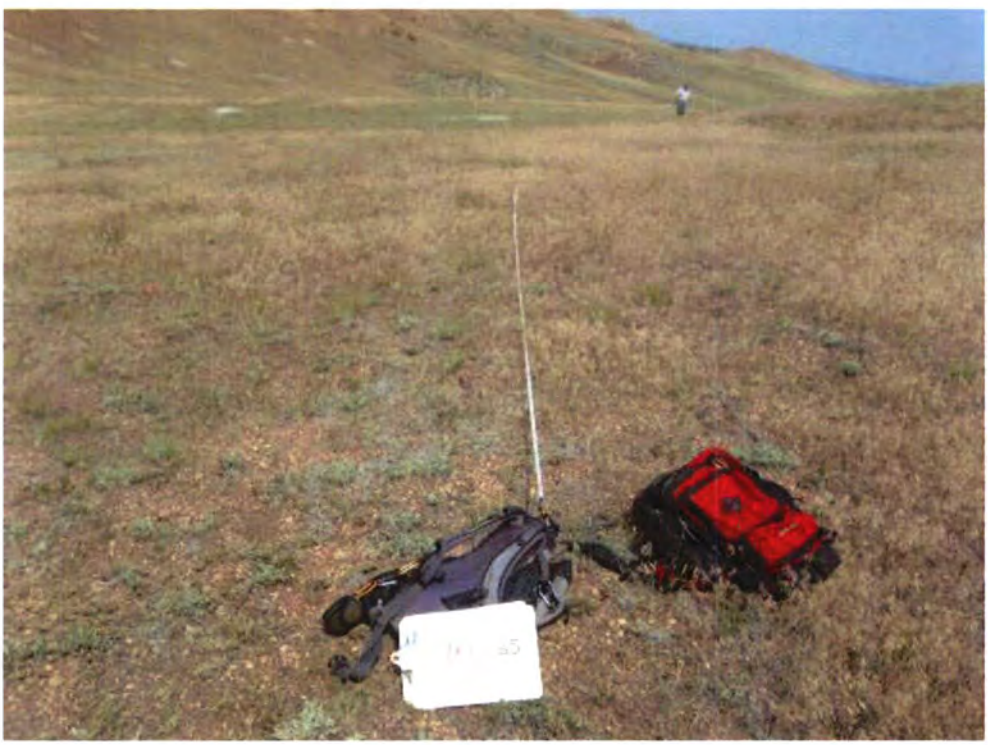


Prairie Dog Modified Grassland 33

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Prairie Dog Modified Grassland 34



Prairie Dog Modified Grassland 35

TFN 6 2/025
RECD NOV 14, 2014

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Prairie Dog Modified Grassland 36

Prairie Dog Modified Grassland 37

TFN 6 2/025
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Prairie Dog Modified Grassland 38

Prairie Dog Modified Grassland 39

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Prairie Dog Modified Grassland 40

Pine and Juniper Woodland 1

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Pine and Juniper Woodland 2

Pine and Juniper Woodland 3

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Pine and Juniper Woodland 4

Pine and Juniper Woodland 5

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Pine and Juniper Woodland 6

Pine and Juniper Woodland 7

TFN 6 2/025
RECD NOV 14, 2014

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Pine and Juniper Woodland 8

Pine and Juniper Woodland 9

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

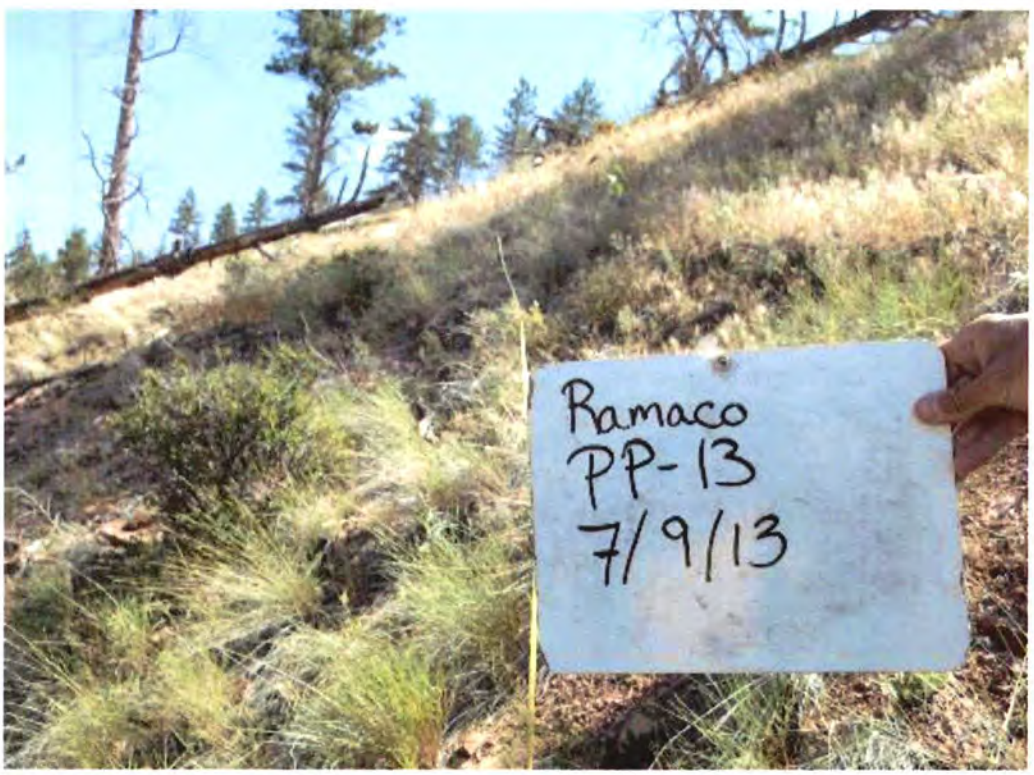
Pine and Juniper Woodland 10

Pine and Juniper Woodland 11

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Pine and Juniper Woodland 12



Pine and Juniper Woodland 13

TFN 6 2/025
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Pine and Juniper Woodland 14

Pine and Juniper Woodland 15

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Rough Breaks Mixed Shrubland 1

Rough Breaks Mixed Shrubland 2

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Rough Breaks Mixed Shrubland 3

Rough Breaks Mixed Shrubland 4

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 5

Rough Breaks Mixed Shrubland 6

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 7

Rough Breaks Mixed Shrubland 8

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 9

Rough Breaks Mixed Shrubland 10

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 11

Rough Breaks Mixed Shrubland 12

TFN 6 2/025
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Rough Breaks Mixed Shrubland 13

Rough Breaks Mixed Shrubland 14

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 15

Rough Breaks Mixed Shrubland 16

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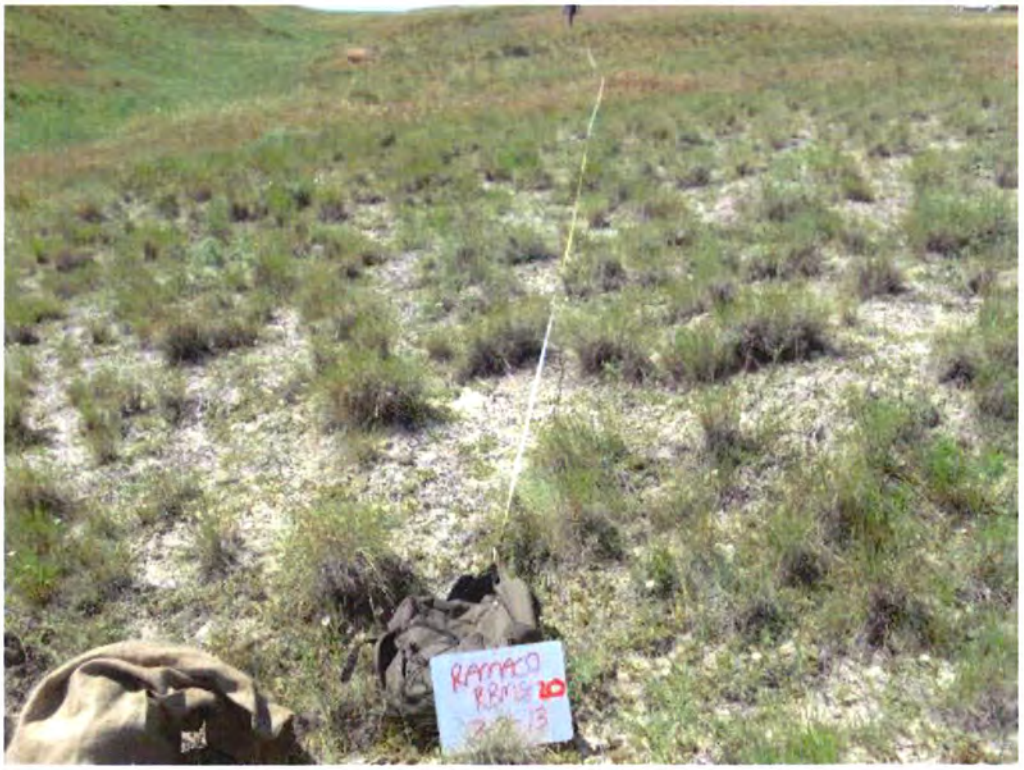
Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 17

Rough Breaks Mixed Shrubland 18

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Rough Breaks Mixed Shrubland 20

Rough Breaks Mixed Shrubland 21

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 22

Rough Breaks Mixed Shrubland 23

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 24

Rough Breaks Mixed Shrubland 25

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 26

Rough Breaks Mixed Shrubland 27

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RECD NOV 14, 2014

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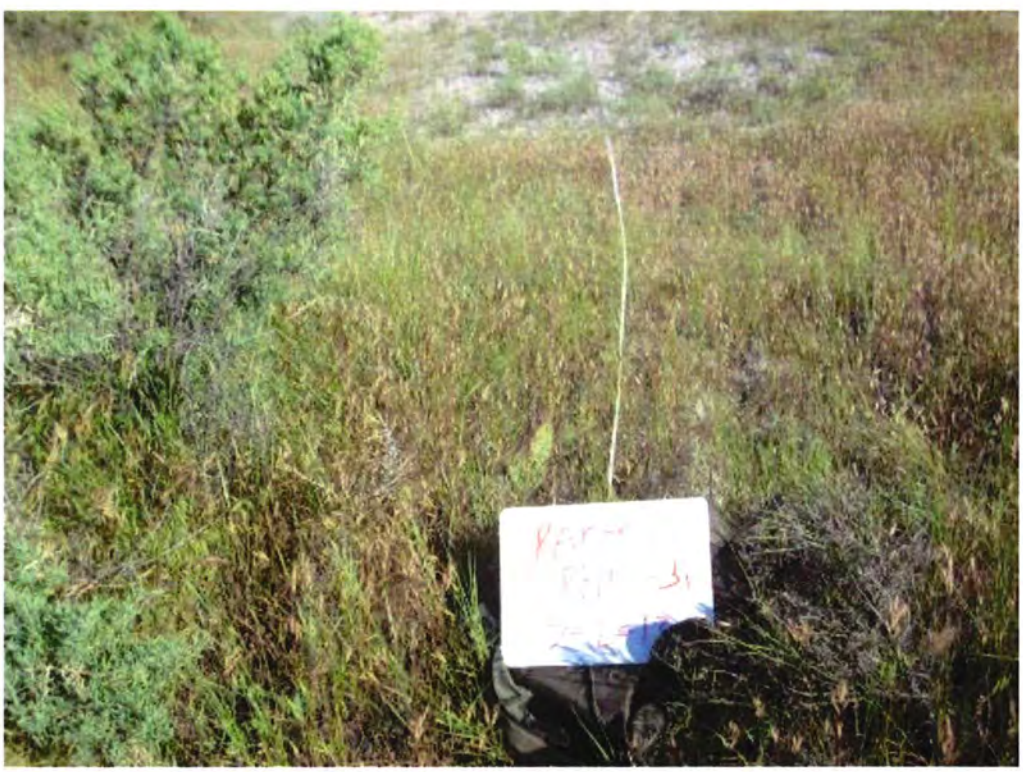
Rough Breaks Mixed Shrubland 28

Rough Breaks Mixed Shrubland 29

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 30



Rough Breaks Mixed Shrubland 31

TFN 6 2/025
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Rough Breaks Mixed Shrubland 32

Rough Breaks Mixed Shrubland 33

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Rough Breaks Mixed Shrubland 34

Rough Breaks Mixed Shrubland 35

TFN 6 2/025
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Rough Breaks Mixed Shrubland 36

Rough Breaks Mixed Shrubland 37

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 38

Rough Breaks Mixed Shrubland 39

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 40

Rough Breaks Mixed Shrubland 41

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 42

Rough Breaks Mixed Shrubland 43

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Rough Breaks Mixed Shrubland 44

Rough Breaks Mixed Shrubland 45

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Rough Breaks Mixed Shrubland 46

PHOTO FOR ROUGH BREAKS MIXED SHRUBLAND 47 NOT AVAILABLE

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Rough Breaks Mixed Shrubland 48

Rough Breaks Mixed Shrubland 49

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 50

Rough Breaks Mixed Shrubland 51

TFN 6 2/025
RECD NOV 14, 2014

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PHOTO FOR ROUGH BREAKS MIXED SHRUBLAND 52 NOT AVAILABLE

Rough Breaks Mixed Shrubland 53

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Rough Breaks Mixed Shrubland 54

Rough Breaks Mixed Shrubland 55

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 56

Rough Breaks Mixed Shrubland 57

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 58

Rough Breaks Mixed Shrubland 59

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 60

Rough Breaks Mixed Shrubland 61

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 62

Rough Breaks Mixed Shrubland 63

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RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 64

Rough Breaks Mixed Shrubland 65

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RECD NOV 14, 2014

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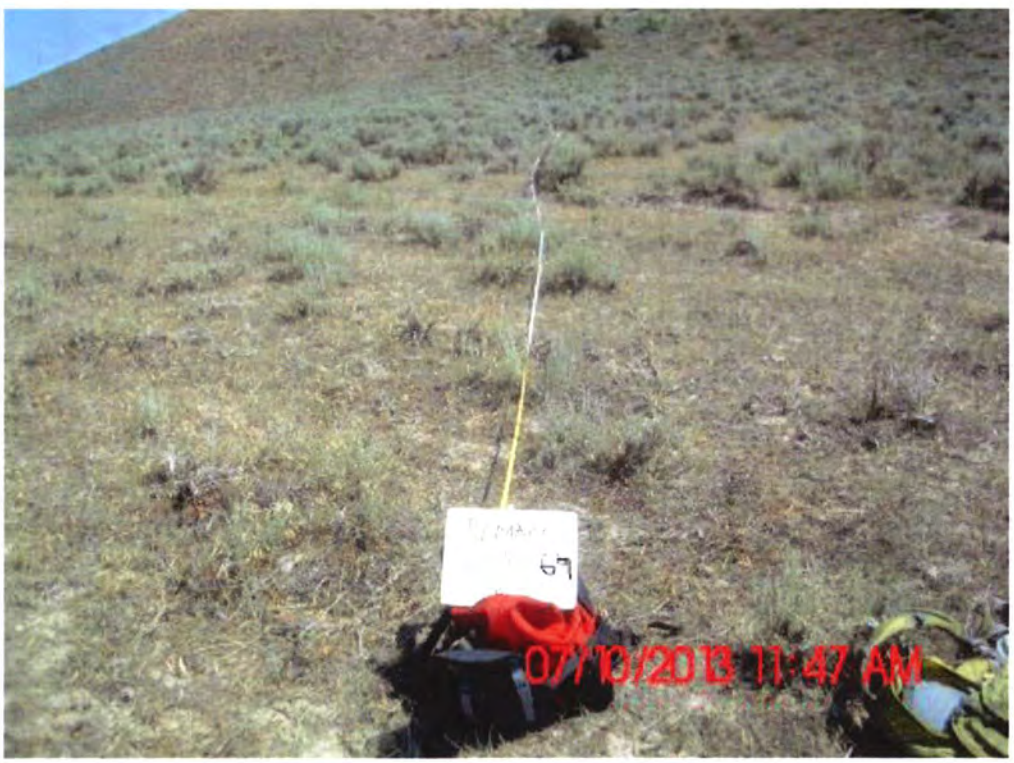
Rough Breaks Mixed Shrubland 66

Rough Breaks Mixed Shrubland 67

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Rough Breaks Mixed Shrubland 68



Rough Breaks Mixed Shrubland 69

TFN 6 2/025
RECD NOV 14, 2014

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Rough Breaks Mixed Shrubland 70

Riparian Woodland 1

TFN 6 2/025
RECD NOV 14, 201

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Riparian Woodland 2

Riparian Woodland 3

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Riparian Woodland 4

Riparian Woodland 5

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 6

Riparian Woodland 7

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 8

Riparian Woodland 9

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 10

Riparian Woodland 11

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 12

Riparian Woodland 13

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 14

Riparian Woodland 15

TFN 6 2/025
RECD NOV 14, 2014

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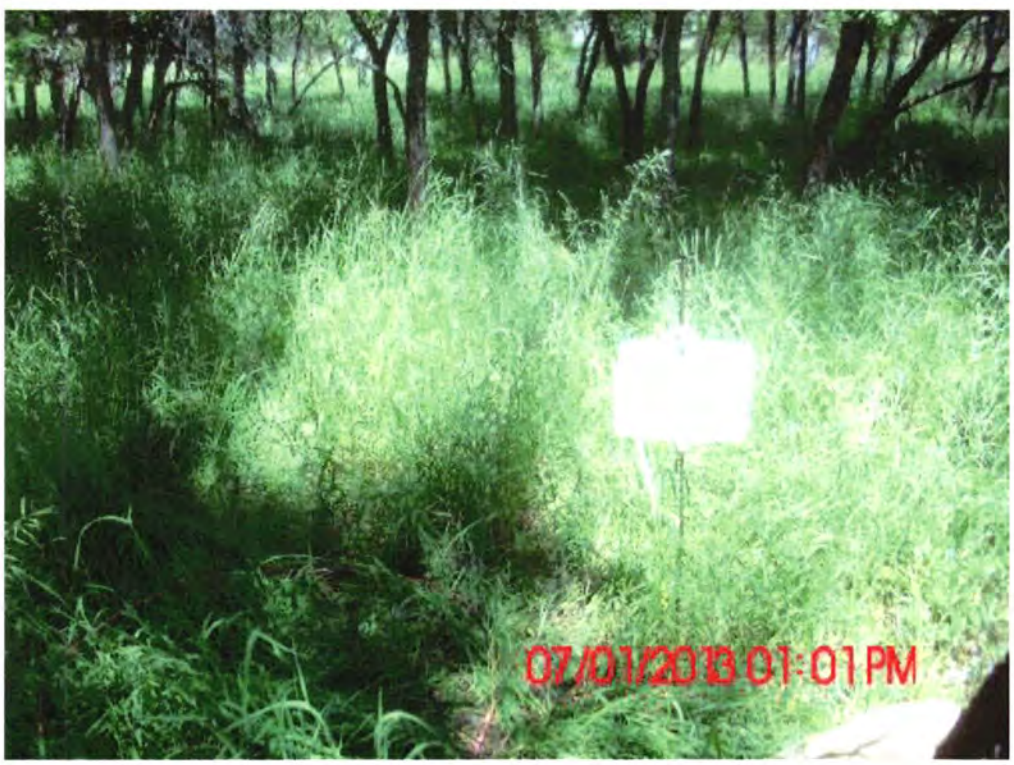
Riparian Woodland 16



Riparian Woodland 17

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 18

Riparian Woodland 19

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 20

Riparian Woodland 21

TFN 6 2/025
RECD NOV 14, 2014

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Riparian Woodland 22

Riparian Woodland 23

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 24

Riparian Woodland 25

TFN 6 2/025
RECD NOV 14,2014

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Riparian Woodland 26

Riparian Woodland 27

TFN 6 2/025
RECD NOV 14, 2014

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Riparian Woodland 28

Riparian Woodland 29

TFN 6 2/025
RECD NOV 14, 2014

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Riparian Woodland 30

Riparian Woodland 31

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 32

Riparian Woodland 33

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 34

Riparian Woodland 35

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 36

Riparian Woodland 37

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 38

Riparian Woodland 39

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 40

Riparian Woodland 41

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 42

Riparian Woodland 43

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 44

Riparian Woodland 45

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Riparian Woodland 46

Riparian Woodland 47

TFN 6 2/025
RECD NOV 14, 2014

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Riparian Woodland 48

Riparian Woodland 49

TFN 6 2/025
RECD NOV 14, 2014

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Scoria Grassland 1

Scoria Grassland 2

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 3

Scoria Grassland 4

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 5

Scoria Grassland 6

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 7

Scoria Grassland 8

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Scoria Grassland 9

Scoria Grassland 10

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 11

Scoria Grassland 12

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 13

Scoria Grassland 14

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 15

Scoria Grassland 16

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 17

Scoria Grassland 18

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 19

Scoria Grassland 20

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 21

Scoria Grassland 22

TFN 6 2/025
RECD NOV 14, 2014

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Scoria Grassland 23

Scoria Grassland 24

TFN 6 2/025
RECD NOV 14, 2014

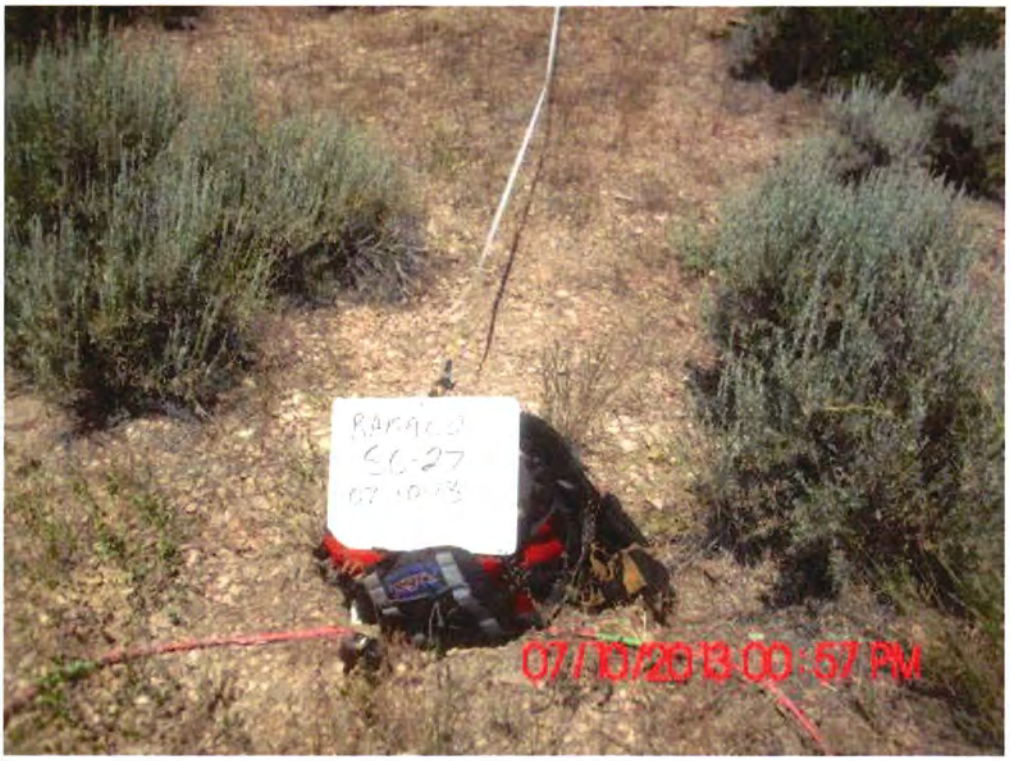
Scanned, 02/27/2020

PHOTO FOR SCORIA GRASSLAND 25 NOT AVAILABLE

Scoria Grassland 26

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Scoria Grassland 27

Scoria Grassland 28

TFN 6 2/025
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Scanned, 02/27/2020

Scoria Grassland 29

Scoria Grassland 30

TFN 6 2/025
RECD NOV 14, 2014

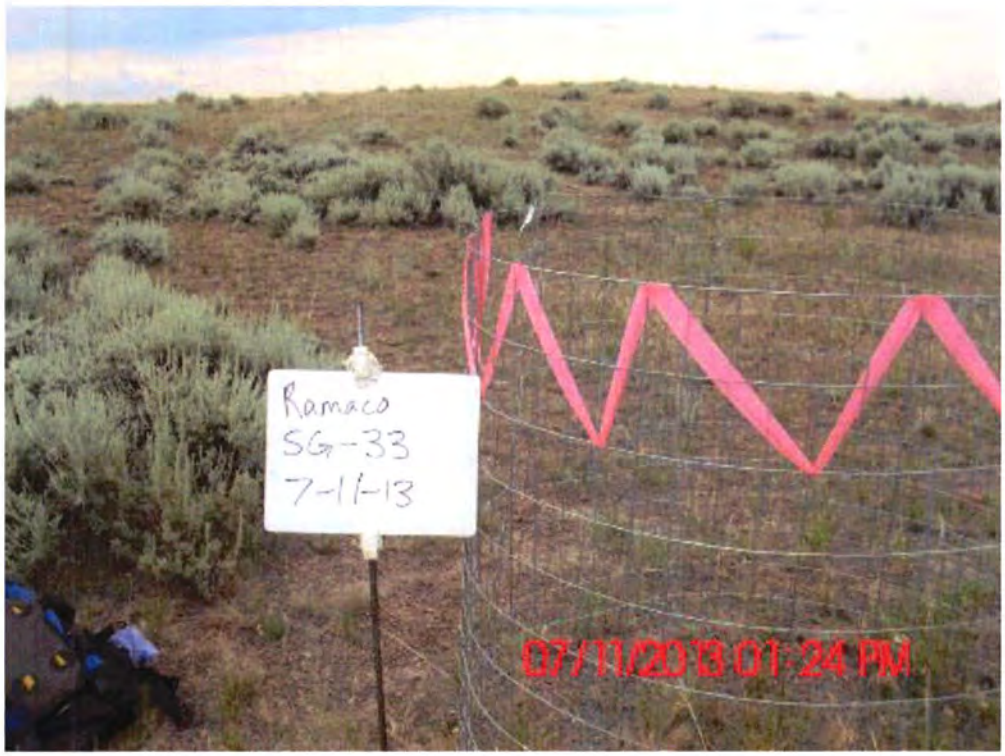
Scanned, 02/27/2020

Scoria Grassland 31

PHOTO FOR SCORIA GRASSLAND 32 NOT AVAILABLE

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Scoria Grassland 33

Scoria Grassland 34

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Scoria Grassland 35

PHOTO FOR SCORIA GRASSLAND 38 NOT AVAILABLE

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RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 37

PHOTO FOR SCORIA GRASSLAND 38 NOT AVAILABLE

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Scoria Grassland 39

Scoria Grassland 40

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Scoria Grassland 41

Scoria Grassland 42

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Scoria Grassland 43

PHOTOS FOR SCORIA GRASSLAND 44-45 NOT AVAILABLE

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Scoria Grassland 46

Scoria Grassland 47

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Scanned, 02/27/2020

Scoria Grassland 48

Scoria Grassland 49

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RECD NOV 14, 2014

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Scoria Grassland 50

Upland Grassland 1

TFN 6 2/025
RECD NOV 14, 2014

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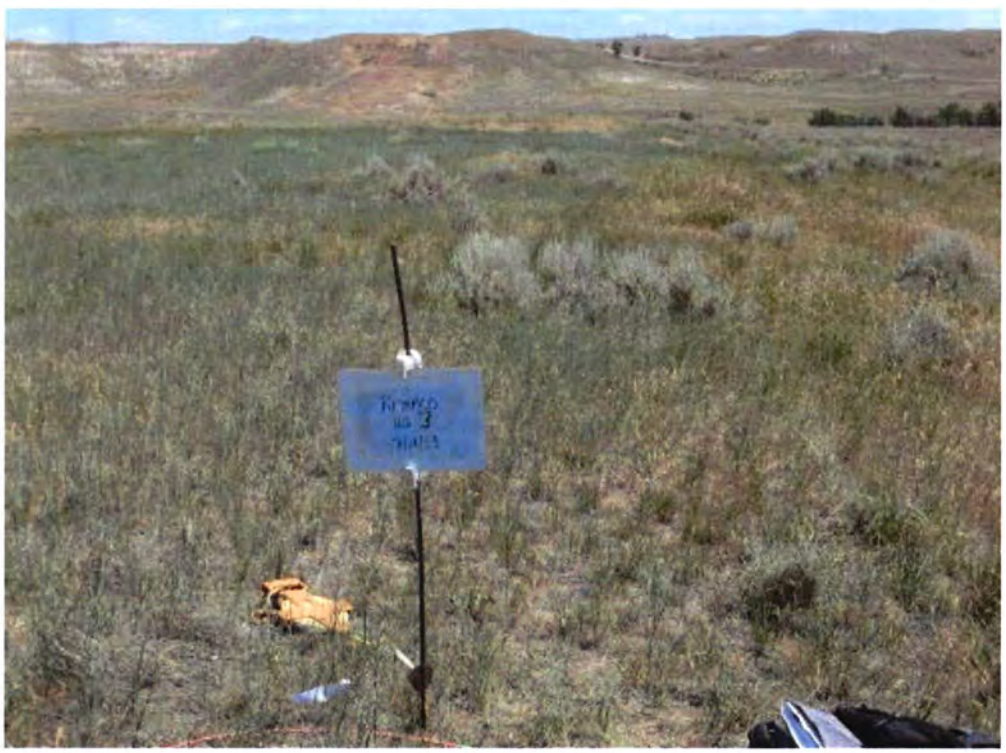
Upland Grassland 2



Upland Grassland 3

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Upland Grassland 4

Upland Grassland 5

TFN 6 2/025
RECD NOV 14, 2014

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Upland Grassland 6

Upland Grassland 7

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RECD NOV 14, 2014

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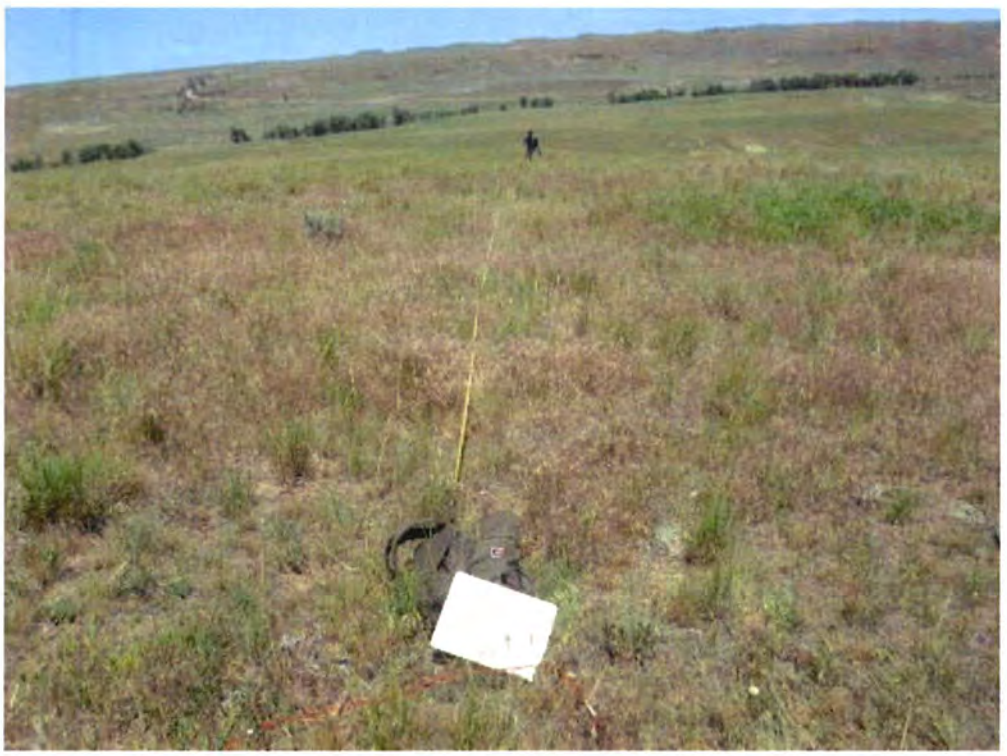
Upland Grassland 8



Upland Grassland 9

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Scanned, 02/27/2020

Upland Grassland 10

Upland Grassland 11

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 12

Upland Grassland 13

TFN 6 2/025
RECD NOV 14, 2014

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Upland Grassland 14

PHOTO FOR UPLAND GRASSLAND 15 NOT AVAILABLE

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RECD NOV 14, 2014

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Upland Grassland 16

Upland Grassland 17

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Upland Grassland 18

Upland Grassland 19

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 20

Upland Grassland 21

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Upland Grassland 22

Upland Grassland 23

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

PHOTO FOR UPLAND GRASSLAND 24 NOT AVAILABLE

Upland Grassland 25

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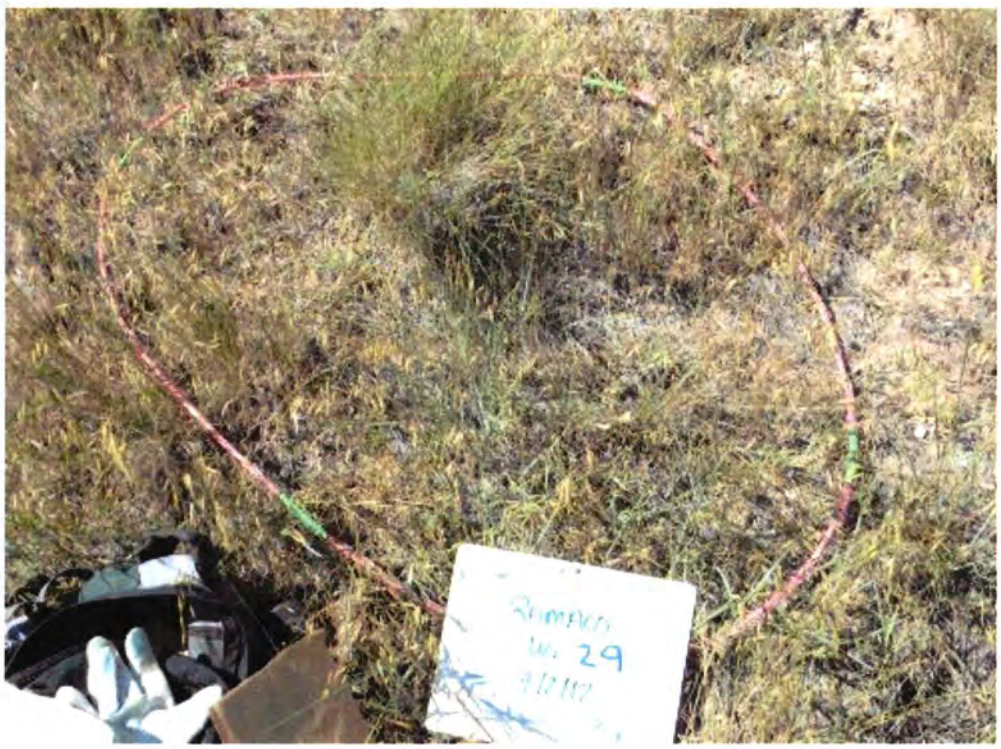
Upland Grassland 26

Upland Grassland 27

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 28



Upland Grassland 29

TFN 6 2/025
RECD NOV 14, 2014

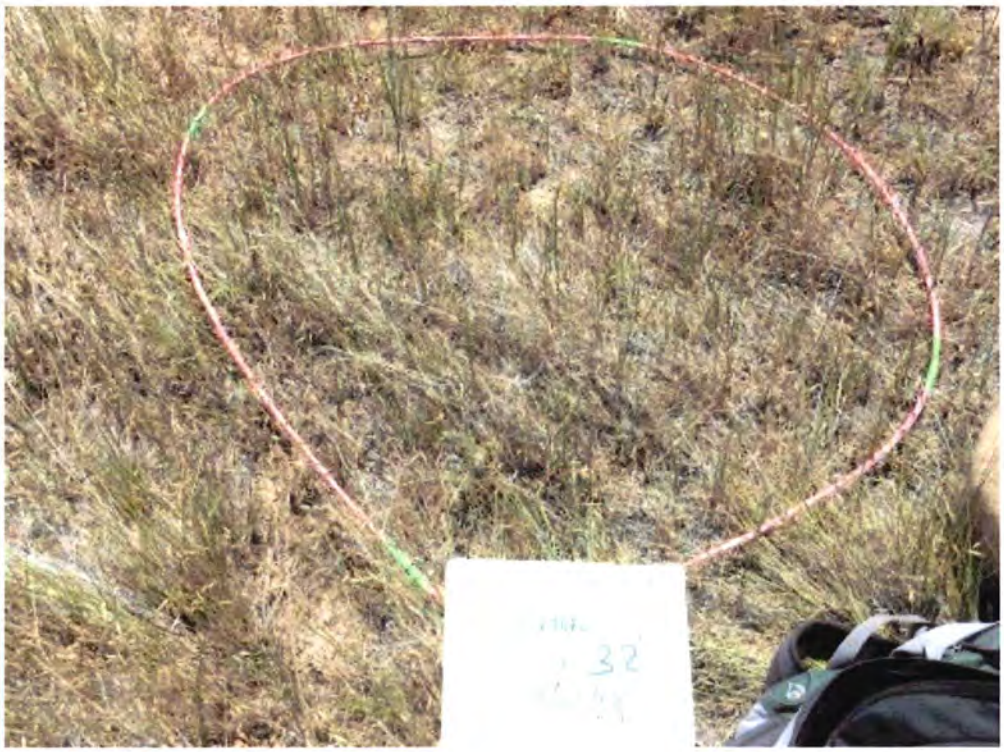
Scanned, 02/27/2020

Upland Grassland 30

Upland Grassland 31

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Upland Grassland 32

Upland Grassland 33

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

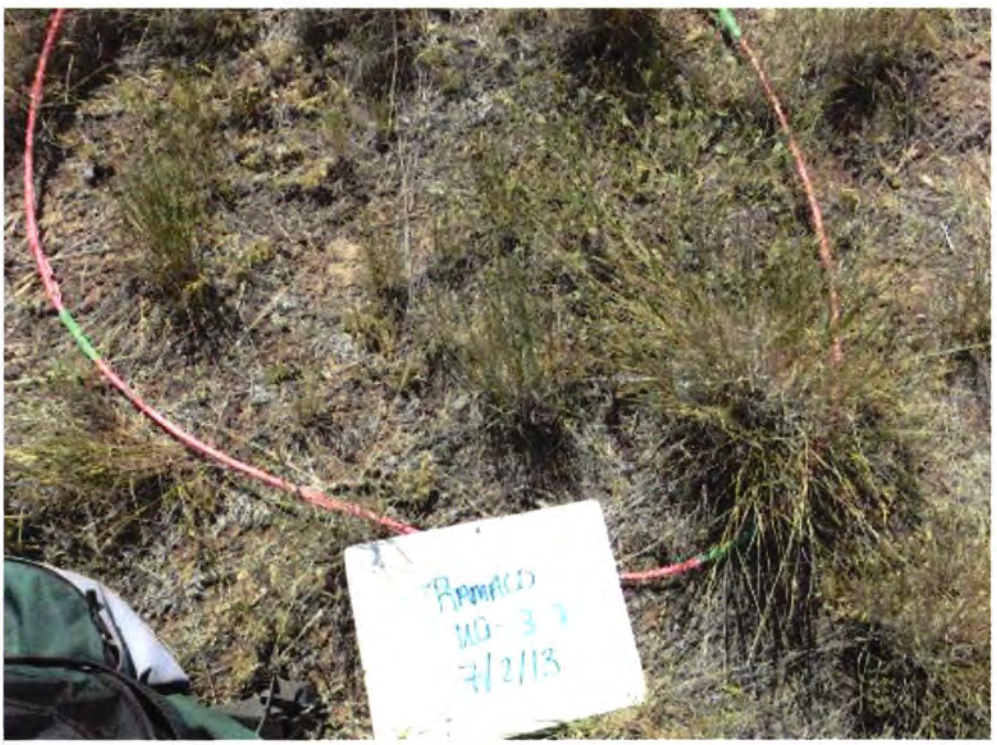
Upland Grassland 34

Upland Grassland 35

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 36

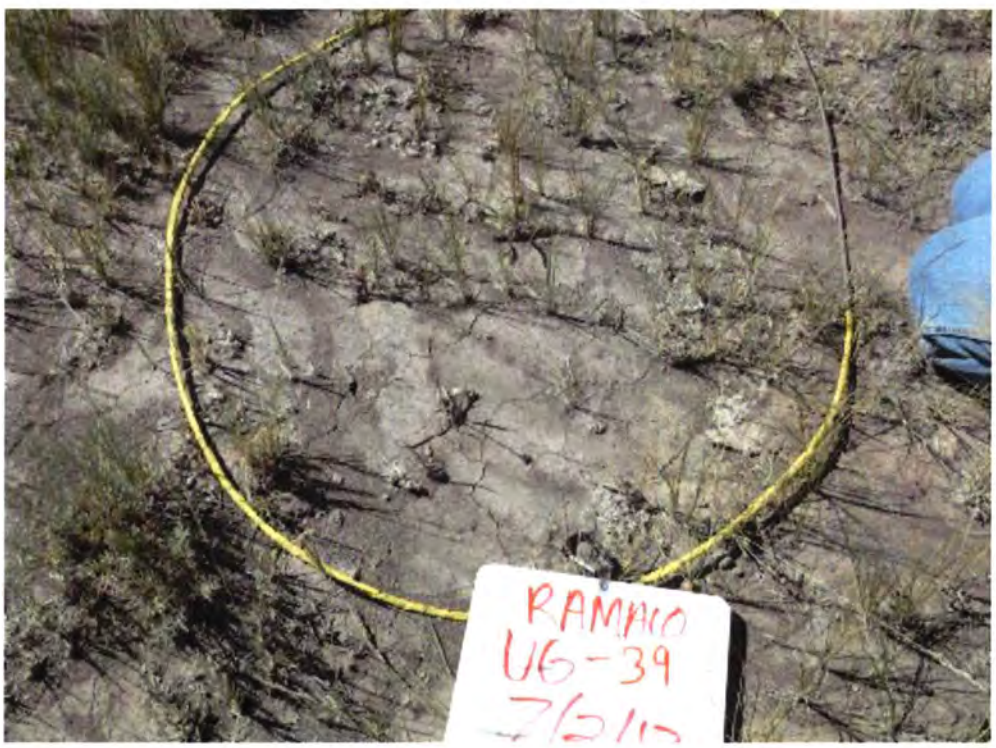


Upland Grassland 37

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 38



Upland Grassland 39

TFN 6 2/025
RECD NOV 14, 2014

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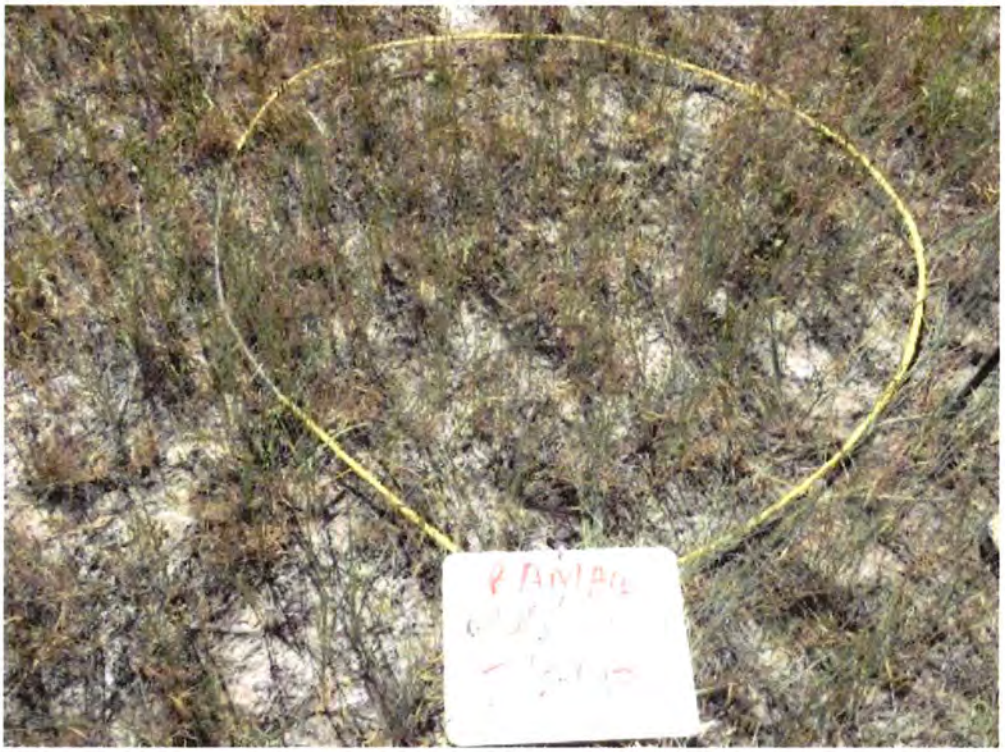

Upland Grassland 40

Upland Grassland 41

TFN 6 2/025
RECD NOV 14, 2014

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Upland Grassland 42

Upland Grassland 43

TFN 6 2/025
RECD NOV 14, 2014

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Upland Grassland 44

Upland Grassland 45

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 46

Upland Grassland 47

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 48

Upland Grassland 49

TFN 6 2/025
RECD NOV 14, 2014

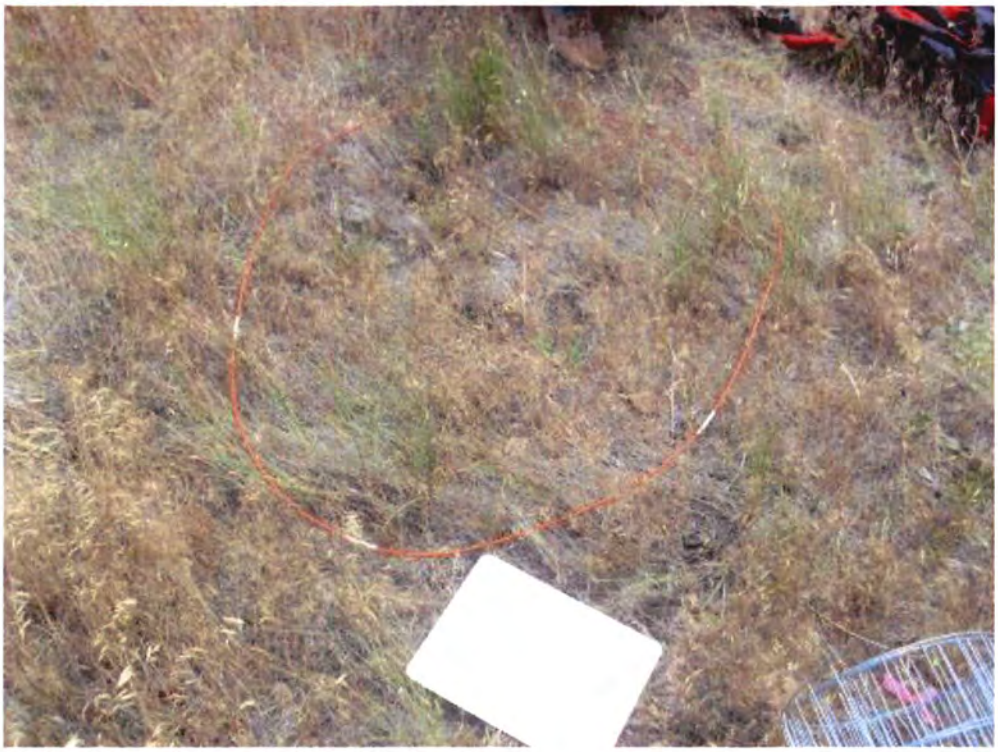
Scanned, 02/27/2020

Upland Grassland 50

Upland Grassland 51

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Upland Grassland 52

Upland Grassland 53

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

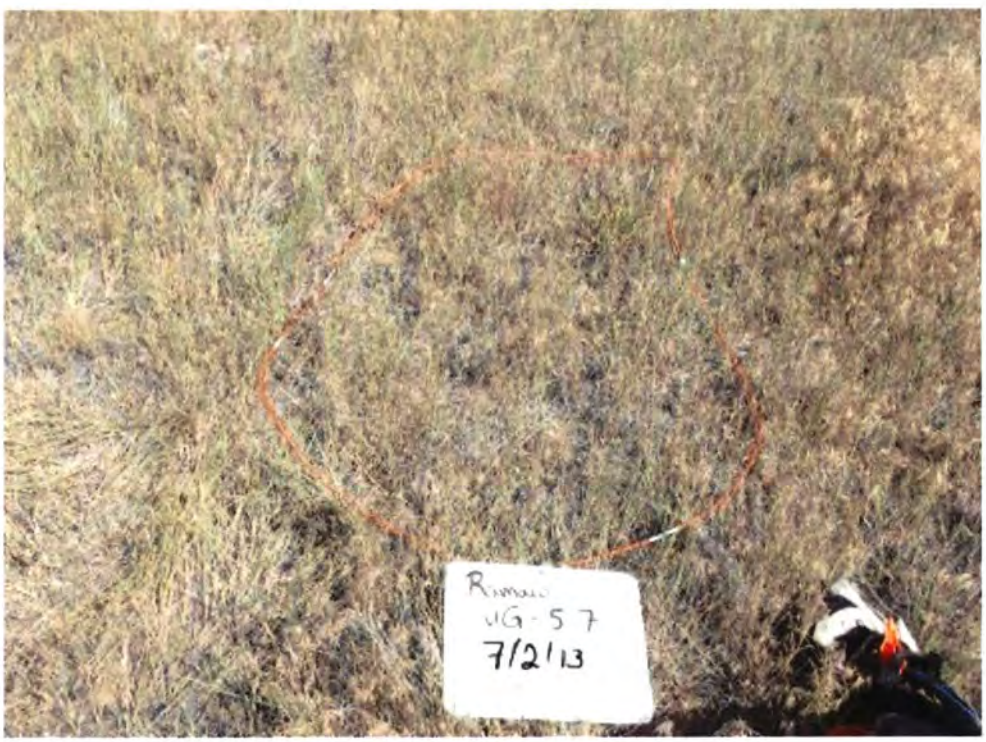
Upland Grassland 54

Upland Grassland 55

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

PHOTO FOR UPLAND GRASSLAND 56 NOT AVAILABLE



Upland Grassland 57

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 58

Upland Grassland 59

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 60

Upland Grassland 61

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 62

Upland Grassland 63

TFN 6 2/025
RECD NOV 14, 2014

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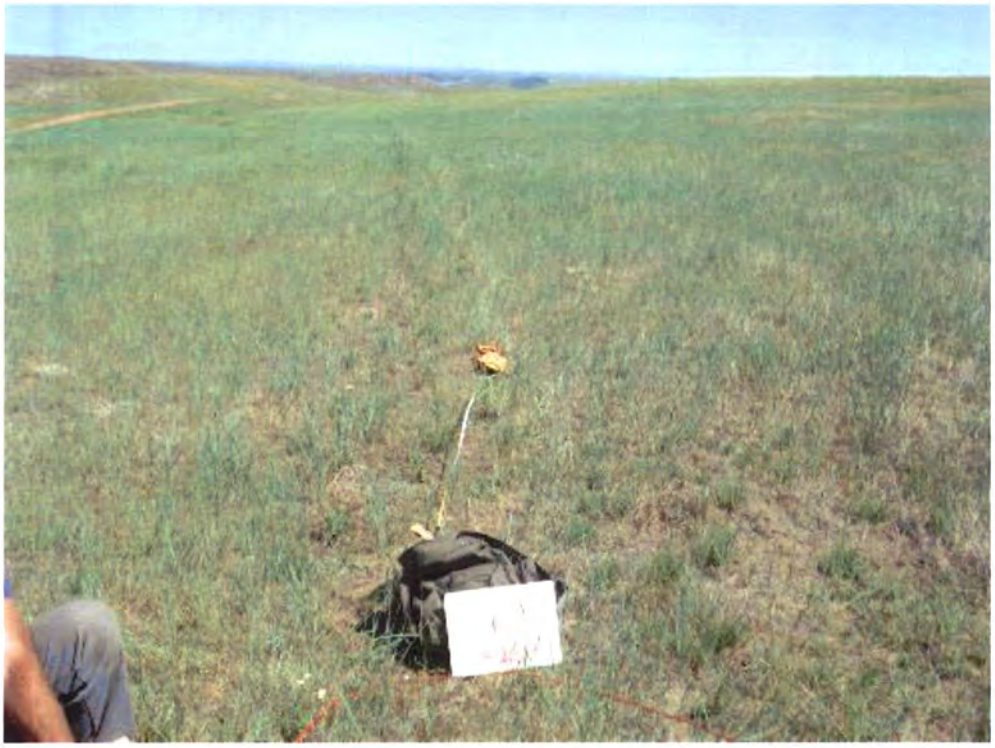
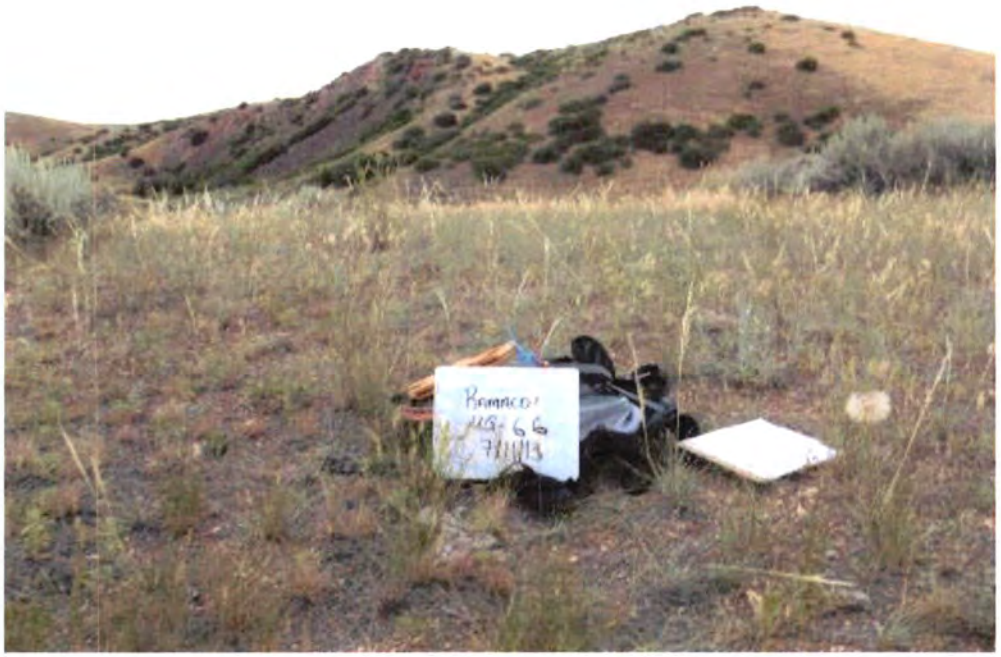


Upland Grassland 64

Upland Grassland 65

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020



Upland Grassland 66

Upland Grassland 67

TFN 6 2/025
RECD NOV 14, 2014

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Upland Grassland 68

Upland Grassland 69

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 70

Upland Grassland 71

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 72

Upland Grassland 73

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 74

Upland Grassland 75

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

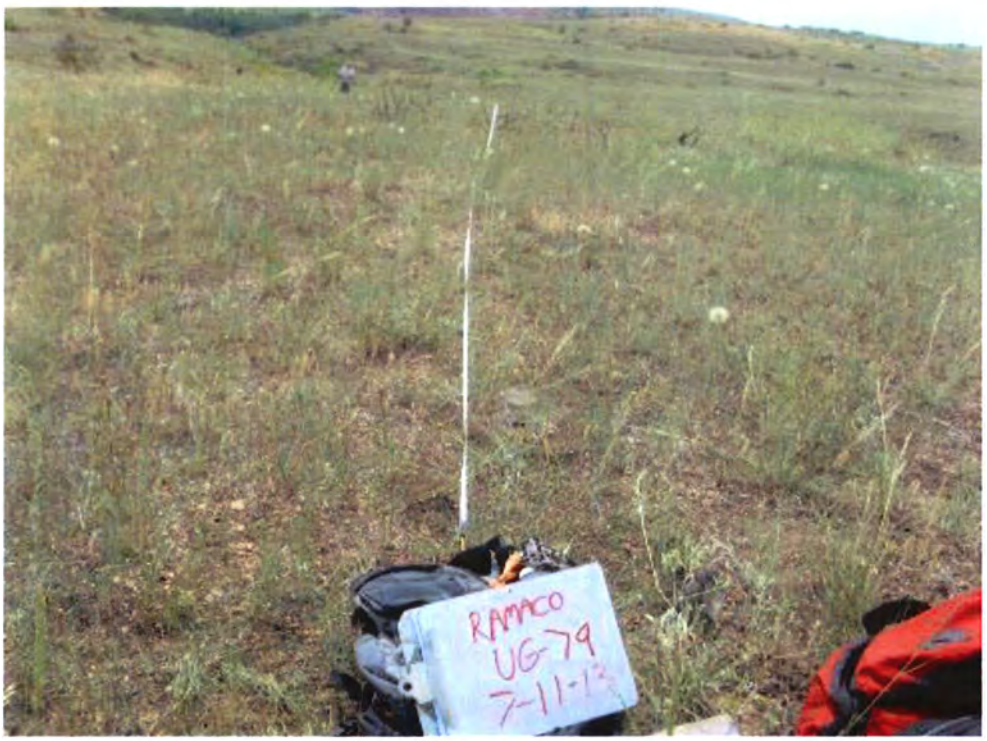
Upland Grassland 76

Upland Grassland 77

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 78



Upland Grassland 79

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 80

Upland Grassland 81

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

Upland Grassland 82

Upland Grassland 83

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

Upland Grassland 84

TFN 6 2/025
RECD NOV 14, 2014

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ATTACHMENT D8-1-G

Maps

TFN 6 2/025
RECD NOV 14, 2014

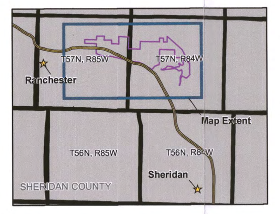
Legend

- Cover, Density Sample Location
- Cover, Density, Production Sample Location
- Density Sample Location
- Production Sample Location
- Density, Production Sample Location
- Sheridan County Declared Weed Location
- Wyoming Designated Weed Location
- Interstate
- Highway
- Vegetation Communities
- Disturbed Land
- Proposed Permit Boundary
- Study Area Boundary
- Half-Mile Buffer
- Section Boundary
- Township/Range Boundary

Vegetation Communities

Map Symbol	Name
AG	Agricultural Land
BSG	Bottomland Sagebrush Grassland
BSS	Big Sagebrush Shrubland
D	Disturbed
PDMG	Prairie Dog Modified Grassland
PJW	Pine and Juniper Woodland
RBMS	Rough Breaks Mixed Shrubland
RG	Reclaimed Grassland
RS	Rabbitbrush Shrubland
RW	Riparian Woodland
SG	Scoria Grassland
UG	Upland Grassland
W	Water

General Location Map



RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS

Date	Description
7/30/13	BKS/JB
1/22/14	BKS/JB
7/31/14	BKS/TS
10/23/14	BKS/TS
12/2015	Round 3 Comments

ADDENDUM: D8
MAP: 1

TFN 6 2/025
RECD DEC 18, 2015

2013 BASELINE VEGETATION ASSESSMENT

Drawn By: BKS/TS
Checked By: BKS/DG
Date: 11/10/15

FILE: Ramaco_Brook_Mine_Veg_Final_11102015.mxd

BKS Environmental Associates, Inc.

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ATTACHMENT D8-1-H

Raw Cover Data

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Agricultural Lands (AG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																									Study Area n=25	
	1	2	3	4	5	6	7	8	9	10	11	12	13*	14*	15	16	17*	18	19	20	21	22	23	24	25*	Mean Absolute	Standard Deviation
Bromus japonicus	0	0	0	0	10	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	6	6	0	1.0	2.6
Bromus tectorum	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.2	0.9
Triticum aestivum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.4
Total Introduced Annual Grasses	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**6**	**6**	**0**	**1.3**	**2.6**
Elymus lanceolatus	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.7	3.2
Elymus smithii	8	0	0	0	16	8	0	0	14	2	0	8	0	0	0	0	0	0	0	6	14	10	12	0	6	4.2	5.5
Elymus spicatus	2	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.7
Elymus trachycaulus	0	0	0	32	0	22	18	42	28	0	16	0	12	10	2	16	68	18	0	0	46	20	0	28	12	15.6	17.6
Glyceria grandis	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	1.2
Hesperostipa comata	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0.2	0.6
Hordeum jubatum	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	2.8
Nassella viridula	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Phalaris arundinacea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4
Poa secunda	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	18	2	0	0	2	1.4	4.2
Total Native Cool Season Perennial Grasses	**12**	**0**	**0**	**32**	**18**	**30**	**38**	**42**	**42**	**18**	**16**	**12**	**24**	**10**	**2**	**16**	**68**	**18**	**2**	**6**	**78**	**32**	**14**	**28**	**22**	**23.3**	**19.5**
Bouteloua gracilis	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.9
Spartina pectinata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Warm Season Perennial Grasses	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.3**	**0.9**
Agropyron cristatum	42	8	22	0	4	0	0	0	0	36	0	42	0	0	16	0	0	0	8	12	0	0	12	0	0	8.1	13.5
Bromus inermis	2	0	0	12	10	0	0	22	18	2	0	0	2	40	0	48	0	0	0	50	0	6	2	0	20	9.4	15.4
Dactylis glomerata	0	0	0	0	0	0	0	2	8	0	0	0	14	4	0	4	0	0	0	0	6	0	0	0	12	2.0	4.0
Phleum pratense	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0	0	0	0	2	0.6	2.0
Poa pratensis	0	0	0	0	0	0	0	2	0	0	0	0	0	22	0	8	0	2	0	0	0	0	0	2	0	1.4	4.6
Total Introduced Perennial Grasses	**44**	**8**	**22**	**12**	**14**	**0**	**0**	**26**	**26**	**38**	**0**	**42**	**16**	**76**	**16**	**62**	**0**	**2**	**8**	**62**	**6**	**6**	**14**	**2**	**34**	**21.5**	**21.8**
Festuca spp.	0	0	0	22	0	0	30	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2.3	7.2
Total Unknown Grass Species	**0**	**0**	**0**	**22**	**0**	**0**	**30**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**2.3**	**7.2**
Carex nebrascensis	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	2.4
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.5**	**2.4**
Chenopodium berlandieri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4
Descurainia pinnata	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Plantago patagonica	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Annual Forbs	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0.3**	**0.7**
Alyssum desertorum	2	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0.3	0.7
Bassia sieversiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0.9	4.4
Polygonum convolvulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0.2	1.2
Total Introduced Annual Forbs	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**28**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**1.4**	**5.6**
Melilotus officinalis	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.6
Tragopogon dubius	0	4	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.4	1.0
Total Introduced Biennial Forbs	**0**	**6**	**2**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0.6**	**1.4**
Achillea millefolium	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Phlox hoodii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0.2	0.8
Psoralidium tenuiflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.4
Symphyotrichum falcatum	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.9

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TFN 6 2/025
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RAMACO
Polygon: Agricultural Lands (AG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																								Study Area n=25	
	1	2	3	4	5	6	7	8	9	10	11	12	13*	14*	15	16	17*	18	19	20	21	22	23	24	25*	Mean Absolute	Standard Deviation
Vicia americana	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Perennial Forbs	**2**	**0**	**0**	**2**	**2**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0.7**	**1.5**
Convolvulus arvensis	0	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	2	14	0	0	0	0	0	1.0	3.0
Medicago sativa	0	82	74	10	4	64	2	20	28	14	0	16	56	12	80	22	0	0	88	0	10	62	0	0	40	27.4	30.8
Rumex crispus	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Taraxacum officinale	0	0	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	4	0	0	0	0	0	4	0	0.6	1.2
Trifolium pratense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	2	0	0.6	2.8
Total Introduced Perennial Forbs	**0**	**86**	**74**	**10**	**4**	**68**	**2**	**20**	**28**	**20**	**0**	**16**	**56**	**14**	**80**	**22**	**0**	**20**	**90**	**14**	**10**	**62**	**0**	**6**	**40**	**29.7**	**30.2**
Artemisia tridentata	0	0	0	0	14	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	10	0	0	1.0	3.4
Chrysothamnus viscidiflorus	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.2	0.6
Total Native Full Shrubs	**0**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**1.2**	**3.9**
Artemisia frigida	2	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	10	0	0	0.7	2.2
Total Native Half &Sub-Shrubs	**2**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0.7**	**2.2**
Lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**0.0**
Bare Ground	16	0	0	0	14	2	0	0	0	2	0	4	0	0	2	0	0	2	0	0	0	0	14	10	0	2.5	5.0
Litter	14	0	2	18	14	0	14	10	0	18	84	6	4	0	0	0	0	58	0	14	4	0	18	48	0	13.0	20.8
Rock	6	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	4	0	0	0.7	2.1
Total Vegetation Cover	64	100	98	82	72	98	86	90	100	80	16	82	96	100	98	100	100	40	100	86	96	100	64	42	100	83.8	22.6
Total Vegetation Cover w/out SLCV	64	96	98	82	62	96	86	90	100	72	16	78	96	100	98	100	78	38	98	70	96	100	58	36	100	80.3	23.4
Total Vegetation w/Cryptograms	64	100	98	82	72	98	86	90	100	80	16	82	96	100	98	100	100	40	100	86	96	100	64	42	100	83.8	22.6
Total Vegetation w/Cryptograms w/out SLCV	64	96	98	82	62	96	86	90	100	72	16	78	96	100	98	100	78	38	98	70	96	100	58	36	100	80.3	23.4
Total Ground Cover	84	100	100	100	86	98	100	100	100	98	100	96	100	100	98	100	100	98	100	100	100	100	86	90	100	97.5	5.0
Total Ground Cover w/out SLCV	84	96	100	100	76	96	100	100	100	90	100	92	100	100	98	100	78	96	98	84	100	100	80	84	100	94.0	8.1
No. of Species Sampled excluding SLCV	9	4	3	7	10	4	7	6	7	6	1	9	5	7	3	6	4	4	3	4	6	5	10	4	10	5.8	2.5
No.of Species Observed excluding SLCV	4	0	2	7	12	5	2	1	3	1	2	6	3	3	3	0	1	1	0	1	4	3	7	1	1	2.9	2.8
Total No. of Species excluding SLCV	13	4	5	14	22	9	9	7	10	7	3	15	8	10	6	6	5	5	3	5	10	8	17	5	11	8.7	4.7
Total No. of SLCV	1	1	1	1	1	3	1	0	1	2	1	1	1	0	0	0	1	1	1	2	2	1	2	3	3	1.2	0.9

S--nned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																							Study Area n=23		Permit Area n=19	
	1	2	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16	17*	18*	19*	20	21*	22*	23*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Echinochloa muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.9	0.4	0.1	0.5
Total Native Annual Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0.9**	**0.4**	**0.1**	**0.5**
Bromus japonicus	8	6	0	6	0	0	4	2	0	0	0	0	4	6	0	16	4	0	0	8	0	0	10	3.2	4.3	1.9	2.9
Bromus tectorum	4	0	0	14	0	0	0	0	0	2	2	6	4	0	0	0	0	0	6	0	0	2	0	1.7	3.3	1.9	3.6
Total Introduced Annual Grasses	**12**	**6**	**0**	**20**	**0**	**0**	**4**	**2**	**0**	**2**	**2**	**6**	**8**	**6**	**0**	**16**	**4**	**0**	**6**	**8**	**0**	**2**	**10**	**4.9**	**5.5**	**3.8**	**5.0**
Elymus smithii	20	4	0	0	0	4	0	6	10	0	0	6	0	10	2	0	0	0	2	18	0	2	2	3.7	5.7	2.3	3.4
Elymus spicatus	0	0	4	8	6	2	8	0	8	2	0	0	4	0	6	0	2	10	0	0	12	2	6	3.5	3.8	4.2	3.8
Hesperostipa comata	2	0	4	0	10	0	0	0	0	6	8	8	0	0	6	8	10	2	6	2	4	0	8	3.7	3.7	3.8	3.8
Nassella viridula	0	12	0	0	0	0	2	10	0	0	0	2	0	0	0	0	0	0	0	8	0	0	0	1.5	3.5	0.7	2.3
Poa secunda	0	0	0	2	4	0	2	0	0	0	0	0	0	4	2	2	0	6	0	0	0	8	0	1.3	2.2	1.5	2.4
Total Native Cool Season Perennial Grasses	**22**	**16**	**8**	**10**	**20**	**6**	**12**	**16**	**18**	**8**	**8**	**16**	**4**	**14**	**16**	**10**	**12**	**18**	**8**	**28**	**16**	**12**	**16**	**13.7**	**5.6**	**12.5**	**4.6**
Aristida purpurea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0.2	0.8	0.2	0.9
Bouteloua gracilis	6	0	0	0	0	0	0	2	0	2	2	2	2	0	0	6	0	0	0	0	0	0	0	1.0	1.8	0.5	0.9
Total Native Warm Season Perennial Grasses	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**2**	**0**	**0**	**6**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**1.2**	**1.9**	**0.7**	**1.2**
Agropyron cristatum	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0.3	1.0	0.3	1.0
Festuca ovina	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0.5	1.8	0.6	2.0
Total Introduced Perennial Grasses	**0**	**0**	**0**	**8**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**0.8**	**2.0**	**0.9**	**2.1**
Carex filifolia	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	0	0.3	1.2	0.2	0.9
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0.3**	**1.2**	**0.2**	**0.9**
Plantago patagonica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.4	0.0	0.0
Total Native Annual Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0.1**	**0.4**	**0.0**	**0.0**
Alyssum desertorum	2	4	0	0	4	2	0	2	6	4	6	4	2	0	0	10	2	2	6	4	2	2	2	2.9	2.5	2.4	2.1
Medicago lupulina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Introduced Annual Forbs	**2**	**4**	**0**	**0**	**4**	**2**	**0**	**2**	**6**	**4**	**6**	**4**	**2**	**0**	**0**	**12**	**2**	**2**	**6**	**4**	**2**	**2**	**2**	**3.0**	**2.8**	**2.4**	**2.1**
Tragopogon dubius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.4	0.0	0.0
Total Introduced Biennial Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0.1**	**0.4**	**0.0**	**0.0**
Achillea millefolium	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.2	0.6	0.0	0.0
Allium textile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Comandra umbellata	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	8	0	0	0	0.7	2.0	0.0	0.0
Dalea purpurea	0	0	0	2	0	0	0	0	0	2	4	0	0	0	0	0	0	2	0	0	0	0	0	0.4	1.0	0.5	1.1
Eriogonum ovalifolium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4	0.1	0.5
Eriogonum pauciflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.4	0.1	0.5
Evolvulus nuttallianus	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Gaura coccinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.1	0.4	0.1	0.5
Phlox hoodii	0	0	8	0	0	2	0	2	0	2	0	0	0	0	6	2	0	0	0	2	2	4	2	1.4	2.1	1.5	2.3
Pediomelum argophyllum	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	0	0	0	0	2	0	0.6	1.5	0.4	1.4
Psoralidium tenuiflorum	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	2	0	4	2	0	0	0	0	0.5	1.1	0.5	1.1
Symphyotrichum falcatum	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Vicia americana	2	0	0	0	0	2	4	0	0	0	0	2	0	16	0	0	0	0	0	0	0	0	0	1.1	3.4	1.3	3.7
Total Native Perennial Forbs	**8**	**2**	**10**	**2**	**0**	**4**	**4**	**2**	**0**	**6**	**4**	**2**	**0**	**20**	**8**	**12**	**6**	**8**	**2**	**12**	**2**	**8**	**4**	**5.5**	**4.8**	**4.8**	**4.7**
Artemisia tridentata	14	16	26	4	32	36	20	34	36	22	30	28	32	2	36	18	24	16	38	16	26	36	20	24.4	10.2	26.2	10.4
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	4	0.3	0.9	0.3	1.0
Ericamera nauseosa	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.2	0.6	0.0	0.0
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	2	0	0	0	0	0.6	2.5	0.7	2.8

S nned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																							Study Area n=23		Permit Area n=19	
	1	2	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16	17*	18*	19*	20	21*	22*	23*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Total Native Full Shrubs	**14**	**18**	**26**	**4**	**32**	**36**	**20**	**34**	**36**	**22**	**30**	**28**	**44**	**2**	**36**	**18**	**26**	**16**	**40**	**18**	**26**	**36**	**24**	**25.5**	**10.8**	**27.2**	**11.1**
Artemisia frigida	6	0	0	2	0	0	0	0	0	0	0	0	0	2	0	4	4	2	0	2	2	0	2	1.1	1.7	0.7	1.2
Gutierrezia sarothrae	0	0	0	0	0	2	0	6	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.4	1.3	0.5	1.5
Yucca glauca	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Total Native Half &Sub-Shrubs	**6**	**0**	**0**	**4**	**0**	**2**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**4**	**4**	**2**	**0**	**2**	**2**	**0**	**2**	**1.6**	**2.0**	**1.3**	**1.8**
Opuntia polyacantha	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2	0.6	0.2	0.6
Total Native Succulents	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0.2**	**0.6**	**0.2**	**0.6**
Lichen	0	8	0	8	0	0	2	4	2	0	2	2	0	0	0	0	0	0	0	0	2	0	2	1.4	2.4	1.3	2.0
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total Cryptograms	**0**	**8**	**0**	**8**	**0**	**0**	**2**	**4**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**1.4**	**2.4**	**1.3**	**2.0**
Bare Ground	10	26	20	2	4	20	8	24	14	10	10	22	12	6	12	4	8	24	14	10	4	4	8	11.7	7.3	12.0	7.1
Litter	20	20	32	28	26	30	32	8	18	30	26	14	26	38	20	18	20	8	20	6	20	28	22	21.9	8.2	23.6	8.0
Rock	0	0	4	14	14	0	14	0	6	14	10	0	2	10	6	0	12	22	4	2	22	8	8	7.2	6.9	9.0	6.7
Total Vegetation Cover	70	46	44	48	56	50	44	64	60	46	52	62	60	46	62	78	60	46	62	82	52	60	60	57.8	10.5	54.1	7.2
Total Vegetation Cover w/out SLCV	58	40	44	28	56	50	40	62	60	44	50	56	52	40	62	62	56	46	56	74	52	58	50	52.0	9.9	50.3	8.7
Total Vegetation w/Cryptograms	70	54	44	56	56	50	46	68	62	46	54	64	60	46	62	78	60	46	62	82	54	60	62	59.2	10.0	55.4	7.4
Total Vegetation w/Cryptograms w/out SLCV	58	48	44	36	56	50	42	66	62	44	52	58	52	40	62	62	56	46	56	74	54	58	52	53.4	9.0	51.6	8.1
Total Ground Cover	90	74	80	98	96	80	92	76	86	90	90	78	88	94	88	96	92	76	86	90	96	96	92	88.3	7.3	88.0	7.1
Total Ground Cover w/out SLCV	78	68	80	78	96	80	88	74	86	88	88	72	80	88	88	80	88	76	80	82	96	94	82	82.5	7.4	84.2	7.1
No. of Species Sampled excluding SLCV	9	6	5	7	5	7	6	7	4	9	5	8	5	8	8	11	9	9	6	14	7	8	10	7.5	2.3	7.0	1.7
No.of Species Observed excluding SLCV	10	4	6	8	7	5	8	0	5	7	12	9	6	11	10	4	4	8	13	4	5	9	4	6.9	3.1	7.2	3.1
Total No. of Species excluding SLCV	19	10	11	15	12	12	14	7	9	16	17	17	11	19	18	15	13	17	19	18	12	17	14	14.4	3.5	14.2	3.4
Total No. of SLCV	2	1	1	2	1	1	1	1	1	2	2	2	2	2	1	2	1	1	2	1	2	2	1	1.5	0.5	1.5	0.5

S[illegible]nned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Cover Sample Data
Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																								Study Area n=25		Permit Area n=17	
	1*	2*	3*	4*	*5	6*	7*	8*	9	10*	11*	12	13*	14	15*	16	17*	18*	19*	20*	21*	22*	23*	24	25	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Bromus japonicus	4	0	4	0	8	0	6	0	0	4	2	0	0	6	0	0	6	2	0	2	4	8	6	0	0	2.5	2.8	3.3	2.8
Bromus tectorum	2	8	0	0	6	0	0	0	0	12	8	0	20	0	0	0	16	6	0	2	6	0	2	0	0	3.5	5.5	5.2	6.1
Total Introduced Annual Grasses	**6**	**8**	**4**	**0**	**14**	**0**	**6**	**0**	**0**	**16**	**10**	**0**	**20**	**6**	**0**	**0**	**22**	**8**	**0**	**4**	**10**	**8**	**8**	**0**	**0**	**6.0**	**6.6**	**8.5**	**6.5**
Elymus elymoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0.2	0.8	0.0	0.0
Elymus lanceolatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	2	0.7	3.2	0.0	0.0
Elymus smithii	20	0	10	0	14	30	0	0	2	22	12	0	20	22	12	22	22	10	0	24	20	32	8	26	4	13.3	10.5	15.1	9.9
Elymus spicatus	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.2	1.0
Elymus trachycaulus	0	0	0	0	0	0	0	0	12	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	2.5	0.0	0.0
Hesperostipa comata	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	10	0	0	0.6	2.1	0.8	2.6
Hordeum jubatum	14	0	30	0	0	18	0	0	26	0	0	2	0	0	0	8	2	0	0	0	6	4	0	0	0	4.4	8.5	4.4	8.5
Nassella viridula	0	0	2	0	2	0	0	0	0	0	0	0	10	0	0	0	0	2	8	6	4	4	2	16	2	2.3	3.9	2.4	3.1
Phalaris arundinacea	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0.2	1.2	0.0	0.0
Poa secunda	0	6	0	0	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0	0	0	2	0	2	0.6	1.5	0.8	1.7
Total Native Cool Season Perennial Grasses	**34**	**6**	**42**	**0**	**16**	**48**	**0**	**0**	**40**	**22**	**16**	**6**	**38**	**28**	**14**	**30**	**24**	**12**	**8**	**30**	**30**	**40**	**22**	**62**	**10**	**23.1**	**16.4**	**23.7**	**13.8**
Bouteloua gracilis	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	1.2	0.4	1.5
Buchloe dactyloides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0.2	1.2	0.0	0.0
Spartina pectinata	0	0	0	0	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	1.8	0.0	0.0
Total Native Warm Season Perennial Grasses	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**8**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.9**	**2.3**	**0.4**	**1.5**
Agropyron cristatum	14	14	0	0	4	0	24	0	0	0	28	0	0	0	36	0	0	14	32	10	0	2	2	0	0	7.2	11.4	10.6	12.5
Bromus inermis	0	0	0	0	0	0	6	0	4	0	0	0	0	10	2	0	0	2	0	0	0	0	0	0	26	2.0	5.5	0.6	1.5
Elymus junceus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0.2	0.9	0.4	1.1
Phleum pratense	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.6	0.0	0.0
Poa pratensis	0	0	0	2	0	8	0	0	4	0	0	4	0	4	0	6	0	0	0	0	0	0	0	0	2	1.2	2.2	0.5	1.9
Total Introduced Perennial Grasses	**14**	**14**	**0**	**2**	**4**	**8**	**30**	**0**	**8**	**0**	**28**	**12**	**0**	**14**	**40**	**6**	**0**	**20**	**32**	**10**	**0**	**2**	**2**	**0**	**28**	**10.9**	**12.1**	**12.1**	**13.3**
Carex nebrascensis	0	0	0	60	0	0	0	32	24	0	0	22	0	24	0	0	0	0	0	0	0	0	0	8	0	6.8	14.7	0.0	0.0
Carex praegracilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	1.2	6.0	0.0	0.0
Juncus balticus	0	0	4	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0.5	1.3	0.2	1.0
Schoenoplectus pungens	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	12.0	0.0	0.0
Total Native Grasslike Species	**0**	**0**	**4**	**60**	**0**	**0**	**0**	**92**	**24**	**0**	**0**	**22**	**0**	**28**	**0**	**34**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**10.9**	**22.5**	**0.2**	**1.0**
Chenopodium berlandieri	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Lappula redowskii	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Plantago patagonica	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	1.2	0.4	1.5
Total Native Annual Forbs	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.4**	**1.3**	**0.5**	**1.5**
Alyssum desertorum	0	6	0	0	0	0	0	0	0	0	10	0	8	0	0	0	0	2	0	0	4	2	2	6	0	1.6	2.9	2.0	3.2
Bassia sieversiana	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Camelina microcarpa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0.2	0.6	0.2	0.7
Descurainia sophia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0.2	0.6	0.2	0.7
Sisymbrium altissimum	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.2	0.6	0.2	0.7
Thlaspi arvense	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0.3	0.9	0.5	1.1
Total Introduced Annual Forbs	**0**	**6**	**0**	**0**	**2**	**0**	**2**	**0**	**4**	**2**	**10**	**0**	**8**	**0**	**0**	**0**	**2**	**6**	**0**	**8**	**4**	**2**	**2**	**6**	**0**	**2.7**	**3.1**	**3.2**	**3.2**
Lactuca serriola	0	0	2	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.9	0.1	0.5
Melilotus officinalis	0	0	8	0	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0.6	1.8	0.9	2.1
Tragopogon dubius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0.2	0.6	0.2	0.7
Total Introduced Biennial Forbs	**0**	**0**	**10**	**0**	**0**	**4**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**1.0**	**2.4**	**1.2**	**2.7**
Achillea millefolium	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	6	0	4	0	2	0	0.8	1.6	1.1	1.9
Ambrosia psilostachya	0	0	4	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0.9	0.5	1.1
Ambrosia tomentosa	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	12	0	0	0	0	0	0	0.7	2.5	1.1	3.0

Scanned 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Cover Sample Data
Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																								Study Area n=25		Permit Area n=17	
	1*	2*	3*	4*	*5	6*	7*	8*	9	10*	11*	12	13*	14	15*	16	17*	18*	19*	20*	21*	22*	23*	24	25	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Asclepias speciosa	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Echinacea angustifolia	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Equisetum laevigatum	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0.4	1.6	0.6	2.0
Glycyrrhiza lepidota	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0.6	2.8	0.0	0.0
Psoralidium tenuiflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.4	0.1	0.5
Sphaeralcea coccinea	0	4	0	0	2	0	0	0	0	8	0	0	4	0	2	0	0	0	0	2	0	2	6	0	0	1.2	2.2	1.8	2.4
Vicia americana	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Total Native Perennial Forbs	**2**	**4**	**8**	**4**	**4**	**8**	**0**	**0**	**0**	**10**	**0**	**0**	**4**	**0**	**2**	**14**	**0**	**6**	**20**	**8**	**0**	**6**	**8**	**2**	**0**	**4.5**	**5.1**	**5.4**	**5.0**
Cirsium arvense	2	0	0	16	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1.0	3.4	0.5	1.5
Convolvulus arvensis	22	0	2	0	6	2	0	0	0	0	0	0	2	0	4	0	16	8	4	14	10	0	0	0	4	3.8	5.9	5.3	6.6
Medicago sativa	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Rumex crispus	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0.3	0.7	0.5	0.9
Taraxacum officinale	0	0	0	0	0	2	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	28	1.4	5.6	0.1	0.5
Total Introduced Perennial Forbs	**24**	**0**	**2**	**20**	**6**	**4**	**8**	**0**	**2**	**0**	**0**	**0**	**2**	**4**	**4**	**0**	**16**	**10**	**6**	**16**	**10**	**0**	**0**	**0**	**34**	**6.7**	**8.9**	**6.4**	**7.0**
Astragalus spp.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Polygonum spp.	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0	4.8	0.0	0.0
Rumex spp.	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Sonchus spp.	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	2.0	0.0	0.0
Total Unknown Forb Species	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**12**	**0**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.6**	**5.3**	**0.1**	**0.5**
Artemisia cana	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	8	4	0	0	0	12	0	0	1.1	2.9	1.6	3.4
Rhus aromatica	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.2	1.0
Symphoricarpos albus	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.2	0.6	0.0	0.0
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.3	1.6	0.0	0.0
Symphoricarpos spp.	0	0	2	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	8	0	0	2	0	0	0	1.0	3.2	1.5	3.8
Total Native Full Shrubs	**0**	**0**	**2**	**0**	**6**	**0**	**14**	**0**	**2**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**8**	**12**	**0**	**0**	**2**	**12**	**0**	**8**	**2.8**	**4.4**	**3.4**	**5.0**
Artemisia frigida	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0.2	0.7	0.4	0.8
Artemisia ludoviciana	0	0	2	0	6	0	2	0	0	2	2	0	0	0	0	0	2	2	2	0	4	2	2	0	0	1.1	1.5	1.6	1.6
Total Native Half &Sub-Shrubs	**0**	**0**	**2**	**0**	**6**	**0**	**4**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**2**	**0**	**4**	**2**	**4**	**0**	**0**	**1.3**	**1.8**	**2.0**	**1.9**
Lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0.0**	**0.0**
Bare Ground	0	12	6	0	8	0	4	0	0	2	4	2	0	2	4	10	10	4	20	2	4	4	0	4	12	4.5	5.0	4.7	5.2
Litter	20	36	18	14	32	28	32	0	0	38	30	34	24	14	36	0	24	16	0	22	38	30	42	18	8	22.1	13.2	27.4	10.4
Rock	0	2	0	0	2	0	0	0	0	6	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0.6	1.4	0.8	1.6
Total Vegetation Cover	80	50	76	86	58	72	64	100	100	54	66	64	74	84	60	90	66	78	80	76	58	66	58	78	80	72.8	13.4	67.1	9.5
Total Vegetation Cover w/out SLCV	50	42	70	66	38	70	50	100	96	38	56	64	52	78	56	76	28	60	74	56	38	58	50	78	74	60.7	17.9	52.1	12.6
Total Vegetation w/Cryptograms	80	50	76	86	58	72	64	100	100	54	66	64	74	84	60	90	66	78	80	76	58	66	58	78	80	72.8	13.4	67.1	9.5
Total Vegetation w/Cryptograms w/out SLCV	50	42	70	66	38	70	50	100	96	38	56	64	52	78	56	76	28	60	74	56	38	58	50	78	74	60.7	17.9	52.1	12.6
Total Ground Cover	100	88	94	100	92	100	96	100	100	98	96	98	100	98	96	90	90	96	80	98	96	96	100	96	88	95.5	5.0	95.3	5.2
Total Ground Cover w/out SLCV	70	80	88	80	72	98	82	100	96	82	86	98	78	92	92	76	52	78	74	78	76	88	92	96	82	83.4	11.0	80.3	10.6
No. of Species Sampled excluding SLCV	4	6	12	3	9	8	6	3	12	6	5	6	7	9	6	6	4	15	7	8	5	11	11	7	8	7.4	3.0	7.6	3.1
No.of Species Observed excluding SLCV	10	7	6	7	4	8	5	2	1	11	4	2	5	8	6	7	9	1	3	3	8	2	4	1	5	5.2	2.9	5.6	2.8
Total No. Species excluding SLCV	14	13	18	10	13	16	11	5	13	17	9	8	12	17	12	13	13	16	10	11	13	13	15	8	13	12.5	3.1	13.3	2.5
Total No. of SLCV	4	1	3	3	3	1	4	0	1	2	3	0	2	2	4	5	4	4	2	5	4	1	2	4	5	2.8	1.5	2.9	1.3

Scanned 02/27/2020

TFN 6 2/025
DECD NOV 14, 2014

RECEIVED, 02/27/2020

RAMACO
Polygon: Pine and Juniper Woodland (PJW)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values) 1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	Study Area and Permit Area n=15 Mean Absolute	Standard Deviation
Bromus japonicus	0	2	0	0	0	0	0	2	2	0	10	0	2	0	0	1.2	2.6
Bromus tectorum	0	0	0	0	0	0	12	6	8	0	10	4	10	0	36	5.7	9.5
Total Introduced Annual Grasses	**0**	**2**	**0**	**0**	**0**	**0**	**12**	**8**	**10**	**0**	**20**	**4**	**12**	**0**	**36**	**6.9**	**10.2**
Elymus smithii	0	0	0	4	2	0	6	18	2	0	0	0	0	2	16	3.3	5.8
Elymus spicatus	14	6	4	4	18	12	14	12	14	8	28	22	30	20	8	14.3	8.1
Hesperostipa comata	0	0	0	0	4	0	0	0	2	0	0	0	0	0	2	0.5	1.2
Nassella viridula	0	0	0	0	0	2	2	4	0	0	0	0	0	0	0	0.5	1.2
Poa secunda	0	8	0	0	0	2	0	0	0	8	0	0	4	2	0	1.6	2.8
Total Native Cool Season Perennial Grasses	**14**	**14**	**4**	**8**	**24**	**16**	**22**	**34**	**18**	**16**	**28**	**22**	**34**	**24**	**26**	**20.2**	**8.6**
Bouteloua gracilis	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0.3	0.7
Total Native Warm Season Perennial Grasses	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0.3**	**0.7**
Carex filifolia	0	0	0	0	0	0	0	0	6	0	2	0	0	0	4	0.8	1.8
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**2**	**0**	**0**	**0**	**4**	**0.8**	**1.8**
Plantago patagonica	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Total Native Annual Forbs	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.5**
Alyssum desertorum	0	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0.4	0.8
Camelina microcarpa	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0.3	0.7
Thlaspi arvense	0	0	0	0	0	0	0	0	0	0	4	0	2	0	0	0.4	1.1
Total Introduced Annual Forbs	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**2**	**2**	**0**	**2**	**1.1**	**2.1**
Tragopogon dubius	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.5
Total Introduced Biennial Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.5**
Achillea millefolium	0	0	0	0	0	0	2	0	0	0	0	2	4	0	2	0.7	1.2
Dalea purpurea	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0.3	1.0
Phlox hoodii	0	2	2	4	2	0	0	0	4	0	0	0	0	10	0	1.6	2.7
Psoralidium tenuiflorum	0	2	0	0	2	0	2	0	2	0	0	0	0	0	0	0.5	0.9
Sphaeralcea coccinea	0	0	0	0	0	0	0	4	0	0	0	2	0	0	0	0.4	1.1
Vicia americana	0	0	0	2	0	0	0	2	0	0	0	4	0	0	0	0.5	1.2
Total Native Perennial Forbs	**0**	**4**	**2**	**6**	**4**	**0**	**4**	**6**	**10**	**0**	**0**	**8**	**4**	**10**	**2**	**4.0**	**3.5**
Cerastium arvense	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.5
Total Introduced Perennial Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.5**
Artemisia tridentata	0	6	0	0	0	0	0	0	0	0	0	0	0	4	0	0.7	1.8
Chrysothamnus viscidiflorus	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Ericameria nauseosa	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0.4	1.1
Rhus aromatica	0	0	0	0	0	0	0	2	0	0	2	2	0	0	0	0.4	0.8
Total Native Full Shrubs	**0**	**6**	**0**	**2**	**4**	**2**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**4**	**0**	**1.6**	**1.9**
Artemisia frigida	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0.3	0.7
Gutierrezia sarothrae	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.1	0.5
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**0.4**	**0.8**
Juniperus scopulorum	0	0	14	6	0	10	0	0	0	16	0	0	0	4	0	3.3	5.6
Pinus ponderosa	0	0	0	0	0	0	20	18	12	0	0	20	0	0	0	4.7	8.2
Total Native Trees	**0**	**0**	**14**	**6**	**0**	**10**	**20**	**18**	**12**	**16**	**0**	**20**	**0**	**4**	**0**	**8.0**	**8.1**
Lichen	0	4	2	2	4	4	0	0	0	4	0	0	0	0	0	1.3	1.8
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total Cryptograms	**0**	**4**	**2**	**2**	**4**	**4**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**1.3**	**1.8**
Bare Ground	16	10	14	48	14	24	2	2	6	4	6	8	6	0	4	11.0	12.1
Litter	6	18	10	8	4	12	38	26	32	8	14	24	30	10	26	17.8	10.8
Rock	64	40	52	20	44	30	0	4	4	50	20	8	12	46	0	26.3	21.6
Total Vegetation Cover	14	28	22	22	34	30	60	68	58	34	60	60	52	44	70	43.6	18.5
Total Vegetation Cover w/out SLCV	14	26	22	22	34	30	48	60	48	34	40	56	40	44	34	37.7	13.0
Total Vegetation w/Cryptograms	14	32	24	24	38	34	60	68	58	38	60	60	52	44	70	44.9	17.5
Total Vegetation w/Cryptograms w/out SLCV	14	30	24	24	38	34	48	60	48	38	40	56	40	44	34	39.0	12.3
Total Ground Cover	84	90	86	52	86	76	98	98	94	96	94	92	94	100	96	89.0	12.1
Total Ground Cover w/out SLCV	84	88	86	52	86	76	86	90	84	96	74	88	82	100	60	83.1	12.5
No. of Species Sampled excluding SLCV	1	6	4	6	7	6	7	7	9	4	6	8	4	7	6	5.9	2.0
No.of Species Observed excluding SLCV	13	16	11	15	5	8	5	3	4	11	7	3	9	6	9	8.3	4.2
Total No. of Species excluding SLCV	14	22	15	21	12	14	12	10	13	15	13	11	13	13	15	14.2	3.3
Total No. of SLCV	0	1	0	2	0	0	1	2	2	1	2	2	2	1	1	1.1	0.8

TFN 6 2/025
RECD NOV 14, 2014

DEQ Ex. 4-472

RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																																								
	1*	2	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14	15	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30*	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*
Vulpia octoflora	0	0	0	0	0	0	0	0	2	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Annual Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Bromus japonicus	0	2	0	0	0	0	0	0	0	0	0	4	16	8	0	0	0	0	0	0	8	6	12	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0
Bromus tectorum	0	12	0	2	0	22	12	12	26	24	0	6	0	0	40	40	16	0	0	0	0	16	4	0	4	0	28	0	44	0	8	28	40	0	22	8	14	18	0	54
Total Introduced Annual Grasses	**0**	**14**	**0**	**2**	**0**	**22**	**12**	**12**	**26**	**24**	**0**	**10**	**16**	**8**	**40**	**40**	**16**	**0**	**0**	**0**	**8**	**22**	**16**	**0**	**4**	**0**	**28**	**0**	**44**	**0**	**8**	**28**	**40**	**0**	**24**	**8**	**14**	**20**	**0**	**54**
Elymus smithii	0	4	0	0	2	30	6	10	12	8	0	10	26	16	8	0	20	2	8	22	8	10	16	2	20	8	2	0	20	0	14	8	6	12	2	10	18	22	16	10
Elymus spicatus	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0
Hesperostipa comata	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Nassella viridula	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poa secunda	0	0	0	0	0	0	2	2	0	0	0	4	4	6	0	0	0	0	0	0	4	4	2	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
Total Native Cool Season Perennial Grasses	**2**	**4**	**0**	**0**	**2**	**30**	**8**	**16**	**12**	**12**	**0**	**14**	**30**	**22**	**8**	**4**	**20**	**2**	**8**	**22**	**18**	**16**	**24**	**2**	**20**	**8**	**2**	**0**	**20**	**0**	**14**	**8**	**8**	**12**	**10**	**10**	**18**	**24**	**16**	**10**
Aristida purpurea	0	0	0	4	0	2	0	4	0	0	0	8	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	2	6	0	0	0	4
Bouteloua gracilis	0	0	0	0	0	0	2	0	0	0	0	8	0	2	0	4	2	0	0	4	0	0	2	0	0	10	0	0	2	0	0	2	0	0	0	0	0	0	0	0
Sporobolus cryptandrus	0	2	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Warm Season Perennial Grasses	**0**	**2**	**0**	**4**	**6**	**2**	**2**	**4**	**0**	**0**	**0**	**16**	**0**	**2**	**0**	**6**	**2**	**4**	**0**	**4**	**0**	**2**	**2**	**0**	**0**	**10**	**0**	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**6**	**0**	**0**	**0**	**4**
Agropyron cristatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	22	14	10	0	0	0	0	20	0	0	0	0	0	10	2	16	0
Bromus inermis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Introduced Perennial Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**22**	**14**	**12**	**0**	**0**	**0**	**0**	**20**	**0**	**0**	**0**	**0**	**0**	**10**	**2**	**16**	**0**
Chamaesyce glyptosperma	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lappula redowskii	0	0	0	0	0	0	0	0	8	0	8	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	2	0	0	0	0
Logfia arvensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Plantago patagonica	0	0	12	0	2	0	10	0	0	0	10	2	0	0	0	0	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	0	
Solanum triflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0
Total Native Annual Forbs	**0**	**0**	**12**	**4**	**2**	**0**	**10**	**0**	**8**	**0**	**18**	**2**	**0**	**0**	**4**	**0**	**8**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**4**	**2**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**4**	**0**
Alyssum desertorum	12	4	2	0	0	0	2	0	8	6	0	0	4	2	4	0	8	2	2	0	0	2	4	0	0	2	2	2	6	0	4	0	0	8	0	0	4	0	6	0
Amaranthus albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Bassia sieversiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brassica juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Medicago lupulina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0
Polygonum argyrocoleon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygonum aviculare	0	0	2	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	0	0	
Polygonum convolvulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0
Sisymbrium altissimum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0
Total Introduced Annual Forbs	**12**	**4**	**4**	**0**	**0**	**2**	**2**	**0**	**10**	**6**	**0**	**0**	**4**	**2**	**4**	**0**	**8**	**2**	**14**	**0**	**0**	**2**	**4**	**0**	**2**	**2**	**2**	**2**	**8**	**40**	**4**	**0**	**0**	**8**	**0**	**8**	**6**	**4**	**6**	**0**
Melilotus officinalis	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Introduced Biennial Forbs	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Achillea millefolium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambrosia psilostachya	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antennaria microphylla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
Dalea purpurea	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evolvulus nuttallianus	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Gaura coccinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grindelia squarrosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heterotheca villosa	0	0	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
Linum lewisii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lygodesmia juncea	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2

Scanned, 02/27/2020

TFN 6 2/025
RECD NOV 14,2014

RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																																								
	1*	2	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14	15	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30*	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*
Pediomelum argophyllum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phlox hoodii	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	0	0	0	0	6	0	6	4	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Psoralidium tenuiflorum	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sphaeralcea coccinea	0	0	0	0	0	0	0	0	0	8	0	2	2	0	2	0	0	0	0	0	0	2	0	2	0	0	2	0	0	0	6	14	0	0	2	6	0	2	2	4
Symphyotrichum falcatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4	0	0	0	0	0	0
Vicia americana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Total Native Perennial Forbs	**0**	**0**	**0**	**8**	**0**	**2**	**2**	**0**	**2**	**10**	**0**	**8**	**6**	**2**	**2**	**2**	**0**	**0**	**2**	**2**	**12**	**4**	**8**	**10**	**0**	**2**	**2**	**0**	**0**	**4**	**10**	**16**	**6**	**4**	**10**	**6**	**0**	**2**	**2**	**6**
Convolvulus arvensis	6	28	34	18	0	0	0	0	0	0	16	0	0	0	8	0	0	0	2	0	0	0	0	0	0	0	14	16	0	14	0	0	20	0	0	12	10	4	0	0
Total Introduced Perennial Forbs	**6**	**28**	**34**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**16**	**0**	**14**	**0**	**0**	**20**	**0**	**0**	**12**	**10**	**4**	**0**	**0**
Astragalus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cirsium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Penstemon spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rumex spp.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Unknown Forb Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**4**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Artemisia tridentata	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Total Native Full Shrubs	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**
Artemisia frigida	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	4	2	0	0	6	4	4	0	0	0	2	0	0	0	0	4	0	0	0	0	0
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**4**	**0**	**0**	**4**	**2**	**0**	**0**	**6**	**4**	**4**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
Opuntia polyacantha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Total Native Succulents	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Bare Ground	12	34	48	38	88	10	48	42	18	14	62	34	20	36	30	16	12	82	50	22	14	28	12	14	28	28	22	54	16	4	10	22	10	50	12	34	14	2	14	14
Litter	32	8	2	4	2	32	14	20	20	26	4	10	14	24	4	24	28	4	18	34	38	26	26	46	28	28	28	24	10	16	32	16	16	16	16	14	24	32	42	8
Rock	36	0	0	22	0	0	2	6	0	8	0	0	2	2	0	8	0	0	4	4	4	0	4	0	0	4	2	0	0	10	0	6	0	6	22	2	2	8	0	4
Total Vegetation Cover	20	58	50	36	10	58	36	32	62	52	34	56	64	38	66	52	60	14	28	40	44	46	58	40	44	40	48	22	74	70	58	56	74	26	50	50	60	58	44	74
Total Vegetation Cover w/out SLCV	14	16	16	16	10	36	24	20	36	28	18	46	48	30	18	12	44	14	24	40	36	24	42	40	40	40	6	6	30	56	50	28	14	26	26	30	36	34	44	20
Total Vegetation w/Cryptograms	20	58	50	36	10	58	36	32	62	52	34	56	64	38	66	52	60	14	28	40	44	46	58	40	44	40	48	22	74	70	58	56	74	28	50	50	60	58	44	74
Total Vegetation w/Cryptograms w/out SLCV	14	16	16	16	10	36	24	20	36	28	18	46	48	30	18	12	44	14	24	40	36	24	42	40	40	40	6	6	30	56	50	28	14	28	26	30	36	34	44	20
Total Ground Cover	88	66	52	62	12	90	52	58	82	86	38	66	80	64	70	84	88	18	50	78	86	72	88	86	72	72	78	46	84	96	90	78	90	50	88	66	86	98	86	86
Total Ground Cover w/out SLCV	82	24	18	42	12	68	40	46	56	62	22	56	64	56	22	44	72	18	46	78	78	50	72	86	68	72	36	30	40	82	82	50	30	50	64	46	62	74	86	32
No. of Species Sampled excluding SLCV	2	5	3	4	3	4	6	4	7	5	2	9	8	6	4	4	7	4	5	5	10	7	11	7	4	8	3	3	4	9	6	5	4	4	9	5	5	7	5	4
No.of Species Observed excluding SLCV	0	3	1	1	3	6	5	7	3	4	1	7	1	4	4	10	1	2	0	3	2	7	5	5	4	5	10	5	3	10	7	2	8	8	10	5	6	9	3	4
Total No. of Species excluding SLCV	2	8	4	5	6	10	11	11	10	9	3	16	9	10	8	14	8	6	5	8	12	14	16	12	8	13	13	8	7	19	13	7	12	12	19	10	11	16	8	8
Total No. of SLCV	1	3	2	2	0	2	2	1	3	1	2	2	1	1	2	1	1	0	2	0	1	2	2	0	1	1	2	1	1	1	2	2	2	1	2	2	3	3	1	1

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RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Study Area n=40		Permit Area n=34	
	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Vulpia octoflora	0.2	1.0	0.0	0.0
Total Native Annual Grasses	**0.2**	**1.0**	**0.0**	**0.0**
Bromus japonicus	1.5	3.6	1.2	3.6
Bromus tectorum	12.5	15.1	11.8	15.3
Total Introduced Annual Grasses	**14.0**	**14.7**	**13.0**	**15.0**
Elymus smithii	9.7	8.1	9.6	8.6
Elymus spicatus	0.4	1.0	0.4	1.1
Hesperostipa comata	0.4	1.0	0.4	1.0
Nassella viridula	0.2	1.0	0.2	1.1
Poa secunda	0.8	1.6	0.5	1.1
Total Native Cool Season Perennial Grasses	**11.5**	**8.6**	**11.1**	**9.0**
Aristida purpurea	0.9	1.9	0.8	1.6
Bouteloua gracilis	1.0	2.2	0.8	2.0
Sporobolus cryptandrus	0.3	1.2	0.3	1.2
Total Native Warm Season Perennial Grasses	**2.2**	**3.2**	**1.9**	**2.5**
Agropyron cristatum	2.6	5.9	3.0	6.3
Bromus inermis	0.1	0.3	0.1	0.3
Total Introduced Perennial Grasses	**2.7**	**5.9**	**3.1**	**6.3**
Chamaesyce glyptosperma	0.1	0.6	0.1	0.7
Lappula redowskii	0.7	1.9	0.5	1.6
Logfia arvensis	0.2	0.7	0.1	0.3
Plantago patagonica	1.3	3.0	1.5	3.2
Solanum triflorum	0.1	0.4	0.1	0.5
Total Native Annual Forbs	**2.4**	**4.0**	**2.3**	**4.1**
Alyssum desertorum	2.4	3.0	2.2	3.0
Amaranthus albus	0.3	1.9	0.4	2.1
Bassia sieversiana	0.1	0.3	0.1	0.3
Brassica juncea	0.1	0.6	0.1	0.7
Medicago lupulina	0.5	3.2	0.6	3.4
Polygonum argyrocoleon	0.1	0.3	0.1	0.3
Polygonum aviculare	0.6	1.8	0.6	1.9
Polygonum convolvulus	0.2	1.3	0.2	1.4
Sisymbrium altissimum	0.1	0.4	0.1	0.5
Total Introduced Annual Forbs	**4.4**	**6.8**	**4.4**	**7.3**
Melilotus officinalis	0.2	0.5	0.1	0.5
Total Introduced Biennial Forbs	**0.2**	**0.5**	**0.1**	**0.5**
Achillea millefolium	0.2	0.5	0.2	0.6
Ambrosia psilostachya	0.1	0.6	0.1	0.7
Antennaria microphylla	0.2	0.7	0.2	0.8
Dalea purpurea	0.1	0.3	0.0	0.0
Evolvulus nuttallianus	0.2	0.7	0.2	0.8
Gaura coccinea	0.1	0.3	0.1	0.3
Grindelia squarrosa	0.1	0.3	0.0	0.0
Heterotheca villosa	0.3	0.9	0.2	0.8
Linum lewisii	0.1	0.3	0.1	0.3
Lygodesmia juncea	0.3	0.9	0.3	0.9
Pediomelum argophyllum	0.1	0.3	0.1	0.3

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RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Study Area n=40		Permit Area n=34	
	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Phlox hoodii	0.7	1.7	0.8	1.8
Psoralidium tenuiflorum	0.1	0.4	0.1	0.5
Sphaeralcea coccinea	1.4	2.8	1.5	3.0
Symphyotrichum falcatum	0.2	0.7	0.2	0.8
Vicia americana	0.1	0.6	0.1	0.7
Total Native Perennial Forbs	**4.3**	**4.1**	**4.2**	**4.3**
Convolvulus arvensis	5.1	8.6	4.9	8.3
Total Introduced Perennial Forbs	**5.1**	**8.6**	**4.9**	**8.3**
Astragalus spp.	0.2	0.5	0.2	0.6
Cirsium spp.	0.1	0.3	0.1	0.3
Penstemon spp.	0.1	0.3	0.1	0.3
Rumex spp.	0.1	0.3	0.0	0.0
Total Unknown Forb Species	**0.5**	**0.9**	**0.4**	**0.9**
Artemisia tridentata	0.2	0.7	0.0	0.0
Chrysothamnus viscidiflorus	0.2	0.8	0.2	0.8
Total Native Full Shrubs	**0.4**	**1.0**	**0.2**	**0.8**
Artemisia frigida	0.8	1.6	0.9	1.7
Artemisia ludoviciana	0.1	0.6	0.1	0.7
Total Native Half &Sub-Shrubs	**0.9**	**1.8**	**1.0**	**1.9**
Opuntia polyacantha	0.1	0.3	0.1	0.3
Total Native Succulents	**0.1**	**0.3**	**0.1**	**0.3**
Lichen	0.1	0.3	0.1	0.3
Fungi	0.0	0.0	0.0	0.0
Algae	0.0	0.0	0.0	0.0
Moss	0.0	0.0	0.0	0.0
Total Cryptograms	**0.1**	**0.3**	**0.1**	**0.3**
Bare Ground	27.5	20.0	27.4	21.6
Litter	19.8	11.4	20.9	11.6
Rock	3.7	7.3	4.9	7.7
Total Vegetation Cover	48.9	16.2	46.7	16.9
Total Vegetation Cover w/out SLCV	29.8	12.9	28.5	13.3
Total Vegetation w/Cryptograms	49.0	16.2	46.8	16.8
Total Vegetation w/Cryptograms w/out SLCV	29.9	12.9	28.6	13.3
Total Ground Cover	72.5	20.0	72.6	21.6
Total Ground Cover w/out SLCV	53.4	21.3	54.4	21.9
No. of Species Sampled excluding SLCV	5.4	2.2	5.3	2.2
No.of Species Observed excluding SLCV	4.6	2.9	4.6	3.1
Total No. of Species excluding SLCV	10.0	4.0	9.9	4.2
Total No. of SLCV	1.5	0.8	1.4	0.8

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RECEIVED, 02/27/2025

RAMACO
Polygon: Reclaimed Grassland (RG)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values) 1*	2*	3*	4*	5*	6	7*	8	9*	10*	Study Area n=10 Mean Absolute	Study Area n=10 Standard Deviation	Permit Area n=8 Mean Absolute	Permit Area n=8 Standard Deviation
Bromus japonicus	2	12	2	0	0	4	0	16	0	2	3.8	5.6	2.3	4.1
Bromus tectorum	2	10	0	2	0	0	0	0	0	0	1.4	3.1	1.8	3.5
Total Introduced Annual Grasses	**4**	**22**	**2**	**2**	**0**	**4**	**0**	**16**	**0**	**2**	**5.2**	**7.6**	**4.1**	**7.4**
Elymus lanceolatus	18	0	0	0	0	0	0	0	0	0	1.8	5.7	2.3	6.4
Elymus smithii	14	0	38	24	12	26	0	18	62	56	25.0	21.3	25.8	24.0
Elymus trachycaulus	14	0	0	0	0	0	0	0	0	0	1.4	4.4	1.8	4.9
Nassella viridula	0	0	0	4	0	0	0	0	0	0	0.4	1.3	0.5	1.4
Poa secunda	0	0	0	0	0	2	0	0	0	0	0.2	0.6	0.0	0.0
Total Native Cool Season Perennial Grasses	**46**	**0**	**38**	**28**	**12**	**28**	**0**	**18**	**62**	**56**	**28.8**	**21.8**	**30.4**	**24.3**
Agropyron cristatum	0	0	8	4	0	2	0	0	0	4	1.8	2.7	2.0	3.0
Bromus inermis	4	22	14	10	52	0	56	0	0	0	15.8	21.4	19.8	22.4
Total Introduced Perennial Grasses	**4**	**22**	**22**	**14**	**52**	**2**	**56**	**0**	**0**	**4**	**17.6**	**20.9**	**21.8**	**21.6**
Carex filifolia	0	0	0	0	0	4	0	0	0	0	0.4	1.3	0.0	0.0
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0.4**	**1.3**	**0.0**	**0.0**
Plantago patagonica	0	0	0	0	0	0	0	2	0	0	0.2	0.6	0.0	0.0
Total Native Annual Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0.2**	**0.6**	**0.0**	**0.0**
Alyssum desertorum	2	0	2	2	2	0	0	6	0	0	1.4	1.9	1.0	1.1
Camelina microcarpa	0	0	0	0	0	0	2	0	4	0	0.6	1.3	0.8	1.5
Halogeton glomeratus	0	2	0	0	0	0	0	0	0	0	0.2	0.6	0.3	0.7
Medicago lupulina	0	2	0	0	0	0	0	0	0	0	0.2	0.6	0.3	0.7
Total Introduced Annual Forbs	**2**	**4**	**2**	**2**	**2**	**0**	**2**	**6**	**4**	**0**	**2.4**	**1.8**	**2.4**	**1.3**
Melilotus officinalis	0	2	0	0	0	8	0	18	0	0	2.8	5.9	0.3	0.7
Tragopogon dubius	0	2	2	0	0	0	0	0	2	0	0.6	1.0	0.8	1.0
Total Introduced Biennial Forbs	**0**	**4**	**2**	**0**	**0**	**8**	**0**	**18**	**2**	**0**	**3.4**	**5.7**	**1.1**	**1.5**
Comandra umbellata	0	0	0	0	0	0	0	2	0	0	0.2	0.6	0.0	0.0
Grindelia squarrosa	0	6	0	0	0	0	0	4	0	0	1.0	2.2	0.8	2.1
Vicia americana	0	0	0	2	0	2	0	0	0	0	0.4	0.8	0.3	0.7
Total Native Perennial Forbs	**0**	**6**	**0**	**2**	**0**	**2**	**0**	**6**	**0**	**0**	**1.6**	**2.5**	**1.1**	**2.1**
Convolvulus arvensis	0	0	0	4	6	0	0	0	0	0	1.0	2.2	1.3	2.4
Medicago sativa	0	0	0	0	0	0	0	2	0	0	0.2	0.6	0.0	0.0
Taraxacum officinale	0	18	0	0	0	2	0	4	0	0	2.4	5.6	2.3	6.4
Total Introduced Perennial Forbs	**0**	**18**	**0**	**4**	**6**	**2**	**0**	**6**	**0**	**0**	**3.6**	**5.6**	**3.6**	**6.3**
Artemisia cana	2	0	0	0	0	0	0	0	0	0	0.2	0.6	0.3	0.7
Ericameria nauseosa	0	0	0	0	0	0	0	2	0	0	0.2	0.6	0.0	0.0
Total Native Full Shrubs	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0.4**	**0.8**	**0.3**	**0.7**
Lichen	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Fungi	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0.0**	**0.0**
Bare Ground	4	12	8	10	0	36	4	18	2	2	9.6	10.8	5.0	4.3
Litter	34	10	24	32	28	14	38	8	30	36	25.4	11.0	28.7	8.9
Rock	4	2	2	6	0	0	0	0	0	0	1.4	2.1	1.5	2.3
Total Vegetation Cover	58	76	66	52	72	50	58	74	68	62	63.6	9.1	64.8	8.0
Total Vegetation Cover w/out SLCV	54	52	64	46	66	46	58	58	68	60	57.2	7.7	58.5	7.5
Total Vegetation w/Cryptograms	58	76	66	52	72	50	58	74	68	62	63.6	9.1	64.8	8.0
Total Vegetation w/Cryptograms w/out SLCV	54	52	64	46	66	46	58	58	68	60	57.2	7.7	58.5	7.5
Total Ground Cover	96	88	92	90	100	64	96	82	98	98	90.4	10.8	95.0	4.3
Total Ground Cover w/out SLCV	92	64	90	84	94	60	96	66	98	96	84.0	14.8	88.7	11.1
No. of Species Sampled excluding SLCV	6	6	5	6	3	7	2	9	3	2	4.9	2.3	4.1	1.8
No.of Species Observed excluding SLCV	7	1	0	2	3	4	0	2	1	3	2.3	2.1	2.1	2.3
Total No. of Species excluding SLCV	13	7	5	8	6	11	2	11	4	5	7.2	3.5	6.3	3.3
Total No. of SLCV	3	4	1	2	2	1	1	1	1	2	1.8	1.0	2.0	1.1

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Riparian Woodland (RW)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number / Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																									Study Area n=25		Permit Area n=14	
	1	2	3	4*	5*	6*	7	8	9*	10	11*	12*	13	14	15*	16*	17	18*	19*	20*	21*	22	23*	24*	25	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Bromus japonicus	0	6	0	0	0	0	0	0	8	0	2	0	4	0	6	0	2	0	4	0	0	0	0	10	0	1.7	2.9	2.1	3.5
Bromus tectorum	0	0	0	0	0	0	0	0	14	0	0	0	4	0	0	0	0	0	6	0	0	0	0	2	0	1.0	3.1	1.6	3.9
Total Introduced Annual Grasses	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**22**	**0**	**2**	**0**	**8**	**0**	**6**	**0**	**2**	**0**	**10**	**0**	**0**	**0**	**0**	**12**	**0**	**2.7**	**5.4**	**3.7**	**6.6**
Elymus cinereus	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0.2	0.7	0.3	0.7
Elymus lanceolatus	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1.3	5.6	0.3	1.1
Elymus smithii	0	0	14	14	26	2	0	28	8	2	16	0	18	10	14	0	28	20	18	8	0	6	12	0	0	9.8	9.5	9.9	8.6
Elymus trachycaulus	6	0	0	0	0	2	6	0	0	0	0	0	0	0	0	2	0	0	0	0	18	0	0	0	12	1.8	4.4	1.6	4.8
Hordeum jubatum	14	0	0	0	4	18	0	2	0	0	0	14	0	0	0	0	22	0	0	40	0	0	0	0	0	4.6	9.8	5.4	11.5
Nassella viridula	0	0	0	0	0	0	0	0	14	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	1.0	3.4	1.0	3.7
Poa secunda	0	2	8	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	2.0	0.0	0.0
Total Native Cool Season Perennial Grasses	**20**	**30**	**22**	**14**	**30**	**22**	**12**	**30**	**22**	**2**	**18**	**14**	**28**	**10**	**14**	**2**	**50**	**20**	**20**	**48**	**18**	**8**	**12**	**4**	**12**	**19.3**	**12.1**	**18.5**	**11.2**
Bouteloua gracilis	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Spartina pectinata	26	0	0	0	0	16	0	0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	10	3.0	7.6	2.9	7.4
Total Native Warm Season Perennial Grasses	**26**	**0**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**24**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**3.2**	**7.5**	**2.9**	**7.4**
Agropyron cristatum	0	0	0	2	0	0	0	2	2	24	2	0	0	24	2	0	0	2	2	0	0	4	2	0	0	2.7	6.5	1.0	1.0
Bromus inermis	0	6	2	0	0	0	4	0	14	14	12	0	0	0	0	4	0	0	2	0	16	0	0	2	2	3.1	5.1	3.6	5.8
Dactylis glomerata	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0.3	1.2	0.4	1.6
Phleum pratense	0	0	0	0	0	0	0	0	6	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0.4	1.3	0.6	1.7
Poa pratensis	0	6	0	0	0	2	0	0	0	0	0	0	12	0	0	6	6	0	0	0	8	0	0	4	0	1.8	3.3	1.4	2.7
Total Introduced Perennial Grasses	**0**	**12**	**2**	**2**	**0**	**2**	**6**	**2**	**22**	**38**	**14**	**0**	**14**	**24**	**2**	**16**	**6**	**2**	**4**	**0**	**24**	**4**	**2**	**8**	**2**	**8.3**	**9.9**	**7.0**	**8.4**
Festuca spp.	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.3	1.1
Total Unknown Grass Species	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.2**	**0.8**	**0.3**	**1.1**
Carex filifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0.4	2.0	0.7	2.7
Carex nebrascensis	22	0	2	0	0	16	0	0	0	0	0	32	0	0	2	10	0	0	0	0	0	0	0	0	4	3.5	8.1	4.3	9.3
Juncus balticus	8	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.0	2.9	0.7	2.7
Schoenoplectus pungens	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Native Grasslike Species	**30**	**2**	**2**	**0**	**0**	**26**	**0**	**0**	**0**	**0**	**0**	**32**	**0**	**0**	**2**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**12**	**5.0**	**9.8**	**5.7**	**10.5**
Chenopodium berlandieri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Galium aparine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.1	0.4	0.1	0.5
Total Native Annual Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0.2**	**0.6**	**0.2**	**0.7**
Alyssum desertorum	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	2	0	0.4	1.0	0.7	1.3
Bassia sieversiana	0	0	0	0	0	2	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.2	0.6	1.7
Lepidium perfoliatum	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.2	0.6	0.1	0.5
Medicago lupulina	0	6	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.2	0.0	0.0
Thlaspi arvense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	0	0.2	0.7	0.4	0.9
Total Introduced Annual Forbs	**0**	**6**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**0**	**2**	**2**	**4**	**4**	**0**	**0**	**0**	**4**	**0**	**1.4**	**2.0**	**1.8**	**2.1**
Cynoglossum officinale	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Lactuca serriola	8	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	14	1.0	3.2	0.1	0.5
Melilotus officinalis	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2	0.7	0.0	0.0
Tragopogon dubius	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0.2	0.6	0.1	0.5
Total Introduced Biennial Forbs	**8**	**2**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**16**	**1.5**	**3.5**	**0.3**	**0.9**
Achillea millefolium	0	2	2	0	0	0	0	0	22	0	0	0	4	0	2	0	0	2	2	0	0	0	2	6	0	1.8	4.5	2.6	5.8
Asclepias speciosa	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2	0.6	0.1	0.5
Asteraceae spp.	0	0	0	0	8	0	0	6	0	0	0	0	0	0	0	0	8	0	0	4	0	0	0	0	0	1.0	2.5	0.9	2.3
Comandra umbellata	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0.3	0.9	0.3	0.7
Equisetum arvense	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Evolvulus nuttallianus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Galium boreale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5

Scanned 02-27-2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Riparian Woodland (RW)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number / Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																									Study Area n=25		Permit Area n=14	
	1	2	3	4*	5*	6*	7	8	9*	10	11*	12*	13	14	15*	16*	17	18*	19*	20*	21*	22	23*	24*	25	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Glycyrrhiza lepidota	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0.2	1.2	0.4	1.6
Grindelia squarrosa	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	8	0	0	16	0	0	0	0	0	1.5	4.4	2.1	5.5
Sphaeralcea coccinea	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Vicia americana	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Total Native Perennial Forbs	**4**	**14**	**2**	**0**	**22**	**2**	**0**	**6**	**22**	**0**	**0**	**0**	**4**	**0**	**2**	**0**	**16**	**12**	**2**	**22**	**0**	**0**	**2**	**8**	**2**	**5.8**	**7.6**	**6.6**	**9.0**
Cardaria draba	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Cirsium arvense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	2	0	0	4	0	0	0	0.4	1.0	0.4	0.9
Convolvulus arvensis	0	8	0	0	6	0	6	4	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1.1	2.3	0.7	1.7
Medicago sativa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.4	0.1	0.5
Taraxacum officinale	0	12	0	2	2	0	0	6	4	0	4	0	4	0	0	0	6	0	0	12	0	2	0	4	0	2.3	3.5	2.0	3.3
Trifolium repens	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Introduced Perennial Forbs	**0**	**22**	**0**	**2**	**8**	**0**	**6**	**10**	**6**	**0**	**4**	**0**	**4**	**0**	**2**	**2**	**6**	**2**	**6**	**12**	**0**	**6**	**0**	**4**	**0**	**4.1**	**5.1**	**3.3**	**3.5**
Astragalus spp.	10	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.8	2.5	0.1	0.5
Sonchus spp.	0	0	0	0	0	16	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	14	1.8	5.1	2.3	5.8
Total Unknown Forb Species	**10**	**0**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**22**	**2.6**	**6.4**	**2.4**	**6.2**
Artemisia cana	0	0	2	0	0	0	0	0	2	0	0	0	4	12	10	0	0	0	16	0	0	0	12	0	0	2.3	4.7	2.9	5.5
Artemisia tridentata	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.0	0.0
Atriplex canescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0.2	1.2	0.4	1.6
Rosa woodsii	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.2	0.6	0.1	0.5
Symphoricarpos albus	2	2	48	10	0	2	0	12	0	32	40	0	0	12	30	2	2	28	4	2	0	30	8	14	8	11.5	14.4	10.0	13.2
Total Native Full Shrubs	**2**	**2**	**52**	**10**	**0**	**2**	**0**	**12**	**2**	**32**	**40**	**0**	**8**	**24**	**40**	**2**	**2**	**36**	**20**	**2**	**0**	**30**	**20**	**14**	**8**	**14.4**	**15.7**	**13.4**	**15.4**
Fraxinus pennsylvanica	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	1.3	6.0	2.3	8.0
Populus deltoides	0	0	0	24	0	0	76	0	0	8	0	0	0	0	0	4	0	0	0	0	0	32	20	0	0	6.6	16.8	3.4	8.0
Salix amygdaloides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0.2	0.8	0.3	1.1
Sorbus scopulina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	0	0	0	58	0	0	0	0	4.6	15.8	8.1	20.7
Total Native Trees	**0**	**0**	**0**	**24**	**0**	**0**	**76**	**0**	**2**	**8**	**0**	**0**	**0**	**0**	**0**	**60**	**0**	**4**	**0**	**0**	**58**	**32**	**20**	**30**	**0**	**12.7**	**22.2**	**14.1**	**21.6**
Elaeagnus angustifolia	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0.6	2.8	0.1	0.5
Total Introduced Trees	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**0.6**	**2.8**	**0.1**	**0.5**
Lichen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**	**0.0**	**0.0**	**0.0**
Bare Ground	0	2	0	2	0	0	0	0	0	0	0	0	10	4	6	0	0	4	0	2	0	6	12	8	0	2.1	3.5	2.4	3.8
Litter	0	2	20	46	36	2	0	38	0	20	0	8	16	38	24	8	14	18	34	10	0	14	22	4	2	15.0	14.3	15.4	15.2
Rock	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	4.4	1.9	5.9
Total Vegetation Cover	100	96	80	52	64	98	100	62	100	80	78	92	74	58	70	92	86	78	66	88	100	80	66	88	98	82.0	14.8	80.3	15.4
Total Vegetation Cover w/out SLCV	100	82	80	52	58	92	94	58	74	80	76	86	66	58	62	90	84	72	52	88	100	76	66	76	82	76.3	14.3	74.0	15.3
Total Vegetation w/Cryptograms	100	96	80	52	64	98	100	62	100	80	78	92	74	58	70	92	86	78	66	88	100	80	66	88	98	82.0	14.8	80.3	15.4
Total Vegetation w/Cryptograms w/out SLCV	100	82	80	52	58	92	94	58	74	80	76	86	66	58	62	90	84	72	52	88	100	76	66	76	82	76.3	14.3	74.0	15.3
Total Ground Cover	100	98	100	98	100	100	100	100	100	100	100	100	90	96	94	100	100	96	100	98	100	94	88	92	100	97.9	3.5	97.6	3.8
Total Ground Cover w/out SLCV	100	84	100	98	94	94	94	96	74	100	98	94	82	96	86	98	98	90	86	98	100	90	88	80	84	92.2	7.3	91.3	7.7
No. of Species Sampled excluding SLCV	9	14	8	5	7	12	5	7	9	5	6	4	11	4	7	8	9	11	10	8	4	6	7	13	10	8.0	2.8	7.9	2.8
No. of Species Observed excluding SLCV	3	4	6	4	8	1	2	6	4	5	6	2	8	6	7	4	3	10	6	8	3	6	6	9	2	5.2	2.4	5.6	2.7
Total No. of Species excluding SLCV	12	18	14	9	15	13	7	13	13	10	12	6	19	10	14	12	12	21	16	16	7	12	13	22	12	13.1	4.0	13.5	4.5
Total No. of SLCV	0	4	1	0	1	3	1	3	4	3	2	1	2	0	2	3	2	4	4	1	0	2	1	4	2	2.0	1.4	2.1	1.5

Scanned, 02/27/2020

TFN 6 2/025
RECD NOV 14,2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																													Study Area n=30		Permit Area n=23	
	1*	2*	3*	4*	5*	7	8*	9*	10*	11	12	13	14*	15*	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30	31	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Bromus japonicus	0	0	0	2	0	10	0	0	4	0	2	2	0	14	2	0	2	6	6	2	0	2	0	0	4	4	2	2	0	6	2.4	3.3	2.3	3.2
Bromus tectorum	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	2	0	0	0	0	0	0.3	0.9	0.4	1.0
Total Introduced Annual Grasses	**0**	**0**	**2**	**2**	**0**	**10**	**0**	**0**	**4**	**0**	**2**	**2**	**0**	**14**	**2**	**0**	**2**	**6**	**10**	**4**	**0**	**2**	**0**	**0**	**6**	**4**	**2**	**2**	**0**	**6**	**2.7**	**3.5**	**2.7**	**3.5**
Achnatherum hymenoides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0.1	0.5	0.1	0.4
Elymus lanceolatus	0	0	2	0	0	0	2	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0.5	1.4	0.7	1.6
Elymus smithii	0	2	4	0	0	14	0	0	4	16	2	0	0	14	16	0	6	0	4	8	2	0	0	4	2	4	0	4	0	18	4.1	5.7	3.1	4.4
Elymus spicatus	14	10	14	2	0	4	14	12	0	2	0	0	16	0	0	14	0	24	14	14	2	14	4	2	2	4	14	2	12	0	7.0	6.9	8.3	7.1
Hesperostipa comata	0	0	0	0	0	6	0	0	0	0	0	0	2	2	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0.7	2.1	0.6	2.1
Koeleria macrantha	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Nassella viridula	0	0	0	0	0	10	2	0	2	0	2	4	0	0	2	2	0	2	0	2	0	0	6	0	0	2	0	0	4	2	1.4	2.2	0.9	1.5
Poa secunda	0	0	2	0	0	0	0	0	0	0	0	4	10	0	2	0	2	0	0	0	0	0	0	0	0	4	2	0	0	0	0.9	2.1	1.0	2.2
Total Native Cool Season Perennial Grasses	**16**	**12**	**22**	**2**	**0**	**34**	**18**	**14**	**12**	**18**	**4**	**8**	**28**	**16**	**20**	**16**	**8**	**26**	**28**	**26**	**6**	**14**	**14**	**6**	**4**	**14**	**16**	**6**	**16**	**20**	**14.8**	**8.4**	**14.8**	**8.0**
Aristida purpurea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Bouteloua gracilis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.4	0.1	0.4
Schizachyrium scoparium	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Native Warm Season Perennial Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0.3**	**0.6**	**0.2**	**0.6**
Agropyron cristatum	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Bromus inermis	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Poa bulbosa	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Introduced Perennial Grasses	**0**	**0**	**0**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.3**	**0.8**	**0.1**	**0.4**
Carex filifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.4	0.1	0.4
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.4**	**0.1**	**0.4**
Atriplex suckleyi	0	0	2	2	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7	2.9	0.9	3.3
Chenopodium berlandieri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Plantago patagonica	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.3	0.9	0.3	0.9
Total Native Annual Forbs	**0**	**0**	**2**	**2**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1.1**	**3.0**	**1.2**	**3.4**
Alyssum desertorum	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0.4	1.5	0.2	0.6
Thlaspi arvense	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Total Introduced Annual Forbs	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0.5**	**1.5**	**0.2**	**0.6**
Tragopogon dubius	0	0	2	0	0	0	2	0	0	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.3	0.8	0.3	0.7
Total Introduced Biennial Forbs	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.3**	**0.8**	**0.3**	**0.7**
Achillea millefolium	0	0	0	0	0	2	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0.4	1.0	0.1	0.4
Comandra umbellata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	4	0	0.3	0.9	0.2	0.6
Dalea candida	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8	0.3	0.9
Dalea purpurea	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.1	0.5	0.2	0.6
Eriogonum pauciflorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0.1	0.7	0.2	0.8
Evolvulus nuttallianus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0.2	1.1	0.3	1.3
Gaura coccinea	2	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.6	0.2	0.6
Grindelia squarrosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.5	0.2	0.6
Heterotheca villosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.1	0.4	0.1	0.4
Machaeranthera tanacetifolia	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Musineon divaricatum	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.5	0.1	0.4
Pediomelum argophyllum	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.5	0.2	0.6
Pediomelum esculentum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0.2	1.1	0.3	1.3

Scanned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																													Study Area n=30		Permit Area n=23	
	1*	2*	3*	4*	5*	7	8*	9*	10*	11	12	13	14*	15*	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30	31	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Phlox hoodii	2	0	4	0	0	0	0	4	0	0	0	0	2	0	2	0	0	0	2	0	0	0	6	0	6	4	0	2	6	0	1.3	2.1	1.5	2.0
Psoralidium tenuiflorum	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	4	8	0	10	0	0	0	0	2	0	2	0	1.1	2.4	1.3	2.7
Ratibida columnifera	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5	0.0	0.0
Sphaeralcea coccinea	0	0	0	0	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	2	0	0	0	0	2	2	0	2	0	0	0.5	0.9	0.5	0.9
Thermopsis rhombifolia	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0.2	0.6	0.2	0.6
Vicia americana	0	0	0	0	0	2	0	0	2	0	2	0	0	4	2	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0.5	1.0	0.5	1.1
Total Native Perennial Forbs	**4**	**6**	**8**	**0**	**2**	**8**	**4**	**4**	**2**	**4**	**6**	**2**	**2**	**8**	**8**	**0**	**4**	**8**	**8**	**10**	**0**	**18**	**8**	**4**	**16**	**10**	**4**	**4**	**14**	**4**	**5.9**	**4.5**	**6.5**	**4.5**
Cirsium arvense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0.1	0.7	0.2	0.8
Convolvulus arvensis	0	0	2	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.5	1.9	0.6	2.1
Total Introduced Perennial Forbs	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.6**	**2.0**	**0.8**	**2.2**
Cirsium spp.	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Total Unknown Forb Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.4**	**0.1**	**0.4**
Artemisia cana	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.1	0.1	0.4
Artemisia tridentata	2	20	0	4	0	2	0	0	10	12	8	16	14	0	2	18	4	12	0	2	20	4	10	4	28	26	30	22	16	0	9.5	9.4	9.2	10.1
Atriplex canescens	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.0	0.0
Ericameria nauseosa	0	0	0	0	0	2	0	0	0	0	4	0	0	0	2	0	6	0	0	0	0	0	0	4	0	0	0	0	0	0	0.6	1.5	0.5	1.5
Rhus aromatica	0	2	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.5	0.4	1.7
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Rosa woodsii	2	0	2	0	0	0	0	0	0	2	4	0	0	0	0	0	8	0	0	0	0	0	0	0	2	0	0	0	0	0	0.7	1.7	0.6	1.8
Sarcobatus vermiculatus	0	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	4	0.9	2.4	0.5	1.8
Total Native Full Shrubs	**4**	**22**	**2**	**12**	**4**	**4**	**0**	**0**	**10**	**18**	**16**	**22**	**22**	**0**	**4**	**20**	**18**	**12**	**0**	**4**	**30**	**4**	**10**	**8**	**30**	**26**	**30**	**22**	**16**	**4**	**12.5**	**10.0**	**11.4**	**10.1**
Artemisia frigida	0	0	0	0	0	0	2	12	2	4	2	0	6	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	2	0	1.1	2.5	1.1	2.8
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.7	0.0	0.0
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4	0.0	0.0
Atriplex gardneri	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Gutierrezia sarothrae	4	0	0	0	0	0	4	8	0	0	0	2	0	0	2	0	0	0	0	0	0	2	2	0	0	0	0	2	4	2	1.1	1.9	1.0	2.0
Total Native Half &Sub-Shrubs	**4**	**0**	**0**	**0**	**2**	**0**	**6**	**20**	**2**	**8**	**2**	**2**	**6**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**4**	**6**	**4**	**2.5**	**4.0**	**2.2**	**4.3**
Juniperus scopulorum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.4	0.1	0.4
Total Native Trees	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.4**	**0.1**	**0.4**
Lichen	0	0	0	0	0	0	6	0	0	0	4	0	0	0	2	0	0	0	0	0	0	2	12	0	2	2	4	0	4	4	1.4	2.6	1.3	2.8
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**12**	**0**	**2**	**2**	**4**	**0**	**4**	**4**	**1.4**	**2.6**	**1.3**	**2.8**
Bare Ground	32	24	20	66	52	12	12	18	34	38	50	50	4	26	48	48	56	26	30	38	36	12	10	60	18	6	6	26	20	36	30.3	17.4	29.0	18.4
Litter	18	10	10	14	10	14	40	24	18	4	10	10	12	22	10	14	8	10	18	8	6	32	30	4	8	26	22	28	16	20	15.7	8.9	17.0	9.4
Rock	22	26	30	2	14	6	10	20	16	8	4	0	26	2	0	2	4	12	2	6	20	14	10	16	10	10	16	8	8	0	10.8	8.4	12.0	8.6
Total Vegetation Cover	28	40	40	18	24	68	32	38	32	50	32	40	58	50	40	36	32	52	50	48	38	40	38	20	62	56	52	38	52	40	41.8	12.0	40.7	11.9
Total Vegetation Cover w/out SLCV	28	40	36	16	24	58	32	38	28	50	30	38	58	26	38	36	30	46	40	42	38	38	34	20	56	52	50	36	52	34	38.1	10.9	37.4	10.8
Total Vegetation w/Cryptograms	28	40	40	18	24	68	38	38	32	50	36	40	58	50	42	36	32	52	50	48	38	42	50	20	64	58	56	38	56	44	43.2	12.3	42.0	12.4
Total Vegetation w/Cryptograms w/out SLCV	28	40	36	16	24	58	38	38	28	50	34	38	58	26	40	36	30	46	40	42	38	40	46	20	58	54	54	36	56	38	39.5	11.3	38.7	11.5
Total Ground Cover	68	76	80	34	48	88	88	82	66	62	50	50	96	74	52	52	44	74	70	62	64	88	90	40	82	94	94	74	80	64	69.7	17.4	71.0	18.4
Total Ground Cover w/out SLCV	68	76	76	32	48	78	88	82	62	62	48	48	96	50	50	52	42	68	60	56	64	86	86	40	76	90	92	72	80	58	66.0	17.3	67.7	18.6
No. of Species Sampled	7	7	10	4	4	13	9	5	7	10	9	9	7	6	11	4	7	6	8	9	6	6	7	6	11	10	5	7	9	8	7.6	2.3	7.1	2.1

S ined, 02/27/2020

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RECD NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Cover Sample Data
Sample Date: 7/01-12/2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																															Study Area n=30		Permit Area n=23	
	1*	2*	3*	4*	5*	7	8*	9*	10*	11	12	13	14*	15*	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30	31	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
excluding SLCV																																		
No.of Species Observed excluding SLCV	13	9	15	11	7	5	7	12	11	5	7	12	5	3	4	10	9	4	3	9	7	12	8	5	7	6	14	11	4	4	8.0	3.5	8.5	3.6
Total No. of Species excluding SLCV	20	16	25	15	11	18	16	17	18	15	16	21	12	9	15	14	16	10	11	18	13	18	15	11	18	16	19	18	13	12	15.5	3.6	15.6	3.7
Total No. of SLCV	1	1	2	1	0	1	1	2	1	2	1	2	0	3	2	1	2	1	2	3	1	1	3	0	2	1	1	2	0	2	1.4	0.9	1.4	0.9

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TFN 6 2/025
DEQ NOV 14, 2014

RAMACO
Polygon: Scoria Grassland (SG)
Cover Sample Data
Sample Date: 7/01-12//2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																											Study Area and Permit Area n=28	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	Mean Absolute	Standard Deviation
Echinochloa muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.1	0.8
Vulpia octoflora	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Annual Grasses	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0.2**	**0.8**
Bromus japonicus	0	0	0	6	2	0	2	0	18	8	6	10	0	6	2	0	0	6	0	0	6	0	10	0	0	0	0	0	2.9	4.5
Bromus tectorum	28	24	8	22	14	34	18	2	6	22	26	4	12	4	0	36	20	18	36	10	24	0	36	52	0	36	26	8	18.8	13.8
Total Introduced Annual Grasses	**28**	**24**	**8**	**28**	**16**	**34**	**20**	**2**	**24**	**30**	**32**	**14**	**12**	**10**	**2**	**36**	**20**	**24**	**36**	**10**	**30**	**0**	**46**	**52**	**0**	**36**	**26**	**8**	**21.7**	**13.9**
Elymus lanceolatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0.1	0.8
Elymus smithii	0	6	4	0	18	0	2	14	2	2	12	2	0	2	0	0	0	0	0	2	2	0	0	0	4	6	0	0	2.8	4.6
Elymus spicatus	8	2	10	12	2	0	6	16	8	0	2	6	0	16	12	0	8	10	8	0	0	18	4	6	22	0	0	2	6.4	6.3
Hesperostipa comata	0	2	4	0	0	2	2	0	14	0	0	4	20	0	6	0	0	14	2	8	16	4	10	0	2	0	4	8	4.4	5.7
Koeleria macrantha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.4
Nassella viridula	0	0	0	0	0	0	0	6	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	14	0	0	0	0.9	2.9
Poa secunda	0	0	0	0	0	2	0	6	4	0	0	4	0	6	8	2	2	0	0	4	0	0	0	0	0	0	0	4	1.5	2.3
Total Native Cool Season Perennial Grasses	**8**	**10**	**18**	**12**	**20**	**4**	**10**	**42**	**28**	**2**	**14**	**16**	**20**	**26**	**26**	**2**	**10**	**24**	**10**	**16**	**20**	**22**	**14**	**6**	**48**	**6**	**4**	**14**	**16.2**	**11.1**
Aristida purpurea	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	2	0	0.4	1.0
Bouteloua gracilis	0	0	0	0	0	0	2	0	0	0	6	2	0	0	4	0	0	2	0	4	0	0	0	0	0	0	0	0	0.7	1.6
Total Native Warm Season Perennial Grasses	**0**	**2**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**6**	**2**	**0**	**0**	**8**	**0**	**0**	**2**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**1.1**	**2.0**
Bromus inermis	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Festuca ovina	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.4	1.9
Total Introduced Perennial Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.5**	**1.9**
Carex filifolia	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Total Native Grasslike Species	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.5**
Helianthus annuus	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Lappula redowskii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Annual Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.2**	**0.5**
Alyssum desertorum	0	0	0	4	2	0	0	0	2	0	0	2	0	2	0	2	0	0	0	2	0	0	4	0	0	0	0	0	0.7	1.2
Camelina microcarpa	0	0	0	4	4	0	0	0	6	0	0	0	0	0	0	6	0	0	0	0	0	0	2	0	0	2	0	0	0.9	1.8
Descurainia sophia	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Lepidium perfoliatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.4
Medicago lupulina	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Sisymbrium altissimum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	2	0	0.3	1.2
Total Introduced Annual Forbs	**0**	**2**	**2**	**10**	**8**	**0**	**0**	**0**	**8**	**0**	**0**	**2**	**0**	**2**	**0**	**8**	**0**	**0**	**6**	**2**	**0**	**0**	**8**	**0**	**0**	**2**	**2**	**0**	**2.2**	**3.2**
Melilotus officinalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Tragopogon dubius	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0.3	0.9
Total Introduced Biennial Forbs	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0.4**	**1.0**
Achillea millefolium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Ambrosia tomentosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Comandra umbellata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.4
Dalea purpurea	0	0	4	2	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6	0	1.0	2.5
Evolvulus nuttallianus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	4	0	0.3	0.9
Galium boreale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Gaura coccinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.4
Glycyrrhiza lepidota	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.4
Heterotheca villosa	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.8
Lactuca oblongifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	4	0.4	1.1

S nned, 02/27/2020

TFN 6 2/025
DECD NOV 14, 2014

RAMACO
Polygon: Scoria Grassland (SG)
Cover Sample Data
Sample Date: 7/01-12//2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																											Study Area and Permit Area n=28	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	Mean Absolute	Standard Deviation
Pediomelum argophyllum	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0.3	1.2
Pediomelum esculentum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0.2	0.8
Phlox hoodii	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Psoralidium tenuiflorum	4	0	4	2	0	0	2	0	4	0	0	0	0	2	0	0	0	0	0	0	2	4	4	0	0	2	0	0	1.1	1.6
Ratibida columnifera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.4
Sphaeralcea coccinea	0	0	8	0	8	0	2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	2	2	0	0	4	0	0	1.1	2.2
Thermopsis rhombifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0.1	0.4
Vicia americana	0	0	4	0	0	0	0	0	2	2	0	0	0	6	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.6	1.4
Total Native Perennial Forbs	**4**	**2**	**26**	**4**	**8**	**0**	**14**	**2**	**6**	**2**	**0**	**2**	**2**	**8**	**2**	**2**	**0**	**6**	**10**	**0**	**8**	**12**	**8**	**0**	**2**	**12**	**14**	**6**	**6.1**	**5.9**
Convolvulus arvensis	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2	6.4
Total Introduced Perennial Forbs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**34**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.2**	**6.4**
Astragalus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.1	0.4
Total Unknown Forb Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0.1**	**0.4**
Artemisia cana	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.5
Artemisia tridentata	14	0	0	0	0	4	2	14	0	0	6	2	0	14	0	0	10	2	0	30	2	8	0	0	0	2	0	6	4.1	6.9
Rhus aromatica	2	6	0	8	0	14	0	2	0	26	0	0	0	0	6	6	0	0	2	0	0	2	0	10	0	0	0	0	3.0	5.8
Total Native Full Shrubs	**16**	**6**	**0**	**8**	**8**	**18**	**2**	**16**	**0**	**26**	**6**	**2**	**0**	**14**	**6**	**6**	**10**	**2**	**2**	**30**	**2**	**10**	**0**	**10**	**0**	**2**	**0**	**6**	**7.4**	**7.9**
Artemisia frigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	2	0	0.2	0.6
Gutierrezia sarothrae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4	0	0	0	0	0	0	0.2	0.8
Linanthus pungens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.4
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0.2	0.8
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**2**	**0**	**4**	**2**	**0**	**0**	**2**	**2**	**0**	**0.7**	**1.7**
Lichen	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.3	0.9
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.4
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**4**	**0.4**	**1.0**
Bare Ground	6	14	14	8	12	12	4	12	4	12	4	20	16	2	10	0	4	12	10	12	12	28	4	32	14	12	8	10	10.8	7.1
Litter	10	36	12	8	22	14	28	18	24	24	38	20	8	16	10	24	22	18	22	16	22	22	10	0	16	20	40	36	19.7	9.6
Rock	28	4	18	18	4	18	8	6	6	4	0	18	6	22	26	22	32	8	4	8	6	2	8	0	18	2	0	12	11.0	9.2
Total Vegetation Cover	56	46	56	66	62	56	58	64	66	60	58	40	70	60	54	54	42	62	64	64	60	48	78	68	50	66	52	38	58.1	9.3
Total Vegetation Cover w/out SLCV	28	22	48	38	46	22	38	62	42	30	26	26	24	50	52	18	22	38	28	54	30	46	32	16	50	30	26	30	34.8	12.2
Total Vegetation w/Cryptograms	56	46	56	66	62	56	60	64	66	60	58	42	70	60	54	54	42	62	64	64	60	48	78	68	52	66	52	42	58.5	8.9
Total Vegetation w/Cryptograms w/out SLCV	28	22	48	38	46	22	40	62	42	30	26	28	24	50	52	18	22	38	28	54	30	46	32	16	52	30	26	34	35.2	12.3
Total Ground Cover	94	86	86	92	88	88	96	88	96	88	96	80	84	98	90	100	96	88	90	88	88	72	96	68	86	88	92	90	89.2	7.1
Total Ground Cover w/out SLCV	66	62	78	64	72	54	76	86	72	58	64	66	38	88	88	64	76	64	54	78	58	70	50	16	86	52	66	82	65.9	15.9
No. of Species Sampled excluding SLCV	4	7	11	9	8	4	9	8	8	3	4	9	3	8	11	5	4	7	8	8	6	9	9	2	7	11	8	7	7.0	2.5
No.of Species Observed excluding SLCV	8	5	9	7	2	7	7	7	10	16	3	4	4	16	10	4	3	6	7	2	5	4	5	2	18	5	3	9	6.7	4.2
Total No. of Species excluding SLCV	12	12	20	16	10	11	16	15	18	19	7	13	7	24	21	9	7	13	15	10	11	13	14	4	25	16	11	16	13.8	5.1
Total No. of SLCV	1	2	1	2	2	1	2	1	2	2	2	2	2	2	2	2	1	2	1	1	2	2	2	2	2	1	2	2	1.7	0.5

S nned, 02/27/2020

TFN 6 2/025
IECD NOV 14, 2014

RAMACO
Polygon: Upland Grassland (UG)
Cover Sample Data
Date: 7/01-12//2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																										Study Area and Permit Area n=28	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	Mean Absolute	Standard Deviation
Cenchrus longispinus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0		0.1	0.8
Echinochloa muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	4	0	0	0	0	2	4	0.6	1.3
Vulpia octoflora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.4
Total Native Annual Grasses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**4**	**4**	**0**	**0**	**0**	**2**	**6**	**4**	**0.8**	**1.7**
Bromus japonicus	2	0	2	0	6	0	2	6	0	2	4	0	2	4	0	16	2	0	20	0	4	8	26	4	4	0	12	8	4.8	6.5
Bromus tectorum	8	0	2	0	0	6	40	12	40	28	0	0	6	6	34	0	34	0	52	36	0	8	0	0	0	38	10	6	13.1	16.6
Total Introduced Annual Grasses	**10**	**0**	**4**	**0**	**6**	**6**	**42**	**18**	**40**	**30**	**4**	**0**	**8**	**10**	**34**	**16**	**36**	**0**	**72**	**36**	**4**	**16**	**26**	**4**	**4**	**38**	**22**	**14**	**17.9**	**17.6**
Elymus lanceolatus	0	0	0	2	0	0	0	0	0	0	2	8	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0.6	1.6
Elymus smithii	2	46	18	16	4	28	4	22	0	2	32	0	2	0	18	16	2	4	2	4	0	4	14	26	6	18	2	0	10.4	12.0
Elymus spicatus	24	0	2	0	0	0	0	0	10	10	0	0	2	12	0	4	0	2	0	8	12	8	0	0	4	0	10	2	3.9	5.8
Elymus trachycaulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0.1	0.4
Hesperostipa comata	0	0	0	4	0	0	6	0	12	20	0	0	10	12	0	0	12	10	4	0	16	12	4	0	8	0	8	12	5.4	6.0
Nassella viridula	4	6	2	0	0	0	0	0	0	0	0	0	0	2	0	4	0	8	0	0	0	0	4	0	0	0	0	2	1.1	2.1
Poa secunda	0	0	8	18	2	0	0	0	0	0	14	12	6	0	0	0	0	16	0	0	0	0	0	0	2	0	2	0	2.9	5.5
Total Native Cool Season Perennial Grasses	**30**	**52**	**30**	**40**	**6**	**28**	**10**	**22**	**22**	**32**	**48**	**20**	**20**	**26**	**18**	**24**	**14**	**42**	**6**	**16**	**28**	**24**	**22**	**26**	**20**	**18**	**22**	**16**	**24.4**	**11.1**
Aristida purpurea	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.5
Bouteloua gracilis	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4	0	2	0	4	0	0	0	0.5	1.2
Distichlis stricta	0	0	0	4	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	1.7
Total Native Warm Season Perennial Grasses	**0**	**0**	**2**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**2**	**0**	**4**	**0**	**0**	**2**	**1.0**	**2.0**
Agropyron cristatum	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0.3	0.9
Poa bulbosa	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Introduced Perennial Grasses	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0.4**	**1.1**
Carex filifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.4
Total Native Grasslike Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.4**
Erigeron strigosus	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Lappula redowskii	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Plantago patagonica	0	0	0	4	2	0	0	0	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	1.7
Total Native Annual Forbs	**0**	**0**	**0**	**4**	**2**	**0**	**2**	**2**	**0**	**0**	**0**	**10**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.8**	**2.1**
Alyssum desertorum	0	0	0	0	4	0	0	0	2	6	0	2	2	2	4	0	2	0	0	2	0	0	0	8	0	0	2	0	1.3	2.1
Camelina microcarpa	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.1	0.5
Sisymbrium altissimum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	6	0	0	2	0	0	0	0	0	0	0	0	0.4	1.2
Thlaspi arvense	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5
Total Introduced Annual Forbs	**0**	**2**	**0**	**2**	**4**	**0**	**0**	**2**	**2**	**6**	**0**	**2**	**2**	**2**	**6**	**0**	**8**	**0**	**0**	**4**	**0**	**0**	**0**	**8**	**0**	**0**	**4**	**0**	**1.9**	**2.5**
Melilotus officinalis	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0.2	0.6
Tragopogon dubius	0	0	2	0	0	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0.4	1.0
Total Introduced Biennial Forbs	**0**	**2**	**2**	**0**	**2**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0.6**	**1.1**
Achillea millefolium	0	6	0	0	0	0	2	2	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0.6	1.4
Evolvulus nuttallianus	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Gaura coccinea	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Grindelia squarrosa	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0.1	0.5
Lactuca oblongifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4
Lygodesmia juncea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0.1	0.4
Musineon divaricatum	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.8
Sedionella pinnata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	2	0	0	0	0	0	0.2	0.6
Phlox hoodii	0	0	0	0	0	2	4	0	0	0	0	0	2	0	4	0	2	0	0	6	2	0	0	2	0	0	2	0	0.9	1.6
Psoralidium tenuiflorum	0	6	2	0	0	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0.5	1.3

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TFN 6 2/025
RECD NOV 14,2014

RAMACO
Polygon: Upland Grassland (UG)
Cover Sample Data
Date: 7/01-12//2013
Point Line Intercept Method

Plant Species	Sample Number Cover (*Denotes Sample Location Used to Calculate Permit Area Values)																											Study Area and Permit Area n=28	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	Mean Absolute	Standard Deviation
Sphaeralcea coccinea	8	0	0	0	0	0	0	0	0	2	0	0	0	2	4	2	0	0	0	4	0	0	0	0	0	0	0	0	0.8	1.8
Symphyotrichum falcatum	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.1	0.5
Vicia americana	0	0	2	0	0	0	0	0	4	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2	0	0.5	1.0
Zigadenus venenosus	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Perennial Forbs	**8**	**12**	**4**	**0**	**4**	**4**	**6**	**2**	**6**	**4**	**0**	**6**	**4**	**8**	**4**	**10**	**2**	**4**	**0**	**8**	**8**	**6**	**2**	**0**	**4**	**2**	**2**	**2**	**4.3**	**3.1**
Convolvulus arvensis	0	8	0	0	0	6	2	18	4	0	4	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	1.7	3.8
Taraxacum officinale	0	4	0	0	0	0	6	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	1.5
Total Introduced Perennial Forbs	**0**	**12**	**0**	**0**	**0**	**6**	**8**	**22**	**4**	**0**	**6**	**0**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2.3**	**4.9**
Astragalus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	0.2	0.8
Cirsium spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Lappula spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4
Polygonum spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Unknown Forb Species	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**4**	**0**	**0**	**2**	**0.5**	**1.1**
Artemisia cana	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0.3	1.0
Artemisia tridentata	0	0	4	0	0	10	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	6	0	0	0	0	0.9	2.3
Rhus aromatica	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0.2	0.6
Ribes cereum	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Sarcobatus vermiculatus	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Symphoricarpos spp.	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	0.5
Total Native Full Shrubs	**4**	**0**	**4**	**0**	**0**	**14**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**4**	**0**	**2**	**0**	**6**	**2**	**0**	**2**	**0**	**1.7**	**2.9**
Artemisia frigida	0	0	2	2	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	0	2	2	0	0	6	0	0	0	0.8	1.4
Gutierrezia sarothrae	0	2	0	0	2	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	1.2
Total Native Half &Sub-Shrubs	**0**	**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**2**	**0**	**2**	**2**	**0**	**2**	**0**	**0**	**2**	**2**	**0**	**0**	**6**	**0**	**0**	**0**	**1.2**	**1.7**
Opuntia polyacantha	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Total Native Succulents	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.1**	**0.4**
Lichen	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0.2	0.8
Fungi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Moss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0
Total Cryptograms	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0.2**	**0.8**
Bare Ground	8	12	6	22	42	2	4	4	4	2	4	28	12	6	6	6	6	12	0	2	10	6	4	6	22	14	8	4	9.3	9.2
Litter	26	6	46	24	30	28	28	28	18	20	28	20	38	42	22	30	22	34	20	24	22	22	44	44	28	22	30	46	28.2	9.6
Rock	14	0	0	2	2	8	0	0	0	4	8	4	0	2	4	8	4	6	2	6	16	16	0	0	2	4	2	10	4.3	4.8
Total Vegetation Cover	52	82	48	52	26	62	68	68	78	74	60	46	50	50	68	56	68	48	78	68	52	56	52	46	48	60	60	40	58.0	12.7
Total Vegetation Cover w/out SLCV	42	74	44	52	20	50	24	32	34	44	52	46	42	40	30	38	32	48	6	32	48	40	26	42	44	22	38	26	38.1	13.0
Total Vegetation w/Cryptograms	52	82	48	52	26	62	68	68	78	74	60	48	50	50	68	56	68	48	78	68	52	56	52	50	48	60	60	40	58.2	12.5
Total Vegetation w/Cryptograms w/out SLCV	42	74	44	52	20	50	24	32	34	44	52	48	42	40	30	38	32	48	6	32	48	40	26	46	44	22	38	26	38.3	13.1
Total Ground Cover	92	88	94	78	58	98	96	96	96	98	96	72	88	94	94	94	94	88	100	98	90	94	96	94	78	86	92	96	90.7	9.2
Total Ground Cover w/out SLCV	82	80	90	78	52	86	52	60	52	68	88	72	80	84	56	76	58	88	28	62	86	78	70	90	74	48	70	82	70.8	15.5
No. of Species Sampled excluding SLCV	6	8	10	8	8	7	6	5	6	7	5	9	11	10	5	9	9	9	2	10	8	10	5	4	11	3	11	7	7.5	2.5
No.of Species Observed excluding SLCV	2	5	11	9	5	9	8	7	7	13	12	11	10	5	6	9	10	5	8	2	6	13	2	6	10	6	4	10	7.5	3.2
Total No. of Species excluding SLCV	8	13	21	17	13	16	14	12	13	20	17	20	21	15	11	18	19	14	10	12	14	23	7	10	21	9	15	17	15.0	4.3
Total No. of SLCV	2	3	2	1	2	3	3	5	3	2	2	2	2	2	2	2	2	2	2	2	1	4	1	1	1	1	2	2	2.1	0.9

Scanned 02/27/2020

TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/27/2020

ATTACHMENT D8-1-I

Raw Production Data

TFN 6 2/025
RECD NOV 14,2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)															
	1	2	3*	4*	5*	24*	25*	26*	27*	28*	29*	30	31*	32*	33*	34*
Vulpia octoflora	11.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.76	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Grasses	**11.59**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.76**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Bromus japonicus	46.44	1.74	0.00	0.00	1.02	1.76	0.03	0.00	0.06	0.00	0.03	3.50	1.91	0.24	0.03	6.42
Bromus tectorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.84	0.00	0.00	0.00	2.15	0.00	0.00
Total Introduced Annual Grasses	**46.44**	**1.74**	**0.00**	**0.00**	**1.02**	**1.76**	**0.03**	**0.00**	**0.06**	**42.84**	**0.03**	**3.50**	**1.91**	**2.39**	**0.03**	**6.42**
Achnatherum hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus smithii	42.54	0.91	0.00	0.00	0.00	3.96	0.00	0.00	0.00	0.00	0.00	6.19	3.31	2.24	0.00	0.00
Elymus spicatus	0.00	0.00	10.35	20.27	7.97	5.94	6.85	4.06	1.40	0.00	21.37	9.29	23.20	0.75	23.84	25.65
Festuca idahoensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperostipa comata	0.00	3.63	0.00	13.51	31.88	3.96	6.85	0.00	8.42	20.35	0.00	0.00	0.00	4.47	0.00	0.00
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	5.94	0.00	0.00	0.00	0.00	2.37	0.00	6.63	0.00	0.03	0.00
Total Native Cool Season Perennial Grasses	**42.54**	**4.54**	**10.35**	**33.78**	**39.85**	**19.81**	**13.70**	**4.06**	**14.03**	**20.35**	**23.74**	**15.48**	**33.14**	**7.45**	**23.87**	**25.65**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bouteloua gracilis	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.88
Total Native Warm Season Perennial Grasses	**2.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.88**
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromus inermis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa bulbosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**13.02**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.33**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Lappula redowskii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plantago patagonica	5.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.47	0.38	0.03	0.00	0.00
Total Native Annual Forbs	**5.41**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.47**	**0.38**	**0.03**	**0.00**	**0.00**
Alyssum desertorum	0.00	0.03	0.76	0.00	1.30	2.37	0.03	0.00	0.03	0.00	0.03	0.00	7.25	0.03	0.03	2.69
Camelina microcarpa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia sophia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.05	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Annual Forbs	**0.00**	**0.03**	**0.76**	**0.00**	**1.30**	**2.37**	**0.03**	**0.00**	**0.03**	**13.05**	**0.03**	**0.00**	**7.25**	**0.03**	**0.03**	**2.69**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	1.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.51	0.00	0.00	0.00	1.10
Total Introduced Biennial Forbs	**1.56**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.51**	**0.00**	**0.00**	**0.00**	**1.10**
Achillea millefolium	0.00	1.32	0.00	0.00	0.00	1.08	0.00	0.00	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.19	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comandra umbellata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	0.00	9.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	0.00	3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Heterotheca villosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lygodesmia juncea	0.00	0.00	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mertensia ciliata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00
Pediomelum anaphalloides	0.00	0.00	0.00	0.00	0.00	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00

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TFN 6 2/025
DECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)															
Psoralidium tenuiflorum	3.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	16.17	0.00	0.00	0.03	0.03	0.00
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thermopsis rhombifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.89	0.00	0.00	0.00	0.00
Vicia americana	0.00	0.00	0.00	0.00	0.00	2.51	0.00	0.00	0.00	0.00	0.00	2.11	0.00	0.00	0.00	0.00
Total Native Perennial Forbs	**3.87**	**1.32**	**2.31**	**9.85**	**0.00**	**8.86**	**9.09**	**0.00**	**1.52**	**4.19**	**16.17**	**5.00**	**1.28**	**0.12**	**0.03**	**0.00**
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Production	**113.52**	**7.63**	**13.42**	**43.63**	**42.17**	**32.80**	**27.19**	**17.08**	**15.64**	**85.19**	**39.97**	**29.96**	**43.96**	**10.02**	**23.96**	**38.74**

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TFN 6 2/025
CD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46*	47*	48*	49*	50*
Vulpia octoflora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Bromus japonicus	0.03	0.06	0.03	3.38	8.37	0.00	0.00	0.03	0.00	0.00	32.26	0.06	0.71	1.08	29.71	6.77
Bromus tectorum	0.00	0.00	0.00	2.25	12.55	11.72	1.57	0.00	0.00	0.00	8.06	0.00	4.03	0.00	0.00	0.00
Total Introduced Annual Grasses	**0.03**	**0.06**	**0.03**	**5.63**	**20.92**	**11.72**	**1.57**	**0.03**	**0.00**	**0.00**	**40.32**	**0.06**	**4.74**	**1.08**	**29.71**	**6.77**
Achnatherum hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.11	0.00	0.00	0.00	0.00	0.00
Elymus smithii	1.52	0.00	3.63	0.00	4.20	0.00	13.19	0.00	0.00	2.57	2.55	0.00	0.00	0.00	48.95	0.00
Elymus spicatus	10.62	6.17	7.86	0.00	18.90	10.80	0.00	45.98	5.22	23.13	0.00	7.04	15.15	20.20	0.00	45.47
Festuca idahoensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperostipa comata	0.00	14.39	0.00	2.94	0.00	43.20	0.00	0.00	7.82	0.00	2.55	7.04	11.99	0.00	0.00	8.53
Nassella viridula	0.00	0.00	0.00	0.00	18.90	0.00	0.00	9.20	0.00	0.00	0.00	0.00	0.00	0.00	5.44	2.84
Poa secunda	1.52	0.00	0.60	0.00	0.00	0.00	0.00	6.13	0.00	0.00	2.55	0.00	2.77	0.00	0.00	0.00
Total Native Cool Season Perennial Grasses	**13.65**	**20.55**	**12.09**	**2.94**	**42.01**	**54.00**	**13.19**	**61.31**	**13.04**	**25.70**	**12.77**	**14.07**	**29.91**	**20.20**	**54.39**	**56.84**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.81	0.00	0.00	0.00	0.00
Bouteloua gracilis	4.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**4.09**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**8.81**	**0.00**	**0.00**	**0.00**	**0.00**
Agropyron cristatum	1.52	3.13	0.00	0.00	0.00	0.00	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromus inermis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa bulbosa	0.00	0.03	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Grasses	**1.52**	**3.16**	**0.00**	**0.00**	**0.00**	**0.00**	**3.81**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Lappula redowskii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00
Plantago patagonica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.22**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Alyssum desertorum	0.03	0.03	0.00	8.20	12.05	0.00	3.92	0.03	0.00	2.81	0.00	0.09	0.03	2.63	0.06	3.06
Camelina microcarpa	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia sophia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Annual Forbs	**0.03**	**0.03**	**0.00**	**8.20**	**12.63**	**0.00**	**3.92**	**0.03**	**0.00**	**2.81**	**0.00**	**0.09**	**0.03**	**2.63**	**0.06**	**3.06**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	1.59	0.00	0.00	0.00	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Biennial Forbs	**0.00**	**0.00**	**1.59**	**0.00**	**0.00**	**0.00**	**1.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	3.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comandra umbellata	0.00	0.00	0.00	0.00	0.00	0.00	4.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	5.64	0.00	0.00	0.00	0.68	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00
Heterotheca villosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.86	0.00	0.00	0.00	0.00	0.00
Lygodesmia juncea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mertensia ciliata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum esculentum	5.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.95
Phlox hoodii	2.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00

Scanned, 02/27/2020

TFN 6 2/025
DEQ NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46*	47*	48*	49*	50*
Psoralidium tenuiflorum	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sphaeralcea coccinea	0.00	0.00	2.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.33	0.00	0.00
Thermopsis rhombifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vicia americana	3.09	0.03	0.00	0.00	0.00	0.00	0.00	1.59	0.00	2.12	0.00	0.00	0.00	1.70	0.00	7.06
Total Native Perennial Forbs	**10.31**	**0.12**	**2.95**	**1.30**	**3.81**	**0.00**	**4.74**	**1.65**	**8.96**	**2.12**	**4.86**	**0.03**	**1.70**	**17.03**	**0.00**	**10.01**
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.45	0.00
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5.45**	**0.00**
Total Production	**29.63**	**23.92**	**16.66**	**18.07**	**79.37**	**65.72**	**28.65**	**63.02**	**22.00**	**30.63**	**59.17**	**23.06**	**36.38**	**40.94**	**89.61**	**76.68**

S ined, 02/27/2020

TFN 6 2/025
ECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)															
	51	52*	53*	54*	55	56*	57*	58*	59*	60	61*	62*	63*	64	65*	66*
Vulpia octoflora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Bromus japonicus	3.86	9.31	4.02	0.00	9.55	0.00	0.00	0.03	0.00	0.00	4.42	0.00	1.55	4.54	1.35	0.00
Bromus tectorum	0.00	0.00	0.45	0.00	6.36	0.03	0.00	0.03	11.22	4.80	0.00	0.00	13.91	0.00	3.16	1.82
Total Introduced Annual Grasses	**3.86**	**9.31**	**4.47**	**0.00**	**15.91**	**0.03**	**0.00**	**0.06**	**11.22**	**4.80**	**4.42**	**0.00**	**15.46**	**4.54**	**4.51**	**1.82**
Achnatherum hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus smithii	9.99	1.40	2.20	0.00	6.59	0.00	0.00	2.49	0.00	14.17	0.00	13.71	2.52	29.02	0.00	0.00
Elymus spicatus	0.00	9.81	0.00	0.00	0.00	11.27	9.24	11.20	0.00	0.00	0.00	0.00	2.52	0.00	8.02	7.83
Festuca idahoensis	0.00	0.00	0.00	0.00	12.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperostipa comata	0.00	8.41	0.00	0.00	0.00	3.76	0.00	11.20	18.28	0.00	0.00	13.71	0.00	0.00	12.03	0.00
Nassella viridula	0.00	8.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.74	8.95	0.00	0.00	0.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	3.24	0.00	0.00	0.00	0.00	0.00	1.57	0.00	6.86	0.00	2.16	0.00	0.00
Total Native Cool Season Perennial Grasses	**9.99**	**28.02**	**2.20**	**3.24**	**18.98**	**15.03**	**9.24**	**24.89**	**18.28**	**31.48**	**8.95**	**34.28**	**5.04**	**31.18**	**20.05**	**7.83**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bouteloua gracilis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**0.00**	**0.00**
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromus inermis	0.00	0.00	0.00	20.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.55	0.00	0.00	0.00
Poa bulbosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Grasses	**0.00**	**0.00**	**0.00**	**20.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**7.55**	**0.00**	**0.00**	**0.00**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Lappula redowskii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.52	0.00	0.00	0.00	0.00	0.00	0.00
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00
Plantago patagonica	1.21	0.00	0.00	0.00	5.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00
Total Native Annual Forbs	**1.21**	**0.00**	**0.00**	**0.00**	**5.31**	**0.00**	**0.00**	**0.00**	**0.00**	**2.52**	**0.00**	**0.00**	**0.00**	**0.40**	**0.00**	**0.00**
Alyssum desertorum	0.06	0.03	0.03	0.03	5.31	0.09	0.00	0.03	0.06	2.52	5.64	0.03	4.98	0.13	5.20	2.85
Camelina microcarpa	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia sophia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Annual Forbs	**0.06**	**0.03**	**0.09**	**0.03**	**5.31**	**0.09**	**0.00**	**0.03**	**0.09**	**2.52**	**5.64**	**0.03**	**4.98**	**0.13**	**5.20**	**2.85**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	0.00	2.83	1.60	0.00	0.00	0.00	0.00	0.00	1.31	0.00	0.00	1.19	0.00	0.00
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.00**	**2.83**	**1.60**	**0.00**	**0.00**	**1.60**	**0.00**	**0.00**	**1.31**	**0.00**	**0.00**	**1.19**	**0.00**	**0.00**
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.27	0.00	0.00	0.00	1.06	0.00	0.00
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comandra umbellata	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heterotheca villosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lygodesmia juncea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mertensia ciliata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.44	0.00	0.00	0.00	0.00

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TFN 6 2/025
ECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	51	52*	53*	54*	55	56*	57*	58*	59*	60	61*	62*	63*	64	65*	66*
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Psoralidium tenuiflorum	0.00	0.00	0.00	0.00	0.00	0.00	1.78	0.00	0.00	26.18	0.00	0.00	0.00	0.00	0.00	0.00
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.27	0.00	0.00	0.00	1.06	0.00	0.00
Thermopsis rhombifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vicia americana	18.97	0.03	0.00	0.03	28.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Perennial Forbs	**18.97**	**0.03**	**0.00**	**0.12**	**28.07**	**0.00**	**1.78**	**1.96**	**2.98**	**32.73**	**0.00**	**2.44**	**0.00**	**2.11**	**0.00**	**1.09**
Taraxacum officinale	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Production	**34.09**	**37.39**	**6.76**	**27.14**	**75.18**	**15.15**	**13.19**	**28.54**	**32.57**	**74.04**	**20.32**	**36.75**	**33.03**	**39.66**	**29.76**	**13.59**

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TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)		Study Area n=50		Permit Area n=43	
	67*	68*	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Vulpia octoflora	0.00	0.00	0.3	1.8	0.1	0.7
Total Native Annual Grasses	**0.00**	**0.00**	**0.3**	**1.8**	**0.1**	**0.7**
Bromus japonicus	0.03	0.00	3.7	8.9	2.7	6.8
Bromus tectorum	0.03	1.60	2.6	6.8	2.7	7.3
Total Introduced Annual Grasses	**0.06**	**1.60**	**6.3**	**11.2**	**5.4**	**10.2**
Achnatherum hymenoides	0.00	0.00	0.1	0.7	0.1	0.8
Elymus smithii	0.00	0.00	4.4	10.0	2.5	7.8
Elymus spicatus	5.40	0.00	8.9	10.9	10.1	11.2
Festuca idahoensis	0.00	0.00	0.2	1.8	0.0	0.0
Hesperostipa comata	0.00	21.53	5.6	9.0	6.4	9.4
Nassella viridula	0.00	0.00	1.5	4.0	1.3	3.7
Poa secunda	2.32	0.00	0.9	1.9	1.0	2.0
Total Native Cool Season Perennial Grasses	**7.72**	**21.53**	**21.6**	**14.8**	**21.4**	**15.1**
Aristida purpurea	0.00	0.00	0.2	1.2	0.2	1.3
Bouteloua gracilis	0.00	0.00	0.2	0.8	0.2	0.8
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.4**	**1.4**	**0.4**	**1.5**
Agropyron cristatum	0.00	0.00	0.4	1.9	0.5	2.1
Bromus inermis	0.00	0.00	0.4	3.0	0.5	3.2
Festuca ovina	0.00	0.00	0.2	1.1	0.2	1.2
Poa bulbosa	0.00	0.00	0.01	0.1	0.0	0.1
Total Introduced Perennial Grasses	**0.000**	**0.00**	**1.0**	**3.6**	**1.2**	**3.9**
Carex filifolia	0.00	5.03	0.2	0.9	0.2	1.0
Total Native Grasslike Species	**0.00**	**5.03**	**0.2**	**0.9**	**0.2**	**1.0**
Lappula redowskii	0.00	0.00	0.1	0.4	0.0	0.0
Logfia arvensis	0.00	0.00	0.03	0.2	0.0	0.2
Plantago patagonica	0.00	0.00	0.3	1.2	0.0	0.1
Total Native Annual Forbs	**0.00**	**0.00**	**0.4**	**1.3**	**0.0**	**0.2**
Alyssum desertorum	1.71	6.89	1.7	2.7	1.7	2.8
Camelina microcarpa	0.00	0.00	0.01	0.1	0.0	0.1
Descurainia sophia	0.00	0.00	0.3	1.8	0.3	2.0
Total Introduced Annual Forbs	**1.71**	**6.89**	**2.0**	**3.2**	**2.0**	**3.3**
Melilotus officinalis	0.00	0.00	0.03	0.2	0.0	0.2
Tragopogon dubius	0.00	0.00	0.3	0.6	0.2	0.6
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.3**	**0.7**	**0.2**	**0.6**
Achillea millefolium	0.00	0.00	0.2	0.5	0.1	0.2
Brickellia eupatorioides	0.00	0.00	0.1	0.6	0.1	0.6
Calochortus nuttallii	0.00	0.00	0.1	0.6	0.1	0.6
Comandra umbellata	0.00	0.00	0.1	0.7	0.1	0.7
Dalea purpurea	8.42	0.00	0.6	2.0	0.7	2.1
Evolvulus nuttallianus	0.00	0.00	0.1	0.5	0.1	0.5
Gaura coccinea	0.00	0.00	0.1	0.4	0.1	0.5
Heterotheca villosa	0.00	0.00	0.1	0.7	0.1	0.7
Lygodesmia juncea	0.00	0.00	0.04	0.3	0.1	0.4
Mertensia ciliata	0.00	0.00	0.01	0.1	0.0	0.1
Pediomelum argophyllum	0.00	0.00	0.1	0.6	0.2	0.7
Pediomelum esculentum	1.49	0.00	0.3	0.9	0.3	1.0
Phlox hoodii	0.00	0.00	0.1	0.4	0.1	0.4

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TFN 6 2/025
ECD NOV 14, 2014

RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)		Study Area n=50		Permit Area n=43	
	67*	68*	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Psoralidium tenuiflorum	0.00	0.00	1.0	4.3	0.4	2.5
Sphaeralcea coccinea	0.00	0.00	0.5	2.2	0.5	2.4
Thermopsis rhombifolia	0.00	0.00	0.1	0.4	0.0	0.0
Vicia americana	0.00	0.00	1.3	4.8	0.4	1.3
Total Native Perennial Forbs	**9.91**	**0.00**	**4.9**	**7.1**	**3.4**	**4.5**
Taraxacum officinale	0.00	0.00	0.1	0.8	0.1	0.8
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.1**	**0.8**	**0.1**	**0.8**
Total Production	**19.40**	**35.05**	**37.5**	**23.7**	**34.4**	**20.5**

Scanned, 02/27/2020

TFN 6 2/025
DEQ NOV 14,2014

RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Production Sample Data
Sample Dates: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																									Study Area n=25		Permit Area n=17	
	1*	2*	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14	15*	16	17*	18*	19*	20*	21*	22*	23*	24	25	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Bromus japonicus	3.36	0.00	19.33	0.00	0.00	0.00	8.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.83	1.41	4.81	0.00	0.00	6.62	10.11	0.59	8.54	0.06	2.6	4.7	3.2	5.3
Bromus tectorum	0.00	0.00	0.00	0.00	14.08	0.00	0.00	0.00	0.00	1.39	0.00	0.00	38.27	0.00	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.35	2.13	0.00	2.5	8.0	3.6	9.6
Total Introduced Annual Grasses	**3.36**	**0.00**	**19.33**	**0.00**	**14.08**	**0.00**	**8.73**	**0.00**	**0.00**	**1.39**	**0.00**	**0.00**	**38.30**	**0.00**	**2.29**	**0.83**	**1.41**	**4.81**	**0.00**	**0.00**	**6.62**	**10.11**	**5.94**	**10.67**	**0.06**	**5.1**	**8.7**	**6.8**	**9.8**
Achnatherum hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60	0.00	0.00	0.00	0.2	0.9	0.3	1.1
Elymus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.09	0.4	2.0	0.0	0.0
Elymus smithii	0.00	1.33	14.94	0.00	53.63	24.27	26.25	0.00	0.00	30.97	0.00	0.00	9.13	15.37	1.33	265.21	14.30	75.10	78.97	29.98	41.00	82.73	5.39	71.09	10.09	34.0	55.4	28.8	28.4
Elymus trachycaulus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.83	0.00	0.00	0.00	12.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	2.8	0.0	0.0
Hordeum jubatum	0.00	0.00	0.00	0.00	0.00	56.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.27	0.00	0.00	0.00	0.00	0.00	4.60	0.00	0.00	0.00	2.8	11.4	3.6	13.7
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.85	27.34	0.00	8.09	0.00	2.52	2.0	6.1	2.8	7.2
Total Native Cool Season Perennial Grasses	**0.00**	**1.33**	**14.94**	**0.00**	**53.63**	**80.89**	**26.25**	**7.83**	**0.00**	**30.97**	**0.00**	**12.04**	**9.13**	**15.37**	**1.33**	**273.48**	**14.30**	**75.10**	**78.97**	**46.77**	**68.34**	**91.92**	**13.48**	**71.09**	**22.70**	**40.2**	**57.4**	**35.7**	**32.8**
Spartina pectinata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.7	8.3	0.0	0.0
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**41.46**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.7**	**8.3**	**0.0**	**0.0**
Agropyron cristatum	0.00	64.93	0.00	0.00	0.54	0.00	91.88	0.00	0.00	34.21	38.58	0.00	0.00	0.00	11.96	0.00	1.59	0.00	184.26	22.35	0.00	0.00	0.00	0.00	0.00	18.0	41.7	26.5	48.7
Bromus inermis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	212.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.70	9.4	42.5	0.0	0.0
Phleum pratense	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	3.6	0.0	0.0
Poa bulbosa	0.00	0.00	0.00	0.00	0.00	0.00	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	2.6	0.8	3.2
Poa pratensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04	0.2	1.0	0.0	0.0
Total Introduced Perennial Grasses	**0.00**	**64.93**	**0.00**	**0.00**	**0.54**	**0.00**	**105.01**	**0.00**	**0.00**	**34.21**	**38.58**	**18.07**	**0.00**	**212.06**	**11.96**	**0.00**	**1.59**	**0.00**	**184.26**	**22.35**	**0.00**	**0.00**	**0.00**	**0.00**	**27.74**	**28.8**	**56.9**	**27.3**	**49.9**
Carex nebrascensis	0.00	0.00	0.00	322.99	0.00	0.00	0.00	71.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.8	65.6	0.0	0.0
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**322.99**	**0.00**	**0.00**	**0.00**	**71.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**15.8**	**65.6**	**0.0**	**0.0**
Carex spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0	5.2	0.0	0.0
Total Unknown Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**25.79**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.0**	**5.2**	**0.0**	**0.0**
Lappula redowskii	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.1	0.5	0.2	0.6
Total Native Annual Forbs	**2.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.31**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.1**	**0.5**	**0.2**	**0.6**
	0.79	3.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	4.71	0.00	0.03	0.00	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24	21.84	0.00	1.4	4.4	0.8	1.5

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RECD NOV 14, 2014

RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Production Sample Data
Sample Dates: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																								Study Area n=25		Permit Area n=17	
	1*	2*	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14	15*	16	17*	18*	19*	20*	21*	22*	23*	24	25	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Alyssum desertorum																													
Camelina microcarpa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.1	0.4	0.1	0.5
Lepidium perfoliatum	0.00	0.00	0.00	0.00	0.00	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.1	0.6
Thlaspi arvense	0.00	0.00	0.00	0.00	10.18	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	2.0	0.6	2.5
Total Introduced Annual Forbs	**0.79**	**3.67**	**0.00**	**0.00**	**10.18**	**3.03**	**0.00**	**0.00**	**0.00**	**2.31**	**4.71**	**0.00**	**0.03**	**0.00**	**2.78**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.24**	**21.93**	**0.00**	**2.0**	**4.8**	**1.6**	**2.7**
Lactuca serriola	0.00	0.00	1.81	0.00	0.00	0.00	0.00	0.00	157.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.4	31.5	0.1	0.4
Tragopogon dubius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.85	0.00	0.00	0.00	10.13	0.00	0.00	0.5	2.0	0.7	2.4
Total Introduced Biennial Forbs	**0.00**	**0.00**	**1.81**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**157.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.04**	**0.00**	**0.00**	**0.00**	**0.85**	**0.00**	**0.00**	**0.00**	**10.13**	**0.00**	**0.00**	**6.9**	**31.5**	**0.8**	**2.5**
Achillea millefolium	0.00	0.00	4.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.58	0.00	0.00	0.00	0.00	0.00	2.4	10.9	3.5	13.2
Ambrosia psilostachya	0.00	0.00	6.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.71	0.00	0.00	0.00	16.53	0.00	0.00	0.00	0.00	4.2	16.3	6.1	19.7
Lygodesmia juncea	0.00	9.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	1.8	0.5	2.2
Sphaeralcea coccinea	0.00	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.11	0.00	6.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.5	1.4	0.7	1.6
Total Native Perennial Forbs	**0.00**	**11.32**	**11.21**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**	**0.00**	**0.00**	**2.11**	**0.00**	**6.25**	**0.00**	**80.71**	**0.00**	**0.00**	**54.58**	**16.53**	**0.00**	**1.00**	**0.00**	**0.00**	**7.5**	**19.1**	**10.8**	**22.5**
Cirsium arvense	0.00	0.00	0.00	7.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01	0.00	0.00	0.00	6.83	0.00	0.00	0.00	0.00	6.54	1.0	2.3	0.4	1.7
Convolvulus arvensis	28.87	0.00	12.27	0.00	0.00	0.00	31.47	0.00	0.00	0.00	0.00	0.00	2.74	0.00	0.00	0.00	13.89	0.00	0.00	49.47	6.57	0.00	0.00	0.00	0.00	5.8	12.6	8.5	14.6
Rumex crispus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.80	0.00	0.7	2.7	0.0	0.0
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.69	0.1	0.5	0.0	0.0
Total Introduced Perennial Forbs	**28.87**	**0.00**	**12.27**	**7.47**	**0.00**	**0.00**	**31.47**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.74**	**0.00**	**0.00**	**16.03**	**13.89**	**0.00**	**0.00**	**56.30**	**6.57**	**0.00**	**0.00**	**3.80**	**9.23**	**7.6**	**13.5**	**8.9**	**15.9**
Astragalus spp.	0.00	0.00	0.00	0.00	0.00	0.00	6.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.2	0.4	1.5
Chenopodium spp.	0.00	0.00	0.00	7.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	1.7	0.0	0.0
Polygonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	4.0	0.0	0.0
Sonchus spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	6.9	0.0	0.0
Trifolium spp.	0.00	0.00	10.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	2.2	0.6	2.7
Total Unknown Forb Species	**0.00**	**0.00**	**10.94**	**7.97**	**0.00**	**0.00**	**6.22**	**0.00**	**34.26**	**0.00**	**0.00**	**19.90**	**0.00**	**0.00**	**0.00**	**3.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.3**	**8.0**	**1.0**	**3.0**
Total Production	**35.3**	**81.25**	**70.50**	**338.43**	**78.43**	**83.92**	**177.68**	**120.42**	**192.08**	**68.88**	**43.29**	**75.80**	**52.31**	**227.43**	**25.96**	**293.53**	**111.90**	**79.91**	**264.08**	**180.00**	**98.06**	**102.03**	**31.82**	**107.49**	**59.73**	**120.0**	**85.2**	**93.3**	**62.2**

S nned: 02/27/2020

TFN 6 2/025
DEC NOV 14, 2014

RAMACO
Polygon: Riparian Woodland (RW)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	1	2	3	4*	5*	6*	7	8	9*	10	11*	12*	13	14	15*	16*	17	18*	19*	20*	21*	22	23*	25	26	27*	28*
Bromus japonicus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01	0.00	66.52	4.30	0.00	9.87	0.00	68.75	0.00	0.00	1.83	16.37	0.00	0.00	11.18	1.93	0.00	44.52	0.00
Bromus tectorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01	0.00	7.39	0.00	0.00	9.87	0.00	0.00	0.00	0.00	7.34	38.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Annual Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**6.02**	**0.00**	**73.91**	**4.30**	**0.00**	**19.74**	**0.00**	**68.75**	**0.00**	**0.00**	**9.17**	**54.56**	**0.00**	**0.00**	**11.18**	**1.93**	**0.00**	**44.52**	**0.00**
Elymus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.87	0.00	0.00	0.00	0.00	0.00	0.00
Elymus smithii	0.00	0.00	0.00	62.47	0.00	2.85	0.00	0.00	37.15	0.00	64.70	52.81	0.00	0.70	20.15	4.94	0.00	0.00	0.00	15.10	10.87	0.00	179.02	6.51	0.00	8.34	0.00
Elymus trachycaulus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	208.08	7.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	321.76	0.00	0.00	0.00	0.00	0.00
Hordeum jubatum	0.00	0.00	1.67	0.00	0.00	45.62	0.71	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	100.64	0.00	0.00	43.47	0.00	0.00	0.00	0.00	0.00	0.00
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.59	0.00	0.00	0.00	0.00	0.00	0.00	2.08	0.00	0.00
Total Native Cool Season Perennial Grasses	**0.00**	**0.00**	**1.67**	**62.47**	**0.00**	**51.32**	**0.71**	**208.08**	**44.58**	**0.00**	**64.70**	**52.81**	**0.78**	**2.79**	**20.15**	**4.94**	**0.00**	**106.23**	**0.00**	**15.10**	**65.21**	**321.76**	**179.02**	**6.51**	**2.08**	**8.34**	**0.00**
Spartina pectinata	94.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**94.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Agropyron cristatum	0.00	0.00	0.00	0.00	264.67	0.00	0.00	0.00	59.44	0.00	43.14	0.00	0.00	0.00	60.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.33	0.00	0.00	33.34	213.87
Agrostis capillaris	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromus inermis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	132.19	0.00	0.00	0.00	43.47	0.00	0.00	0.00	0.00	0.00	0.00
Poa pratensis	0.00	30.00	0.00	0.00	0.03	5.70	0.00	0.00	7.43	40.75	0.00	0.00	0.00	11.14	0.00	0.00	0.00	5.59	0.00	0.00	0.00	0.00	0.00	4.73	0.00	0.00	0.00
Total Introduced Perennial Grasses	**0.00**	**31.55**	**0.00**	**0.00**	**264.70**	**5.70**	**0.00**	**0.00**	**104.02**	**40.75**	**43.14**	**0.00**	**0.00**	**11.14**	**60.46**	**0.00**	**132.19**	**5.59**	**0.00**	**0.00**	**43.47**	**0.00**	**22.33**	**4.73**	**0.00**	**33.34**	**213.87**
Festuca spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.56	0.00	0.00
Total Unknown Grass Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**61.56**	**0.00**	**0.00**
Carex nebrascensis	20.14	0.00	82.05	0.00	0.00	0.00	123.87	0.00	0.00	0.00	0.00	0.00	107.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Schoenoplectus pungens	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**20.14**	**1.41**	**82.05**	**0.00**	**0.00**	**0.00**	**123.87**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**107.87**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Chenopodium berlandieri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.21	0.00	0.00	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galium aparine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Helianthus annuus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**19.59**	**0.00**	**0.00**	**2.61**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Alyssum desertorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.21	6.14	0.00	0.00	3.92	5.59	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Atriplex heterosperma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Camelina microcarpa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.37	0.00	0.00	0.29	4.21	9.21	0.00	0.00	2.61	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia sophia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lepidium perfoliatum	0.00	0.00	0.00	0.00	0.00	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	46.59	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Medicago lupulina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
Polygonum convolvulus	3.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thlaspi arvense	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.37	0.00	0.00	0.00	0.00	30.71	0.00	0.00	3.92	0.00	0.00	0.00	0.00	0.09	0.00	0.00	5.36
Total Introduced Annual Forbs	**3.37**	**0.00**	**0.00**	**0.00**	**0.00**	**3.72**	**0.00**	**0.00**	**0.00**	**0.00**	**4.74**	**0.00**	**0.00**	**0.29**	**8.42**	**46.06**	**0.00**	**78.67**	**10.45**	**9.31**	**0.03**	**0.00**	**0.00**	**0.18**	**0.00**	**0.00**	**5.36**
Cynoglossum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lactuca serriola	0.00	0.00	38.36	0.00	0.03	0.83	0.00	0.00	0.00	0.00	2.37	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.00	0.00
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.61	0.00

Scanned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Riparian Woodland (RW)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	1	2	3	4*	5*	6*	7	8	9*	10	11*	12*	13	14	15*	16*	17	18*	19*	20*	21*	22	23*	25	26	27*	28*
Total Introduced Biennial Forbs	**0.00**	**0.00**	**38.36**	**0.00**	**0.03**	**0.83**	**0.00**	**0.00**	**0.00**	**8.42**	**2.37**	**1.70**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.33**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.87**	**0.00**	**5.61**	**0.00**
Achillea millefolium	0.00	0.00	0.00	29.29	0.00	0.00	0.00	0.00	0.00	12.23	38.37	0.00	0.00	13.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agoseris aurantiaca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.95	0.00	0.00	0.00
Apocynum cannabinum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asclepias speciosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	33.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comandra umbellata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.53	0.00	0.00	0.00	0.00	0.00	0.00
Equisetum laevigatum	0.00	0.00	0.00	21.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galium boreale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Glycyrrhiza lepidota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grindelia squarrosa	0.00	0.00	0.00	0.00	0.00	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.00	0.00	0.00	0.00	0.00	0.00
Lactuca oblongifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lepidium fremontii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Linum lewisii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Symphyotrichum falcatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Typha latifolia	0.00	0.00	1.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wyethia amplexicaulis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Perennial Forbs	**0.00**	**0.00**	**1.84**	**50.62**	**0.00**	**36.82**	**0.00**	**0.00**	**0.00**	**12.23**	**39.55**	**0.00**	**0.00**	**13.57**	**0.00**	**15.14**	**1.35**	**0.00**	**38.64**	**0.00**	**8.30**	**0.00**	**0.00**	**1.95**	**0.00**	**0.00**	**0.00**
Cardaria draba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cirsium arvense	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.67	0.00
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.55	32.24	0.00	0.00	0.00	0.00	0.00	0.00	20.62	0.00	27.67	0.00	0.00	0.00	0.00	0.00	0.00
Medicago sativa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rumex crispus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.74	0.00
Taraxacum officinale	11.29	1.70	0.00	0.00	0.00	0.00	5.56	1.96	1.72	3.16	0.00	0.00	3.67	14.44	0.00	0.00	0.00	0.00	0.00	0.00	16.60	0.00	0.00	2.77	0.93	0.00	0.00
Trifolium repens	0.00	2.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00
Total Introduced Perennial Forbs	**11.29**	**4.57**	**0.00**	**0.00**	**0.00**	**0.00**	**5.56**	**1.96**	**1.72**	**3.16**	**3.55**	**32.24**	**3.67**	**14.44**	**0.00**	**0.00**	**0.00**	**0.00**	**20.62**	**0.00**	**44.27**	**0.00**	**0.00**	**2.83**	**0.93**	**34.41**	**0.00**
Astragalus spp.	0.00	0.00	0.00	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asteraceae spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.64	0.00	0.00	2.77	0.00	0.00	0.00	0.00	0.00	0.00
Chenopodium spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00	0.00
Sonchus spp.	30.36	0.00	0.00	0.00	0.00	0.00	3.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Unknown Forb Species	**30.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.63**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.58**	**0.00**	**0.00**	**0.00**	**16.64**	**0.00**	**0.00**	**2.77**	**2.46**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Production	**160.02**	**37.53**	**123.92**	**113.09**	**264.73**	**98.39**	**134.77**	**210.04**	**156.34**	**68.29**	**231.96**	**91.05**	**112.32**	**62.55**	**89.03**	**154.48**	**133.54**	**210.46**	**81.49**	**78.97**	**164.05**	**324.22**	**212.53**	**19.00**	**64.57**	**126.22**	**219.23**

S nned, 02/27/2020

TFN 6 2/025
RECD NOV 14,2014

RAMACO
Polygon: Riparian Woodland (RW)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																					Study Area n=48		Permit Area n=24	
	29	30*	31*	32	33	34	35	36	37*	38	39*	40	41*	42	43*	44*	45	46*	47*	48*	49	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Bromus japonicus	0.00	34.34	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	9.57	0.00	0.00	1.38	0.00	1.36	0.00	0.00	0.00	5.7	15.5	11.0	20.8
Bromus tectorum	0.00	34.34	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.92	0.00	1.36	0.00	0.00	0.00	2.1	7.5	3.9	10.2
Total Introduced Annual Grasses	**0.00**	**68.68**	**0.00**	**0.00**	**0.00**	**0.12**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**9.57**	**0.00**	**0.00**	**2.30**	**0.00**	**2.72**	**0.00**	**0.00**	**0.00**	**7.8**	**19.4**	**14.9**	**25.5**
Elymus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	10.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	2.1	0.5	2.2
Elymus smithii	0.00	0.00	0.00	0.00	0.00	31.14	3.06	0.00	0.00	8.00	0.00	5.76	10.74	0.00	0.00	0.00	42.61	46.84	14.91	0.00	0.00	13.1	30.0	22.1	39.5
Elymus trachycaulus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	230.95	16.4	63.2	0.3	1.5
Hordeum jubatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.74	0.00	0.00	5.0	17.8	9.8	24.5
Nassella viridula	0.00	0.00	0.00	0.00	0.00	24.91	0.00	0.00	0.00	4.00	0.00	5.76	0.00	0.00	0.00	0.00	0.00	0.00	44.74	0.00	0.00	1.7	7.3	1.9	9.1
Poa secunda	0.00	0.00	0.00	0.00	0.00	6.23	0.00	0.00	0.00	1.40	0.00	1.39	0.00	0.00	0.00	0.00	28.41	0.00	0.00	0.00	0.00	1.0	4.2	0.4	1.3
Total Native Cool Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**62.28**	**13.26**	**17.76**	**0.00**	**13.40**	**0.00**	**12.91**	**10.74**	**0.00**	**0.00**	**0.00**	**71.02**	**46.84**	**104.39**	**0.00**	**230.95**	**37.6**	**68.3**	**35.0**	**45.6**
Spartina pectinata	0.00	0.00	130.74	0.00	31.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	118.01	0.00	7.8	28.5	4.9	24.1
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**130.74**	**0.00**	**31.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**118.01**	**0.00**	**7.8**	**28.5**	**4.9**	**24.1**
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	136.59	0.00	0.00	0.00	42.98	188.99	426.45	0.00	0.00	0.00	0.00	0.00	0.00	31.1	82.3	54.3	105.9
Agrostis capillaris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2	0.0	0.0
Bromus inermis	115.50	0.00	0.00	0.00	0.00	0.00	0.00	155.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.44	0.00	10.3	33.7	3.8	11.5
Poa pratensis	6.08	0.00	0.00	0.00	0.00	0.00	7.14	0.00	0.00	8.00	11.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.9	7.6	1.3	3.1
Total Introduced Perennial Grasses	**121.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**7.14**	**155.83**	**136.59**	**8.00**	**11.75**	**0.00**	**42.98**	**188.99**	**426.45**	**0.00**	**0.00**	**0.00**	**0.00**	**10.44**	**0.00**	**44.3**	**85.0**	**59.4**	**105.0**
Festuca spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.74	0.00	0.00	2.2	10.9	1.9	9.1
Total Unknown Grass Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**44.74**	**0.00**	**0.00**	**2.2**	**10.9**	**1.9**	**9.1**
Carex nebrascensis	0.00	0.00	0.00	177.48	74.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.2	36.9	0.0	0.0
Schoenoplectus pungens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	0.1	0.3	0.1	0.3
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**177.48**	**74.66**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.33**	**0.00**	**0.00**	**12.3**	**36.9**	**0.1**	**0.3**
Chenopodium berlandieri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.5	0.4	2.1
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.4	0.5	1.9
Galium aparine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.0	0.0
Helianthus annuus	0.00	20.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	2.9	0.9	4.2
Total Native Annual Forbs	**0.00**	**20.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.0**	**4.1**	**1.8**	**5.6**
Alyssum desertorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	1.45	0.00	0.00	0.00	0.4	1.4	0.9	1.9
Atriplex heterosperma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	4.6	1.3	6.5
Camelina microcarpa	0.00	10.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.8	2.2	1.5	2.9
Descurainia sophia	0.00	10.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.5	0.4	2.1
Lepidium perfoliatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0	6.7	2.1	9.5
Medicago lupulina	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.00	0.00	8.42	0.00	27.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	4.2	0.0	0.0
Polygonum convolvulus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.0	0.0
Thlaspi arvense	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.9	4.5	1.8	6.3
Total Introduced Annual Forbs	**0.00**	**20.42**	**0.00**	**0.00**	**0.00**	**0.00**	**1.94**	**0.00**	**0.00**	**8.42**	**0.00**	**27.82**	**0.00**	**1.97**	**0.00**	**4.46**	**0.03**	**1.45**	**0.00**	**0.00**	**0.00**	**4.9**	**13.7**	**8.0**	**18.1**
Cynoglossum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.2	0.0	0.0

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TFN 6 2/025
DEQD NOV 14,2014

RAMACO
Polygon: Riparian Woodland (RW)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																					Study Area n=48		Permit Area n=24	
	29	30*	31*	32	33	34	35	36	37*	38	39*	40	41*	42	43*	44*	45	46*	47*	48*	49	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Lactuca serriola	0.00	10.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.2	5.7	0.7	2.2
Melilotus officinalis	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1	0.0	0.0
Tragopogon dubius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	0.00	0.00	0.00	0.00	0.2	0.9	0.3	1.2
Total Introduced Biennial Forbs	**0.00**	**10.21**	**0.00**	**0.00**	**0.76**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.19**	**0.00**	**0.00**	**0.00**	**0.00**	**1.6**	**5.8**	**1.0**	**2.4**
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	1.22	2.91	0.00	0.00	7.02	0.00	6.96	0.00	0.00	0.00	0.00	12.04	0.00	0.00	0.00	0.00	2.6	7.4	2.8	9.6
Agoseris aurantiaca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.0	0.0
Apocynum cannabinum	0.00	0.00	0.00	0.00	6.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	1.0	0.0	0.0
Asclepias speciosa	0.00	0.00	12.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.9	0.0	0.0
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	4.8	1.4	6.8
Comandra umbellata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.8	0.2	1.1
Equisetum laevigatum	6.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.61	0.00	0.7	3.3	1.2	4.5
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.8	5.6	1.6	7.9
Galium boreale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.9	0.3	1.3
Glycyrrhiza lepidota	0.00	0.00	0.00	0.00	4.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.7	0.0	0.0
Grindelia squarrosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.10	0.00	0.00	0.00	1.78	0.00	7.76	0.00	0.00	1.9	10.9	3.7	15.3
Lactuca oblongifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.3	0.4	1.8
Lepidium fremontii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.2	0.0	0.2
Linum lewisii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.03	0.2	0.0	0.0
Symphyotrichum falcatum	9.74	0.00	0.00	0.00	0.00	5.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.76	0.00	0.00	0.5	1.9	0.3	1.6
Typha latifolia	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.0	0.0
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1	0.0	0.0
Wyethia amplexicaulis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2	0.0	0.0
Total Native Perennial Forbs	**16.39**	**0.00**	**12.83**	**0.03**	**11.74**	**6.93**	**3.88**	**0.00**	**0.00**	**7.02**	**0.00**	**6.96**	**75.10**	**0.00**	**0.00**	**0.00**	**15.02**	**0.00**	**15.52**	**6.61**	**0.00**	**8.3**	**15.4**	**11.9**	**20.6**
Cardaria draba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	186.26	0.00	0.00	0.00	0.00	148.66	0.00	0.00	1.29	0.00	0.00	7.0	34.0	14.0	47.6
Cirsium arvense	0.00	0.00	35.01	0.00	0.00	5.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.5	6.7	1.3	6.3
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.8	6.7	3.5	9.2
Medicago sativa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.8	0.0	0.0
Rumex crispus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.2	0.8
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	1.22	13.57	0.00	0.00	11.23	0.00	27.82	0.00	0.00	0.00	0.00	10.84	0.00	2.59	0.00	0.00	2.7	5.7	0.9	3.4
Trifolium repens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4	0.0	0.0
Total Introduced Perennial Forbs	**0.00**	**0.00**	**35.01**	**0.00**	**0.00**	**6.98**	**13.57**	**0.00**	**0.00**	**11.23**	**186.26**	**33.38**	**0.00**	**1.85**	**0.00**	**148.66**	**10.84**	**0.00**	**3.88**	**0.00**	**0.00**	**13.3**	**34.6**	**19.9**	**47.6**
Astragalus spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.74	0.9	6.2	0.0	0.0
Asteraceae spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.47	0.00	0.00	0.5	2.6	1.1	3.6
Chenopodium spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4	0.0	0.0
Sonchus spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	4.4	0.0	0.0
Total Unknown Forb Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**6.47**	**0.00**	**42.74**	**2.2**	**7.8**	**1.1**	**3.6**
Total Production	**137.97**	**119.73**	**178.58**	**177.51**	**118.30**	**76.31**	**39.79**	**173.59**	**136.59**	**48.07**	**198.01**	**81.07**	**138.39**	**192.81**	**426.45**	**155.42**	**98.10**	**51.01**	**176.33**	**135.06**	**273.69**	**143.3**	**78.1**	**159.9**	**78.8**

S--nned, 02/27/2020

TFN 6 2/025
DEQ NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	1*	2*	3*	4*	5*	6*	7	8*	9*	10*	11	12	13	14*	15*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46
Bromus japonicus	0.00	0.00	0.00	0.03	0.00	0.00	2.41	0.00	0.00	0.00	0.03	6.77	0.24	0.00	0.00	0.00	0.00	3.51	0.00	2.81	0.00	0.09	0.00	1.56	0.00	0.00	0.00	90.79	19.12	0.00
Bromus tectorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	4.47	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	0.00	22.70	0.00	0.00
Total Introduced Annual Grasses	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**2.41**	**0.00**	**0.03**	**0.00**	**0.03**	**6.77**	**4.71**	**0.00**	**0.03**	**0.00**	**0.00**	**3.51**	**0.00**	**2.81**	**0.00**	**0.09**	**0.00**	**1.56**	**0.00**	**18.50**	**0.00**	**113.49**	**19.12**	**0.00**
Elymus lanceolatus	0.00	0.00	0.00	0.00	2.01	0.00	0.00	0.00	0.00	6.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus smithii	3.29	0.00	0.00	0.00	2.01	3.17	3.12	6.16	2.89	0.00	0.00	0.94	0.17	0.00	16.90	1.82	1.26	7.39	0.00	14.66	1.68	8.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus spicatus	29.62	13.91	26.05	14.91	0.00	0.00	0.00	7.04	0.00	0.00	0.00	0.00	0.00	15.16	0.00	16.41	23.89	66.55	27.68	34.22	13.40	75.37	17.46	23.78	19.71	0.00	18.59	0.00	18.63	28.01
Hesperostipa comata	0.00	0.00	0.00	0.00	0.00	0.00	8.06	0.00	0.00	0.00	4.38	0.94	0.00	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.26	0.00	15.87	0.00	0.00
Koeleria macrantha	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	2.04	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Cool Season Perennial Grasses	**37.11**	**13.91**	**26.05**	**14.91**	**4.02**	**3.17**	**13.22**	**17.59**	**4.26**	**6.69**	**4.38**	**1.88**	**0.17**	**18.95**	**16.90**	**18.23**	**25.15**	**73.94**	**27.68**	**48.88**	**16.75**	**83.74**	**17.46**	**23.78**	**19.71**	**26.26**	**18.59**	**15.87**	**18.63**	**28.01**
Bouteloua gracilis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Schizachyrium scoparium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.32**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Atriplex suckleyi	0.00	0.00	0.00	0.00	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.00
Plantago patagonica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**1.71**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.06**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.89**	**0.00**	**0.79**	**0.00**	**0.00**
Alyssum desertorum	0.00	0.00	0.00	0.00	0.03	0.00	2.55	0.00	2.94	0.00	0.00	1.16	0.00	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chenopodium album	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medicago lupulina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.92	0.00
Total Introduced Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.28**	**0.00**	**2.55**	**0.00**	**2.94**	**0.03**	**0.00**	**2.38**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.03**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.92**	**0.00**
Lactuca serriola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.43	0.00	0.00	0.00	0.00
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.17**	**0.00**	**3.89**	**0.00**	**0.00**	**0.00**	**0.00**	**1.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**6.43**	**0.00**	**0.00**	**0.00**	**0.00**
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.02	1.46	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.86	0.00	0.00	0.00	0.00	0.00	0.00
Agoseris glauca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Allium textile	0.00	0.00	0.00	0.00	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Antennaria microphylla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comandra umbellata	0.00	0.00	0.00	0.00	0.00	0.00	6.45	0.00	0.00	0.00	12.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.21	0.00
Dalea candida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	13.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.02	0.00	0.00	0.00	3.05	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	1.26	0.00	0.00	0.00	4.63	9.59	0.85	0.00	0.00	15.22	0.00	0.00	0.00	0.00	0.00	2.49	0.00	3.98	0.00	0.00	1.29	0.00	0.00	9.49	0.00	0.00	0.00	0.00	0.00
Glycyrrhiza lepidota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grindelia squarrosa	0.00	4.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	0.00	0.00	0.00	0.00	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.46	2.85	0.00	3.17	0.00	0.00	2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oxytropis lambertii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oxytropis sericea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.76	0.00	0.00
Packera cana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scanned 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	1*	2*	3*	4*	5*	6*	7	8*	9*	10*	11	12	13	14*	15*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46
Pediomelum argophyllum	0.00	11.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phlox hoodii	13.51	0.00	5.25	8.14	0.00	0.00	0.00	0.00	3.17	0.00	0.00	0.00	0.00	3.28	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09
Psoralidium lanceolatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.84	0.00	0.00	0.00	3.29	0.00	0.00	0.00	4.26	0.00	0.00	0.00
Psoralidium tenuiflorum	0.00	12.61	7.88	18.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	11.56	0.00	4.04	11.02	0.00	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00
Ratibida columnifera	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	1.07	4.26	4.22	0.00	0.00	0.00	0.00	0.00	5.10	0.00	0.00	0.03	0.00	0.00	0.00	3.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stenotus armerioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.01	0.00	0.00	0.00
Symphyotrichum falcatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.28	0.00	0.00	0.00	2.61	0.00	0.00	0.00	0.00	0.00	0.00
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	1.29	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	0.00	0.17	0.00	0.00	0.81	0.00	0.00	0.00
Total Native Perennial Forbs	**13.51**	**30.12**	**26.26**	**27.13**	**2.28**	**5.09**	**20.02**	**6.81**	**10.56**	**1.29**	**28.03**	**5.41**	**7.32**	**3.97**	**5.10**	**4.88**	**7.54**	**11.59**	**13.37**	**10.32**	**11.05**	**10.34**	**8.91**	**9.51**	**9.49**	**0.00**	**10.13**	**3.76**	**2.21**	**1.09**
Astragalus cicer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.31	0.00	0.00	0.00	0.00	0.00	0.00	17.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.37	0.00	1.77	38.45	0.00	0.00	0.00	0.00
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**17.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.59**	**18.37**	**0.00**	**1.77**	**38.45**	**0.00**	**0.00**	**0.00**	**0.00**
Eriogonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penstemon spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.38
Total Unknown Forb Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.38**
Total Production	**50.62**	**44.03**	**52.31**	**42.07**	**8.29**	**12.43**	**38.20**	**33.30**	**17.79**	**8.01**	**32.44**	**16.47**	**16.74**	**22.92**	**39.13**	**23.14**	**32.69**	**89.07**	**41.05**	**62.01**	**27.83**	**96.79**	**44.74**	**34.85**	**30.97**	**90.53**	**28.72**	**133.91**	**43.88**	**33.48**

S--nned, 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area n=50		Permit Area n=38	
	47*	48*	49*	50	51*	52*	53	54	55	56	57*	58	59*	60	61*	62*	63*	64*	65*	66*	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Bromus japonicus	0.00	0.00	0.00	7.20	0.74	0.00	7.42	10.84	0.87	7.21	0.06	5.29	0.00	5.29	0.00	0.00	3.84	0.00	1.64	0.00	3.6	13.1	3.3	14.9
Bromus tectorum	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.39	0.00	0.00	0.41	0.00	1.1	4.3	1.3	4.8
Total Introduced Annual Grasses	**0.00**	**0.00**	**0.00**	**7.23**	**0.74**	**0.00**	**7.42**	**10.84**	**0.87**	**7.21**	**0.06**	**5.29**	**0.00**	**5.29**	**0.00**	**8.39**	**3.84**	**0.00**	**2.05**	**0.00**	**4.7**	**16.3**	**4.6**	**18.7**
Elymus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	13.73	17.66	5.19	0.00	7.39	6.08	1.2	3.5	1.6	3.9
Elymus smithii	0.00	0.00	0.00	7.20	0.00	4.81	1.38	13.67	0.00	0.00	0.00	2.34	2.25	9.76	0.00	10.60	2.22	0.00	0.00	0.00	2.6	4.2	2.4	4.2
Elymus spicatus	16.68	18.27	14.06	0.00	37.37	43.33	0.00	0.00	0.00	0.00	1.61	0.00	0.00	0.00	0.00	0.00	0.00	20.50	4.93	14.18	13.2	16.9	16.7	17.6
Hesperostipa comata	0.00	0.00	0.00	28.80	0.00	0.00	1.93	0.00	2.05	0.00	0.00	0.00	20.22	1.72	0.00	0.00	0.00	0.00	0.00	0.00	2.3	6.4	1.7	5.8
Koeleria macrantha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.1	0.7
Nassella viridula	8.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.20	0.00	0.00	0.00	0.00	0.00	0.00	7.06	0.00	0.00	0.00	0.00	0.6	2.0	0.5	1.9
Poa secunda	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.1	0.5
Total Native Cool Season Perennial Grasses	**27.80**	**18.27**	**14.06**	**36.00**	**37.37**	**48.14**	**3.31**	**13.67**	**10.25**	**0.00**	**5.35**	**2.34**	**22.47**	**11.48**	**13.73**	**35.32**	**7.41**	**20.50**	**12.32**	**20.26**	**20.1**	**16.8**	**23.1**	**17.1**
Bouteloua gracilis	0.00	0.00	3.52	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.1	0.6
Schizachyrium scoparium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.0	0.0
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**3.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.80**	**0.00**	**0.78**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.2**	**0.7**	**0.1**	**0.6**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52	2.27	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4	0.0	0.0
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.52**	**2.27**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.1**	**0.4**	**0.0**	**0.0**
Atriplex suckleyi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2	0.0	0.3
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1	0.0	0.1
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1	0.0	0.1
Plantago patagonica	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.03	0.2	0.0	0.1
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**	**0.00**	**1.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.31**	**0.00**	**0.00**	**0.00**	**0.1**	**0.3**	**0.1**	**0.3**
Alyssum desertorum	0.03	0.00	0.00	0.03	0.00	0.03	2.96	0.00	0.03	1.93	0.03	1.44	0.00	0.00	0.00	3.14	0.00	0.03	0.03	0.00	0.3	0.9	0.2	0.7
Chenopodium album	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.0	0.0	0.0
Medicago lupulina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.7	0.1	0.6
Total Introduced Annual Forbs	**0.03**	**0.00**	**0.00**	**0.03**	**0.00**	**0.06**	**2.96**	**0.00**	**2.48**	**1.93**	**0.03**	**1.44**	**0.00**	**0.00**	**0.00**	**3.14**	**0.00**	**0.03**	**0.03**	**0.00**	**0.5**	**1.1**	**0.3**	**0.9**
Lactuca serriola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.2	0.0	0.0
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.1	0.7
Tragopogon dubius	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	0.00	0.00	0.00	0.3	1.2	0.4	1.4
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.78**	**0.00**	**0.00**	**0.00**	**0.4**	**1.3**	**0.5**	**1.5**
Achillea millefolium	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.2	0.7	0.2	0.7
Agoseris glauca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.0	0.0
Allium textile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.1	0.4
Antennaria microphylla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.1	0.2	1.3
Calochortus nuttallii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.1	0.0	0.1
Comandra umbellata	0.00	1.84	0.00	0.00	0.00	0.00	0.00	0.00	1.57	0.00	0.00	4.12	1.44	3.36	0.00	0.00	0.00	0.00	0.00	0.00	0.7	2.1	0.2	0.6
Dalea candida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.76	0.00	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.2	0.1	0.8
Dalea purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.82	0.5	2.0	0.6	2.3
Evolvulus nuttallianus	0.00	0.00	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.2	0.0	0.3
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.00	0.00	4.05	0.00	0.00	0.00	1.72	0.00	0.00	0.00	0.00	0.00	1.1	2.9	0.8	1.9
Glycyrrhiza lepidota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.67	0.2	1.7	0.3	1.9
Grindelia squarrosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.1	0.4	1.2
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.0	0.0
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.18	0.00	0.00	0.00	0.2	0.7	0.2	0.6
Oxytropis lambertii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.0	0.0
Oxytropis sericea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.1	0.6

Scanned 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area n=50		Permit Area n=38	
	47*	48*	49*	50	51*	52*	53	54	55	56	57*	58	59*	60	61*	62*	63*	64*	65*	66*	Mean Production	Standard Deviation	Mean Production	Standard Deviation
Packera cana	0.00	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.2	0.7
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.6	0.3	1.8
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.2	0.0	0.1
Phlox hoodii	1.61	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	2.53	0.00	0.00	0.00	0.00	0.00	0.62	7.07	2.20	11.27	1.3	2.9	1.7	3.3
Psoralidium lanceolatum	0.00	0.00	0.00	0.00	6.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	1.4	0.5	1.6
Psoralidium tenuiflorum	0.00	6.21	4.03	0.00	0.00	5.33	0.00	0.00	3.59	0.00	0.00	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00	14.09	2.1	4.4	2.6	4.9
Ratibida columnifera	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2	0.0	0.0
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.4	1.2	0.5	1.4
Stenotus armerioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.3	0.1	0.4
Symphyotrichum falcatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.0	0.2	1.1
Vicia americana	7.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.1	0.3	1.3
Total Native Perennial Forbs	**14.09**	**12.24**	**5.79**	**0.00**	**6.90**	**9.33**	**0.00**	**1.42**	**14.65**	**6.76**	**7.60**	**8.33**	**11.33**	**5.02**	**1.72**	**0.00**	**2.81**	**7.07**	**4.39**	**39.84**	**9.2**	**8.5**	**9.7**	**8.5**
Astragalus cicer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3	0.0	0.3
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	5.04	0.00	17.68	0.00	2.1	6.8	2.7	7.7
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.1	0.4	0.1	0.5
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.81**	**0.00**	**0.00**	**2.86**	**5.04**	**0.00**	**17.68**	**0.00**	**2.2**	**6.8**	**2.8**	**7.7**
Eriogonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.53	0.00	0.00	0.00	2.58	0.00	0.00	0.00	0.00	0.00	0.1	0.5	0.1	0.6
Penstemon spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6	0.0	0.0
Total Unknown Forb Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.53**	**0.00**	**0.00**	**0.00**	**2.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.2**	**0.8**	**0.1**	**0.6**
Total Production	**41.92**	**30.51**	**23.37**	**43.26**	**45.01**	**61.53**	**13.78**	**25.93**	**29.77**	**21.08**	**15.57**	**18.18**	**35.61**	**21.82**	**18.03**	**49.71**	**22.19**	**27.60**	**36.47**	**60.10**	**37.7**	**24.0**	**41.3**	**26.0**

S--nned, 02/27/2020

RAMACO
Polygon: Scoria Grassland (SG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number

(*Denotes Sample Location Used to Calculate Permit Area Values)

Oven-dry Weight (grams/square meter)

	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	30*
Echinochloa muricata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Bromus japonicus	0.00	9.99	0.00	2.62	4.07	0.00	5.48	0.00	7.11	0.00	0.00	1.13	0.00	0.00	0.03	8.27	0.00	2.26	0.00	0.00	8.43	0.00	0.00	0.06	0.09	0.00	0.00	0.00	0.00	2.50
Bromus tectorum	22.34	89.90	0.00	49.81	23.09	42.99	0.00	0.06	36.38	1.78	0.00	10.21	120.42	0.00	0.03	19.29	0.00	5.27	0.09	0.09	33.73	0.00	31.30	105.02	0.00	52.70	0.00	15.33	36.18	0.62
Total Introduced Annual Grasses	**22.34**	**99.89**	**0.00**	**52.43**	**27.16**	**42.99**	**5.48**	**0.06**	**43.49**	**3.55**	**0.00**	**11.34**	**120.42**	**0.00**	**0.06**	**27.55**	**0.00**	**7.53**	**0.09**	**0.09**	**42.16**	**0.00**	**31.30**	**105.08**	**0.09**	**52.70**	**0.00**	**15.33**	**36.18**	**3.12**
Elymus smithii	0.00	0.00	0.00	0.00	1.21	0.00	0.00	5.50	0.00	0.76	0.00	9.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elymus spicatus	0.00	0.00	5.26	0.00	23.07	0.00	12.62	12.83	0.00	14.44	53.11	1.14	0.00	11.47	20.95	1.48	64.39	0.00	0.00	28.06	0.00	25.56	0.00	0.00	17.26	0.00	2.64	15.74	4.64	58.90
Festuca idahoensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	0.00	0.00	0.00
Hesperostipa comata	0.00	10.96	5.26	0.00	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.74	23.28	0.00	0.00	62.13	62.13	7.01	9.68	0.00	25.61	0.00	4.93	0.00	0.00	0.00	0.00	0.00
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.55	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	1.91	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.47	0.00	0.00	0.00	0.00	0.00
Total Native Cool Season Perennial Grasses	**0.00**	**10.96**	**10.53**	**0.00**	**24.28**	**3.20**	**12.62**	**18.42**	**0.00**	**21.75**	**53.11**	**11.36**	**0.00**	**19.12**	**46.56**	**1.48**	**64.39**	**62.13**	**62.13**	**35.07**	**9.68**	**34.08**	**25.61**	**0.00**	**24.66**	**0.00**	**5.56**	**15.74**	**4.64**	**58.90**
Aristida purpurea	0.00	0.00	2.63	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bouteloua gracilis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.57
Buchloe dactyloides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**2.63**	**0.90**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.26**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.57**
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	0.00
Helianthus annuus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.17	0.00	0.00	0.00
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**66.69**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5.17**	**0.00**	**2.78**	**0.00**
Alyssum desertorum	4.19	0.00	0.03	1.83	0.00	0.03	8.91	0.03	0.03	0.03	0.00	9.45	0.00	0.06	0.03	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.03	0.00	0.03	4.66	0.03	0.76	0.00	0.00
Camelina microcarpa	0.00	0.00	0.00	0.00	3.94	0.00	0.00	0.00	7.30	0.00	0.00	0.00	0.00	0.00	0.00	50.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	2.09	0.81
Descurainia sophia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sisymbrium altissimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.84	0.00	0.00	0.00	0.00
Total Introduced Annual Forbs	**4.19**	**0.00**	**0.03**	**1.83**	**3.94**	**0.03**	**8.91**	**0.03**	**7.36**	**0.03**	**0.00**	**9.45**	**0.00**	**0.06**	**0.03**	**50.79**	**0.00**	**0.00**	**0.03**	**0.00**	**0.03**	**0.00**	**0.03**	**0.00**	**0.03**	**14.50**	**0.09**	**1.53**	**2.09**	**0.81**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	0.00	1.25	0.00	0.00	0.00	0.00	0.00	0.00	2.73	6.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.00**	**1.25**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**2.73**	**6.91**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Ambrosia psilostachya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	0.00	0.00	0.00
Brickellia eupatorioides	11.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	9.46	15.76	0.00	0.00	7.38	0.00	1.32	0.00	0.00	0.74	0.00	6.05	3.49	0.00	0.00	0.00	0.00	0.00	5.32	0.00	0.00	0.00	0.00	0.00	0.00	3.05	0.00	6.53
Eriogonum pauciflorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.53
Evolvulus nuttallianus	22.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galium boreale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	1.50	0.00	4.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lactuca tatarica	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lomatium foeniculaceum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lygodesmia juncea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oxytropis sericea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.08	0.00	0.00	0.00	0.00	5.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scanned 02/27/2020

TFN 6 2/025
RECD NOV 14, 2014

RAMACO
Polygon: Scoria Grassland (SG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number
(*Denotes Sample Location Used to Calculate Permit Area Values)
Oven-dry Weight (grams/square meter)

	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16*	17*	18*	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	30*
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	3.69	0.00	0.00	0.00	0.00	1.72	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum esculentum	0.00	0.00	0.00	1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.11	0.00	3.12	0.00	0.00	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Psoralidium tenuiflorum	79.63	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74	4.28	0.00	0.00	0.00	0.00	7.64	0.00	0.00
Sphaeralcea coccinea	0.00	0.00	1.03	0.00	2.50	0.00	9.45	8.05	4.87	4.69	0.00	0.00	0.00	0.86	0.00	6.55	0.00	22.40	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.88	0.00	0.00	0.00
Symphyotrichum falcatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Perennial Forbs	**113.51**	**1.35**	**10.61**	**17.15**	**2.50**	**1.50**	**20.52**	**40.27**	**8.68**	**7.81**	**0.00**	**2.46**	**14.76**	**13.96**	**6.98**	**6.55**	**0.00**	**28.40**	**0.03**	**0.00**	**5.32**	**2.80**	**34.84**	**0.00**	**0.00**	**0.00**	**7.75**	**10.69**	**0.00**	**13.06**
Astragalus cicer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Medicago sativa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.05	0.00	0.00
Taraxacum officinale	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.32**	**0.00**	**0.00**	**0.00**	**0.00**	**0.43**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.05**	**0.00**	**0.00**
Cryptantha spp.	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eriogonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.17	0.00	0.00	0.00	0.00	0.00
Total Unknown Forb Species	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Production	**140.04**	**112.20**	**24.17**	**73.56**	**57.88**	**48.72**	**47.53**	**58.78**	**60.91**	**33.17**	**55.84**	**41.52**	**201.87**	**35.83**	**53.66**	**86.37**	**64.39**	**98.06**	**62.28**	**35.16**	**57.19**	**36.88**	**91.78**	**105.08**	**28.95**	**67.20**	**18.57**	**46.34**	**45.69**	**78.46**

S nned, 02/27/2020

TFN 6 2/025
ECD NOV 14, 2014

Polygon: Scoria Grassland (SG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area and Permit Area n=50	
	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46*	47*	48*	49*	50*	Mean Production	Standard Deviation
Echinochloa muricata	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1
Total Native Annual Grasses	**0.00**	**0.00**	**0.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.1**
Bromus japonicus	0.00	1.53	5.65	9.32	0.00	0.00	1.06	0.03	0.00	1.21	1.91	0.00	0.00	0.00	5.05	2.14	0.00	0.00	0.00	0.03	1.6	2.8
Bromus tectorum	24.83	75.03	5.65	37.29	8.73	15.88	1.58	10.83	0.00	0.00	0.00	0.00	37.08	0.00	0.00	19.23	29.15	0.00	23.87	0.00	19.7	28.2
Total Introduced Annual Grasses	**24.83**	**76.56**	**11.29**	**46.61**	**8.73**	**15.88**	**2.64**	**10.86**	**0.00**	**1.21**	**1.91**	**0.00**	**37.08**	**0.00**	**5.05**	**21.37**	**29.15**	**0.00**	**23.87**	**0.03**	**21.3**	**28.9**
Elymus smithii	0.00	0.00	15.96	0.00	14.35	0.00	0.00	0.00	1.36	0.00	0.00	0.00	0.00	0.00	7.31	0.03	0.00	0.00	13.52	0.00	1.6	4.0
Elymus spicatus	0.00	0.00	0.00	0.00	0.00	0.00	15.48	52.75	52.04	22.38	18.86	0.00	0.00	70.74	65.83	19.23	0.00	63.65	0.00	42.00	15.9	21.9
Festuca idahoensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4
Hesperostipa comata	2.15	0.00	9.57	2.34	0.00	11.26	0.00	0.00	0.00	0.00	0.00	0.00	9.65	0.00	0.00	8.96	9.77	0.00	0.00	0.00	5.5	13.0
Nassella viridula	0.00	16.80	0.00	0.00	0.00	0.00	23.21	0.00	0.00	0.00	4.71	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0	4.1
Poa secunda	0.00	0.00	6.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.0
Total Native Cool Season Perennial Grasses	**2.15**	**16.80**	**31.91**	**2.34**	**14.35**	**11.26**	**38.69**	**52.75**	**53.40**	**22.38**	**23.57**	**0.06**	**9.65**	**70.74**	**73.14**	**30.36**	**9.77**	**63.65**	**13.52**	**42.00**	**24.4**	**22.3**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4
Bouteloua gracilis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4
Buchloe dactyloides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
Calamagrostis purpurascens	0.00	0.00	0.00	0.00	9.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.4
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**9.70**	**0.00**	**0.00**	**0.00**	**1.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.4**	**1.5**
Festuca ovina	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2
Total Introduced Perennial Grasses	**1.44**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.2**
Descurainia pinnata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
Helianthus annuus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	9.4
Logfia arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.1
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**1.5**	**9.4**
Alyssum desertorum	3.88	0.00	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	9.81	0.00	0.03	13.89	0.00	0.00	0.00	0.00	1.2	3.0
Camelina microcarpa	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	7.2
Descurainia sophia	0.00	0.00	0.00	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
Sisymbrium altissimum	6.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.3	1.6
Total Introduced Annual Forbs	**10.34**	**3.00**	**0.00**	**2.15**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.03**	**0.00**	**9.81**	**0.00**	**0.03**	**13.89**	**0.00**	**0.00**	**0.00**	**0.00**	**2.9**	**7.9**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.47	0.00	0.00	0.00	0.00	0.1	0.5
Tragopogon dubius	2.58	9.35	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	1.7
Total Introduced Biennial Forbs	**2.58**	**9.35**	**0.00**	**0.00**	**1.45**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.47**	**0.00**	**0.00**	**0.00**	**0.00**	**0.6**	**1.7**
Ambrosia psilostachya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5
Brickellia eupatorioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.6
Dalea purpurea	2.18	0.00	2.93	34.57	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	12.76	0.00	0.00	0.00	0.00	0.00	2.2	5.8
Eriogonum pauciflorum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.0
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	3.2
Galium boreale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.01	0.1
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6
Lactuca tatarica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2
Lomatium foeniculaceum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.3
Lygodesmia juncea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.7

Signed, 02/27/2020

TFN 6 2/025
DECD NOV 14, 2014

Polygon: Scoria Grassland (SG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area and Permit Area n=50	
	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*	46*	47*	48*	49*	50*	Mean Production	Standard Deviation
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1
Oxytropis sericea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.0	4.7
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.0
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.5
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.4	2.3
Psoralidium tenuiflorum	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.9	11.3
Sphaeralcea coccinea	2.18	0.00	0.00	0.00	5.12	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	2.45	0.00	0.00	0.00	7.34	0.00	1.6	3.8
Symphyotrichum falcatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.11	0.00	0.00	0.2	1.4
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.38	0.00	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.2	0.7
Total Native Perennial Forbs	**6.22**	**0.00**	**2.93**	**34.57**	**5.12**	**0.00**	**0.00**	**4.41**	**2.86**	**2.50**	**1.15**	**0.00**	**16.10**	**0.00**	**15.24**	**0.00**	**0.00**	**10.11**	**8.15**	**0.00**	**9.4**	**17.9**
Astragalus cicer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.2
Medicago sativa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4
Taraxacum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1
Total Introduced Perennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.2**	**0.5**
Cryptantha spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.1
Eriogonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6
Total Unknown Forb Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.1**	**0.6**
Total Production	**47.56**	**105.71**	**46.86**	**85.67**	**39.35**	**27.14**	**41.33**	**68.05**	**57.27**	**26.09**	**26.66**	**0.06**	**72.64**	**70.74**	**93.46**	**69.09**	**38.95**	**73.76**	**45.54**	**42.03**	**60.8**	**33.8**

S nned, 02/27/2020

TFN 6 2/025
ECD NOV 14,2014

RAMACO
Polygon: Upland Grassland (UG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species

Sample Number

(*Denotes Sample Location Used to Calculate Permit Area Values)

Oven-dry Weight (grams/square meter)

	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	29*	30*	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*
Bromus japonicus	0.00	0.90	0.28	0.81	5.60	0.00	12.19	0.03	0.92	0.00	0.00	1.54	5.07	1.98	0.00	1.94	11.45	11.93	0.03	16.76	7.46	2.66	1.53	0.00	0.00	0.00	0.00	0.00	3.07	32.14
Bromus tectorum	0.00	0.23	5.26	0.00	0.00	0.00	12.19	0.00	8.29	10.10	0.00	0.00	0.56	17.86	0.00	0.00	0.00	11.93	0.00	5.59	0.00	0.00	1.53	0.00	0.00	0.00	61.96	0.00	0.00	74.98
Total Introduced Annual Grasses	**0.00**	**1.13**	**5.54**	**0.81**	**5.60**	**0.00**	**24.37**	**0.03**	**9.21**	**10.10**	**0.00**	**1.54**	**5.63**	**19.84**	**0.00**	**1.94**	**11.45**	**23.85**	**0.03**	**22.34**	**7.46**	**2.66**	**3.05**	**0.00**	**0.00**	**0.00**	**61.96**	**0.00**	**3.07**	**107.12**
Elymus lanceolatus	0.00	0.00	22.80	15.20	0.00	0.00	0.00	0.00	0.00	0.00	7.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.79	0.00	0.00	9.07	0.00	0.00	0.00	0.00	0.00	0.00
Elymus smithii	25.58	92.75	0.00	81.08	28.60	72.23	29.42	12.46	0.00	0.00	44.30	0.00	7.59	6.61	27.47	4.14	36.81	29.14	52.70	7.68	22.19	0.00	26.30	5.44	0.00	62.32	6.60	21.15	30.80	0.90
Elymus spicatus	30.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.98	0.00	0.00	0.00	0.00	59.48	0.00	33.14	0.00	0.00	0.00	30.71	0.00	44.49	26.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperostipa comata	0.00	0.00	2.53	0.00	0.00	0.00	6.62	0.00	14.56	6.33	0.00	0.00	11.39	0.00	11.77	4.14	0.00	0.00	0.00	0.00	0.00	11.12	0.00	0.00	0.00	0.00	0.00	21.15	0.00	26.51
Nassella viridula	0.00	0.00	22.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.98	0.00	0.00	0.00	1.94	0.00	4.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.58	0.00	0.00
Poa secunda	0.00	0.00	2.53	5.07	19.07	0.00	0.74	0.00	0.00	0.00	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.86	3.63	0.00	0.00	0.00	0.00	3.42	0.00
Total Native Cool Season Perennial Grasses	**56.35**	**92.75**	**50.67**	**101.35**	**47.67**	**72.23**	**36.78**	**12.46**	**48.54**	**6.33**	**58.07**	**0.00**	**37.96**	**66.09**	**39.24**	**41.42**	**38.75**	**29.14**	**57.39**	**38.39**	**36.98**	**55.61**	**62.45**	**18.13**	**0.00**	**62.32**	**6.60**	**52.88**	**34.22**	**27.41**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bouteloua gracilis	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.49	0.00	6.34	0.00	5.97	0.00	0.00	2.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distichlis stricta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sporobolus cryptandrus	0.00	0.00	0.00	0.00	0.00	0.00	4.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.58**	**0.00**	**0.00**	**0.00**	**4.25**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.21**	**0.00**	**4.49**	**0.00**	**6.34**	**0.00**	**5.97**	**0.00**	**0.00**	**2.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	2.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa bulbosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	3.29	0.00	0.00	0.00	0.00	3.87	0.00	0.00
Total Introduced Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.44**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.17**	**0.00**	**0.00**	**0.00**	**3.29**	**0.00**	**0.00**	**0.00**	**0.00**	**3.87**	**0.00**	**0.00**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**25.31**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Lappula redowskii	0.00	0.00	0.00	0.00	0.00	0.00	0.03	54.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Logfia arvensis	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plantago patagonica	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.69	0.00	0.92	0.00	0.00	0.00	0.03	4.77	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Annual Forbs	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.03**	**54.13**	**0.00**	**0.00**	**6.09**	**0.00**	**0.92**	**0.00**	**0.00**	**0.00**	**0.06**	**4.77**	**0.00**	**0.00**	**0.00**	**0.09**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**
Alyssum desertorum	0.00	0.00	0.00	0.03	4.46	0.00	0.03	0.03	0.00	0.90	1.40	0.68	0.03	4.54	0.00	0.03	0.00	4.77	0.00	0.00	0.06	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.62	0.00
Total Introduced Annual Forbs	**0.00**	**0.00**	**0.00**	**0.03**	**4.46**	**0.00**	**0.03**	**0.03**	**0.00**	**0.95**	**1.40**	**0.68**	**0.03**	**4.54**	**0.00**	**0.03**	**0.00**	**4.77**	**0.00**	**0.00**	**0.06**	**0.03**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.62**	**0.00**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tragopogon dubius	0.00	0.00	0.00	0.00	2.61	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	6.38	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Introduced Biennial Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**2.61**	**0.00**	**0.00**	**0.53**	**0.00**	**0.00**	**1.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.75**	**6.38**	**0.00**	**0.00**	**0.81**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.15	0.00	0.00	0.00	0.00	3.68	0.00	0.00	0.00	4.70	0.00	0.00	0.00	0.00	3.70	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00
Agoseris glauca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ambrosia psilostachya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.95	0.00	0.00	0.00
Antennaria microphylla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cirsium flodmanii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dalea purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaura coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grindelia squarrosa	0.00	0.00	0.00	0.00	4.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.18
Pediomelum esculentum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

S nned 02/27/2020

TFN 6 2/025
DEC NOV 14, 2014

RAMACO
Polygon: Upland Grassland (UG)
Production Sample Data
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Sample Number

(*Denotes Sample Location Used to Calculate Permit Area Values)

Oven-dry Weight (grams/square meter)

Plant Species	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	29*	30*	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*	41*	42*	43*	44*	45*
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.36	0.00	0.00	0.65	0.06	0.00	0.00	0.00	0.00	4.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Psoralidium tenuiflorum	0.00	6.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.76	0.00	1.74	0.00	0.00	0.00	0.00	0.00	0.00	11.14	15.42	0.00	0.00	0.00	0.00	0.00	0.00	6.55
Sphaeralcea coccinea	2.77	0.00	1.50	0.00	0.00	0.85	0.00	0.00	0.00	4.66	0.78	0.00	3.68	1.43	0.00	7.12	0.00	0.00	0.00	2.74	0.00	3.70	0.00	0.00	0.00	0.00	0.00	2.66	10.30	0.00
Thermopsis rhombifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.31	0.00	0.00	0.00	0.00
Vicia americana	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.42	0.00	1.17	0.00	0.00	12.13	0.00	0.00	0.00	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Native Perennial Forbs	**4.62**	**6.65**	**1.50**	**0.00**	**4.01**	**0.85**	**0.00**	**10.15**	**7.42**	**4.66**	**2.46**	**0.00**	**17.49**	**14.27**	**1.74**	**12.94**	**5.34**	**4.30**	**0.00**	**2.74**	**0.00**	**23.47**	**15.42**	**0.59**	**0.00**	**7.31**	**3.95**	**2.66**	**10.30**	**8.73**
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taraxacum officinale	0.00	1.90	0.00	0.00	0.00	0.00	7.30	3.38	0.00	0.00	0.00	0.00	0.00	0.00	1.74	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00	0.00	2.18
Total Introduced Perennial Forbs	**0.00**	**1.90**	**0.00**	**0.00**	**0.00**	**2.59**	**7.30**	**3.38**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.74**	**0.00**	**0.59**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.18**
Eriogonum spp.	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Penstemon spp.	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Unknown Forb Species	**0.00**	**0.95**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total Production	**60.97**	**103.38**	**59.35**	**102.19**	**64.35**	**78.11**	**72.76**	**80.71**	**65.17**	**47.35**	**69.19**	**2.22**	**64.24**	**104.74**	**47.21**	**56.33**	**62.53**	**66.83**	**65.31**	**69.85**	**44.50**	**84.23**	**85.02**	**20.09**	**0.03**	**69.63**	**72.51**	**59.41**	**48.21**	**145.47**

S--nned, 02/27/2020

TFN 6 2/025
DECD NOV 14, 2014

RAMACO
Polygon: Upland Grassland (UG)
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area and Permit Area n=50	
	46*	47*	48*	49*	50*	51*	52*	53*	54*	55*	56*	57*	58*	59*	60*	61*	62*	63*	64*	65*	Mean Production	Standard Deviation
Bromus japonicus	6.86	2.61	0.00	0.06	2.73	7.57	12.42	0.00	6.58	0.00	25.15	0.00	0.00	16.16	2.18	0.00	10.14	29.12	0.00	0.00	4.8	7.7
Bromus tectorum	10.29	6.08	0.00	0.06	10.90	1.89	12.42	51.19	0.00	44.70	16.76	27.66	83.44	16.16	0.00	0.00	10.14	43.69	0.00	0.00	10.9	20.0
Total Introduced Annual Grasses	**17.15**	**8.69**	**0.00**	**0.12**	**13.63**	**9.46**	**24.83**	**51.19**	**6.58**	**44.70**	**41.91**	**27.66**	**83.44**	**32.32**	**2.18**	**0.00**	**20.27**	**72.81**	**0.00**	**0.00**	**15.7**	**23.8**
Elymus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	4.6
Elymus smithii	8.84	2.35	77.71	1.99	10.43	8.00	0.00	0.00	0.00	0.00	26.00	21.41	0.00	6.33	0.00	0.00	21.23	0.00	43.52	53.15	20.3	24.5
Elymus spicatus	0.00	16.45	0.00	27.85	0.00	6.00	26.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61.32	0.00	0.00	0.00	0.00	0.00	7.9	16.1
Hesperostipa comata	20.64	0.00	0.00	3.98	6.26	23.99	0.00	5.91	0.00	0.00	0.00	0.00	0.00	25.33	0.00	0.00	0.00	4.08	0.00	0.00	4.1	7.5
Nassella viridula	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.38	0.00	0.00	0.00	1.9	6.5
Poa secunda	0.00	4.70	4.09	3.98	4.17	2.00	2.98	0.00	0.03	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.4	3.2
Total Native Cool Season Perennial Grasses	**29.48**	**23.50**	**81.80**	**37.80**	**20.85**	**39.99**	**29.82**	**5.91**	**0.03**	**0.00**	**26.53**	**21.41**	**0.00**	**31.66**	**61.32**	**0.00**	**56.61**	**4.08**	**43.52**	**53.15**	**37.0**	**24.9**
Aristida purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.6
Bouteloua gracilis	0.00	0.00	0.00	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.08	0.00	0.00	0.00	0.6	1.7
Distichlis stricta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Sporobolus cryptandrus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.08	0.00	0.00	0.00	0.2	1.2
Total Native Warm Season Perennial Grasses	**0.00**	**0.00**	**0.00**	**1.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**11.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**14.15**	**0.00**	**0.00**	**0.00**	**1.0**	**2.9**
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.35	0.00	0.00	0.00	0.00	0.4	2.8
Festuca ovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6
Poa bulbosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	0.7
Total Introduced Perennial Grasses	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.94**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**19.35**	**0.00**	**0.00**	**0.00**	**0.00**	**0.7**	**2.9**
Carex filifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	3.6
Total Native Grasslike Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.5**	**3.6**
Lappula redowskii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.1	7.7
Logfia arvensis	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.3
Plantago patagonica	0.00	0.00	0.00	0.00	1.30	0.00	0.00	1.69	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.3	1.0
Total Native Annual Forbs	**0.00**	**0.00**	**0.00**	**0.00**	**2.59**	**0.00**	**0.00**	**1.69**	**2.16**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**1.5**	**7.7**
Alyssum desertorum	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	1.44	0.00	0.00	2.02	0.00	0.06	0.00	0.00	0.03	0.00	0.00	0.00	0.4	1.1
Total Introduced Annual Forbs	**0.00**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**	**1.44**	**0.00**	**0.00**	**2.02**	**0.00**	**0.06**	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.4**	**1.1**
Melilotus officinalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.1	0.3
Tragopogon dubius	0.00	1.27	1.70	0.00	2.32	0.00	0.00	0.00	0.79	0.00	2.19	3.86	0.00	0.00	0.00	0.00	0.00	2.00	2.26	0.00	0.5	1.2
Total Introduced Biennial Forbs	**0.00**	**1.27**	**1.70**	**0.00**	**2.32**	**0.00**	**0.00**	**0.00**	**0.79**	**0.00**	**2.19**	**3.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.00**	**2.26**	**1.83**	**0.6**	**1.2**
Achillea millefolium	0.00	0.00	8.25	0.00	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.7	2.0
Agoseris glauca	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Ambrosia psilostachya	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00	0.00	0.00	0.00	3.12	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.2	0.7
Antennaria microphylla	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Cirsium flodmanii	0.00	0.00	0.00	7.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.1
Dalea purpurea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.83	0.00	0.00	0.00	0.00	11.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	2.6
Evolvulus nuttallianus	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	24.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.5	3.4
Gaura coccinea	0.00	0.00	4.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6
Grindelia squarrosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.6
Musineon divaricatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Pediomelum argophyllum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.23	0.00	0.00	0.00	0.00	0.00	0.1	0.7
Pediomelum esculentum	0.00	5.60	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.8
Phlox hoodii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.84	0.00	0.00	0.00	0.00	0.00	0.3	1.3
Psoralidium tenuiflorum	0.00	0.00	0.00	17.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00	1.36	0.00	0.00	0.00	1.3	3.8
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.32	0.00	0.00	0.00	1.0	2.3
Thermopsis rhombifolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.2	1.3

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RAMACO
Polygon: Upland Grassland (UG)
Sample Date: 7/01-12/2013
Plot Size: 1.0 Square Meter

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Oven-dry Weight (grams/square meter)																				Study Area and Permit Area n=50	
	46*	47*	48*	49*	50*	51*	52*	53*	54*	55*	56*	57*	58*	59*	60*	61*	62*	63*	64*	65*	Mean Production	Standard Deviation
Vicia americana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.90	0.00	0.00	0.00	1.1	4.1
Total Native Perennial Forbs	**0.00**	**5.60**	**12.37**	**25.83**	**1.54**	**1.64**	**0.96**	**14.83**	**0.00**	**24.07**	**0.00**	**0.00**	**14.78**	**0.00**	**7.13**	**0.00**	**36.58**	**0.03**	**0.00**	**0.00**	**6.4**	**8.2**
Convolvulus arvensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.4
Taraxacum officinale	0.00	0.00	4.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.5	1.3
Total Introduced Perennial Forbs	**0.00**	**0.00**	**4.12**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.83**	**0.6**	**1.4**
Eriogonum spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13
Penstemon spp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14
Total Unknown Forb Species	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.0**	**0.19**
Total Production	**46.63**	**39.06**	**99.99**	**65.77**	**40.93**	**51.09**	**55.61**	**77.56**	**11.00**	**80.19**	**70.75**	**54.95**	**98.22**	**64.04**	**70.63**	**19.35**	**127.64**	**78.95**	**45.78**	**56.80**	**64.4**	**27.9**

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ATTACHMENT D8-1-J

Raw Shrub Density Data

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RECD NOV 14, 2014

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Polygon: Big Sagebrush Shrubland (BSS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																						
	1	2	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16	17*	18*	19*	20	21*	22*	23*
Artemisia cana	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
Artemisia tridentata	209	165	73	16	93	79	57	87	60	62	71	105	65	61	83	52	140	73	42	58	95	116	116
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	14	0
Ericameria nauseosa	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhus aromatica	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	7	0	0	0	0	1
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**209**	**200**	**73**	**17**	**95**	**80**	**57**	**87**	**60**	**62**	**71**	**105**	**66**	**61**	**83**	**53**	**140**	**80**	**45**	**58**	**107**	**130**	**117**
Artemisia frigida	12	8	12	28	45	0	2	0	2	6	4	0	2	1	9	13	15	0	22	8	68	36	19
Gutierrezia sarothrae	0	0	6	20	63	0	0	0	6	22	0	53	0	5	2	3	1	0	0	29	3	0	2
Yucca glauca	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**12**	**8**	**18**	**50**	**108**	**0**	**2**	**0**	**8**	**28**	**4**	**53**	**2**	**6**	**11**	**16**	**16**	**0**	**22**	**37**	**71**	**36**	**21**
Total Density	**221**	**208**	**91**	**67**	**203**	**80**	**59**	**87**	**68**	**90**	**75**	**158**	**68**	**67**	**94**	**69**	**156**	**80**	**67**	**95**	**178**	**166**	**138**

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RAMACO

Polygon: Big Sagebrush Shrubland (BSS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																						
	64	65*	66*	67*	68*	69*	70*	71	72	73*	74*	75	76*	77*	78	79	80*	81	82*	83	84*	85*	86*
Artemisia cana	0	0	0	0	0	0	21	63	0	8	0	0	0	0	0	34	0	18	7	0	0	0	0
Artemisia tridentata	57	97	50	153	42	110	58	177	67	78	92	80	53	174	87	252	102	40	66	78	63	71	104
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0
Ericameria nauseosa	0	0	1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1
Rhus aromatica	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**63**	**97**	**51**	**165**	**42**	**110**	**79**	**240**	**67**	**86**	**92**	**80**	**53**	**174**	**87**	**286**	**142**	**58**	**73**	**78**	**63**	**77**	**105**
Artemisia frigida	18	0	5	21	8	0	69	27	0	4	77	5	0	23	24	37	31	27	7	6	1	14	21
Gutierrezia sarothrae	2	0	18	11	0	0	0	0	32	0	0	12	0	76	14	41	0	0	0	2	0	27	14
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**20**	**0**	**23**	**32**	**8**	**0**	**69**	**27**	**32**	**4**	**77**	**17**	**0**	**99**	**38**	**78**	**31**	**27**	**7**	**8**	**1**	**41**	**35**
Total Density	**83**	**97**	**74**	**197**	**50**	**110**	**148**	**267**	**99**	**90**	**169**	**97**	**53**	**273**	**125**	**364**	**173**	**85**	**80**	**86**	**64**	**118**	**140**

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RAMACO
Polygon: Big Sagebrush Shrubland (BSS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect				Study Area n=50		Permit Area n=38	
	87*	88*	89*	90*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	0	0	0	0	3.3	10.7	1.3	4.1
Artemisia tridentata	130	101	56	118	90.7	45.5	84.5	32.8
Chrysothamnus viscidiflorus	0	0	0	0	1.1	6.0	1.5	6.8
Ericameria nauseosa	0	0	0	0	1.1	5.2	0.5	2.2
Rhus aromatica	0	0	0	0	0.3	1.1	0.3	1.2
Ribes cereum	0	0	0	0	<0.01	<0.01	0.0	0.0
Symphoricarpos albus	0	0	0	0	0.1	0.6	0.0	0.0
Total Native Full Shrubs	**130**	**101**	**56**	**118**	**96.6**	**52.3**	**88.2**	**34.5**
Artemisia frigida	0	3	16	2	15.2	18.4	15.1	20.2
Gutierrezia sarothrae	0	24	9	0	9.9	17.2	9.5	18.1
Yucca glauca	0	0	0	0	0.04	0.3	0.1	0.3
Total Native Half &Sub-Shrubs	**0**	**27**	**25**	**2**	**25.1**	**26.4**	**24.7**	**28.5**
Total Density	**130**	**128**	**81**	**120**	**121.7**	**64.5**	**112.9**	**50.7**

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RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Density Sample Data
Sample Date: 7/01-12//2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect													
	1*	2*	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14
Artemisia cana	0	0	0	0	6	0	5	0	0	0	0	0	18	4
Rhus aromatica	0	0	0	0	3	0	2	0	0	0	0	0	0	0
Rosa woodsii	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	25	0	0	0	0	2
Symphoricarpos occidentalis	0	0	0	0	0	0	52	0	0	0	0	0	0	0
Symphoricarpos spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**0**	**0**	**0**	**0**	**9**	**0**	**59**	**0**	**25**	**0**	**0**	**0**	**18**	**6**
Artemisia frigida	0	6	0	0	0	0	4	0	0	7	0	0	7	0
Artemisia ludoviciana	17	0	143	0	97	0	2	0	0	1	70	0	2	2
Total Native Half &Sub-Shrubs	**17**	**6**	**143**	**0**	**97**	**0**	**6**	**0**	**0**	**8**	**70**	**0**	**9**	**2**
Total	**17**	**6**	**143**	**0**	**106**	**0**	**65**	**0**	**25**	**8**	**70**	**0**	**27**	**8**

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RAMACO
Polygon: Bottomland Sagebrush Grassland (BSG)
Density Sample Data
Sample Date: 7/01-12//2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect											Study Area n=25		Permit Area n=17	
	15*	16	17*	18*	19*	20*	21*	22*	23*	24	25	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	20	0	0	29	7	0	0	0	192	0	18	12.0	38.4	16.3	46.1
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0.2	0.7	0.3	0.8
Rosa woodsii	0	0	0	0	0	0	0	0	0	0	2	0.1	0.4	0.0	0.0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	1.1	5.0	0.0	0.0
Symphoricarpos occidentalis	0	0	0	5	63	0	0	25	0	0	48	7.7	18.4	8.5	19.5
Symphoricarpos spp.	0	10	0	0	0	0	0	0	0	0	0	0.4	2.0	0.0	0.0
Total Native Full Shrubs	**20**	**10**	**0**	**34**	**70**	**0**	**0**	**25**	**192**	**0**	**68**	**21.5**	**41.7**	**25.1**	**48.2**
Artemisia frigida	0	0	0	3	0	0	2	0	18	0	0	1.9	4.1	2.8	4.7
Artemisia ludoviciana	0	3	0	31	122	0	133	163	0	0	0	31.4	54.2	45.9	60.9
Total Native Half &Sub-Shrubs	**0**	**3**	**0**	**34**	**122**	**0**	**135**	**163**	**18**	**0**	**0**	**33.3**	**53.5**	**48.7**	**59.2**
Total	**20**	**13**	**0**	**68**	**192**	**0**	**135**	**188**	**210**	**0**	**68**	**54.8**	**68.3**	**73.8**	**74.5**

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RAMACO
Polygon: Pine and Juniper Woodland (PJW)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect															Study Area and Permit Area n=15	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	Mean Absolute	Standard Deviation
Artemisia tridentata	0	15	0	7	13	19	0	0	9	17	0	0	0	41	0	8.1	11.6
Chrysothamnus viscidiflorus	0	2	0	0	0	15	0	0	0	0	0	0	0	0	0	1.1	3.9
Ericameria nauseosa	2	0	1	28	14	4	0	0	0	0	0	0	0	0	0	3.3	7.8
Rhus aromatica	7	21	0	1	1	5	0	0	0	3	0	0	0	11	0	3.3	5.9
Ribes cereum	0	0	0	0	0	0	0	3	0	0	15	7	3	0	0	1.9	4.1
Rosa woodsii	0	39	0	0	2	0	0	0	0	0	0	0	0	0	0	2.7	10.0
Total Native Full Shrubs	**9**	**77**	**1**	**36**	**30**	**43**	**0**	**3**	**9**	**20**	**15**	**7**	**3**	**52**	**0**	**20.4**	**22.9**
Artemisia frigida	0	15	0	0	10	0	36	0	48	8	6	62	7	13	4	13.9	19.3
Artemisia ludoviciana	0	135	0	0	0	0	0	0	0	0	0	0	0	0	0	9.0	34.9
Gutierrezia sarothrae	66	28	7	24	46	17	5	0	0	0	0	18	0	0	0	14.1	19.9
Total Native Half &Sub-Shrubs	**66**	**178**	**7**	**24**	**56**	**17**	**41**	**0**	**48**	**8**	**6**	**80**	**7**	**13**	**4**	**37.0**	**46.5**
Total Density	**75**	**255**	**8**	**60**	**86**	**60**	**41**	**3**	**57**	**28**	**21**	**87**	**10**	**65**	**4**	**57.4**	**62.2**

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RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect														
	1*	2	3*	4*	5*	6*	7*	8*	9	10*	11*	12	13*	14	15
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Artemisia tridentata	0	52	0	1	0	0	1	0	0	0	0	2	0	11	0
Chrysothamnus viscidiflorus	0	0	0	0	43	0	0	0	0	0	0	0	2	0	0
Ericameria nauseosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**0**	**52**	**0**	**1**	**43**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**11**	**0**
Artemisia frigida	0	0	0	0	0	0	3	0	0	10	0	12	39	2	6
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**10**	**0**	**12**	**39**	**2**	**6**
Total Density	**0**	**52**	**0**	**1**	**43**	**0**	**15**	**0**	**0**	**10**	**0**	**14**	**41**	**13**	**6**

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RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect														
	16*	17*	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30*
Artemisia cana	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Artemisia tridentata	0	0	2	0	0	0	0	1	0	0	0	18	8	0	18
Chrysothamnus viscidiflorus	0	0	0	0	2	1	0	2	2	0	26	0	0	0	0
Ericameria nauseosa	0	0	56	0	0	0	0	0	0	0	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Total Native Full Shrubs	**0**	**0**	**58**	**0**	**2**	**1**	**0**	**4**	**3**	**0**	**26**	**18**	**8**	**0**	**26**
Artemisia frigida	10	27	0	0	109	26	2	1	64	136	388	0	0	0	7
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	115
Gutierrezia sarothrae	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**19**	**27**	**0**	**0**	**109**	**26**	**2**	**1**	**64**	**136**	**388**	**0**	**0**	**0**	**122**
Total Density	**19**	**27**	**58**	**0**	**111**	**27**	**2**	**5**	**67**	**136**	**414**	**18**	**8**	**0**	**148**

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RAMACO
Polygon: Prairie Dog Modified Grassland (PDMG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect										Study Area n=40		Permit Area n=34	
	31*	32*	33*	34*	35*	36*	37*	38*	39*	40*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0.03	0.2	0.0	0.2
Artemisia tridentata	0	0	0	12	0	0	0	3	2	0	3.3	9.2	1.9	4.8
Chrysothamnus viscidiflorus	1	0	0	0	0	0	0	0	0	0	2.0	7.8	2.3	8.5
Ericameria nauseosa	0	0	0	2	0	0	0	0	0	0	1.5	8.9	1.7	9.6
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0.03	0.2	0.0	0.2
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0.2	1.3	0.2	1.4
Total Native Full Shrubs	**1**	**0**	**0**	**14**	**0**	**0**	**0**	**3**	**2**	**0**	**7.1**	**14.4**	**6.2**	**13.3**
Artemisia frigida	9	0	0	0	71	0	0	12	111	0	26.1	67.7	30.1	72.8
Artemisia ludoviciana	0	0	0	0	0	0	7	0	0	0	3.1	18.2	3.6	19.7
Gutierrezia sarothrae	0	0	2	71	5	0	0	0	0	0	2.5	11.4	2.9	12.3
Total Native Half &Sub-Shrubs	**9**	**0**	**2**	**71**	**76**	**0**	**7**	**12**	**111**	**0**	**31.7**	**69.3**	**36.6**	**74.2**
Total Density	**10**	**0**	**2**	**85**	**76**	**0**	**7**	**15**	**113**	**0**	**38.8**	**73.0**	**42.8**	**78.2**

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RAMACO
Polygon: Reclaimed Grassland (RG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect										Study Area n=10		Permit Area n=8	
	1*	2*	3*	4*	5*	6	7*	8	9*	10*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	4	0	0	0	0	0	0	0	0	0	0.4	1.3	0.5	1.4
Artemisia tridentata	1	0	0	0	0	0	0	0	0	0	0.1	0.3	0.1	0.4
Atriplex canescens	1	0	0	35	0	0	0	0	0	2	3.8	11.0	4.8	12.2
Ericameria nauseosa	0	0	0	0	0	0	0	4	0	0	0.4	1.3	0.0	0.0
Total Native Full Shrubs	**6**	**0**	**0**	**35**	**0**	**0**	**0**	**4**	**0**	**2**	**4.7**	**10.9**	**5.4**	**12.2**
Artemisia frigida	0	0	0	0	0	1	0	0	0	0	0.1	0.3	0.0	0.0
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0.1**	**0.3**	**0.0**	**0.0**
Total Density	**6**	**0**	**0**	**35**	**0**	**1**	**0**	**4**	**0**	**2**	**4.8**	**10.8**	**5.4**	**12.2**

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RAMACO
Polygon: Riparian Woodland (RW)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																	
	1	2	3	4*	5*	6*	7	8	9*	10	11*	12*	13	14	15*	16*	17	18*
Artemisia cana	0	0	0	9	1	1	0	0	0	19	0	6	0	105	88	38	0	0
Artemisia tridentata	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0
Ericameria nauseosa	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ribes cereum	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rosa woodsii	0	0	0	18	0	0	0	0	15	0	0	0	0	1	0	7	0	0
Shepherdia canadensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	20	35	50	317	230	2	0	0	265	0	470	704	25	0	150	135	99	65
Symphoricarpos occidentalis	0	0	325	0	0	0	0	0	0	0	0	0	0	101	0	0	0	0
Total Native Full Shrubs	**20**	**35**	**375**	**346**	**231**	**3**	**0**	**0**	**281**	**19**	**470**	**710**	**25**	**216**	**238**	**180**	**99**	**65**
Artemisia frigida	0	2	0	0	0	1	0	0	0	0	0	0	0	10	0	0	0	0
Artemisia ludoviciana	0	0	0	49	0	0	0	0	0	21	0	48	0	42	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**0**	**2**	**0**	**49**	**0**	**1**	**0**	**0**	**0**	**21**	**0**	**48**	**0**	**52**	**0**	**0**	**0**	**0**
Total Density	**20**	**37**	**375**	**395**	**231**	**4**	**0**	**0**	**281**	**40**	**470**	**758**	**25**	**268**	**238**	**180**	**99**	**65**

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RAMACO
Polygon: Riparian Woodland (RW)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect														
	19*	20*	21*	22	23*	24*	25	26	27*	28*	29	30*	31*	32	33
Artemisia cana	44	51	0	0	8	35	0	0	25	115	0	0	0	0	0
Artemisia tridentata	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Ericameria nauseosa	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ribes cereum	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0
Rosa woodsii	0	0	0	0	0	0	3	180	1	0	0	0	0	117	0
Shepherdia canadensis	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0
Symphoricarpos albus	112	22	0	0	178	116	140	186	334	60	25	545	0	107	76
Symphoricarpos occidentalis	0	17	100	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**160**	**90**	**100**	**0**	**186**	**156**	**145**	**382**	**364**	**175**	**25**	**545**	**0**	**224**	**76**
Artemisia frigida	19	0	0	0	0	4	0	0	3	0	0	0	0	0	0
Artemisia ludoviciana	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**19**	**0**	**30**	**0**	**0**	**4**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Total Density	**179**	**90**	**130**	**0**	**186**	**160**	**145**	**382**	**367**	**175**	**25**	**545**	**0**	**224**	**76**

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RAMACO
Polygon: Riparian Woodland (RW)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect													Study Area n=46		Permit Area n=23	
	34	35	36	37*	38	39*	40	41*	42	43*	44*	45	46*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	0	30	0	160	64	42	77	13	7	0	0	24	0	20.9	36.3	27.7	42.1
Artemisia tridentata	0	0	0	0	12	0	0	0	0	0	0	0	13	0.9	2.9	0.8	2.8
Ericameria nauseosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	0.6	0.3	0.9
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	1	0	0.02	0.1	0.0	0.0
Ribes cereum	0	0	0	0	0	1	0	0	0	0	0	0	0	0.1	0.5	0.2	0.5
Rosa woodsii	5	0	0	0	3	7	1	9	0	0	0	0	7	8.1	31.2	2.8	5.2
Shepherdia canadensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	2.4	0.0	0.0
Symphoricarpos albus	0	0	15	10	0	513	0	270	0	0	489	0	37	126.1	175.6	218.4	206.1
Symphoricarpos occidentalis	8	26	0	0	28	0	12	0	0	0	0	38	0	14.2	51.6	5.1	21.0
Total Native Full Shrubs	**13**	**56**	**15**	**170**	**107**	**563**	**90**	**292**	**7**	**0**	**489**	**63**	**57**	**170.8**	**177.2**	**255.3**	**191.6**
Artemisia frigida	0	0	0	0	8	0	1	0	0	0	0	0	44	2.0	7.2	3.1	9.8
Artemisia ludoviciana	65	12	0	0	0	0	0	0	57	0	15	0	0	7.4	17.1	6.2	15.0
Gutierrezia sarothrae	0	0	0	0	0	0	0	0	0	0	0	0	2	0.04	0.3	0.1	0.4
Total Native Half &Sub-Shrubs	**65**	**12**	**0**	**0**	**8**	**0**	**1**	**0**	**57**	**0**	**15**	**0**	**46**	**9.4**	**18.3**	**9.4**	**17.0**
Total Density	**78**	**68**	**15**	**170**	**115**	**563**	**91**	**292**	**64**	**0**	**504**	**63**	**103**	**180.2**	**179.3**	**264.7**	**195.6**

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RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per transect																
	1*	2*	3*	4*	5*	6*	7	8*	9*	10*	11	12	13	14*	15*	16*	17*
Artemisia cana	0	17	3	0	0	0	0	0	0	0	0	0	15	0	0	0	0
Artemisia tridentata	22	86	2	27	14	13	66	17	102	61	192	151	48	55	1	196	111
Atriplex canescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	9	0	0	2	0	0	0	0
Ericameria nauseosa	0	0	5	11	15	4	20	31	0	9	0	58	0	0	0	71	12
Rhus aromatica	7	4	6	0	0	0	0	0	0	0	0	0	0	7	0	0	0
Rosa woodsii	70	0	35	0	0	0	0	0	0	0	29	107	69	0	0	60	15
Sarcobatus vermiculatus	0	0	0	61	29	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0
Total Native Full Shrubs	**99**	**107**	**51**	**99**	**58**	**17**	**86**	**48**	**102**	**79**	**221**	**316**	**145**	**62**	**1**	**327**	**138**
Artemisia frigida	13	14	77	0	0	0	7	16	55	19	38	17	0	29	89	38	0
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atriplex gardneri	0	0	0	4	12	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	62	26	42	7	0	56	0	35	120	1	0	0	1	0	73	0	7
Juniperus horizontalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linanthus pungens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yucca glauca	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**76**	**40**	**119**	**11**	**12**	**56**	**7**	**51**	**175**	**20**	**55**	**17**	**1**	**29**	**162**	**38**	**7**
Total Density	**175**	**147**	**170**	**110**	**70**	**73**	**93**	**99**	**277**	**99**	**276**	**333**	**146**	**91**	**163**	**365**	**145**

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RCD NOV 14, 2014

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RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per transect															
	18*	19*	20*	21*	22	23*	24*	25*	26*	27*	28*	29*	30	31	52*	53
Artemisia cana	0	31	0	0	0	0	0	0	0	0	5	0	0	0	0	0
Artemisia tridentata	86	186	79	194	23	125	95	43	0	15	25	10	49	34	83	47
Atriplex canescens	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ericameria nauseosa	28	21	4	85	2	54	22	32	0	0	5	83	8	52	8	0
Rhus aromatica	0	0	0	0	2	0	0	4	0	0	8	0	0	0	0	0
Rosa woodsii	70	0	55	39	0	37	40	25	175	0	0	0	0	187	0	2
Sarcobatus vermiculatus	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**184**	**238**	**138**	**318**	**27**	**216**	**159**	**104**	**178**	**15**	**43**	**93**	**59**	**273**	**91**	**49**
Artemisia frigida	0	37	5	18	68	0	0	33	21	60	56	21	0	0	21	0
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Atriplex gardneri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	12	18	56	21	153	0	3	8	117	45	6	25	11	13	41	0
Juniperus horizontalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Linanthus pungens	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0
Yucca glauca	0	0	0	0	0	0	0	0	0	4	12	0	0	0	0	0
Total Native Half &Sub-Shrubs	**12**	**55**	**61**	**39**	**221**	**0**	**3**	**41**	**138**	**109**	**74**	**46**	**19**	**13**	**62**	**0**
Total Density	**196**	**293**	**199**	**357**	**248**	**216**	**162**	**145**	**316**	**124**	**117**	**139**	**78**	**286**	**153**	**49**

TFN 6 2/025
RCD NOV 14, 2014

Scanned, 02/27/2020

RAMACO
Polygon: Rough Breaks Mixed Shrubland (RBMS)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per transect																Study Area n=49		Permit Area n=35	
	54	55	56	57*	58	59*	60	61*	62*	63*	64*	65*	66*	67	68*	69*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1.5	5.4	1.7	5.9
Artemisia tridentata	0	23	60	30	90	28	21	108	107	37	62	53	21	68	3	93	62.5	53.6	62.6	54.8
Atriplex canescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.3	0.0	0.0
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0.4	2.0	0.6	2.4
Ericameria nauseosa	0	5	0	24	36	142	8	0	4	0	1	0	0	1	0	9	17.8	28.8	19.4	31.7
Rhus aromatica	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.9	2.1	1.1	2.4
Rosa woodsii	86	1	0	0	0	3	61	0	0	0	10	0	0	15	0	0	24.3	42.9	18.1	35.2
Sarcobatus vermiculatus	0	0	25	0	0	0	0	0	0	0	0	0	0	0	6	0	2.6	10.1	2.9	11.3
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.1	0.4	0.1	0.5
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	1.6	0.0	0.0
Total Native Full Shrubs	**88**	**30**	**85**	**54**	**126**	**173**	**90**	**108**	**111**	**37**	**85**	**53**	**23**	**84**	**9**	**105**	**110.3**	**81.6**	**106.5**	**79.3**
Artemisia frigida	57	6	0	25	0	0	30	13	55	12	7	0	18	10	0	10	20.3	23.2	21.8	23.5
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0.6	2.9	0.3	1.9
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0.2	1.6	0.3	1.9
Atriplex gardneri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.8	0.5	2.1
Gutierrezia sarothrae	20	1	0	38	9	7	75	25	5	8	0	8	52	50	43	13	26.8	34.4	28.0	30.8
Juniperus horizontalis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.02	0.1	0.0	0.0
Linanthus pungens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	1.1	0.0	0.0
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.8	0.5	2.1
Total Native Half &Sub-Shrubs	**77**	**7**	**0**	**63**	**9**	**7**	**105**	**38**	**60**	**31**	**7**	**8**	**70**	**61**	**54**	**23**	**48.7**	**49.0**	**51.4**	**44.0**
Total Density	**165**	**37**	**85**	**117**	**135**	**180**	**195**	**146**	**171**	**68**	**92**	**61**	**93**	**145**	**63**	**128**	**159.0**	**83.1**	**157.9**	**80.0**

TFN 6 2/025
RCD NOV 14, 2014

Scanned, 02/27/2020

RAMACO
Polygon: Scoria Grassland (SG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Sample Number

(*Denotes Sample Location Used to Calculate Permit Area Values)

Plant Species	Number per Transect																	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	16*	17*	18*
Artemisia cana	0	0	0	3	22	0	0	0	0	2	0	0	0	0	0	0	0	0
Artemisia tridentata	31	0	0	2	0	19	10	108	0	0	15	5	0	26	0	0	37	15
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ericameria nauseosa	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0
Rhus aromatica	4	16	2	12	0	15	1	5	5	25	0	2	0	0	10	2	5	0
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rosa woodsii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**35**	**16**	**2**	**17**	**22**	**34**	**11**	**115**	**5**	**28**	**15**	**7**	**0**	**29**	**10**	**2**	**43**	**15**
Artemisia frigida	0	0	0	12	17	0	29	45	0	4	0	0	0	40	28	6	11	13
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	9	0	0	5	17	5	0	0	0	0	1	3	0	0	8
Krascheninnikovia lanata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0
Total Native Half &Sub-Shrubs	**0**	**0**	**0**	**21**	**17**	**0**	**34**	**62**	**5**	**4**	**0**	**0**	**0**	**41**	**55**	**6**	**11**	**21**
Total Density	**35**	**16**	**2**	**38**	**39**	**34**	**45**	**177**	**10**	**32**	**15**	**7**	**0**	**70**	**65**	**8**	**54**	**36**

TFN 6 2/025
DEQ NOV 14, 2014

Scanned, 02/27/2020

RAMACO
Polygon: Scoria Grassland (SG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																		
	19*	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	30*	31*	32*	33*	34*	35*	36*	37*
Artemisia cana	0	0	0	0	0	0	4	0	0	0	0	0	0	46	0	0	0	0	10
Artemisia tridentata	13	48	8	60	0	0	0	0	0	21	9	50	20	0	45	18	1	41	0
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Ericameria nauseosa	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4
Rhus aromatica	0	0	1	7	5	8	0	12	4	11	19	10	1	27	0	4	0	0	8
Ribes cereum	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Rosa woodsii	0	0	0	0	0	20	22	6	0	6	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**13**	**48**	**9**	**67**	**5**	**28**	**27**	**20**	**4**	**38**	**30**	**60**	**21**	**73**	**47**	**22**	**1**	**41**	**24**
Artemisia frigida	8	0	0	0	0	0	100	20	0	5	12	4	1	40	40	0	0	0	11
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	15	0	0	20	0	0	12	0	3	2	11	0	0	0	0	5
Krascheninnikovia lanata	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Total Native Half &Sub-Shrubs	**8**	**0**	**0**	**15**	**0**	**0**	**122**	**20**	**0**	**17**	**12**	**7**	**3**	**114**	**40**	**0**	**1**	**0**	**16**
Total Density	**21**	**48**	**9**	**82**	**5**	**28**	**149**	**40**	**4**	**55**	**42**	**67**	**24**	**187**	**87**	**22**	**2**	**41**	**40**

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/27/2020

RAMACO
Polygon: Scoria Grassland (SG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect													Study Area and Permit Area n=50	
	38*	39*	40*	41*	42*	43*	44*	45*	46*	47*	48*	49*	50*	Mean Absolute	Standard Deviation
Artemisia cana	0	0	0	0	0	0	0	0	0	0	23	25	0	2.7	8.5
Artemisia tridentata	20	3	47	0	62	9	45	0	42	17	0	0	70	18.3	23.9
Chrysothamnus viscidiflorus	0	0	0	0	0	0	3	0	0	0	0	0	0	0.1	0.5
Ericameria nauseosa	0	0	0	0	37	0	0	0	0	0	0	0	0	0.9	5.3
Rhus aromatica	18	5	6	11	0	7	0	7	5	1	5	6	15	6.1	6.7
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.3
Rosa woodsii	0	0	0	8	15	0	0	0	0	0	0	0	0	1.5	4.8
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.4
Symphoricarpos occidentalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.1
Total Native Full Shrubs	**38**	**8**	**53**	**19**	**114**	**16**	**48**	**7**	**47**	**18**	**28**	**31**	**85**	**29.8**	**26.2**
Artemisia frigida	10	0	6	0	12	1	2	15	0	6	2	2	10	10.2	17.7
Artemisia ludoviciana	0	0	0	0	0	0	0	0	0	0	0	0	0	1.3	8.9
Gutierrezia sarothrae	0	31	3	0	16	0	0	5	0	0	16	0	0	3.7	6.7
Krascheninnikovia lanata	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.3
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	3.4
Total Native Half &Sub-Shrubs	**10**	**31**	**9**	**0**	**28**	**1**	**2**	**20**	**0**	**6**	**18**	**2**	**10**	**15.7**	**25.7**
Total Density	**48**	**39**	**62**	**19**	**142**	**17**	**50**	**27**	**47**	**24**	**46**	**33**	**95**	**45.5**	**42.0**

TFN 6 2/025
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Scanned, 02/27/2020

RAMACO
Polygon: Upland Grassland (UG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																	
	1*	2*	3*	4*	5*	6*	7*	8*	9*	10*	11*	12*	13*	14*	15*	17*	18*	19*
Artemisia cana	0	0	0	0	0	39	0	0	0	0	1	0	0	17	0	0	1	0
Artemisia tridentata	0	0	15	10	0	43	0	0	1	1	0	12	0	35	0	3	0	25
Chrysothamnus viscidiflorus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ericameria nauseosa	0	0	0	0	19	0	0	2	0	0	0	9	3	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ribes cereum	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Rosa woodsii	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0
Sarcobatus vermiculatus	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Full Shrubs	**5**	**0**	**15**	**10**	**19**	**82**	**0**	**17**	**1**	**1**	**1**	**34**	**3**	**52**	**0**	**5**	**1**	**25**
Artemisia frigida	0	20	19	11	0	7	0	2	12	2	33	0	113	3	2	59	1	39
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gutierrezia sarothrae	0	15	0	0	12	0	0	0	0	0	0	21	0	0	0	0	0	0
Krascheninnikovia lanata	0	45	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yucca glauca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Native Half &Sub-Shrubs	**0**	**80**	**19**	**12**	**12**	**7**	**0**	**2**	**12**	**2**	**33**	**21**	**113**	**3**	**2**	**59**	**1**	**40**
Total Density	**5**	**80**	**34**	**22**	**31**	**89**	**0**	**19**	**13**	**3**	**34**	**55**	**116**	**55**	**2**	**64**	**2**	**65**

TFN 6 2/025
DEQ NOV 14, 2014

Scanned, 02/27/2020

RAMACO
Polygon: Upland Grassland (UG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect																				
	20*	21*	22*	23*	24*	25*	26*	27*	28*	29*	63*	64*	65*	66*	67*	68*	69*	70*	71*	72*	73*	74*
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0
Artemisia tridentata	0	2	0	0	0	0	2	0	0	7	2	0	0	7	0	0	28	0	9	0	0	0
Chrysothamnus viscidiflorus	0	0	2	0	0	0	9	0	0	0	0	0	23	3	0	0	0	1	0	0	0	0
Ericameria nauseosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhus aromatica	0	0	0	0	0	1	0	0	0	0	0	0	3	5	0	0	0	0	0	1	0	1
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rosa woodsii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sarcobatus vermiculatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Symphoricarpos albus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0
Total Native Full Shrubs	**0**	**2**	**2**	**0**	**0**	**1**	**11**	**0**	**0**	**7**	**2**	**11**	**26**	**15**	**0**	**0**	**28**	**1**	**69**	**1**	**0**	**1**
Artemisia frigida	2	5	87	9	78	3	18	0	0	98	0	0	40	37	2	42	5	3	49	27	0	0
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gutierrezia sarothrae	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0
Krascheninnikovia lanata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yucca glauca	0	0	1	0	0	0	0	0	3	0	0	0	1	0	0	0	0	7	1	0	2	0
Total Native Half &Sub-Shrubs	**2**	**5**	**88**	**9**	**98**	**3**	**18**	**0**	**3**	**98**	**0**	**0**	**41**	**37**	**2**	**42**	**5**	**10**	**50**	**44**	**2**	**0**
Total Density	**2**	**7**	**90**	**9**	**98**	**4**	**29**	**0**	**3**	**105**	**2**	**11**	**67**	**52**	**2**	**42**	**33**	**11**	**119**	**45**	**2**	**1**

TFN 6 2/025
2ED NOV 14, 201

Scanned, 02/27/2020

RAMACO
Polygon: Upland Grassland (UG)
Density Sample Data
Sample Date: 7/01-12/2013
Plot Size: 100 Square Meters

Plant Species	Sample Number (*Denotes Sample Location Used to Calculate Permit Area Values) Number per Transect												Study Area n=52		Permit Area n=50	
	75*	76*	77*	78	79*	80*	81*	82*	83*	84	85*	86*	Mean Absolute	Standard Deviation	Mean Absolute	Standard Deviation
Artemisia cana	0	0	0	0	0	0	0	0	0	0	0	0	1.3	6.0	1.4	6.2
Artemisia tridentata	0	0	0	0	0	0	0	0	0	0	12	0	4.1	9.3	4.3	9.5
Chrysothamnus viscidiflorus	0	4	0	4	0	0	20	17	0	0	0	0	1.6	4.9	1.6	5.0
Ericameria nauseosa	0	0	0	0	0	0	0	0	0	0	0	0	0.6	2.9	0.7	3.0
Rhus aromatica	2	0	0	0	0	1	6	0	0	0	0	0	0.4	1.2	0.4	1.2
Ribes cereum	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.7	0.1	0.8
Rosa woodsii	0	0	0	5	0	0	0	0	0	0	0	0	0.4	2.2	0.3	2.1
Sarcobatus vermiculatus	0	0	0	0	0	0	0	0	0	0	0	0	0.3	1.8	0.3	1.9
Symphoricarpos albus	0	0	0	0	0	0	1	0	0	0	0	0	1.2	8.3	1.2	8.6
Total Native Full Shrubs	**2**	**4**	**0**	**9**	**0**	**1**	**27**	**17**	**0**	**0**	**12**	**0**	**10.0**	**17.2**	**10.3**	**17.7**
Artemisia frigida	1	2	34	74	1	0	45	78	78	0	0	0	21.9	30.5	21.3	30.2
Artemisia pedatifida	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.1	0.0	0.1
Gutierrezia sarothrae	0	0	0	0	2	0	0	0	0	0	0	0	1.7	5.2	1.7	5.3
Krascheninnikovia lanata	0	0	0	0	0	0	0	0	0	0	0	0	0.9	6.2	0.9	6.4
Yucca glauca	0	0	0	0	0	0	5	0	0	0	0	0	0.4	1.3	0.4	1.3
Total Native Half &Sub-Shrubs	**1**	**2**	**34**	**74**	**3**	**0**	**50**	**78**	**78**	**0**	**0**	**0**	**24.9**	**32.1**	**24.3**	**31.9**
Total Density	**3**	**6**	**34**	**83**	**3**	**1**	**77**	**95**	**78**	**0**	**12**	**0**	**34.9**	**36.7**	**34.6**	**36.7**

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ATTACHMENT D8-1-K

Sampling Plan

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RAMACO

Brook Mine

Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Matthew H. Mead, Governor

Todd Parfitt, Director

August 28, 2013

Dawn Gardner
BKS Environmental Associates, Inc.
P.O. box 3467
Gillette, WY 82717

RE: Sampling Plan for Ramaco Surface Coal Mine, TFN 6 2/025

Dear Dawn:

I approve the attached sampling plan. I corrected the acreage table and added a page 13 with the agreements that we made during your sampling.

If you have questions please call me.

Sincerely,

Stacy Page

Stacy Page

sp\

attachment

cc: Cheyenne File w/attachment

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MJK 8/28/13

Herschler Building · 122 West 25th Street · Cheyenne, WY 82002 · http://deq.state.wy.us

ADMIN/OUTREACH (307) 777-7758 FAX 777-7682
ABANDONED MINES (307) 777-6145 FAX 777-6462
AIR QUALITY (307) 777-7391 FAX 777-5616
INDUSTRIAL SITING (307) 777-7368 FAX 777-3973
LAND QUALITY (307) 777-7756 FAX 777-5864
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WATER QUALITY (307) 777-7781 FAX 777-5973

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Sampling Methods for Baseline Vegetation Study
Ramaco Wyoming Coal Co. - Ramaco Surface Coal Mine
June 20, 2013

INTRODUCTION

A baseline vegetation study will be performed in Sheridan County northeast of Ranchester, Wyoming, within the proposed Ramaco Surface Coal Mine permit area. The proposed permit area includes approximately 5,902 acres and is located in all or portions of:

- Sections 10, 11, 12, 13, 14, 15, 21, 22, 23, 24, 26, and 27 T57N R85W.
- Sections 7, 8, 9, 10, 15, 17, 18, 19, 20, and 22 T57N R84W.

The following 10 vegetation communities are located within the proposed permit area: Agricultural Lands, Bottomland Sagebrush Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Juniper Woodland, Reclaimed, Rough Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, and Upland Grassland. Disturbed areas are also present within the proposed permit area and consist primarily of roads and facilities associated with abandoned mine land activity, as well as existing Big Horn Coal and other historic surface coal mines. Refer to Table 1 for mapping acreages.

Potential wetland areas have been identified predominantly within the Bottomland Sagebrush Grassland and Riparian Woodland vegetation communities which encompass approximately 206.05 acres of the proposed permit area. Potential wetland areas include areas along Slater Creek and unnamed tributaries, Hidden Water Creek and unnamed tributaries, seeps, drainages, and reservoirs. Potential wetland areas were identified using color infra-red (CIR) photography and field observation of areas that visually contained plant species more adapted to moist and/or saline conditions. These areas may not be jurisdictional wetlands under the U.S. Army Corps of Engineers (USACE) delineation criteria.

Table 1: Vegetation Map Units, Symbols, and Associated Acreages.

Vegetation Map Units	Map Unit Symbol	Permit Area Acreage June 2013 Methodology	Permit Area Acreage for Final Mapping Acreage
Agricultural Lands	AG	508.52	495.02
Bottomland Sagebrush Grassland	BSG	76.67	76.71
Big Sagebrush Shrubland	BSS	1,385.93	1,368.90
Prairie Dog Modified Grassland	PDMG	504.38	517.68
Juniper Woodland	JW	50.93	51.03
Reclaimed	R	541.17	542.45
Rough Breaks Mixed Shrubland	RBMS	782.42	738.53
Riparian Woodland	RW	129.38	132.08
Scoria Grassland	SG	539.08	582.23
Upland Grassland	UG	1,253.30	1,245.68
Disturbed	D	115.05	115.25
Water/Seep	W	15.45	15.48
TOTAL		**5,902.28**	**5,881.04**

Baseline vegetation sampling will be conducted no later than August 31, 2013. Sampling, once initiated, will be completed within a three-week period. If sampling within a three week period is not possible, BKS will notify the Wyoming Department of Environmental Quality, Land Quality Division (LQD) immediately. Vegetation baseline sampling will be conducted using the procedures described in this document. Vegetation parameter sampling will be conducted by vegetation community as specified in Table 2. Wetlands will not be sampled as part of the baseline study but will be included under USACE delineation requirements.

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Table 2: Baseline Vegetation Sampling – Measured Parameters.

Parameter	AG	BLG	BSS	PDMG	JW	R	RBMS	RW	SG	UG
% Absolute Total Ground Cover	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Hit % Absolute Total Vegetation Cover	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multiple Hit Vegetation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Production	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Shrub/Sub-shrub Density	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tree Count and Distribution	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

VEGETATION COMMUNITY CLASSIFICATION & MAPPING

Vegetation communities within the proposed permit area were classified and mapped prior to commencing vegetation sampling. Mapping and classification identified the following 10 vegetation communities (disturbed and water not included):

- Agricultural Lands
- Bottomland Sagebrush Grassland
- Big Sagebrush Shrubland
- Prairie Dog Modified Grassland
- Juniper Woodland
- Reclaimed
- Rough Breaks Mixed Shrubland
- Riparian Woodland
- Scoria Grassland
- Upland Grassland

Vegetation communities were mapped using August 2011 ArcGIS Online World Imagery and verified through field surveys in April and June 2013. The acreages will be verified in the field throughout the duration of the study and may change slightly from this original methodology. The following apply to the mapping and/or sampling:

1) Disturbed areas and open water within the proposed permit area were also identified and mapped, based on the scale of available mapping. Disturbed areas and open water will be excluded from all vegetation parameter sampling.
2) Prairie dog towns are scattered throughout the proposed permit and were mapped to the extent possible based on the scale of available mapping, independent of size.
3) The areas of the 2001 and 2011 burn, due to the lack of shrubs, were placed in the Upland Grassland vegetation community regardless of the likely pre-fire vegetation type.
4) Marginal older agricultural areas containing a limited amount of crested wheatgrass which are not hayed will be included in the Upland Grassland vegetation community.
5) A seep area that consists of approximately one acre will be mapped and described, but not sampled.

All areas within ½ mile of the proposed permit area will be mapped, based on a review of August 2011 ArcGIS Online World Imagery and known expression of this imagery within the proposed permit area. It

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will not be necessary to field verify mapping within ½ mile of the proposed permit area; in addition, vegetation sampling will not be conducted within this area.

TRANSECT ORIGIN SELECTION

A computerized systematic grid (through ArcGIS) will be used to randomly locate sample points within each vegetation community. Due to changes in the permit boundary between cage placement and sampling portions of this project, separate sample point locations will be generated for production and cover/shrub density sampling. These computer generated random numbers will be uploaded to a hand-held GPS unit for actual location in the field. Sample points will be sampled in numerical order until the minimum sample size is attained and then until either sample adequacy is met or the required maximum number of samples has been collected.

LINE TRANSECT LAYOUT

A 50-meter line transect will be used in the 10 vegetation communities to be sampled: Agricultural Lands, Bottomland Sagebrush Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Juniper Woodland, Reclaimed, Rough Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, and Upland Grassland. Each 50-meter line transect will begin at its specified random origin point and extend in a randomly generated compass direction.

Transects that exceed the boundaries of the vegetation community being sampled will be redirected back into its vegetation community at a 90 degree angle from the original transect direction at the point of intercept. In instances where a 90 degree angle of reflection does not place the transect within the sampled vegetation community, a 45 degree angle of reflection will be used.

GROUND COVER

Line-transect point-intercept methods will be used to collect percent absolute cover data from the 10 vegetation communities. Each 50-meter transect will represent a single sample point. Percent cover measurements will be taken from point-intercepts at 1-meter intervals along a 50-meter transect using a laser pointer. Should a transect run out of the vegetation community boundary or a non-vegetated feature, it will be redirected as described above. Each point-intercept will represent 2% of the cover measurements.

Percent cover measurements will record "first-hit" point-intercepts by live foliar vegetation species, litter, rock, or bare ground. Litter will include all non-living organic material. Manure will be included with bare ground. Rock fragments will be recorded when they are equal to or greater than one centimeter in size (i.e., sheet flow, minimum non-erodable particle size). First-hit data will be recorded and tabulated to evaluate total ground cover and total vegetation cover. Multiple hits on vegetation will be recorded, but used only for the purpose of constructing a plant species list for each vegetation community.

Total Vegetation Cover

Vegetation cover is the vertical projection of the general outline of plants to the ground surface. Vegetation cover data will be recorded by species using first hit data. All point intercepts of living vegetation and growth produced during the current growing season will be counted toward total vegetation cover. Total vegetation cover measurements will be expressed in absolute percentages for each sample point. Relative cover values for percent species cover may be provided. Total vegetation cover WILL NOT include lichen and moss.

Total Ground Cover

Total ground cover is the sum of cover values for percent vegetation, percent litter, and percent rock. Total ground cover data will be recorded by live vegetation, litter, rock, or bare ground. Litter will include all dead organic matter that is recognizable. Total ground cover measurements will be expressed in absolute percentages for each sample point. Total ground cover WILL include lichen and moss.

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Species Diversity

Species diversity will be determined by noting all plant species observed or sampled within a 100-square meter belt transect centered over the cover transect (1-meter on either side of the 50-meter cover transect). The number of belt transects will equal the number of cover transects for a given vegetation community. Sample adequacy will not be calculated for species diversity. Species diversity will be summarized by lifeform and vegetation community.

PRODUCTION

Annual herbaceous production will be quantitatively sampled within each vegetation community, excluding Agricultural Lands, Prairie Dog Modified Grassland, Juniper Woodland and Reclaimed. Each production quadrat will cover an area of no less than 0.5 m square meter. All standing 2013 biomass will be clipped as close to the ground as possible and placed in paper bags. Major species (contributing greater than 2% relative cover) will be collected and bagged by species. Minor species (contributing less than 2% relative cover) will be collected by lifeform, and relative percent contribution estimated by species. Species lacking creditable value, full shrubs, succulents, *Yucca* species, cushion plants, mosses, lichens, and trees will not be clipped. Although clipping annual forbs is not required, annual forbs will be collected in the field, and 2013 annual forb data will be reported.

Clipped biomass will be dried in a forced air oven at 105° C for 24 hours and weighed on an electronic balance scale to the nearest 0.10 gram. Clipped samples contributing less than 0.10 gram of matter will be considered trace samples and calculated at 0.033 grams of weight. The bag weight will be calculated and subtracted from the sample weight to yield only the dry weight of the vegetative matter. The final results will be reported in grams/m^2 and pounds/acre.

Production quadrats will be sampled until either sample adequacy is achieved or the maximum number of samples is reached for a given vegetation community. All production quadrats will be sampled within grazing exclosures. Exclosures will be established as soon as field conditions permit. Each exclosure will exceed the quadrat size to accommodate the sample quadrat and a buffer area. Permanent fences used to control livestock grazing are considered a type of grazing exclosure.

Production within the Agricultural Lands vegetation community will not be quantitatively sampled, but a ten-year county-wide productivity mean (2003-2012) based on Wyoming Agriculture Statistics Service yield data will be provided.

SHRUB DENSITY

Shrub density data will be collected in conjunction with randomly selected cover transects, wherever possible. All shrubs, full or sub, will be counted within 1-meter on either side of the 50-meter cover transect (100-square meter belt transect). Shrub density data will be quantitatively evaluated and sample adequacy will be calculated for shrub density transects. Shrub density belt transects will be sampled until either sample adequacy is achieved or the maximum number of samples is reached for a given vegetation community. If sample adequacy has not been reached LQD will be notified for a decision about the need for additional sampling. No shrub height measurements will be statistically summarized. General approximations of shrub heights will be recorded.

TREE DENSITY

It is anticipated that trees will be found within the proposed permit area. No tree density sampling will be carried out; however, if trees are observed within the proposed permit area, they will be noted and qualitatively summarized within the report text.

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SAMPLE ADEQUACY

Table 3 lists the minimum and maximum number of cover, production, and/or shrub density transects per vegetation community that will be sampled in the Agricultural Lands, Bottomland Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Pine and Juniper Woodland, Reclaimed, Rough

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Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, and Upland Grassland. Sample adequacy will be calculated after the minimum sample size is attainted and an incremental number of cover, production, and/or shrub density transects will be sampled until either sample adequacy is met or the maximum number of samples has been collected. The sample adequacy formula outlined in LQD Handbook of Approved Sampling and Statistical Methods for Evaluation of Revegetation Success on Wyoming Coal Mines will be utilized to determine the minimum required size of the sample population.

Table 3: Vegetation Monitoring Minimum/Maximum Sample Population Requirements for Sampled Vegetation Communities.

Vegetation Community	Parameter	Plant Community Minimum Sample Size	Plant Community Maximum Sample Size
Agricultural Lands	Ground Cover Vegetation Cover Shrub Density	20	50
Bottomland Sagebrush Grassland	Ground Cover Vegetation Cover Shrub Density Total Production	15	25
Big Sagebrush Shrubland	Ground Cover Vegetation Cover Shrub Density Total Production	20	50[1]
Prairie Dog Modified Grassland	Ground Cover Vegetation Cover Shrub Density	20	50
Juniper Woodland	Ground Cover Vegetation Cover Shrub Density	10	15
Reclaimed[2]	Ground Cover Vegetation Cover Shrub Density	10	10
Rough Breaks Mixed Grassland	Ground Cover Vegetation Cover Shrub Density Total Production	20	50[1]
Riparian Woodland	Ground Cover Vegetation Cover Shrub Density Total Production	20	50[1]
Scoria Grassland	Ground Cover Vegetation Cover Shrub Density Total Production	20	50[1]
Upland Grassland	Ground Cover Vegetation Cover Shrub Density Total Production	20	50[1]
Total		**175**	**400**

[1]If sample adequacy is not met for shrub density with the maximum number of transects, LQD will be notified and a decision will be made about additional sampling.
[2] There are five data sets for this community and the semi-quantitative methods in Ch. 2 Coal Regulations are acceptable.

The 10 sampled vegetation communities have been identified as either "grassland", "shrubland", or "woodland". Using Table 1 in LQD Handbook of Approved Sampling and Statistical Methods for Evaluation of Revegetation Success on Wyoming Coal Mines, the constant values to be used in statistical

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test are (for both grassland and shrubland total vegetation cover, total cover, total production, and shrub density): "z"=1.28 and "d" = 0.1. All sampled vegetation will be included in the sample adequacy test (i.e., "Species Lacking Creditable Value" will not be eliminated from the equation).

PLANT SPECIES LISTS

A plant species list by scientific name, common name, and lifeform will be developed individually for each of the 10 vegetation communities. This list will be compiled from species noted during all vegetation monitoring activities including point-intercept line transect cover measurements, species diversity belt transect measurements, and other opportunistic observations of the sampling area.

OTHER DATA COLLECTED

Habitat and species surveys for any United States Fish and Wildlife Service (USFWS) threatened, endangered, or candidate species or any state species of special concern listed in the Wyoming Natural Heritage database will be conducted during the appropriate period based on phenology, and any identified individuals or populations or appropriate habitat will be identified on the baseline vegetation map. All state listed noxious weeds will be noted and significant concentrations identified on the baseline vegetation map.

Photographs will be taken of the 10 vegetation communities. Photographic locations will be documented and illustrated on the baseline vegetation map.

EXTENDED REFERENCE AREA MAPPING & JUSTIFICATION

As noted in the Vegetation Community Classification & Mapping section, all lands within the proposed permit area were mapped as one of 10 vegetation communities, disturbed lands, or water. All Agricultural Land, Bottomland Sagebrush Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Juniper Woodland, Reclaimed, Rough Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, and Upland Grassland areas unaffected by the mining operation will serve as Extended Reference Area (EXREFA). For the purposes of this permit, EXREFA means a land unit which will be used to evaluate revegetation success for each of the same vegetation communities which were affected by the mining operation. The EXREFA will be a subset of the mapped vegetation communities and will be included as potential sample points for the sampling program. The EXREFA will remain unaffected over the course of the mining operation and will be as large as practical, at least two acres, considering land ownership patterns, and land management history. The permit application Appendix D-8 will show the EXREFA on the vegetation map and will include text justifying the choice of the EXREFA.

BASELINE VEGETATION SURVEY REPORT

A summary of all field data collected and will include the following major headings and content:

I. Table of Contents

II. Approved mapping and sampling methods

- Text that briefly lists the title and date for the approval for the approved methods and includes a reference to the location of the approved methods in Appendix D-8.
- Text making a clear statement that all sampling methods were executed as approved.
- Text noting the time periods when field sampling occurred.

III. Map of the Agricultural Land, Bottomland Sagebrush Grassland, Big Sagebrush Shrubland, Prairie Dog Modified Grassland, Juniper Woodland, Reclaimed, Rough Breaks Mixed Shrubland, Riparian Woodland, Scoria Grassland, Upland Grassland, and Extended Reference Areas

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- Map with appropriate legend information for all entries.
- Identify photo locations.
- Identify sample points in each vegetation community.
- Identify projected affected area and tabulate acreage.
- Tabulate acreage of each map unit.

IV. Present and discuss sample numbers.

- Tabular presentation

Plant Community	Total Vegetation Cover (%)	Actual Sample Size	Computed Adequate Sample Size	Computed Z-Value	Confidence Level Achieved
Agricultural Land					
Bottomland Sagebrush Grassland					
Big Sagebrush Shrubland					
Prairie Dog Modified Grassland					
Juniper Woodland					
Reclaimed					
Rough Breaks Mixed Shrubland					
Riparian Woodland					
Scoria Grassland					
Upland Grassland					

Plant Community	Total Ground Cover (%)	Actual Sample Size	Computed Adequate Sample Size	Computed Z-Value	Confidence Level Achieved
Agricultural Land					
Bottomland Sagebrush Grassland					
Big Sagebrush Shrubland					
Prairie Dog Modified Grassland					
Juniper Woodland					
Reclaimed					
Rough Breaks Mixed Shrubland					
Riparian Woodland					
Scoria Grassland					
Upland Grassland					

- Text briefly discussing numbers in relation to the approved methods

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V. Present sample data

- Optional tabular presentation.

Vegetation Parameter	Vegetation Community									
	AG	BLS	BSS	PDMG	JW	R	RBMS	RW	SG	UG
Absolute Vegetation Cover (%)										
Absolute Total Ground Cover (%)										

- Text which describes the major vegetation and topographic characteristics of each community; integrate soil type(s) as useful.
- Tabulate and discuss relative cover values by life form.
- Present and discuss photographs.

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Optional Relative Vegetation Cover by Lifeform Table.

Life Form	AG	BLS	BSS	PDMG	JW	R	RBMS	RW	SG	UG
	Relative %	Relative %	Relative %	Relative %	Relative %	Relative %	Relative %	Relative %	Relative %	Relative %
Native Annual Grasses										
Introduced Annual Grasses										
Native Cool Season Perennial Grasses										
Native Warm Season Perennial Grasses										
Introduced Perennial Grasses										
Native Annual Forbs										
Introduced Annual Forbs										
Native Perennial Forbs										
Introduced Perennial Forbs										
Half and Sub-Shrubs										
Full Shrubs										
Native Trees										
Introduced Trees										
Succulents										

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Absolute Cover Summary by Species Table

Species (list of species organized in the life forms below)	AG Absolute %	BLS Absolute %	BSS Absolute %	PDMG Absolute %	JW Absolute %	R Absolute %	RBMS Absolute %	RW Absolute %	SG Absolute %	UG Absolute %
Annual Grasses										
Vulpia octoflora										
Bromus tectorum										
Bromus japonicus										
Total Annual Grasses										
etc										
Introduced Perennial Grasses										
Total Introduced Perennial Grasses										
Native Annual Forbs										
Total Native Annual Forbs										
Introduced Annual Forbs										
Total Introduced Annual Forbs										
Native Perennial Forbs										
Total Native Perennial Forbs										
Introduced Perennial Forbs										
Total Introduced Perennial Forbs										
Half and Sub-Shrubs										
Total Half and Sub-Shrubs										
Full Shrubs										
Total Full Shrubs										
Native Trees										
Total Native Trees										
Introduced Trees										
Total Introduced Trees										
Succulents										
Total Succulents										
Total Vegetative Cover										
Litter										
Rock										
Cryptograms										
Total Ground Cover										
Bare Ground										

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VI. Present species lists by vegetation community.

- Text briefly discussing lists.
- Text noting the presence or absence of federally listed threatened and endangered species and state listed noxious weeds.

VII. Present Extended Reference Area

- Text briefly describing reference units in baseline map.
- Text discussing and justifying representative nature of the EXREFA.

VIII. References

- Includes citations for plant identification, etc.

IX. Photographs

- Each caption is complete and descriptive.

X. Raw Cover Data

- Includes tables for raw cover.

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Attachment to Sampling Plan date June 20, 2013

Additional Agreements.

Juniper dominated one portion and Ponderosa Pine dominated the other portion of the Juniper Woodland vegetation community. Sample adequacy was not met in this community when combined. When split apart the Ponderosa Pine community meets adequacy. The Juniper community still does not meet adequacy. Fifteen transects total were sampled for 50 acres. . The Juniper dominated area is 18.58 acres and 8 samples were collected. The Ponderosa Pine dominated area (PPs in Section Section 10, T57N, R84W) is 32.45 acres and 7 samples were collected. **No more samples were required**

2. Sample adequacy was not met for any of the vegetation communities for shrub density. Review of the data indicated that the target shrub would unlikely change with more sampling on any of the communities except for the Upland Grassland. The shrub density was extremely low in this community and probably would not increase very much if at all with addtiional sampling. **No additional sampling will be required.**

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D9.1.1 Methods D9-1
D9.1.2 Results D9-2
D9.2 Sage-grouse D9-2
D9.3 References D9-3

LIST OF TABLES

Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area ... D9-T1

LIST OF EXHIBITS

Exhibit D9.1-1 Wildlife Inventory
Exhibit D9.1-2 Sage-grouse Core Area (2 sheets)

LIST OF ADDENDA

Addendum D9-1 Baseline Wildlife Inventory

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WILDLIFE

Appendix D9

Prepared by:
WWC Engineering

October 2014

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D9 WILDLIFE

Baseline wildlife studies for RAMACO's Brook Mine were conducted by Intermountain Resources of Laramie, Wyoming. The baseline report is presented in Addendum D9-1(Baseline Wildlife Inventory).

D9.1 Wildlife

D9.1.1 Methods

Wildlife baseline inventories followed standard survey requirements and protocols used and approved by the U.S. Fish and Wildlife Service (USFWS), Wyoming Game and Fish Department (WGFD) and Wyoming Department of Environmental Quality (WDEQ). Sampling protocols for threatened and endangered (T&E) species followed current federal (USFWS and USFS) guidelines. All other methods were consistent with the Handbook of Biological Techniques (WGFD, 2007) and Guideline No. 5 (WDEQ/LQD, 1994). Guidance was regularly sought from managers and biological specialists from federal and state agencies throughout the baseline survey period. Methods were coordinated with USFWS, WGFD and WDEQ.

Baseline wildlife inventories were conducted 2013 through 2014 at the Brook Mine. Biologists also conducted a wildlife habitat assessment to record any unique or critical habitats that could support T&E species, or other species of special concern. Most of the surveys were completed using binoculars or spotting scopes while travelling throughout the survey area. Standard field guides and references were used to identify wildlife and their sign. Potential species lists were developed based on observances, references, and guides. Habitat requirements and availability for species, as well as critical (USFWS-designated) and crucial (WGFD-designated) habitats and geographical distribution maps, were considered for each species when developing the potential species occurrence lists. Detailed discussions of survey methods for

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each species or general wildlife type (i.e. big game) are included in Addendum D9-1 for the Brook Mine.

D9.1.2 Results

Detailed results of the baseline wildlife monitoring are discussed, tabulated, and shown on figures in Addendum D9-1 for the Brook Mine. A summary of wildlife species that could potentially inhabit or migrate through the Brook Mine Permit Area is included in Table D9.1-1. A wildlife inventory summary is provided in Exhibit D9.1-1.

D9.2 Sage-grouse

The greater sage-grouse is a species whose existence is of great concern throughout the west and is considered a "landscape species" due to its use of wide expanses of sagebrush as primary habitat during each phase of its life cycle. USFWS had previously classified the greater sage-grouse as a candidate threatened or endangered species under the Endangered Species Act (ESA), however in 2015 the USFWS determined that protection for the greater sage-grouse under the ESA is no longer warranted and has withdrawn the species from the candidate species list (USFWS 2015). Candidate species are plants and animals for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened, but development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species receive no statutory protection under the ESA (USFWS, 2014). In August 2019, Wyoming Governor Mark Gordon issued a revised executive order (2019-3) updating Wyoming's sage-grouse core population area strategy (State of Wyoming Executive Department Executive Order, 2019). The core areas represent habitats where special restrictions apply to several activities, including energy development, agriculture, and recreation. The new executive order included modified boundaries describing the core areas, including corridors for potential electrical transmission lines.

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The Brook Mine permit boundary does not reside within these aforementioned core areas. However, several sage-grouse leks were identified in adjacent study areas. None of these leks are located within the Brook Mine permit area or within one mile. Addendum D9-1 has the detailed discussion of sage-grouse surveys. A request has been made of the Wyoming Game & Fish for a determination of the relation of the Brook Mine to known Sage Grouse core areas and is provided in Exhibit D9.1-2. When this letter is received it will be provided to WDEQ.

D9.3 References

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS		
Scientific Nomenclature[1]	**Common Name**	**Observed**
INSECTIVORA		
Soricidae		
Sorex cinereus	Masked shrew	*
Sorex merriami	Merriam's shrew	
Sorex monticolus	Dusky shrew	
Sorex palustris	Water shrew	*
Sorex vagrans	Vagrant shrew	
CHIROPTERA		
Vespertilionidae		
Myotis ciliolabrum	Western small-footed myotis	
Myotis evotis	Long-eared myotis	
Myotis lucifugus	Little brown myotis	*
Myotis thysanodes	Fringed myotis	
Myotis volans	Long-legged myotis	
Lasiurus cinereus	Hoary bat	
Lasionycteris noctivagans	Silver-haired bat	
Eptesicus fuscus	Big brown bat	
Plecotus townsendii	Townsend's big-eared bat	
Antrozous pallidus	Pallid bat	
LAGOMORPHA		
Leporidae		
Sylvilagus audubonii	Desert cottontail	*
Sylvilagus nuttallii	Mountain (Nuttall's) cottontail	*
Lepus townsendii	White-tailed jack rabbit	*
RODENTIA		
Sciuridae		
Neotamias minimum	Least chipmunk	*
Marmota flaviventris	Yellow-bellied marmot	*
Spermophilus tridecemlineatus	Thirteen-lined ground squirrel	*
Cynomys ludoviciana	Black-tailed prairie dog	*
Sciurus niger	Eastern fox squirrel	
Tamiasciurus hudsonicus	Red squirrel	*
Geomyidae		
Thomomys talpoides	Northern pocket gopher	*
Heteromyidae		
Perognathus fasciatus	Olive-backed pocket mouse	
Dipodomys ordii	Ord's kangaroo rat	*
Castoridae		
Castor canadensis	Beaver	*
Cricetidae		
Reithrodontomys megalotis	Western harvest mouse	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
RODENTIA (cont.)		
Peromyscus leucopus	White-footed mouse	
Peromyscus maniculatus	Deer mouse	*
Onychomys leucogaster	Northern grasshopper mouse	*
Neotoma cinerea	Bushy-tailed woodrat	*
Clethrionomys gapperi	Southern red-backed vole	
Microtus longicaudus	Long-tailed vole	*
Microtus montanus	Montane vole	
Microtus ochrogaster	Prairie vole	
Microtus pennsylvanicus	Meadow vole	*
Lemmiscus curtatus	Sagebrush vole	*
Ondatra zibethicus	Muskrat	*
Muridae		
Rattus norvegicus	Norway rat	
Mus musculus	House mouse	*
Dipodidae		
Zapus hudsonius	Meadow jumping mouse	*
Zapus princeps	Western jumping mouse	*
Erethizontidae		
Erethizon dorsatum	Porcupine	*
CARNIVORA		
Canidae		
Canis latrans	Coyote	*
Canis lupus	Gray wolf	
Vulpes vulpes	Red fox	*
Ursidae		
Ursus americanaus	Black bear	*
Procyonidae		
Procyon lotor	Raccoon	*
Mustelidae		
Mustela erminea	Short-tailed weasel	
Mustela frenata	Long-tailed weasel	*
Mustela nigripes	Black-footed ferret	
Mustela nivalis	Least weasel	
Mustela vision	Mink	*
Taxidea taxus	Badger	*
Mephitis mephitis	Stripped skunk	*
Lutra canadensis	River otter	
Felidae		
Puma concolor	Mountain lion	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
CARNIVORA (cont.)		
Lynx rufus	Bobcat	*
ARTIODACTYLA		
Cervidae		
Cervus elaphus	Elk	*
Odocoileus hemionus	Mule deer	*
Odocoileus virginianus	White-tailed deer	*
Alces alces	Moose	*
Antilocapridae		
Antilocapra americana	Pronghorn	*
OBSERVED AND POTENTIAL BIRD INHABITANTS		
ANATIDAE		
Chen caerulescens	Snow Goose	
Branta canadensis	Canada goose	*
Aix sponsa	Wood duck	*
Anas strepera	Gadwall	*
Anas americana	American widgeon	*
Anas platyrhynchos	Mallard	*
Anas discors	Blue-winged teal	*
Anas cyanoptera	Cinnamon teal	*
Anas clypeata	Northern shoveler	*
Anas acuta	Northern pintail	*
Anas crecca	Green-winged teal	*
Aythya valisineria	Canvasback	*
Aythya americana	Redhead	*
Aythya collaris	Ring-necked duck	
Aytha marila	Greater scaup	
Aythya affinis	Lesser scaup	*
Bucephala albeola	Bufflehead	*
Bucephala clangula	Common goldeneye	*
Bucephala islandica	Barrow's goldeneye	
Lophodytes cucullatus	Hooded merganzer	*
Mergus merganser	Common merganser	*
Mergus serrator	Red-breasted merganzer	*
Oxyura jamaicensis	Ruddy duck	*
PHASIANIDAE		
Alectoris chukar	Chukar	*
Perdix perdix	Gray partridge	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
PHASIANIDAE (cont.)		
Phasianus colchicus	Ring-necked pheasant	*
Centrocercus urophasianus	Greater sage grouse	*
Tympanuchus phasianellus	Sharp-tailed grouse	*
Meleagris gallopava	Wild turkey	*
PODICIPEDIDAE		
Podilymbus podicepts	Pied-billed grebe	*
Podiceps auritus	Horned grebe	*
Podiceps nigricollis	Eared grebe	*
Aechmophorus occidentalis	Western grebe	*
PELECONIDAE		
Pelecanus erythrorynchos	American white pelican	*
PHALACROCORACIDAE		
Phalacrocorax auritus	Double-crested cormorant	*
ARDEIDAE		
Botaurus lentiginosus	American bittern	
Ardea herodius	Great blue heron	*
Egretta thula	Snowy egret	
Nycticorax nycticorax	Black-crowned night-heron	
THRESKIORNITHIDAE		
Plegadis chihi	White-faced ibis	
CATHARTIDAE		
Cathartes aura	Turkey vulture	*
PANDIONIDAE		
Pandion haliaetus	Osprey	*
ACCIPITRIDAE		
Haliaeetus leucocephalus	Bald eagle	*
Circus cyaneus	Northern harrier	*
Accipiter striatus	Sharp-shinned hawk	*
Accipiter cooperii	Cooper's hawk	*
Accipiter gentilis	Northern goshawk	*
Buteo swainsoni	Swainson's hawk	*
Buteo jamaicensis	Red-tailed hawk	*
Buteo regalis	Ferruginous hawk	*
Buteo lagopus	Rough-legged hawk	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
ACCIPITRIDAE (cont.)		
Aquila chyrsaetos	Golden eagle	*
FALCONIDAE		
Falco sparverius	American kestrel	*
Falco columbarius	Merlin	
Falco rusticolus	Gyrfalcon	*
Falco peregrinus	Peregrine falcon	
Falco mexicanus	Prairie falcon	*
RALLIDAE		
Rallus limicola	Virginia rail	*
Porzana carolina	Sora	*
Fulica americana	American coot	*
GRUIDAE		
Grus canadensis	Sandhill crane	*
CHARADRIIDAE		
Pluvialis squatarola	Black-billed plover	
Pluvialis dominica	American golden-plover	
Charadrius semipalmatus	Semipalmated plover	
Charadrius vociferous	Killdeer	*
Charadrius montana	Mountain plover	
RECURVIROSTRIDAE		
Himantopus mexicanus	Black-necked stilt	
Recurvirostra americana	American Avocet	*
SCOLOPACIDAE		
Tringa melanoleucus	Greater yellowlegs	
Tringa flavipes	Lesser yellowlegs	*
Tringa solitaria	Solitary sandpiper	*
Tringa semipalmatas	Willet	
Actitis maculata	Spotted sandpiper	*
Bartramia longicauda	Upland sandpiper	*
Numenius americanus	Long-billed curlew	*
Limosa fedoa	Marbled godwit	
Calidris alba	Sanderling	
Calidris pusilla	Semipalmated sandpiper	
Calidris mauri	Western sandpiper	

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
SCOLOPACIDAE (cont.)		
Calidris minutilla	Least sandpiper	*
Calidris bairdii	Baird's sandpiper	
Calidris melanotos	Pectoral sandpiper	
Calidris himanotopus	Stilt sandpiper	
Limnodromus scolopaceus	Long-billed dowitcher	*
Gallinago delicata	Wilson's snipe	*
Leucophaeus pipixcan	Franklin's gull	
PHALAROPODIDAE		
Phalaropus tricolor	Wilson's phalarope	*
Phalaropus lobatus	Red-necked phalarope	
LARIDAE		
Chroicocephalus philadelphia	Bonaparte's gull	
Larus delawarensis	Ring-billed gull	
Larus californicus	California gull	*
Larus argentatus	Herring gull	
Hydroprogne caspia	Caspian tern	
Sterna hirundo	Common tern	*
Sterna forsteri	Forester's tern	
Childonias niger	Black tern	*
COLUMBIDAE		
Columba livia	Rock pigeon	*
Patagioenas fasciata	Band-tailed pigeon	
Steptopela decaocto	Eurasian collared dove	*
Zenaida macroura	Mourning dove	*
CUCULIDAE		
Coccyzus erythropthalmus	Black billed cuckoo	*
Coccyzus americanus	Yellow-billed cuckoo	
TYTONIDAE		
Tyto alba	Barn owl	
STRIGIDAE		
Megascops kennicottii	Western screech-owl	
Megascops asio	Eastern screech-owl	*
Bubo virginianus	Great horned owl	*
Bubo scandiacus	Snowy owl	

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
Athene cunicularia	Burrowing owl	*
Asio otus	Long-eared owl	
Asio flammeus	Short-eared owl	*
Aegolius acadicus	Northern saw-whet owl	*
CAPRIMULGIDAE		
Chordeiles minor	Common nighthawk	*
Phalaenoptilus nuttalli	Common poor-will	
APODIDAE		
Chaetura pelagica	Chimney swift	
Aeronautes saxatalis	White-throated swift	
TROCHILIDAE		
Archilochus alexandri	Black-chinned hummingbird	
Stellula calliope	Calliope Hummingbird	*
Selasphorus platycercus	Broad-tailed hummingbird	
Selasphorus rufus	Rufous hummingbird	
ALCEDINIDAE		
Megaceryle alcyon	Belted kingfisher	*
PICIDAE		
Melanerpes lewis	Lewis's woodpecker	*
Melanerpes erythrocephalus	Red-headed woodpecker	*
Sphyrapicus thyroideus	Williamson's sapsucker	
Sphyrapicus nuchalis	Red-naped sapsucker	*
Picoides pubescens	Downy woodpecker	*
Picoides villosus	Hairy woodpecker	*
Colaptes auratus	Northern flicker	*
TYRANNIDAE		
Contopus cooperi	Olive-sided flycatcher	*
Contopus sordidulus	Western wood peewee	*
Empidonax traillii	Willow flycatcher	*
Empidonax minimus	Least flycatcher	*
Empidonax oberholseri	Dusky flycatcher	
Empidonax occidentalis	Cordilleran flycatcher	
Sayornis saya	Say's phoebe	*
Tyranus vociferans	Cassin's kingbird	
Tyrannus verticalis	Western kingbird	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
TYRANNIDAE (cont.)		
Tyrannus tyrannus	Eastern kingbird	*
LANIIDAE		
Lanius ludovicianus	Loggerhead shrike	*
Lanius excubitor	Northern shrike	*
VIREONIDAE		
Vireo plumbeus	Plumbeous vireo	
Vireo gilvus	Warbling vireo	*
Vireo olivaceus	Red-eyed vireo	*
CORVIDAE		
Perisoreus canadensis	Gray jay	*
Cyanocitta stelleri	Stellar's jay	
Cyanocitta cristata	Blue jay	
Gymnorhinus cyanocephalus	Pinyon jay	*
Nucifraga columbiana	Clark's nutcracker	*
Pica hudsonia	Black-billed magpie	*
Corvus brachyrhynchos	Common crow	*
Corvus corax	Common raven	*
ALAUDIDAE		
Eremophila alpestris	Horned lark	*
HIRUNDINIDAE		
Tachycineta bicolor	Tree swallow	*
Tachycineta thalassina	Violet-green swallow	
Stelgidopteryx serripennis	Northern rough-winged swallow	*
Riparia riparia	Bank swallow	
Petrochelidon pyrrhonota	Cliff swallow	*
Hirundo rustica	Barn swallow	*
PARIDAE		
Poecile atricapillus	Black-capped chickadee	*
Poecile gambeli	Mountain chickadee	*
SITTIDAE		
Sitta canadensis	Red-breasted nuthatch	*
Sitta carolinensis	White-breasted nuthatch	*
Sitta pygmaea	Pygmy nuthatch	

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
CERTHIIDAE		
Certhia americana	Brown creeper	*
TROGLODYTIDAE		
Salpinctes obsoletus	Rock wren	*
Catherpes mexicanus	Canyon wren	
Troglodytes aedon	House wren	*
Cistothorus palustris	Marsh wren	
CINCLIDAE		
Cinclus mexicanus	American dipper	
REGULIDAE		
Regulus calendula	Ruby-crowned kinglet	
TURDIDAE		
Sialia sialis	Eastern bluebird	
Sialia mexicana	Western bluebird	*
Sialia currucoides	Mountain bluebird	*
Myadestes townsendi	Townsend's solitaire	*
Catharus fuscescens	Veery	*
Catharus ustulatus	Swainson's thrush	*
Catharus guttatus	Hermit thrush	*
Turdus migratorius	American robin	*
Ixoreus naevius	Varied thrush	
MIMIDAE		
Dumetella carolinensis	Gray catbird	*
Mimus polyglottos	Northern mockingbird	
Oreoscoptes montanus	Sage thrasher	*
Toxostoma rufum	Brown thrasher	*
STURNIDAE		
Sturnus vulgaris	European starling	*
MOTACILLIDAE		
Anthus rubescens	American pipit	
Anthus spragueii	Sprague's pipit	
BOMBYCILLIDAE		
Bombycilla garrulus	Bohemian waxwing	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
BOMBYCILLIDAE (cont.)		
Bombycilla cedrorum	Cedar waxwing	*
PARULIDAE		
Mniotilta varia	Black-and-white warbler	
Oreothlypis peregrina	Tennessee warbler	
Oreothlypis celata	Orange-crowned warbler	
Oreothlypis virginiae	Virginia's warbler	
Setophaga petechia	Yellow warbler	*
Setophaga magnolia	Magnolia warbler	*
Setophaga coronata	Yellow-rumped warbler	*
Setophaga ruticilla	American redstart	*
Seiurus aurocapillus	Ovenbird	
Seiurus noveboracensis	Northern waterthrush	
Geothlypis tolmiei	MacGillivray's warbler	
Geothlypis trichas	Common yellowthroat	*
Cardellina pusilla	Wilson's warbler	*
Icteria virens	Yellow-breasted chat	*
THRAUPIDAE		
Piranga ludoviciana	Western tanager	*
Pheucticus ludovicianus	Rose-breasted grosbeak	
Pheucticus meloncephalus	Black-headed grosbeak	*
Passerina caerulea	Blue grosbeak	
Passerina amoena	Lazuli bunting	*
Passerina cyanea	Indigo bunting	
Spiza americana	Dickcissel	
EMBERIZIDAE		
Pipilo chlorurus	Green-tailed towhee	
Pipilo maculatus	Spotted towhee	*
Spizella arborea	American tree sparrow	*
Spizella passerina	Chipping sparrow	*
Spizella pallida	Clay-colored sparrow	
Spizella breweri	Brewer's sparrow	*
Pooecetes gramineus	Vesper sparrow	*
Chondestes grammacus	Lark sparrow	*
Amphispoza belli	Sage sparrow	
Calamospiza melanocorys	Lark bunting	*
Passerculus sandwichensis	Savannah sparrow	*
Ammodramus savannarum	Grasshopper sparrow	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
EMBERIZIDAE (cont.)		
Ammodramus bairdii	Baird's sparrow	
Passerella iliaca	Fox sparrow	
Melospiza melodia	Song sparrow	*
Melospiza lincolnii	Lincoln's sparrow	
Zonotrichia albicollis	White-throated sparrow	
Zonotrichia querula	Harris sparrow	
Zonotrichia leucophrys	White-crowned sparrow	*
Junco hyemalis	Dark-eyed junco	*
CALCARIIDAE		
Rhynchophanes mccownii	McCown's longspur	*
Calcarius lapponicus	Lapland longspur	
Calcarius ornatus	Chestnut-collared longspur	
Plectrophenax nivalis	Snow bunting	
ICTERIDAE		
Dolichonyx oryzivorus	Bobolink	
Agelaius phoeniceus	Red-winged blackbird	*
Sturnella neglecta	Western meadowlark	*
Xanthocephalus	Yellow-headed blackbird	*
Euphagus carolinus	Rusty blackbird	
Euphagus cyanocephalus	Brewer's blackbird	*
Quiscalus quiscula	Common grackle	*
Molothrus ater	Brown-headed cowbird	*
Icterus spurius	Orchard oriole	*
Icterus bullockii	Bullock's oriole	*
Icterus galbula	Baltimore oriole	*
FRINGILLIDAE		
Leucosticte tephrocotis	Gray-crowned rosy-finch	*
Leucosticte atrara	Black rosy-finch	
Pinicola enncleator	Pine grosbeak	*
Carpodacus cassinii	Cassin's finch	
Carpodacus mexicanus	House finch	
Loxia curvirostra	Red crossbill	*
Acanthis flammea	Common redpoll	
Spinus pinus	Pine siskin	
Spinus tristis	American goldfinch	*
Coccothraustes vespertinus	Evening grosbeak	

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

Scientific Nomenclature[1]	Common Name	Observed
OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
PASSERIDAE		
Passer domesticus	House sparrow	*
OBSERVED AND POTENTIAL HERPTILE INHABITANTS		
AMBYSTOMATIDAE		
Ambystoma tigrinum	Tiger salamander	*
BUFONIDAE		
Spea bombifrons	Plains spadefoot toad	*
Bufo woodhousei woodhousei	Woodhouse's toad	
RANIDAE		
Lithobates pipiens	Northern leopard frog	*
HYLIDAE		
Pseudacris maculata	Boreal chorus frog	*
TESTUDINIDAE		
Apalone spinifera hartwegi	Western spiny softshell	*
Chrysemys picta belli	Western painted turtle	*
CHELYDRIDAE		
Chelydra serpentina	Snapping turtle	*
IGUANIDAE		
Sceloporus graciosus graciosus	Northern sagebrush lizard	*
Phrynosoma hernandesi	Greater short-horned lizard	*
COLUBRIDAE		
Coluber constrictor flaviventris	Eastern yellowbelly racer	*
Lampropeltis triangulum	Pale milk snake	*
Pituophis catenifer sayi	Bullsnake	*
Thamnophis elegans vagrans	Intermountain wandering	*
Thamnophis sirtalis parietalis	Red-sided gartersnake	*
Thamnophis radix	Plains gartersnake	*
CROTALIDAE		
Crotalus viridis viridis	Prairie rattlesnake	*

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL FISH INHABITANTS		
Scientific Nomenclature[1]	**Common Name**	**Observed**
SALMONIDAE		
Prosopium williamsoni	Mountain whitefish	*
Oncorhynchus clarki	Cutthroat trout	
Oncorhynchus mykiss	Rainbow trout	*
Salmo trutta	Brown trout	*
Salvelinus fontinalis	Brook trout	
ESOCIDAE		
Esox lucius	Northern pike	*
CYPRINIDAE		
Cyprinus carpio	Common carp	*
Carassius auratus	Goldfish	*
Notemigonus crysoleucas	Golden shiner	*
Semotilus atromaculatus	Creek chub	*
Couesius plumbeus	Lake chub	*
Platygobio gracilis	Flathead chub	*
Macrhybopsis gelida	Sturgeon chub	
Rhinichthys cataractae	Longnose dace	*
Notropis stramineus	Sand shiner	*
Hybognathus hankinsoni	Brassy minnow	
Hybognathus placitus	Plains minnow	*
Hybognathus agryritis	Silvery minnow	
Pimephales promelas	Fathead minnow	*
CATOSTOMIDEA		
Carpiodes carpio	River carpsucker	
Moxostoma macrolepidotum	Shorthead redhorse	*
Catostomus commersoni	White sucker	*
Catostomus catostomus	Longnose sucker	*
Catostomus platyrhynchus	Mountain sucker	*
ICTALURIDAE		
Ameiurus melas	Black bullhead	*
Ameiurus naulis	Yellow bullhead	*
Ictalurus punctatus	Channel catfish	*
Noturus flavus	Stonecat	*
GADIDAE		
Lota lota	Burbot	

[1] Nomenclature from WGFD 2012.

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Table D9.1-1. Wildlife Species List for the Brook Coal Mine Study Area (cont.)

OBSERVED AND POTENTIAL FISH INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
CENTRARCHIDAE		
Micropterus dolomieui	Smallmouth bass	*
Micropterus salmoides	Largemouth bass	*
Lepomis cyanellus	Green sunfish	*
Lepomis gibbosus	Pumpkinseed	
Lepomis macrochirus	Bluegill	
Ambloplites rupestris	Rock bass	*
Pomoxis annularis	White crappie	*
Pomoxis nigromaculatus	Black crappie	*
PERCIDAE		
Stizostedion canadense	Sauger	*
Stizostedion vitreum	Walleye	*
Perca flavescens	Yellow perch	*

[1] Nomenclature from WGFD 2012.

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LEGEND

BROOK MINE PERMIT BOUNDARY	BE - BALD EAGLE		PG - PRAIRIE DOG TOWN GRASSLAND
INTACT RAPTOR NEST	GE - GOLDEN EAGLE	SAGE-GROUSE LEK	UG - UPLAND GRASSLAND
INTACT RAPTOR PLATFORM NEST	RT - RED TAILED HAWK		SS - SAGEBRUSH SHRUBLAND
FORMER RAPTOR NEST	GH - GREAT HORNED OWL	SHARP-TAILED GROUSE LEK	RC - RECLAIMED LANDS
LAGOMORPH SURVEY ROUTE	BO - BURROWING OWL		RB - ROUGH BREAKS/JUNIPER
BREEDING BIRD SURVEY TRANSECT	OS - OSPREY	BLACK-TAILED PRAIRIE DOG COLONY	RW- RIPARIAN WOODLAND

N

0 1,000 2,000 3,000 4,000
GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
06/15	ROUND 1 COMMENTS

EXHIBIT D9.1-1

WILDLIFE INVENTORY

TFN 6 2/025
RECD JUL 30, 2015

Drawn By: MBM/RET
Checked By: JGB/JEO
Date: 10/17/14

WWC ENGINEERING
www.wwcengineering.com

FILE: D9-1_WILDLIFE_INV.dwg

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Exhibit D9.1-2 Sheet 1 of 2

Jeff

This has been sent to Cheyenne and they have my comments concurring that the proposed project area is outside designated sage-grouse core areas.

You should get a letter to that affect sometime late next week.

TIM

On Fri, Oct 31, 2014 at 9:36 AM, jbarron <jbarron@wwcengineering.com> wrote:
Tim,

Thank you for allowing time for a brief meeting this morning. As we discussed, I am providing the map I shared with you today 10/31/2014 showing the known core areas in relation to our project area. I am respectfully requesting a letter in confirmation of your verbal comments today that our project area is not within a Sage Grouse core area and not within a half mile of known LEK's.

Thanks again.

Jeff Barron, P.E. | Project Manager

1849 Terra Avenue | Sheridan, WY 82801

Tel 307-672-0761 | Cell 307-751-1427

www.wwcengineering.com

-

Tim Thomas, Certified Wildlife Biologist
Wyoming Game and Fish Department
Sheridan Wildlife Biologist
700 Valley View Drive
Sheridan, WY 82801
(307) 672-7418
Tim.Thomas@wyo.gov

http://wgfd.wyo.gov

E-Mail to and from me, in connection with the transaction of public business, is subject to the Wyoming Public Records Act and may be disclosed to third parties.

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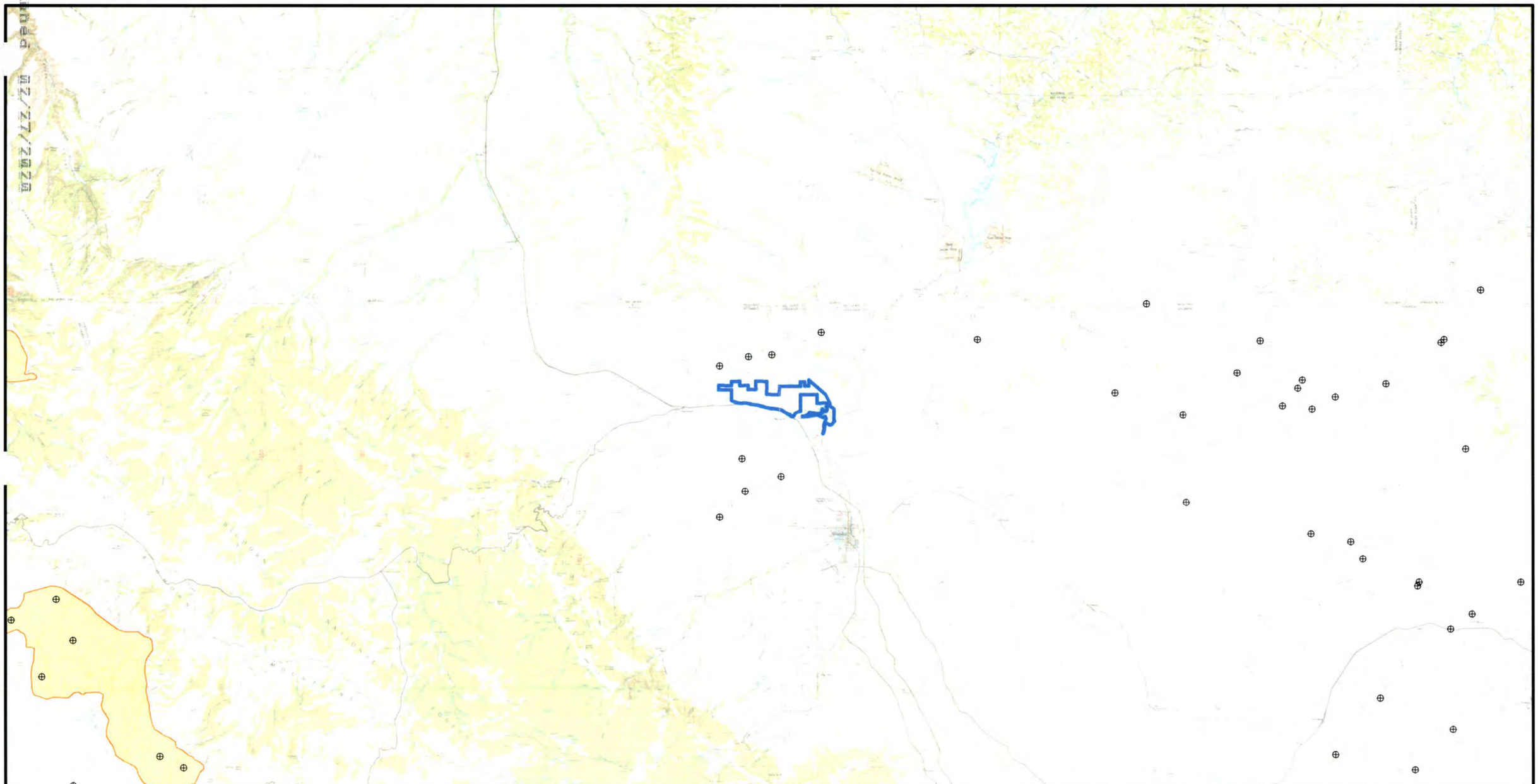

LEGEND

BROOK MINE PERMIT BOUNDARY

SAGE GROUSE CORE AREA

SAGE GROUSE LEK

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GRAPHIC SCALE (FEET)

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RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

EXHIBIT 9.1-2

SHEET 2 OF 2

SAGE GROUSE LEKS AND CORE AREAS

Drawn By: CIG
Checked By: JGB
Date: 10/30/14

WWC ENGINEERING

FILE: SAGEGROUSE_WGF.dwg

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RAMACO

Brook Mine

WYOMING GAME AND FISH DEPARTMENT

5400 Bishop Blvd. Cheyenne, WY 82006

Phone: (307) 777-4600 Fax: (307) 777-4699

wgfd.wyo.gov

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T. CARRIE LITTLE

October 31, 2014

WER 13541
WWC Engineering
WWC Sage Grouse Core Areas
Sheridan County

Jeff Barron
Project Manager
1849 Terra Ave
Sheridan, WY 82801

Dear Mr. Barron:
The staff of the Wyoming Game and Fish Department (WGFD) has reviewed the WWC Sage Grouse Core Areas Project in Sheridan County concerning the Brook Coal Mine. We offer the following comments for your consideration.

The entirety of the project lies outside of Sage-grouse core area. However, there are two leks, Ash Creek and Slater Creek, which lie within the two mile lek buffer for non-core area. We recommend avoiding initial development activity during the seasonal stipulation time of March 15 – June 30 to avoid disrupting lekking, nesting and brood rearing sage-grouse in the area. It would be best to start activity outside this time frame, and, once started, activity may continue without interruption.

Thank you for the opportunity to comment. If you have any questions or concerns, please contact Linda Cope, Staff Terrestrial Biologist, at 307-777-2533.

Sincerely,

Scott Cam

for John Kennedy
Deputy Director

JK/mf/ns

cc: USFWS
Chris Wichmann, Wyoming Department of Agriculture, Cheyenne
Tim Thomas, WGFD, Sheridan Region

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ADDENDUM D9-1

Baseline Wildlife Inventory

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D9-1 WILDLIFE INVENTORY

D9-1.1 Executive Summary – Brook Mine

Detailed wildlife inventories covering the full suite of studies as required by state and federal regulatory agencies were completed for the Brook Mine Baseline Study Area in 2013 and 2014 by Intermountain Resources (Laramie, Wyoming). The study area included the mine permit area and one to two mile perimeter for selected wildlife species as discussed in this report.

D9-1.2 Introduction

The Brook Mine is located in Sheridan County, Wyoming north of the town of Sheridan. The Brook Mine permit area is specifically located in Sections 7, 8, 9, 10, 15, 17, 18, 20, 21, 22 and 27 of Township 57 North, Range 84 West and Sections 10, 11, 12, 13, 14 and 15 of Township 57 North, Range 85 West. This wildlife baseline inventory includes all of the Brook Mine permit area of approximately 4,548.8 acres. Wildlife inventories included a minimum of surveying a one to two mile buffer surrounding these lands for selected species where access was provided. The purpose of this report is to provide the required wildlife baseline information which includes the 2013-2014 field surveys, data from prior baseline inventories completed in the area and other surveys completed by state and federal agencies or other entities. The permit area location is shown on Addendum D9-1 Exhibit 1.

The wildlife species with the potential to be found on the Brook Mine or surrounding lands are presented in the list in Attachment D9-1-A. This list also identifies the species actually observed in the area and provides both the common and scientific names for all species.

A wildlife survey plan for this project was submitted to the Wyoming Game and Fish Department (WGFD) and US Fish and Wildlife Service (USFWS) for approval. The plan and response letters are provided in Attachment D9-1-B (Correspondence) of this report.

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The majority of the mining to be completed at the Brook Coal Mine will be underground in nature. Operations will be conducted by first exposing the coal seam and then mining the seam underground using an auger. Therefore actual surface disturbance will be kept to a minimum.

D9-1.3 Background

The Brook Mine permit area includes lands that were part of the original Big Horn Coal Mine permit No. 213. Baseline wildlife inventories were completed for the Big Horn Coal Mine in the mid 1970's and early 1980's. Wildlife monitoring inventories have been conducted yearly for the Big Horn Coal Mine from the 1980's through 2014. These surveys generally included the permit area and one to two mile perimeter. Baseline wildlife inventories were also completed for the Youngs Creek Coal Mine permit No. 407 and the Welch No. 1 Coal Mine permit No. 497 and one to two mile perimeters surrounding those mine permit areas. Those wildlife survey areas covered portions of the Brook Coal Mine survey area.

The major habitat type on the Brook Mine is upland grassland followed by sagebrush shrubland, rough breaks mixed shrub and reclaimed lands. Habitat or other land use types occupying smaller acreages include juniper woodland, riparian woodland, hayland, currently disturbed land and stockponds.

D9-1.4 Methods

The methods included in this section pertain to specific field surveys conducted in 2013-2014 for the Brook Mine. Much of this study area has also been inventoried during surveys conducted for the Youngs Creek Mine permit No. 407, the Big Horn Coal Mine permit No. 213 and the Welch No.1 Mine permit No. 497 with the adjacent one to two mile perimeters for these permit areas. Those surveys included baseline inventories and subsequent monitoring completed from 1975 through 2014. Detailed methods of those surveys are included in Appendix D9 and annual monitoring reports for the Youngs Creek,

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Welch No. 1 and Big Horn Coal Mines. Pertinent data from those studies are also included in this report as agreed upon with the WGFD and USFWS.

D9-1.4.1 Big Game Surveys

Specific big game surveys were not required in 2013 or 2014 on the Brook Mine study area as agreed upon with the Wyoming Game and Fish Department. Big game ranges and any crucial ranges as mapped by the WGFD were determined and are presented. Incidental observations of big game habitat use are discussed for individual species observed.

D9-1.4.2 Upland Game Birds

Surveys for strutting sage-grouse and sharp-tailed grouse for this permit area and two mile perimeter were completed on six mornings at dawn in April and early May of 2013 and on six mornings at dawn in April and early May of 2014. Dates of lek surveys and lek counts are included in the results section of this report. Counts were made for any leks (sage-grouse and sharp-tailed grouse) known to occur and for any new leks discovered in the study area. Specific production surveys were not completed as agreed upon by the WGFD, but incidental observations of seasonal use and any broods observed were recorded and will be discussed. Searches were completed by driving on roads and using ATV's, stopping frequently to scan and listen for displaying sounds. Observations of sage-grouse made during other seasons or surveys were also recorded and winter occurrence was documented if observed. Ten years of data were compiled and presented for each sage-grouse lek when that data was available.

D9-1.4.3 Raptors

Raptor nests located, on the permit area and within two miles, during previous inventories were documented and plotted on maps. These nests were inventoried in the field as access permitted and searches for new nests were completed in April through May of 2013 and February through May of 2014.

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Nest surveys were also completed to determine whether nest sites were occupied by nesting birds. Nests were observed at sufficient distances so that incubating birds were not disturbed.

Active nests were again inspected during the summer surveys (June-August) of 2013 and 2014 to determine nesting success. Potential nesting habitat was resurveyed at this time for the presence of any late nesting species. The number of young present in each active nest was determined only when possible to do so without causing excessive disturbance.

Records were kept of all bald eagles observed during the winter roost surveys. All other raptors seen during wildlife surveys were also documented and included in the wildlife species list.

D9-1.4.4 Waterfowl and Shorebirds

Specific waterfowl and shorebird surveys were conducted in 2013 and 2014. Stockponds and other bodies of water within the permit area were surveyed to determine waterfowl use and production.

Waterfowl and shorebirds were also noted during all other survey periods when they were observed on the study area. Records of waterfowl use of the waterbodies within the study area were also documented during previous surveys. Data was obtained from those prior surveys as applicable to this inventory. Additional data was collected from the opportunistic observations in 2013 and 2014 and areas of major waterfowl production were identified, if present.

D9-1.4.5 Mammalian Predators

Numerous predator surveys have been completed in the area and vicinity during prior mine permitting activities. Surveys were conducted during the night using spotlights and vehicle headlights, surveys were conducted using scent stations and surveys were conducted during daylight hours by walking various habitat types searching for predators or sign. Opportunistic observations of

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predators encountered in 2013 and 2014 were also recorded. The summaries of those surveys are presented in the results section of this report.

D9-1.4.6 Lagomorphs

Specific lagomorph surveys were completed for the Brook Mine on July 11 of 2013 and August 7 of 2014. Surveys were conducted right after dusk by driving selected routes and counting all lagomorphs illuminated by the vehicle headlights. Approximately 10.0 miles (16.0 kilometers) of roads were covered during these surveys. The lagomorph survey route is shown on the wildlife inventory map (Addendum D9-1 Exhibit 1).

D9-1.4.7 Passerine Birds

Passerine bird surveys were completed in dominant habitat types on the Brook Mine in 2013 and 2014. Surveys were conducted by walking belt transects 1000 meters long by 100 meters wide. All birds observed or heard calling within these transects were recorded. Surveys were completed between one-half hour before sunrise and 9:30 AM. These breeding bird surveys were completed on June 11 and June 26 of 2013 and May 28 and June 13 of 2014. Opportunistic observations were also recorded for birds seen or heard during other surveys conducted in 2013 and 2014.

Numerous breeding bird surveys were conducted for the Big Horn Coal Mine and other mines in the area. The results of those surveys will be included in the results section of this report as applicable.

D9-1.4.8 Small Mammals

Due to the abundance of data collected from prior small mammal trapping and other surveys completed on this area and in the vicinity for the Big Horn, Welch No. 1 and Youngs Creek Coal mines, specific small mammal surveys were not required for this project. The prior data collected will be discussed in the results section. Any new or additional species observed during the 2013-2014

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field surveys for the Brook Mine will be discussed and are included on the wildlife species list

D9-1.4.9 Threatened or Endangered (T&E) Species

Throughout all phases of wildlife survey work completed in 2013 and 2014 special vigilance was maintained for any evidence of species listed as rare, threatened or endangered by the state (Wyoming) or federal (US Fish and Wildlife Service) governments. Searches for rare, threatened or endangered species have also been conducted on the Big Horn Coal Mine permit No. 213 area since initial baseline surveys were conducted in 1976. Surveys for species of concern continued throughout yearly wildlife monitoring events.

The USFWS Wyoming website was periodically checked to determine listing or status changes for T&E or species of concern. The T&E species list was updated January 2020 using data from the USFWS IPaC system, see attachment D9-1-B pages D9-1-107 through D9-1-113. Surveys for the Ute ladies'-tresses orchid, listed as threatened, were completed as described in Appendix D8

D9-1.4.10 Other Species of High Federal or State Interest

Black-tailed prairie dog towns within the permit area were mapped in 2013-2014. Black-footed ferret surveys were not conducted in any prairie dog towns within the study area. This was because in February of 2004 the USFWS Ecological Services Office in Cheyenne, Wyoming, issued a letter stating "black-footed ferret surveys are no longer necessary in black-tailed prairie dog colonies state wide" (USFWS, 2004). Since only black-tailed prairie dog colonies are present within the Brook Mine study area, no black-footed ferret surveys are required.

Bald eagle winter roost surveys were completed in February of 2014 specifically for the Brook Mine study area. Suitable roost habitat was surveyed at dawn and dusk. Similar surveys were completed on the study area in prior years by the Big Horn Coal Mine.

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In 2013 and 2014, the required surveys were completed for T&E, Migratory Birds of High Federal Interest (MBHFI) and state listed species which have the potential for inhabiting the site. These surveys were completed in conjunction with all other wildlife surveys and species specific surveys were completed at other times as required.

D9-1.4.11 Reptiles and Amphibians

No specific surveys were completed for reptile or amphibian species on the study area in 2013 or 2014 except traversing suitable habitats during the course of other field work. Surveys have also been completed previously for the three local mine permit study areas. This area does not have a high density of such species. All reptile and amphibian species observed during surveys completed on the area in 2013-2014 were documented.

D9-1.4.12 Aquatics

The Brook Mine permit area was surveyed for potential aquatic habitat and very little of that habitat was found. Only a small portion of stockpond/water habitat is present and this is comprised primarily of stockponds observed within the permit area that contain water with any frequency. Those stockponds do not provide suitable habitats for viable fisheries but do provide amphibian habitat.

The Tongue River should not be affected since this waterway is located outside of the permit area except for an existing bridge crossing. Since this bridge is already constructed and will not require any modifications, the Tongue River will not be disturbed. Goose Creek is also located outside of the permit area so no disturbance is proposed for this waterway. Since disturbances will not occur in the Tongue River or Goose Creek their aquatic systems were not sampled in this study. Data from prior samplings of these drainages is included in the results section for background information. The WGFD has additional information on these drainages from their samplings.

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Portions of Slater Creek, Early Creek and some of their tributaries cross the Brook Mine and may be affected. These are ephemeral streams and do not provide fisheries so they were not sampled.

D9-1.4.13 Wildlife Habitats and Affinity

Data collected in 2013 and 2014 for each class of wildlife was used for habitat affinity determinations. Habitat affinities for wildlife species on the study area were also determined using data collected previously. All wildlife habitat types within this study area have been previously inventoried during surveys completed for the other three coal mines present within this study area. Wildlife habitat acreages were calculated and descriptions were developed.

D9-1.5 Results and Discussion

D9-1.5.1 Big Game

No specific big game surveys were completed during the 2013 and 2014 wildlife surveys conducted for the Brook Mine permit area as agreed upon with the WGFD. Mule deer, pronghorn and white-tailed deer were the only big game species commonly observed on this study area in 2013 and 2014. These observations were consistent with surveys completed in previous years by other mines in the area. Local landowners indicated the American elk was uncommonly observed in the area and the moose has been observed along the Tongue River.

Based on previous data and the 2013-2014 observations, mule deer were the most common big game species recorded on the area during all seasons. Habitats that mule deer were commonly associated with were sagebrush shrublands, rough breaks, juniper woodland and riparian woodland. This permit area is considered by the WGFD to be primarily mule deer winter yearlong range. Mule deer are commonly found on this area throughout the year. No crucial mule deer winter range has been delineated within the Brook Mine permit area

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Pronghorn were recorded on this area in limited numbers throughout the year. Pronghorn were most commonly associated with the sagebrush shrubland and upland grassland habitats. The WGFD has classified a majority of the area as yearlong range while a very small portion of the area is classified as out of normal pronghorn use. Single and doe/fawn pronghorn were typically observed during the summer while small groups (<25) are observed during the spring and fall.

White-tailed deer were commonly observed on the area during all seasons. Habitats frequented were riparian woodlands, haylands, reclamation and pine and juniper woodlands. A portion of the permit area is considered by the WGFD to be yearlong white-tailed deer range while the remainder is considered out of the normal use of this species. The yearlong white-tailed deer range is delineated primarily along Early Creek, Slater Creek, Goose Creek and the Tongue River.

The Brook Mine permit area is considered out of the normal range for elk and moose. However both elk and moose have infrequently been observed in the area by local ranchers.

D9-1.5.2 Upland Game Birds

Six species of upland game birds were recorded on this study area during the previous inventories and the 2013-2014 wildlife surveys. These species were the mourning dove, sage-grouse, sharp-tailed grouse, gray partridge, wild turkey and ring-necked pheasant. These upland game bird species are all generally expected to be found in this area. A seventh species, the chukar partridge, was recorded once and is not common in this area.

Sage-grouse lek and sharp-tailed lek surveys were completed early in the morning (1/2 hour prior to sunrise to about one hour after sunrise) on April 3, 4, 5, 25 and 26 and May 9 of 2013 and April 3, 4, 16 and 18 and May 2 and 3 of 2014. The permit area and two mile perimeter were surveyed where access was allowed.

Several sage-grouse leks are located within this study area and survey results from 2003 through 2014 are shown in Table D9-1. The locations of these

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lek sites are identified on Addendum D9-1 Exhibit 1. None of these sage-grouse leks are located within the Brook Mine permit area or within one mile. The Brook Mine is not situated within a designated sage-grouse core or connectivity area.

The Ash Creek Lek is located over one mile north of the permit area (NWSW4 of Section 31, T58N, R84W) and was first recorded in 1967. The maximum number of males using this lek during any one year from 2003 through 2014 was 12 in 2005 as shown in Table D9-1. That was the only year the Ash Creek lek was active from 2003 through 2014. In 2013 a powerline was constructed adjacent to this lek most likely impacting future use of the site.

The French Springs lek site is located about 1 ½ miles north of the mine permit area in the SESE4 of Section 35, T58N R85W. This lek site was first identified in 1988 but no birds have been observed there in 2003 through 2014 although 34 separate surveys were conducted during that period. In fact the WGFD database indicates no birds have been observed at this lek site since 1988, the year of discovery. Sagebrush was removed from the site and adjacent lands through chemical control by the Padlock Ranch. Therefore it appears the French Springs lek may have been destroyed because the sagebrush cover necessary for forage and to protect birds roosting near the lek has been removed and the entire lek site and surrounding area is currently upland grassland.

The Slater Creek lek is located a little over one mile north of the Brook Mine permit area in the SWNW4 of Section 3, T57N R85W. This lek was identified in 1967 and has had strutting males in all years surveyed since that time. According to the WGFD database the peak count for this lek was in 1978 when 79 males were recorded. Survey data from 2003 through 2014 for the Slater Creek Lek is provided in Table D9-1. During that period the highest number of males was recorded in 2006 when 20 birds were observed. Numbers have steadily declined from that time to only one male observed in 2014.

Sage-grouse brood surveys were not required as agreed upon by the WGFD. Opportunistic sightings of sage-grouse broods have been recorded in

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past studies on the area but none were observed on the study area in 2013 or 2014. Sage-grouse have not been recorded on the study area during winter surveys.

Sharp-tailed grouse were occasionally observed in the study area during the 2013-2014 surveys and two active sharp-tailed grouse leks were recorded during this period. The Pit 5 West lek is located in the SESW4 of Section 4, T57N R84W on lands reclaimed by the Big Horn Coal Mine. The Pit 5 East lek is located in the NWSW4 of Section 10, T57N R84W and is also established on lands reclaimed by the Big Horn Coal Mine. These lek sites are shown on Addendum D9-1 Exhibit 1. Table D9-2 provides the 2013-2014 survey data for these two active leks. Other sharp-tailed grouse leks had previously been identified in the area but none were active in 2013 or 2014. Sharp-tailed grouse were commonly observed on reclaimed habitats at the Big Horn Coal Mine and were also common on upland grassland and AML reclamation in the area.

Mourning doves were common on the study area during summer months. They were most abundant on reclaimed areas and adjacent to water during those times. Mourning doves have been recorded nesting on the study area in past studies and during 2013-2014. This species is commonly observed throughout the nesting season and utilizes all habitats. This species migrates out of the area for the winter.

The gray partridge has been inconsistently observed on the study area over the past several years. The gray partridge is generally associated with upland grassland habitats, agricultural lands, and reclamation.

The wild turkey has been commonly observed on the study area during all past surveys. The wild turkey is not native to this area but was transplanted here from other locations. No specific surveys, other than opportunistic observations, have been completed for this species on any of the mine sites in the past. This species is typically associated with riparian woodland and ponderosa pine habitats during the spring and summer while during the fall and

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winter they are associated with riparian woodland and agricultural lowland habitats. Wild turkeys winter in flocks primarily along Goose Creek and the Tongue River but can also be found along some of the minor drainages.

Ring-necked pheasants, an introduced species, were also commonly observed on some portions of the study area. Ring-necked pheasants are typically associated with the riparian woodland and agricultural habitats. The WGFD annually stocks ring-necked pheasants for hunting on walk in areas and public lands along the Tongue River and other locations with the study area. However, resident populations are also present along Goose Creek and the Tongue River. These resident populations are maintained primarily on agricultural lands.

The chukar partridge was observed along Goose Creek just upstream of the permit area. This species is generally not present in the area and the observed birds were most likely released for hunting.

D9-1.5.3 Raptors

In 2013-2014, a total of 9 intact raptor nests were located within the permit area while another 50 intact nest sites were located within two miles. Of the 59 total nest sites, six (6) had been constructed for mitigation of nest sites removed by mining on adjacent areas or due to powerline conflicts. The raptors known to nest on, or within, two miles of the permit area include the bald eagle, golden eagle, red-tailed hawk, great horned owl, burrowing owl, and osprey. All raptor nest sites are shown on Addendum D9-1 Exhibit 1 and nesting information on these sites for 2013-2014 is provided in Table D9-3. Production details for previous years on nests monitored by various mines, with take and mitigation measures completed on the area, are included in the various annual mine reports submitted yearly for each of the corresponding mines (Youngs Creek, Welch No. 1 and Big Horn Coal).

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Other raptors were observed in the area but were not recorded nesting on the site. These additional raptors recorded are listed on the species list in Attachment D9-1-A.

As shown in Table D9-3 the red-tailed hawk was the most productive raptor nesting on the study area. Within the study area in 2014, there were three active bald eagle nest sites with a combined known production of four young, there were four active golden eagle nest sites with a combined production of three young, there were 16 active red-tailed hawk nest sites with a combined production of 19 young, there were three active great horned owl nest sites with a combined production of five young, there was one active burrowing owl nest site which produced four young, and finally there were three active osprey nest sites with a combined production of six young. The total number of young produced in 2014 from the 30 active nests sites was 41. According to the data, about 50 percent of the intact nest sites identified were active on the study area in 2014. Overall raptor nest occupancy in 2014 was about the same as 2013 but production in 2014 was much higher than 2013.

D9-1.5.4 Waterfowl and Shorebirds

Specific waterfowl and shorebird surveys completed during 2013-2014 and prior surveys on this study area documented a total of 44 species. These species are all reported on the species list in Attachment D9-1-A of this report. The greatest diversity overall was observed adjacent to the permit area along the Tongue River and Goose Creek as well as the Pit 3 reservoir located on Big Horn Coal mine reclamation northeast of the Brook Mine. Waterfowl production was significant at the Pit 3 reservoir northeast of the permit.

Waterfowl habitat is very limited within the permit area itself. The primary waterfowl habitat within the permit area was provided by stockponds. Slater Creek and Earley Creek provide minimal habitat due to their narrow incised channels and inconsistent ephemeral flows. Few waterfowl were observed on these water bodies during the spring and summer surveys when most of them

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contained water. The most common species observed within the permit area were the Canada goose, mallard, Gadwall, American widgeon and killdeer. No significant waterfowl production was observed on these sites in 2013 or 2014.

D9-1.5.5 Mammalian Predators

The total number of carnivores observed within the Brook Mine permit area or adjacent lands during the 2013-2014 surveys and prior inventories was 11. These species are identified on the list in Attachment D9-1-A. The most common predator observed was the coyote but the badger, striped skunk and raccoon also appeared to be fairly common. Black bears were observed on or adjacent to the permit area in both 2013 and 2014 as well as prior years. The wolf has been observed along the base of the Big Horn Mountains west of the permit area and may pass through the mine site. The black-footed ferret has never been recorded in the area. The mountain lion and bobcat are occasionally observed in the area and are considered residents.

D9-1.5.6 Lagomorphs

Lagomorph night surveys were completed for the Brook Mine on July 11 of 2013 and August 7 of 2014. Approximately 10 miles were covered by vehicle during each survey event using the headlights to spot and identify lagomorphs. The survey route is shown on Addendum D9-1 Exhibit 1. The white-tailed jackrabbit and cottontail rabbit were the only lagomorphs identified in the area.

In 2013 four cottontail rabbits and three white-tailed jackrabbits were observed along the survey route for a total density of 0.7 lagomorphs per survey mile. In 2014 three white-tailed jackrabbits and one cottontail rabbit were recorded along the survey route for a total density of 0.4 lagomorphs per survey mile. Lagomorph numbers appeared to be slightly lower in 2014 than 2013 in this area.

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D9-1.5.7 Passerine Birds

Passerine bird surveys were completed in 2013 and 2014 by walking belt transects 1000 meters long by 50 meters wide. All birds seen and heard within these transects were recorded. The major habitats of upland grassland, sagebrush shrubland and rough breaks/juniper were sampled in 2013. The reclaimed land, prairie dog town grassland and riparian woodland habitats which comprise less acreage were sampled in 2014. Breeding bird transect locations are shown on Addendum D9-1 Exhibit 1.

The results of the 2013-2014 breeding bird transects are shown in Table D9-4. In all, a total of 38 different bird species were recorded along the various transects. Overall the western meadowlark and lark sparrow were most common and consistently observed over all habitats. The riparian woodland habitat type exhibited the greatest abundance and diversity of species while the least diversity was recorded in the sagebrush shrubland habitat.

Numerous other bird species have been recorded on or in the vicinity of the Brook Mine. All bird species recorded during the 2013-2014 inventory and prior surveys are presented on the species list in Attachment D9-1-A. Breeding bird survey data collected in the vicinity for other mine permit areas is presented in Tables D9-5 through D9-10. Additional details on those other surveys are contained in the respective mine permits referenced.

D9-1.5.8 Small Mammals

The black-tailed prairie dog was the most common small mammal observed on the study area. Black-tailed prairie dog colonies on and immediately adjacent to the permit area were mapped in 2013 and 2014. These prairie dog colonies are shown on Addendum D9-1 Exhibit 1. The porcupine, muskrat, yellow bellied marmot and northern pocket gopher or sign of these species were also commonly observed.

Tables D9-11 through D9-14 show the efforts of small mammal trapping completed by the various mines in the area. Details of their specific sampling

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methodologies are provided in the mine permits referenced. Overall the deer mouse was the most common species captured. Other species commonly encountered include the least chipmunk, thirteen-lined ground squirrel and bushy-tailed wood rat. A list of all the small mammals encountered in the area is provided in Attachment D9-1-A.

D9-1.5.9 Threatened or Endangered Species

Species officially designated by the United States government as threatened or endangered are listed in the Federal Register and afforded protection under the Endangered Species Act of 1973 (ESA). As of August 2014, the US Fish and Wildlife Service (USFWS) has determined the greater sage-grouse (Candidate species), Canada lynx (Threatened species), and Ute ladies'-tresses (Threatened species) may be impacted by projects in Sheridan County of Wyoming. As of 2020, only the Canada Lynx and Ute Ladies'-tresses are listed as T&E species for Sheridan County, Wyoming.

The Ute ladies'-tresses is a plant species and was addressed in Appendix D8 Vegetation. BKS conducted surveys in July of 2013 but did not find that plant species.

The Canada lynx requires mountainous forest habitat. Those types of habitats for this species are not found on or near the Brook Mine so the Canada lynx should not be affected by this operation.

As of October 2, 2013 the northern long-eared bat (*Myotis septentrionalis*) was proposed for listing under the ESA as an endangered species. This bat requires forested habitats for roosting and foraging and has only been found in Wyoming in the extreme northeastern corner in the forests of the Black Hills. Suitable habitat for the northern long-eared bat is not present on the Brook Mine.

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D9-1.5.10 Other Species of High Federal or State Interest

The current USFWS list of Migratory Bird Species of Conservation Concern is provided in Table D9-15. The American bittern has not been recorded in the mine permit area and the site provides marginal habitat for this species. The American bittern may be found in more suitable habitats near the Brook Mine but was not observed during wildlife surveys.

The bald eagle is common in the area as a winter migrant and breeder. Bald eagles are commonly observed along the Tongue River and Goose Creek in the winter but tend to be scattered with few high concentration roost areas. Bald eagles also breed and nest near the mine site but not within the permit area as discussed in Section D9-1.4.3 of this report.

The black rosy-finch and Cassins finch have not been recorded in this area These species would most likely not breed in the area but there is a higher possibility they could be present in the winter.

The Brewer's sparrow is generally common in sagebrush shrubland habitats as a breeder but does not appear to be abundant. This species was generally observed during most of the breeding bird surveys conducted in suitable habitats.

One pair of burrowing owls nested north of the Brook Mine in 2013 and 2014 as discussed in Section D9-1.4.3 of this report. This pair nested in a prairie dog burrow. Prairie dog towns are common within and adjacent to the Brook Mine permit area so burrowing owl nesting habitat is also common. These prairie dog towns were surveyed in 2013 and 2014 but new nesting burrowing owl pairs were not observed.

The ferruginous hawk has been uncommonly observed in the study area as a transient. This species has not been recorded nesting in the area after 30 years of baseline inventories and monitoring.

The golden eagle nests in the study area as discussed in Section D9-1.4.3 of this report. Only one golden eagle nest is present within the permit

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area and that nest was occupied in 2013 but did not produce any young. That nest was not active in 2014.

Grasshopper sparrows were observed in upland grassland habitat in the western portion of the Brook Mine permit area during the 2013 breeding bird surveys. This species was not observed during any of the other breeding bird surveys so was not common in the area and had a definite affinity for the upland grassland habitat types.

The greater sage-grouse was discussed previously in this section as an upland game bird in Section D9-1.4.2 of this report. Sage-grouse are present in the area but no longer appear to be common.

Mountain plovers were not recorded during the specific 2013 and 2014 surveys conducted on the site. Habitat in the form of black-tailed prairie dog colonies was abundant. No mountain plovers were recorded on adjacent lands either.

The pinyon jay was not recorded during the 2013 or 2014 surveys but had been previously identified in the vicinity. This species would most likely be a transient through the area and is currently considered uncommon.

The prairie falcon has been observed in the study area as a transient. Suitable nesting habitat in the form of cliffs or large rock outcrops is not present on the Brook Mine. Suitable falcon nesting habitat is also generally uncommon in the vicinity of the permit area.

Williamson's sapsuckers have not been observed on the Brook Mine or adjacent lands. This species is considered a breeder in the area but suitable habitat is limited on the mine site.

The willow flycatcher has been recorded as a breeder in the area. This species does not appear to be common but was observed during the 2014 breeding bird surveys as well as prior bird surveys conducted in the vicinity.

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D9-1.5.11 Reptiles and Amphibians

The species list in Attachment D9-1-A shows that 16 amphibians and reptiles were observed on the Brook Mine site and vicinity. The boreal chorus frog was heard calling at all the stockponds within the permit area. The leopard frog was also observed but did not appear to be abundant like the chorus frog. Garter snakes appeared to be common in wetter areas while rattlesnakes and bull snakes were observed primarily on uplands. The painted turtle and snapping turtle were observed in a few large ponds.

D9-1.5.12 Aquatics

According to the WDEQ-Water Quality Division, the adjacent Tongue River and Goose Creek are classified as Class 2AB waters. The 2AB classification of these waters indicates that they are suitable for drinking water, game fish, non-game fish, fish consumption, other aquatic life, recreation, wildlife, agriculture, industry and scenic value. The WDEQ-Water Quality Division has classified Slater Creek and Earley Creek as Class 3B waters. The classification 3B of these waters indicates that they are not suitable for drinking water or fish but are suitable for other aquatic life, recreation, wildlife, agriculture, industry and scenic value. Detailed descriptions of all drainages within the permit area are presented in Appendix D6 of this permit.

Representative aquatic data collected in the past for the Tongue River and Goose Creek are presented in Tables D9-16, D9-17 and D9-18. As mentioned previously these drainages will not be disturbed by mining activities.

D9-1.5.13 Wildlife Habitats and Affinity

The wildlife habitat types identified on the study area (Table D9-19) are generally consistent with the vegetation map units described and mapped in Appendix D8 and the wetlands presented in Appendix D10 for this permit area.

The top four major habitat types encountered on the permit area were upland grassland, sagebrush shrubland, rough breaks mixed shrubland and

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reclaimed lands as shown in Table D9-19. Four other habitat types comprising much less acreage were also identified on this area. Those four types were juniper woodland, riparian woodland, hayland and stockpond/water habitats. Appendix D8 and Appendix D10 provide detailed descriptions of these habitat types along with mapping showing locations. Brief descriptions of these types are provided here.

Upland Grassland

The upland grassland habitat type is the largest type found on this area. The upland grassland habitat type included two sub-unit types that consist of the Prairie Dog Modified Grassland and the Scoria Grassland. This community is rangeland dominated by native graminoids and forbs. Typically, grasses include western wheatgrass, (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needleandthread (*Stipa comata*), prairie junegrass (*Koeleria macrantha*), blue grama (*Bouleloua gracilis*) and threadleaf sedge (*Carex filifolia*). Shrubs and subshrubs are essentially absent from the upland grassland community. Prickly pear cactus (*Opuntia polyacantha*) is found throughout this habitat type in varying densities. Introduced annual grasses are found throughout the upland grassland habitats with varying contribution to cover. In limited areas, crested wheatgrass (*Agropyron cristatum*) from various seedings has established itself in this community. This community generally occurs on gentle slopes or flatlands. The Prairie Dog Modified sub-unit typically has more annual grasses such as cheatgrass (*Bromus tectorum*) and annual forbs such as mustard species (*Descurainia* sp.) due to overgrazing and other disturbances caused by the prairie dogs. The scoria grassland subunit has bluebunch wheatgrass (*Pseudoroegneria spicata*) as a dominant in some areas.

Sagebrush Shrubland

The sagebrush shrubland habitat type is the second largest type found on the permit area. This community is rangeland dominated by big sagebrush (*Artemisia tridentata*). Some native graminoids, forbs and subshrubs occur in

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the understory and inner-space in the shrub mosaic. Typically, perennial grasses include western wheatgrass, green needlegrass, needleandthread, prairie sandreed (*Calamovilfa longifolia*), prairie junegrass, blue grama and threadleaf sedge. Introduced annual grasses are found throughout the sagebrush shrubland habitat type with varying contributions to cover. In limited areas, crested wheatgrass from various seedings has established itself in this habitat type.

Rough Breaks Mixed Shrubland

The rough breaks mixed shrub habitat is rather diverse in both topography and vegetation. It generally occurs on steep slopes and is sometimes associated with scoria and sandstone rock outcrops. These areas are covered with coarse rock fragments. Graminoid species in these areas include little bluestem (*Andropogon scoparius),* bluebunch wheatgrass and needleandthread. Shrub species include big sagebrush, skunkbush sumac (*Rhus trilobata*), rubber rabbitbrush (*Ericameria nauseosus*) and western snowberry (*Symphoricarpos occidentalis*). There are also some inclusions of Rocky Mountain juniper (*Juniperus scopulorum*) and the juniper woodland habitat is found within this rough breaks habitat type.

Reclamation

The reclamation habitat type consists primarily of lands reclaimed by the Big Horn Mine. This habitat is dominated by perennial grasses which include western wheatgrass, thickspike wheatgrass (*Elymus lanceolatus*), intermediate wheatgrass (*Thinopyrum intermedium*), crested wheatgrass, green needlegrass and smooth brome (*Bromus inermis*). Introduced annual grasses and forbs are also present in varying amounts depending on yearly climatic conditions. Patches of shrubland are located within this reclaimed community type with rubber rabbitbrush, fourwing saltbush (*Atriplex canescens*) and big sagebrush being the most common shrubs.

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Juniper Woodland

The juniper woodland habitat type is dominated by Rocky Mountain juniper and big sagebrush. There are some inclusions of grassland within the understory of this community. Graminoid species include little bluestem, western wheatgrass, blue grama and bluebunch wheatgrass. The juniper woodlands are generally found on rather steep to gently sloping uplands on relatively poor soils within the rough breaks type.

Riparian Woodland

The riparian woodland habitat type is associated with creek and river channels, primarily Slater Creek within the Brook Mine permit area. Species found in this community include cottonwood (*Populus* sp.), green ash (*Fraxinus pensylvanica*), some peachleaf willow (*Salix amygdaloides*) and Greene's mountain ash (*Sorbus scopulina*). A variable understory of shrubs, grasses, grasslike species and forbs is present.

Hayland

The hayland habitat type is found in small portions throughout the Brook Mine permit area. The main resource derived from this community is grass hay, alfalfa and small grain production for livestock use.

Disturbed Lands

The current unreclaimed disturbance on this area is attributed to an existing gravel mine, other past mine facilities, county roads, other roads and railroad.

Stockpond/Water

The stockpond/water habitat type consists primarily of stockponds constructed for livestock watering. These ponds support livestock production and wildlife habitat.

Habitat affinity for the various classes of wildlife were generally presented or discussed in each of the results sections for those species. In general, the

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most important habitat, or the habitat where the greatest diversity and abundance of species were observed, was the riparian woodland followed by the sagebrush shrubland, upland grassland, juniper woodland, rough breaks mixed shrubland and reclamation grassland. The various ponds present on the permit area provided sources of water for all classes of wildlife but were essential for aquatic species, waterfowl and shorebirds. Haylands also provide seasonal habitats for a variety of wildlife species.

D9-1.6 Conclusions and Impacts

Wildlife habitats designated by state or federal agencies as crucial or critical are not present within the permit area. Species currently listed as threatened or endangered have not been identified on the study area.

Big Game

Pronghorn and mule deer are the primary big game animals that may be displaced by this operation. White-tailed deer may be impacted to a lesser degree. Long term monitoring of big game animals at other coal mines in Wyoming has revealed these animals will habituate to mining activities and will readily feed on available forage adjacent to haul roads, mine pits and facilities. All of the disturbed area will be reclaimed for use as rangeland and wildlife habitat including planting several species of shrubs which are utilized by big game. The stockponds, reservoirs and wells that will be established following mining will be available for use by big game as well as livestock.

Road kills of pronghorn and deer may be expected to increase as a result of increased traffic associated with mine employees and venders. Brook Mine will also cooperate in any way possible with the Wyoming Game and Fish Department to reduce or eliminate the illegal or unwarranted killing of any animals at the mine location.

Hazards to deer and antelope movement will be reduced by using minimum amounts of fencing and using fences passable to antelope and deer except where these species need to be excluded such as hazardous sites or newly

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seeded areas. Fences where big game will be allowed to pass will be constructed according to WDEQ-LQD and/or WGFD recommendations.

Upland Game Birds and Waterbirds

Some upland game birds will be displaced as mining proceeds. Habitat for the mourning dove will be enhanced since they flourish on newly reclaimed areas. The ponds and reservoirs that will be established are also important habitats for mourning doves. Sage-grouse and sharp-tailed grouse are present on the study area so they will be impacted. However, sage-grouse leks and active sharp-tailed grouse strutting grounds are not known to be present near proposed mining activities. Big sagebrush, which is used by sage-grouse for cover, nesting and a major portion of their winter diet, is included in the revegetation seed mixtures. Premining topography will also be replaced and grassy draws established for brood rearing (see the Reclamation Plan).

The permit area provides limited waterbird habitat. The temporary elimination of any stockponds during mining will preclude the use of those portions of the permit area for some migrating waterbirds. It will also temporarily displace the few waterbirds (e.g. mallard, gadwall, and killdeer) recorded nesting on the permit area. Waterbird habitat is abundant nearby along the Tongue River, Goose Creek and Pit 3 Reservoir. Waterbirds will also use the temporary mine sediment ponds. The postmining impoundments will provide habitat for waterbirds on the reclaimed landscape.

Predatory Birds and Mammals

Predator use of the permit area will decline as the prey base and their habitat is removed. As habitat of prey species (small mammals, birds, large insects) is reclaimed, prey species density will increase and predator densities will respond. Nesting and foraging raptors will also be affected by mining activities. Tree nest sites and rock cairns will be erected on the post mine landscape to enhance raptor nesting habitat. Boulder piles of various sizes will be distributed over the area to provide shelter and den sites for both mammalian

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predators and their various prey species. These boulder piles will be distributed in a non-systematic manner to give a more natural effect. The permanent stockponds and reservoirs will also provide habitat for predatory birds and mammals which frequent the area. Throughout the mining operation predators will use the area as a hunting ground in proportion to the availability of prey species. Two bald eagle nests and several golden eagle nests are known to occur within one mile of the permit boundary but they should be far enough away from mine activities to avoid major impacts.

Small Mammals and Birds

Small mammals and birds will be displaced as mining proceeds but will return as habitat is reclaimed. Since revegetated habitat will not be grazed by livestock for several years, it may support higher densities of birds and small mammals during these periods than the premining habitat. The reestablishment of small mammals and bird species should be relatively rapid for the following reasons:

1. The diversity of plant species being used in reclamation.
2. The thorough distribution and number of permanent water sources being established after mining.
3. The establishment of boulder piles for immediate use as shelter and dens.
4. The establishment of shrub patches and trees in reclamation.

Reptiles and Amphibians

Reptiles and amphibians are about the least mobile of all groups of wildlife species inhabiting the permit area. Many will be destroyed as topsoil is stripped prior to mining and if any reservoirs or stockponds will be removed. Proposed wildlife habitat restoration will also benefit these species and allow recolonization of reclaimed areas. Of particular importance to some reptiles will be the rock piles. The reclaimed waterbodies and riparian habitats will allow the reestablishment of other herptiles on the permit area.

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Aquatic Habitats

Portions of Slater Creek and Earley Creek may be affected by the project. Neither of these drainages supports viable fisheries so impacts to the fisheries resource will be minimal. The characteristics of the portions of these channels disturbed will be replaced when these creeks are reclaimed. No disturbances will occur in Goose Creek or the Tongue River so impacts to fisheries in those streams will be minimal. Several ponds may be mined through, but these ponds will be replaced in the postmine landscape.

Threatened or Endangered Species

No wildlife or plant species currently listed by the USFWS as threatened or endangered are known to exist on the permit area or adjacent lands. The appropriate state and federal agencies will be contacted, and acceptable mitigation measures developed, if a listed species is identified on the area during future surveys.

Hunting Access

The Brook Mine may allow hunting on the area when it does not jeopardize the safety of ranching operations, sportsmen and/or mine personnel. Landowners also control access on portions of the study area. Currently a portion of the permit area is under the WGFD Private Land Public Wildlife Program (PLPW) which allows access to sportsman for hunting. This access may be limited during the mine operation to protect the safety of mine employees as well as sportsmen. Hunting that is allowed will be in compliance with Wyoming State Game Laws.

Monitoring and Mitigation

Wildlife protection measures are provided in Section MP.18 of the Mine Plan and an outline of general wildlife monitoring commitments is provided in Addendum MP-8 also of the Mine Plan volume. The Migratory Birds of Conservation Concern and Raptor Monitoring and Mitigation Plans are presented in Addendum MP-9 of the Mine Plan volume. These various plans proved the

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wildlife commitments and also commit to providing annual wildlife monitoring reports to the WDEQ-LQD. The Reclamation Plan includes wildlife habitat restoration practices and commitments.

D9-1.7 Persons Consulted

The collection and preparation of this wildlife information for the Brook Mine was completed by Jim Orpet and Russell Tait of Intermountain Resources, P.O. Box 1589, Laramie, Wyoming 82073, telephone 307-745-3803.

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Table D9-1. Sage-grouse Survey Results for Leks Located Within Two Miles of the Brook Mine Permit Area

	C-Slater Creek			C-French Springs			C-Ash Creek		
Year/Date	M	F	U	M	F	U	M	F	U
2003									
4/11	12	9*	0	-	-	-	0	0	0
4/18	4	0	0	0	0	0	0	0	0
4/23	15	0	0	0	0	0	0	0	0
2004									
3/31	8	3	0	-	-	-	0	0	0
4/19	10	0	0	0	0	0	0	0	0
4/28	10	0	0	0	0	0	0	0	0
2005									
4/11	6	0	20	-	-	-	0	0	0
4/18	13	0	10	0	0	0	0	0	0
4/24	12	0	0	-	-	-	12	0	0
4/25	-	-	-	0	0	0	-	-	-
5/6	13	0	0	-	-	-	-	-	-
2006									
4/8	12	16	0	-	-	-	0	0	0
4/13	14	3	0	0	0	0	0	0	0
4/30	20	2	0	0	0	0	0	0	0
5/5	17	0	0	0	0	0	-	-	-
2007									
4/4	-	-	-	-	-	-	0	0	0
4/15	-	-	-	-	-	-	0	0	0
4/17	13	7	0	-	-	-	0	0	0
4/18	-	-	-	0	0	0	0	0	0
4/24	13	1	0	0	0	0	0	0	0
5/3	13	0	0	0	0	0	0	0	0
2008									
4/12	4	3	0	0	0	0	0	0	0
4/13	-	-	-	-	-	-	0	0	0
4/18	5	0	0	0	0	0	0	0	0
4/24	-	-	-	-	-	-	0	0	0
4/27	4	0	0	0	0	0	0	0	0
2009									
4/4	-	-	-	-	-	-	0	0	0
4/20	7	0	0	0	0	0	0	0	0
4/28	6	0	0	0	0	0	0	0	0
5/4	5	0	0	0	0	0	-	-	-

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Table D9-1. Sage-grouse Survey Results for Leks Located Within Two Miles of the Brook Mine Permit Area (Continued)

Year/Date	C-Slater Creek M	C-Slater Creek F	C-Slater Creek U	C-French Springs M	C-French Springs F	C-French Springs U	C-Ash Creek M	C-Ash Creek F	C-Ash Creek U
2010									
4/10	9	0	0	0	0	0	0	0	0
4/16	9	0	0	0	0	0	0	0	0
4/22	14	0	0	-	-	-	-	-	-
4/26	-	-	-	0	0	0	0	0	0
2011	No Surveys								
2012									
4/6	6	1	0	0	0	0	0	0	0
4/14	0	0	0	0	0	0	0	0	0
4/23	6	0	0	0	0	0	0	0	0
5/2	5	0	0	0	0	0	0	0	0
2013									
4/3	3	0	0	0	0	0	0	0	0
4/4	-	-	-	-	-	-	0	0	0
4/6	3	3	0	0	0	0	0	0	0
4/25	2	0	0	0	0	0	0	0	0
4/27	4	0	0	0	0	0	0	0	0
5/3	4	0	0	0	0	0	0	0	0
5/9	4	0	0	-	-	-	-	-	-
2014									
4/4	1	0	0	0	0	0	0	0	0
4/9	1	0	0	0	0	0	0	0	0
4/18	0	0	0	0	0	0	0	0	0
5/2	1	0	0	0	0	0	0	0	0

M = Male
F = Female
U = Unknown
- = Not surveyed on this data.

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Table D9-2. Active Sharp-tailed Grouse Leks Observed in the 2013-2014 Brook Mine Study Area

Year/Date	Pit 5 West Unclassified	Pit 5 East Unclassified
2013		
4/5	17	4
4/26	20	3
2014		
4/16	17	3
5/3	15	2

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Bald Eagle (BE)					
BE1	T57N R85W NWNE Sec. 24	Cottonwood	Intact	A,?,?	A,1+,?
BE2	T57N R85W SENE Sec. 21	Cottonwood	Intact	A,1+,1	A,2,2
BE3	T57N R84W SWSE Sec. 14	Cottonwood	Intact	A,0,0	Goose
BE4	T57N R84W NWNW Sec. 13	Cottonwood	Intact	RT26a	A,2,2
	Total BE Nests = 4		Total	3,1+,1+	3,5+,4+
Golden Eagle (GE)					
GE1a	T57N R84W SESE Sec. 5	Pine	Intact	I	A,0,0
GE1b	T57N R84W NENE Sec. 8	Pine	Intact	I	I
GE1c*	T57N R84W NESE Sec. 9	Pine	Intact	A,0,0	I
GE2	T57N R84W NENE Sec. 27	Pine	Intact	A,2,2	A,2,2
GE3	T57N R85W NWNW Sec. 11	Cottonwood	Intact	A,2,2	A,2,1
GE4	T57N R85W NESW Sec. 15	Cottonwood	Intact	A,1,1	I

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Golden Eagle (GE) - Continued					
GE5	T57N R84W SESW Sec. 2	Pine	Intact	A,1,1	A,0,0
GE6	T57N R85W NENE Sec. 8	Cottonwood	Intact	A,0,0	I
	Total GE Nests = 8		Total	6,6,6	4,4,3
Red-tailed Hawk (RT)					
RT1*	T57N R84W SWNW Sec. 18	Cottonwood	Intact	A,0,0	A,3,3
RT2a*	T57N R85W NWNE Sec. 13	Cottonwood	Intact	--	A,3,3
RT2b*	T57N R84W NWNE Sec. 13	Cottonwood	Intact	A,2,2	I
RT3a*	T57N R84W NWSW Sec. 18	Cottonwood	Intact	I	I
RT3b*	T57N R84W NESW Sec. 18	Cottonwood	Intact	I	I
RT4	T57N R84W NWSW Sec. 17	Pine	Intact	I	I
RT5	T57N R84W SESW Sec. 15	Cottonwood	Intact	A,0,0	A,0,0
RT6*	T57N R84W NWNW Sec. 22	Mitigation Platform	Intact	I	I

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Red-tailed Hawk (RT) - Continued					
RT7	T57N R84W NENW Sec. 23	Cottonwood	Intact	I	A,0,0
RT8	T57N R85W SWSE Sec. 9	Cottonwood	Intact	A,0,0	I
RT9a	T57N R84W SESW Sec. 16	Cottonwood	Intact	I	I
RT9b	T57N R84W SESW Sec. 16	Cottonwood	No Longer Intact	I	DN
RT10	T57N R84W NENW Sec. 21	Cottonwood	Intact	A,2,2	A,2,2
RT11	T57N R84W NENW Sec. 21	Mitigation Platform	Intact	I	I
RT12	T57N R84W NENE Sec. 20	Cottonwood	Intact	I	GH1
RT13a	T57N R84W SWNW Sec. 20	Cottonwood	Intact	A,2,2	A,3,2
RT13b	T57N R84W SWNW Sec. 20	Cottonwood	Intact	Goose	I
RT14	T57N R84W NENE Sec. 19	Cottonwood	Intact	A,2,2	I
RT15a	T57N R84W SWNE Sec. 19	Cottonwood	Intact	A,?,?	Goose
RT15b	T57N R84W SWNE Sec. 19	Cottonwood	Intact	--	A,?,?

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Red-tailed Hawk (RT) - Continued					
RT16	T57N R85W NENW Sec. 23	Cottonwood	Intact	A,?,?	A,?,?
RT17a	T57N R85W SESW Sec. 15	Cottonwood	Intact	I	I
RT17b	T57N R85W SWSE Sec. 15	Cottonwood	Intact	--	A,?,?
RT18	T57N R85W SWSE Sec. 16	Cottonwood	Intact	I	A,0,0
RT19	T57N R85W NESW Sec. 3	Cottonwood	Intact	I	I
RT20	T57N R84W SWSW Sec. 3	Pine	Intact	--	A,3,3
RT21	T57N R84W NWSE Sec. 10	Pine	Intact	A,0,0	A,0,0
RT22	T57N R84W NENW Sec. 14	Pine	Intact	I	I
RT23	T57N R84W NESW Sec. 21	Pine	No Longer Intact	I	DN
RT24	T57N R84W NWSE Sec. 20	Cottonwood	Intact	I	I
RT25	T57N R84W SWSE Sec. 14	Cottonwood	Intact	BE3	Goose
RT26a	T57N R84W NWNW Sec. 13	Cottonwood	Intact	A,2,1	BE4

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Red-tailed Hawk (RT) - Continued					
RT26b	T57N R84W NESW Sec. 13	Cottonwood	Intact	--	A,3,3
RT27	T57N R84W NWSE Sec. 11	Cottonwood	Intact	I	I
RT28a	T57N R84W NESW Sec. 12	Cottonwood	Intact	A,2,2	I
RT28b	T57N R84W NWSW Sec. 12	Cottonwood	Intact	--	A,3,3
RT29	T57N R84W SWNE Sec. 11	Cottonwood	No Longer Intact	I	DN
RT30	T57N R84W NWSE Sec. 3	Pine	Intact	A,2,2	I
RT31	T58N R84W SWSE Sec. 32	Pine	No Longer Intact	A,0,0	DN
RT32	T58N R85W SESW Sec. 36	Cottonwood	Intact	A,0,0	A,0,0
RT33	T57N R84W SWSW Sec. 24	Cottonwood	Intact	GH3	A,0,0
	Total RT Nests = 41		Total	15,14+,13+	16,20+,19+
Great Horned Owl (GH)					
GH1	T57N R84W NENE Sec. 20	Cottonwood	Intact	I	A,3,3

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Great Horned Owl (GH) - Continued					
GH2	T57N R84W NENW Sec. 21	Platform	Intact	I	I
GH3	T57N R84W SWSW Sec. 24	Cottonwood	Intact	A,1,1	A,0,0
GH4	T58N R85W SESW Sec. 36	Cottonwood	No Longer Intact	A,2,2	DN
GH5	T57N R85W SWNE Sec. 17	Cottonwood	Intact	--	A,2,2
	Total GH Nests = 5		Total	2,3,3	3,5,5
Osprey (OS)					
OS1	T57N R84W SESE Sec. 15	Platform	Intact	Goose	I
OS2	T57N R84W SESE Sec. 15	Platform	Intact	Goose	AT
OS3	T57N R84W NWNW Sec. 22	Platform	Intact	A,0,0	A,3,3
OS4	T57N R84W SWSE Sec. 15	Platform	Intact	I	I
OS5	T57N R84W NWNW Sec. 24	Light Pole	Intact	A,2,2	A,3,3
	Total OS Nests = 5		Total	2,2,2	3,6,6

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Table D9-3. Raptor Nests Recorded on the Brook Mine Study Area in 2013 and 2014 (Continued)

Species / Nest Site	Location	Nest Substrate	Status	Activity 2013	Activity 2014
Burrowing Owl (BO)					
BO1	T57N R84W NWNW Sec. 4	Prairie Dog Burrow	Intact	A,3+,3+	A,4+,4+
	Total BO Nests = 1		Total	1,3+,3+	1,4+,4+
	All Total Nests = 59 (Adjusted for nests used by more than one species)		**Total**	**29,29+,28+**	**30,44+,41+**

Abbreviation/Symbol Codes

X,#,# = Nest Status (A-active, I-inactive), number of young hatched, number of young fledged
Totals rows: #,#,# = total active nests, total young hatched, total young fledged

* = Denotes Nest Within Permit Area
-- = Nest Not Present
DN = Destroyed Naturally
AT = Nest Actively Tended

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Table D9-4. Passerine Bird Surveys Completed in 2013 and 2014 for the Brook Coal Mine

	2013 Surveys					
	UG		SS		RB	
Species	6/11	6/26	6/11	6/26	6/11	6/26
Western Meadowlark	11	10	9	7	7	2
Lark Sparrow	3	7	6	2	7	3
Grasshopper Sparrow	1	4				
Vesper Sparrow	1	2	1	2	2	
Cliff Swallow		1				
Brewer's Sparrow			9	6	1	
Lark Bunting			4	2		
Rufous-sided Towhee				1		3
Black-billed Magpie			2		5	5
Horned Lark	4					
Killdeer	1					
Mourning Dove	3					
McCown's Longspur	2					
Sage Thrasher			1			
American Robin	1				1	2
Golden Eagle					1	
American Kestrel					1	

	2014 Surveys					
	RW		PG		RC	
Species	5/28	6/13	5/28	6/13	5/28	6/13
Western Meadowlark	3	1	1	1	5	9
Lark Sparrow	2	2	1		7	3
Cliff Swallow						3
Rufous-sided Towhee	1	2				
Black-billed Magpie	2	4	2	2		
Killdeer			1	1	2	
American Robin	5	10		3	1	
American Kestrel	1					
Bullocks Oriole	3					1
Eastern Kingbird	5					
Western Wood Pewee	1					
Yellow Warbler	7	4				
Western Kingbird	2	3	2			
Starling	11	6	2	2	4	2

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Table D9-4. Passerine Bird Surveys Completed in 2013 and 2014 for the Brook Coal Mine (Continued)

	2014 Surveys					
	RW		PG		RC	
Species	5/28	6/13	5/28	6/13	5/28	6/13
Brown Headed Cowbird	5		1		1	
Common Flicker	3	2				1
Red-tailed Hawk	2	2		1		
Willow Flycatcher	1					
Orchard Oriole	3	2				
Say's Phoebe					1	
Ring-necked Pheasant					1	
Mallard					4	
Canada Goose					1	
House Wren		3				
Yellow-breasted Chat		2				
Gray Catbird		1				
Osprey						1
Great Blue Heron						1
Turkey Vulture						1

UG = Upland Grassland
SS = Sagebrush Shrubland
RB = Rough Breaks / Juniper
RW = Riparian Woodland
PG = Prairie Dog Town Grassland
RC = Reclaimed Lands

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Table D9-5. Passerine Species Observed on or within One Mile of the Original Mine Youngs Creek Mine Permit Area No. 407 during July, 1975

Species	Estimated Abundance	Principal Habitat Type Frequented
Eastern kingbird	Fairly common	Hayland
Say's phoebe	Fairly common	Big sagebrush shrubland
Olive-sided flycatcher	Uncommon	Pine and juniper woodland
Cliff swallow	Abundant	Big sagebrush shrubland
Black-billed magpie	Common	Riparian woodland
House wren	Abundant	Riparian woodland
Rock wren	Common	Big sagebrush shrubland
American robin	Common	Riparian woodland
Mountain bluebird	Common	Pine and juniper woodland
Starling	Fairly common	Riparian woodland
Red-eyed vireo	Uncommon	Riparian woodland
Common yellowthroat	Common	Riparian woodland
Western meadowlark	Abundant	Hayland
Red-winged blackbird	Fairly common	Riparian woodland
Brewer's blackbird	Fairly common	Riparian woodland
Bullocks oriole	Uncommon	Riparian woodland
Lazuli bunting	Common	Riparian woodland
American goldfinch	Common	Riparian woodland
Rufous-sided towhee	Fairly common	Pine and juniper woodland
Lark bunting	Abundant	Big sagebrush shrubland
Vesper sparrow	Common	Big sagebrush shrubland
Lark sparrow	Common	Big sagebrush shrubland
Brewer's sparrow	Abundant	Big sagebrush shrubland

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Table D9-6. Results of Breeding Bird Strip Censuses on the Original Youngs Creek Permit Area No. 407 (June, 1980)[a, b]

	Riparian Woodland [c]	Bottomland Grassland	Pine and Juniper Woodland	Big Sagebrush Shrubland	Rough Breaks Mixed Shrubland	Reclamation
ORDER PASSERIFORMES						
Eastern kingbird	1(.04)		1(.04)			
Traill's flycatcher	1(.04)					
Barn swallow	1(.04)		1(.01)			
Cliff swallow	11(.44)	17(.68)	11(.45)	4(.16)	18(.73)	10(.40)
Black-billed magpie		3(.12)	1(.04)			
House wren	1(.04)					
Rock wren		1(.04)			7(.28)	
American robin	4(.16)	1(.04)	2(.08)	1(.01)	1(.04)	
Mountain bluebird					1(.04)	
Starling	2(.08)			1(.01)		
Yellow warbler	3(.12)					
Common yellowthroat	1(.04)					
Western meadowlark	13(.52)	6(.24)	4(.16)	7(.28)	5(.20)	4(.16)
Red-winged blackbird	15(.60)					1(.01)
Brewer's blackbird	9(.36)		1(.01)		1(.04)	
Bullock's oriole	1(.04)					
American goldfinch	1(.04)					
Rufous-sided towhee		3(.12)	2(.08)			
Vesper sparrow	4(.16)	3(.12)	2(.08)	4(.16)	1(.04)	
Lark sparrow	4(.16)		10(.40)	5(.20)		
Chipping sparrow				1(.01)		
Brewer's sparrow		2(.08)	1(.04)	4(.16)	1(.04)	
ORDER ANSERIFORMES						
Mallard	1(.04)					
ORDER FALCONIFORMES						
Turkey vulture			1(.01)			
Red-tailed hawk			1(.01)			
American kestrel	1(.04)	3(.12)	2(.08)	1(.01)		3(.12)
ORDER GALLIFORMES						
Sage-grouse			1(.04)			
Ring-necked pheasant	1(.04)					
ORDER GRUIFORMES						
Sora rail	1(.04)					
ORDER CHARADRIIFORMES						
Upland plover			1(.01)	1(.04)		
Killdeer	2(.08)		1(.04)			1(.04)

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Table D9-6. Results of Breeding Bird Strip (Continued)

	Riparian Woodland[c]	Bottomland Grassland	Pine and Juniper Woodland	Big Sagebrush Shrubland	Rough Breaks Mixed Shrubland	Reclamation
ORDER COLUMBIFORMES						
Mourning dove	3(.12)		1(.04)	1(.04)		3(.12)
ORDER CUCULIFORMES						
Black-billed cuckoo	1(.04)					
ORDER STRIGIFORMES						
Great horned owl		3(.12)	1(.01)			
ORDER CAPRIMULGIFORMES						
Common nighthawk				1(.01)		
ORDER PICIFORMES						
Common flicker		3(.12)	1(.04)	1(.01)		
Number of Species Observed	23	11	20	13	8	6
No. of Birds Observed per 1000 meter transect	81	44	42	28	35	21

[a] Represents average number per day per 1000-meter transect rounded to nearest whole number

[b] Number in parenthesis indicated estimated density per acre

[c] Rerouted Youngs Creek and woodlands associated with the original streambed.

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Table D9-7. Results of Winter Bird Surveys on the Original Youngs Creek Mine Permit Area No. 407 (February, 1981)[a]

	HABITAT TYPE					
Species	Riparian Woodland[b]	Bottomland Grassland	Pine and Juniper Woodland	Big Sagebrush Shrubland	Rough Breaks Mixed Shrubland	Reclamation
PASSERIFORMES						
Black-billed magpie	1		1			
Red crossbill	2					
Black-capped chickadee	5	1	7			
Horned lark				3		
Gray jay	1					
Pine grosbeak	2		1			
Tree sparrow	8					
American robin		1	2			
Gray-crowned rosy finch			2		37	
Townsend's solitaire		1	1			
White-breasted nuthatch			1			
Red-breasted nuthatch			2			
GALLIFORMES						
Sage-grouse				2 roosts		
Wild turkey	Tracks					
STIGIFORMES						
Great horned owl	1	1	1			
PICIFORMES						
Hairy woodpecker	1					
Downy woodpecker	1					
Number of Species	10	5	9	2	1	0

[a] - Figures represent the number of birds observed per 1000-meters of transect.

[b] - Rerouted Little Youngs Creek, woodlands associated with original streambed, and a portion of undisturbed Little Youngs Creek above the permit area.

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Table D9-8. Estimated Densities per Hectare of Species Recorded from All Riparian Woodland Point-Transects on the Big Horn Coal Mine Permit No. 213 Study Area in 1979

Species	# Individual Birds Recorded				# Stations Observed at				# Birds/ha			
	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep
Mallard	2	1	1	2	1	1	1	2	0.06	0.03	0.03	0.06
Killdeer	13	5	5	4	11	5	3	3	0.41	0.16	0.16	0.13
Spotted Sandpiper	4	1	1		4	1	1		0.13	0.03	0.03	
Mourning Dove	8	7	11		6	5	8		0.25	0.22	0.35	
Belted Kingfisher	1		3		1		3		0.03		0.1	
Common Flicker	5	8	10	2	5	6	7	1	0.16	0.25	0.32	0.06
Downy Woodpecker		1				1				0.03		
Eastern Kingbird	22	20	17		15	11	7		0.7	0.64	0.54	
Western Kingbird	1	1	17		1	1	2		0.03	0.03	0.13	
Western Wood Pewee	4		3		2		3		0.13		0.1	
Black-billed Magpie			7	1			5	1			0.22	0.03
Black-capped Chickadee	1		4	6	1		2	3	0.03		0.13	0.19
House Wren	3	7	6		3	6	3		0.1	0.22	0.19	
Gray Catbird	7	2	5		5	2	5		0.22	0.06	0.16	
American Robin	29	10	24	2	14	7	10	2	0.92	0.32	0.76	0.06
Cedar Waxwing			2				1				0.06	
Yellow Warbler	22	18	8	1	12	11	5	1	0.7	0.57	0.25	0.03
Common Yellowthroat	8	3			5	2			0.25	0.1		
Yellow-breasted Chat		5				4				0.16		
American Redstart	2	1	4		2	1	3		0.06	0.03	0.13	
Western Meadowlark	1	1		2	1	1		1	0.03	0.03		0.06
Bullocks Oriole	4				4				0.13			
Lazuli Bunting	5	2			4	2			0.16	0.06		
American Goldfinch	7	4	3		5	4	3		0.22	0.13	0.1	
Rufous-sided Towhee			1				1				0.03	
Lark Sparrow			1				1				0.03	
Chipping Sparrow				5				1				0.16
White-crowned Sparrow				9				2				0.29
Song Sparrow	3	2		1	2	1		1	0.1	0.06		0.03
Unidentified Passerine	23	35	41	11	14	14	27	8	0.73	1.11	1.31	0.35

ha = hectare

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Table D9-9. Passerine Bird Breeding Densities (#/ha) in Habitats Present on the Big Horn Coal Mine Permit No. 213 Area. Habitats were Sampled in 1980, Except Where Otherwise Noted

	Habitat Types							
Species	Big Sagebrush Shrubland	Big Sagebrush Shrubland (1981)	Big Sagebrush Shrubland	Pine & Juniper Woodland	Rough Breaks Mixed Shrubland	Rough Breaks Mixed Shrubland Rim-rock	Rough Breaks Mixed Shrubland Rim-rock (1981)	Upland Grassland
Common Flicker	*	0.13	*	*	*	*	*	*
Says Phoebe	*	0.03	*	*	*	*	*	*
Black-billed Magpie	*	*	*	0.60	*	*	*	*
Black-capped Chickadee	*	*	*	0.69	*	*	*	*
Rock Wren	*	*	*	*	*	*	1.19	*
American Robin	*	*	*	0.34	*	*	*	*
Yellow Warbler	*	*	*	0.09	*	*	*	*
Yellow-rumped Warbler	*	*	*	0.17	*	*	*	*
Western Meadowlark	*	0.37	0.4	0.09	0.3	0.22	0.07	1.07
Common Grackle	*	0.13	*	*	*	*	*	*
Bullocks Oriole	*	*	*	0.09	*	*	*	*
Rufous-sided Towhee	*	*	*	0.34	0.6	*	*	*
Vesper Sparrow	0.13	0.43	*	0.09	*	1.78	0.22	0.13
Lark Sparrow	0.4	0.03	0.53	1.46	1.49	*	0.67	*
Chipping Sparrow	0.13	*	0.13	1.29	*	*	*	*
Brewer's Sparrow	0.93	0.4	*	*	*	*	*	*

* - Species not recorded in this habitat type.
ha - Hectare

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Table D9-10. Breeding Bird Density Data Collected on the Welch No. 1 Mine Permit No. 497 Property and Vicinity

	Relative Density - #/ha					
	Riparian		Big Sagebrush Shrubland		Pine and Juniper	
Species	**Welch**	**Vicinity**	**Welch**	**Vicinity**	**Welch**	**Vicinity**
Yellow warbler	2.22	3.28				
American robin	1.06	2.08		0.14		
House wren	0.97	0.22				
Least flycatcher	0.87					
Western wood pewee	0.68	0.87				
Eastern kingbird	0.58	0.66	0.12			
Bullocks oriole	0.39	0.43				
Common flicker	0.29	1.09	0.12			
Mourning dove	0.29	0.87				
Western meadowlark	0.29	1.31	0.49	0.82	0.16	
Barn swallow	0.29					
Black-capped chickadee	0.58	0.44			0.33	
Brewer's blackbird	0.29	2.62				
Brown-headed cowbird	0.29	0.66				
American redstart	0.29	0.22				
Yellow-breasted chat	0.20					
Lark sparrow	0.29	1.75	0.36	0.14	0.33	
Rufous-sided towhee	0.29	0.22			0.66	
Killdeer	0.19	0.22		0.14		
American goldfinch	0.19	0.87				
Black-billed cuckoo	0.19					
Least flycatcher	0.19	0.22	0.12		0.16	
Common grackle	0.19	0.44				
Great horned owl	0.10					
White-breasted nuthatch	0.10					
Red-eyed vireo	0.10					
Gray catbird	0.10	0.43				
Lazuli bunting	0.10					
Rose-breasted grosbeak	0.10					
Common yellowthroat	0.10	0.22				
Downy woodpecker	0.10	0.22				
Brewer's sparrow	0.33		0.49	0.55	0.33	
Chipping sparrow	1.48				1.48	
Yellow-rumped warbler	0.16				0.16	
Rock Wren	0.16		0.27		0.16	
Cliff swallow	0.12	large feeding group	0.12			
Red-winged blackbird		0.22				
Starling		0.22				
Yellow-billed cuckoo		0.22				
Vesper sparrow		0.22	0.24	0.27		
Brown thrasher		0.44				

ha - hectare

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Table D9-11. Small Mammal Capture Results for the Original Youngs Creek Mine Permit Area No. 407 (1975, 1977)

	AVERAGE NUMBER OF CAPTURES PER DAY						
	July 1-3, 1975				July 5-8, 1977		
Species	Xeric Sagebrush	Mesic Sagebrush	Riparian Woodland	Ponderosa Pine	Sagebrush Grassland	Ponderosa Pine	Wet Meadow
Deer mouse	11.3	9.7	6.3	1.5	1.7	13	2.0
Least chipmunk	0.7	-	-	1.0	-	-	0.3
Thirteen-lined ground squirrel	0.3	-	-	-	0.3	-	-
Meadow jumping mouse	-	-	0.3	-	-	-	-
Total Number of Species Captured	3	1	2	2	2	1	2

- indicates that species was not captured in the habitat type.

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Table D9-12. Small Mammal Capture Results for the Original Youngs Creek Mine Permit Area No. 407 (August/September, 1980)[a]

	Habitat Type						
Species	Riparian Woodland[b]	Bottomland Grassland	Pine and Juniper Woodland	Big Sagebrush Shrubland	Rough Breaks Mixed Shrubland	Reclamation	Number of Habitat Types in which Captured
Deer mouse	38	18	19	18	30	21	6
House mouse	2						1
Masked shrew	1	2					2
Grasshopper mouse				1			1
Bushy-tailed woodrat			1				1
Total Number of Species Captured	3	2	2	2	1	1	
Total Average Number of Individuals Captured	41	20	20	19	30	21	

[a] Riparian woodland (225 trap-nights and days), Bottomland Grassland (75), Rough Breaks Mixed Shrubland (75), and Reclamation (225) were all adjusted to 150 trap-nights and days for comparison. All trap lines were of equal length and consisted of 25 traps. These lines were run for three consecutive 24-hour periods. Number of lines per habitat was based on the extent and location of habitats.

[b] Rerouted Little Youngs Creek and woodland areas associated with the original streambed.

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Table D9-13. Abundance and Community Diversity Indices by Habitat for the Big Horn Coal Mine Permit No. 213 Small Mammal Trappings

Habitat	UG		BSS			RW	PJ		Reclaimed							
Site #	W1	P4-1	W2	P4-2	80-2	BH1	BH3	80-1	BH4			80-3	BH2			
Month-Year Trapped	Jun 76	Oct 78	Jun 76	Oct 78	Sep 80	Jun 76	Jun 76	Sep 80	Jun 76	Jun 77	Sep 77	Sep 80	Jun 76	Jun 77	Sep 77	Sep 80
Number Genera Captured	4	2	2	1	2	1	2	2	1	1	1	2	1	3	2	3
Captures/100 TN																
Peromyscus sp.	1.7	10.0	3.7	2.7	11.3	4.0	4.0	14.7	4.0		1.0	4.7	2.0	0.4		6.7
Microtus sp.	1.7									0.5		2.0		4.8	5.6	1.3
House mouse	0.3															
Thirteen-lined ground squirrel	0.3		2.0													
Least chipmunk							1.3	7.3								
Harvest Mouse		0.7			2.0									0.8	0.8	
Olive-backed pocket mouse																0.7
TOTAL	**4.0**	**10.7**	**3.7**	**2.7**	**13.3**	**4.0**	**5.3**	**22.0**	**4.0**	**0.5**	**1.0**	**6.7**	**2.0**	**6.0**	**6.4**	**8.7**
Diversity																
E(H')[1]	1.02	0.20	0.62		0.40		0.50	0.62				0.56		0.56	0.35	0.61
J[2]	0.73	0.29	0.89		0.57		0.72	0.90				0.81		0.51	0.50	0.56

UG - Upland Grassland
BSS - Big Sagebrush Shrubland
RW - Riparian Woodland
PJ - Pine and Juniper Woodland

1 - Shannon-Weaver Diversity
2 - Evenness

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Table D9-14. Small Mammal Trap Lines on the Welch No.1 Mine Permit No. 497 Study Area*

Species	Number Captured 1979	1980	Habitat
Deer mouse	6	21	Big Sagebrush Shrubland
	31	3**	Riparian Woodland/Hayland
	2	3	Pine and Juniper Woodland
	4	3	Upland Grassland
White-footed mouse	2	2**	Riparian Woodland/Hayland
	1	0	Pine and Juniper Woodland
Long-tailed vole	1	0	Riparian Woodland
Bushy-tailed wood rat	0	1	Pine and Juniper Woodland

* - Trapping efforts were carried out during the month of October. No mammals were trapped in the rock outcrop trapping line.

** - The 1980 riparian woodland trap lines were raided each night by raccoon and/or mink.

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Table D9-15. USFWS Migratory Birds of Conservation Concern in Sheridan County, Wyoming, Updated August of 2014

Species	Regional Seasonal Status	Recorded on Area or in Vicinity	Expected Occurrence On Study Area
American Bittern	Migrant	No	Uncommon
Bald Eagle	Winter	Yes	Common/Winter
Black Rosy-Finch	Breeder/ Winter	No	Uncommon
Brewer's Sparrow	Breeder	Yes	Common
Burrowing Owl	Breeder	Yes	Uncommon
Calliope Hummingbird	Breeder	Yes	Occasional
Cassins Finch	Winter	No	Occasional
Ferruginous Hawk	Breeder	Yes	Uncommon
Golden Eagle	Breeder	Yes	Common
Grasshopper Sparrow	Breeder	Yes	Occasional
Greater Sage-grouse	Breeder	Yes	Uncommon
Mountain Plover	Breeder	No	Rare
Pinyon Jay	Breeder	Yes	Uncommon
Prairie Falcon	Breeder	Yes	Occasional
Williamson's Sapsucker	Breeder	No	Uncommon
Willow Flycatcher	Breeder	Yes	Occasional

*Based on USFWS Wyoming Ecological Services Field Office, Cheyenne, Wyoming and IPAC (Information, Planning and Conservation System), August, 2014. Scientific names are provided in Addendum D9-1.

Regional Seasonal Status and expected occurrence compiled from Wyoming Game and Fish Department Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming, 2012 and Subsequent Revisions

Specific records of observations on area or in the vicinity are from wildlife baseline and monitoring surveys completed for the Brook Mine in 2013-2014, the Youngs Creek Coal Mine Permit No. 407, the Big Horn Coal Mine Permit No. 213 and the Welch No. 1 Coal Mine Permit No. 497.

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Table D9-16. Results of Fish Sampling Completed by the Big Horn Coal Mine on the Tongue River and Goose Creek, 1977 to 1979

Species	Tongue River	Goose Creek
Mountain whitefish	*	
Rainbow trout	*	
Brown trout	*	*
Northern pike	*	
Common carp	*	*
Golden shiner	*	
Flathead chub	*	*
Longnose dace	*	*
Sand shiner	*	
Plains minnow		
Fathead minnow	*	*
Shorthead redhorse	*	*
White sucker	*	*
Longnose sucker	*	*
Mountain sucker	*	*
Black bullhead	*	*
Stonecat	*	*
Smallmouth bass	*	*
Green sunfish	*	*
Rock bass	*	*
White crappie	*	
Sauger	*	
Yellow perch	*	

* - Indicates species was recorded in that waterbody.

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Table D9-17. Summary of Quantitative Data for the Benthic Community Sampling along the Tongue River between Acme and Montana State Border, 1976[1]

	Station [2]					
	Tongue River No.2		Tongue River No. 3		Tongue River No. 4	
Parameter	**Jul**	**Oct**	**Jul**	**Oct**	**Jul**	**Oct**
Mean Organisms sampled (n/o.1m^2)	1441.5	767.6	1995.4	1686.5	824.3	463.6
Total taxa	27	33	30	25	26	33
Biomass (mg/0.1m^2)	237.7	411.7	300.2	319.1	111.2	162.9
Mean Diversity (D_{IB})[3]	2.359	2.232	2.380	2.657	2.969	2.755
Mean Diversity (D_{IN})[4]	2.014	2.167	2.903	2.218	2.908	2.490
Equitability (e)	0.365	0.403	0.583	0.821	0.719	0.533

[1] – From WRRI, 1977

[2] – Station Locations: Tongue River No. 2 - Below Brown and Williams Pit, Big Horn Mine Section 23, T57N, R84W.
Tongue River No. 3 - 300 meters upstream of Highway 338 Bridge, Section 1, T58N, R83W.
Tongue River No. 4 - River at Section 31, T58N, R83W.

[3] – Mean diversity based on biomass from sample replicates.

[4] – Mean diversity based on numbers from sample replicates.

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Table D9-18. Results of Fisheries Evaluations Completed for the Welch No.1 Mine Permit No. 497 on the Tongue River

Species	Tongue River Acme to Montana [1]	Tongue River Vicinity of Highway 338 [2]	Tongue River Reservoir, Montana [3]
Mountain whitefish	*		
Rainbow trout			*
Brown trout	*		*
Northern pike			*
Common carp	*	*	*
Goldfish			*
Golden shiner	*		*
Creek chub	*		
Lake chub	*	*	
Flathead chub	*	*	*
Longnose dace	*	*	
Sand shiner	*		
Plains minnow	*		
Fathead minnow	*		
Shorthead redhorse	*	*	*
White sucker	*	*	*
Longnose sucker	*		*
Mountain sucker	*		
Black bullhead	*		
Channel catfish	*		
Stonecat	*		
Yellow bullhead			*
Pumpkinseed			*
Smallmouth bass	*	*	*
Largemouth bass		*	*
Green sunfish	*		*
Rock bass	*		*
White crappie	*	*	*
Black crappie			*
Bluegill		*	
Sauger	*		*
Walleye			*
Yellow perch	*	*	*

* - Indicates species was recorded in that waterbody.
1) – Mueller, 1977
2) – D'Appolonia Consulting Engineers, 1977
3) – Penkel, 1977

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Table D9-19. Wildlife Habitat Type Acreages for the Brook Mine Permit Area, 2014

Habitat Type	Acres	Percent of Area
Upland Grassland	2158.6	47.5
Sagebrush Shrubland	965.6	21.2
Rough Breaks Mixed Shrubland	576.0	12.7
Reclamation	596.7	13.1
Juniper Woodland	67.7	1.5
Riparian Woodland	57.2	1.3
Hayland	4.5	<0.1
Stockpond/Water	12.8	0.3
Disturbed Lands	109.7	2.4
TOTAL	**4548.8**	**100.0**

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ATTACHMENT D9-1-A

WILDLIFE SPECIES LIST

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Attachment D9-1-A. **WILDLIFE SPECIES LIST**

This section provides the entire list of wildlife species having the potential to occur on or near the mine permit area and those species observed in the area based on site specific surveys conducted for the Brook Coal Mine in 2013 and surveys completed for the adjacent Big Horn Coal Mine and the nearby Welch No. 1 Coal Mine and the Youngs Creek Coal Mine. Species that have been observed within the study area are identified on the list with an asterisk. In all, a total of 251 individual wildlife species have been recorded within the Brook Coal Mine permit area or nearby lands. This list of 251 species observed on the study area includes 42 mammals, 162 birds, 16 reptiles or amphibians and 31 fish.

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WILDLIFE SPECIES LIST FOR THE BROOK COAL MINE STUDY AREA

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS

Scientific Nomenclature[1]	Common Name	Observed
INSECTIVORA		
Soricidae		
Sorex cinereus	Masked shrew	*
Sorex merriami	Merriam's shrew	
Sorex monticolus	Dusky shrew	
Sorex palustris	Water shrew	*
Sorex vagrans	Vagrant shrew	
CHIROPTERA		
Vespertilionidae		
Myotis ciliolabrum	Western small-footed myotis	
Myotis evotis	Long-eared myotis	
Myotis lucifugus	Little brown myotis	*
Myotis thysanodes	Fringed myotis	
Myotis volans	Long-legged myotis	
Lasiurus cinereus	Hoary bat	
Lasionycteris noctivagans	Silver-haired bat	
Eptesicus fuscus	Big brown bat	
Plecotus townsendii	Townsend's big-eared bat	
Antrozous pallidus	Pallid bat	
LAGOMORPHA		
Leporidae		
Sylvilagus audubonii	Desert cottontail	*
Sylvilagus nuttallii	Mountain (Nuttall's) cottontail	*
Lepus townsendii	White-tailed jack rabbit	*
RODENTIA		
Sciuridae		
Neotamias minimum	Least chipmunk	*
Marmota flaviventris	Yellow-bellied marmot	*
Spermophilus tridecemlineatus	Thirteen-lined ground squirrel	*
Cynomys ludoviciana	Black-tailed prairie dog	*
Sciurus niger	Eastern fox squirrel	
Tamiasciurus hudsonicus	Red squirrel	*
Geomyidae		
Thomomys talpoides	Northern pocket gopher	*
Heteromyidae		
Perognathus fasciatus	Olive-backed pocket mouse	
Dipodomys ordii	Ord's kangaroo rat	*
Castoridae		
Castor canadensis	Beaver	*
Cricetidae		
Reithrodontomys megalotis	Western harvest mouse	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
RODENTIA (cont.)		
Peromyscus leucopus	White-footed mouse	
Peromyscus maniculatus	Deer mouse	*
Onychomys leucogaster	Northern grasshopper mouse	*
Neotoma cinerea	Bushy-tailed woodrat	*
Clethrionomys gapperi	Southern red-backed vole	
Microtus longicaudus	Long-tailed vole	*
Microtus montanus	Montane vole	
Microtus ochrogaster	Prairie vole	
Microtus pennsylvanicus	Meadow vole	*
Lemmiscus curtatus	Sagebrush vole	*
Ondatra zibethicus	Muskrat	*
Muridae		
Rattus norvegicus	Norway rat	
Mus musculus	House mouse	*
Dipodidae		
Zapus hudsonius	Meadow jumping mouse	*
Zapus princeps	Western jumping mouse	*
Erethizontidae		
Erethizon dorsatum	Porcupine	*
CARNIVORA		
Canidae		
Canis latrans	Coyote	*
Canis lupus	Gray wolf	
Vulpes vulpes	Red fox	*
Ursidae		
Ursus americanaus	Black bear	*
Procyonidae		
Procyon lotor	Raccoon	*
Mustelidae		
Mustela erminea	Short-tailed weasel	
Mustela frenata	Long-tailed weasel	*
Mustela nigripes	Black-footed ferret	
Mustela nivalis	Least weasel	
Mustela vision	Mink	*
Taxidea taxus	Badger	*
Mephitis mephitis	Stripped skunk	*
Lutra canadensis	River otter	
Felidae		
Puma concolor	Mountain lion	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL MAMMALIAN INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
CARNIVORA (cont.)		
Lynx rufus	Bobcat	*
ARTIODACTYLA		
Cervidae		
Cervus elaphus	Elk	*
Odocoileus hemionus	Mule deer	*
Odocoileus virginianus	White-tailed deer	*
Alces alces	Moose	*
Antilocapridae		
Antilocapra americana	Pronghorn	*

OBSERVED AND POTENTIAL BIRD INHABITANTS

ANATIDAE		
Chen caerulescens	Snow Goose	
Branta canadensis	Canada goose	*
Aix sponsa	Wood duck	*
Anas strepera	Gadwall	*
Anas americana	American widgeon	*
Anas platyrhynchos	Mallard	*
Anas discors	Blue-winged teal	*
Anas cyanoptera	Cinnamon teal	*
Anas clypeata	Northern shoveler	*
Anas acuta	Northern pintail	*
Anas crecca	Green-winged teal	*
Aythya valisineria	Canvasback	*
Aythya americana	Redhead	*
Aythya collaris	Ring-necked duck	
Aytha marila	Greater scaup	
Aythya affinis	Lesser scaup	*
Bucephala albeola	Bufflehead	*
Bucephala clangula	Common goldeneye	*
Bucephala islandica	Barrow's goldeneye	
Lophodytes cucullatus	Hooded merganzer	*
Mergus merganser	Common merganser	*
Mergus serrator	Red-breasted merganzer	*
Oxyura jamaicensis	Ruddy duck	*
PHASIANIDAE		
Alectoris chukar	Chukar	*
Perdix perdix	Gray partridge	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
PHASIANIDAE (cont.)		
Phasianus colchicus	Ring-necked pheasant	*
Centrocercus urophasianus	Greater sage grouse	*
Tympanuchus phasianellus	Sharp-tailed grouse	*
Meleagris gallopava	Wild turkey	*
PODICIPEDIDAE		
Podilymbus podicepts	Pied-billed grebe	*
Podiceps auritus	Horned grebe	*
Podiceps nigricollis	Eared grebe	*
Aechmophorus occidentalis	Western grebe	*
PELECONIDAE		
Pelecanus erythrorynchos	American white pelican	*
PHALACROCORACIDAE		
Phalacrocorax auritus	Double-crested cormorant	*
ARDEIDAE		
Botaurus lentiginosus	American bittern	
Ardea herodius	Great blue heron	*
Egretta thula	Snowy egret	
Nycticorax nycticorax	Black-crowned night-heron	
THRESKIORNITHIDAE		
Plegadis chihi	White-faced ibis	
CATHARTIDAE		
Cathartes aura	Turkey vulture	*
PANDIONIDAE		
Pandion haliaetus	Osprey	*
ACCIPITRIDAE		
Haliaeetus leucocephalus	Bald eagle	*
Circus cyaneus	Northern harrier	*
Accipiter striatus	Sharp-shinned hawk	*
Accipiter cooperii	Cooper's hawk	*
Accipiter gentilis	Northern goshawk	*
Buteo swainsoni	Swainson's hawk	*
Buteo jamaicensis	Red-tailed hawk	*
Buteo regalis	Ferruginous hawk	*
Buteo lagopus	Rough-legged hawk	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
ACCIPITRIDAE (cont.)		
Aquila chyrsaetos	Golden eagle	*
FALCONIDAE		
Falco sparverius	American kestrel	*
Falco columbarius	Merlin	
Falco rusticolus	Gyrfalcon	*
Falco peregrinus	Peregrine falcon	
Falco mexicanus	Prairie falcon	*
RALLIDAE		
Rallus limicola	Virginia rail	*
Porzana carolina	Sora	*
Fulica americana	American coot	*
GRUIDAE		
Grus canadensis	Sandhill crane	*
CHARADRIIDAE		
Pluvialis squatarola	Black-billed plover	
Pluvialis dominica	American golden-plover	
Charadrius semipalmatus	Semipalmated plover	
Charadrius vociferous	Killdeer	*
Charadrius montana	Mountain plover	
RECURVIROSTRIDAE		
Himantopus mexicanus	Black-necked stilt	
Recurvirostra americana	American Avocet	*
SCOLOPACIDAE		
Tringa melanoleucus	Greater yellowlegs	
Tringa flavipes	Lesser yellowlegs	*
Tringa solitaria	Solitary sandpiper	*
Tringa semipalmatas	Willet	
Actitis maculata	Spotted sandpiper	*
Bartramia longicauda	Upland sandpiper	*
Numenius americanus	Long-billed curlew	*
Limosa fedoa	Marbled godwit	
Calidris alba	Sanderling	
Calidris pusilla	Semipalmated sandpiper	
Calidris mauri	Western sandpiper	

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
SCOLOPACIDAE (cont.)		
Calidris minutilla	Least sandpiper	*
Calidris bairdii	Baird's sandpiper	
Calidris melanotos	Pectoral sandpiper	
Calidris himanotopus	Stilt sandpiper	
Limnodromus scolopaceus	Long-billed dowitcher	*
Gallinago delicata	Wilson's snipe	*
Leucophaeus pipixcan	Franklin's gull	
PHALAROPODIDAE		
Phalaropus tricolor	Wilson's phalarope	*
Phalaropus lobatus	Red-necked phalarope	
LARIDAE		
Chroicocephalus philadelphia	Bonaparte's gull	
Larus delawarensis	Ring-billed gull	
Larus californicus	California gull	*
Larus argentatus	Herring gull	
Hydroprogne caspia	Caspian tern	
Sterna hirundo	Common tern	*
Sterna forsteri	Forester's tern	
Childonias niger	Black tern	*
COLUMBIDAE		
Columba livia	Rock pigeon	*
Patagioenas fasciata	Band-tailed pigeon	
Steptopela decaocto	Eurasian collared dove	*
Zenaida macroura	Mourning dove	*
CUCULIDAE		
Coccyzus erythropthalmus	Black billed cuckoo	*
Coccyzus americanus	Yellow-billed cuckoo	
TYTONIDAE		
Tyto alba	Barn owl	
STRIGIDAE		
Megascops kennicottii	Western screech-owl	
Megascops asio	Eastern screech-owl	*
Bubo virginianus	Great horned owl	*
Bubo scandiacus	Snowy owl	

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
Athene cunicularia	Burrowing owl	*
Asio otus	Long-eared owl	
Asio flammeus	Short-eared owl	*
Aegolius acadicus	Northern saw-whet owl	*
CAPRIMULGIDAE		
Chordeiles minor	Common nighthawk	*
Phalaenoptilus nuttalli	Common poor-will	
APODIDAE		
Chaetura pelagica	Chimney swift	
Aeronautes saxatalis	White-throated swift	
TROCHILIDAE		
Archilochus alexandri	Black-chinned hummingbird	
Stellula calliope	Calliope Hummingbird	*
Selasphorus platycercus	Broad-tailed hummingbird	
Selasphorus rufus	Rufous hummingbird	
ALCEDINIDAE		
Megaceryle alcyon	Belted kingfisher	*
PICIDAE		
Melanerpes lewis	Lewis's woodpecker	*
Melanerpes erythrocephalus	Red-headed woodpecker	*
Sphyrapicus thyroideus	Williamson's sapsucker	
Sphyrapicus nuchalis	Red-naped sapsucker	*
Picoides pubescens	Downy woodpecker	*
Picoides villosus	Hairy woodpecker	*
Colaptes auratus	Northern flicker	*
TYRANNIDAE		
Contopus cooperi	Olive-sided flycatcher	*
Contopus sordidulus	Western wood peewee	*
Empidonax traillii	Willow flycatcher	*
Empidonax minimus	Least flycatcher	*
Empidonax oberholseri	Dusky flycatcher	
Empidonax occidentalis	Cordilleran flycatcher	
Sayornis saya	Say's phoebe	*
Tyranus vociferans	Cassin's kingbird	
Tyrannus verticalis	Western kingbird	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
TYRANNIDAE (cont.)		
Tyrannus tyrannus	Eastern kingbird	*
LANIIDAE		
Lanius ludovicianus	Loggerhead shrike	*
Lanius excubitor	Northern shrike	*
VIREONIDAE		
Vireo plumbeus	Plumbeous vireo	
Vireo gilvus	Warbling vireo	*
Vireo olivaceus	Red-eyed vireo	*
CORVIDAE		
Perisoreus canadensis	Gray jay	*
Cyanocitta stelleri	Stellar's jay	
Cyanocitta cristata	Blue jay	
Gymnorhinus cyanocephalus	Pinyon jay	*
Nucifraga columbiana	Clark's nutcracker	*
Pica hudsonia	Black-billed magpie	*
Corvus brachyrhynchos	Common crow	*
Corvus corax	Common raven	*
ALAUDIDAE		
Eremophila alpestris	Horned lark	*
HIRUNDINIDAE		
Tachycineta bicolor	Tree swallow	*
Tachycineta thalassina	Violet-green swallow	
Stelgidopteryx serripennis	Northern rough-winged swallow	*
Riparia riparia	Bank swallow	
Petrochelidon pyrrhonota	Cliff swallow	*
Hirundo rustica	Barn swallow	*
PARIDAE		
Poecile atricapillus	Black-capped chickadee	*
Poecile gambeli	Mountain chickadee	*
SITTIDAE		
Sitta canadensis	Red-breasted nuthatch	*
Sitta carolinensis	White-breasted nuthatch	*
Sitta pygmaea	Pygmy nuthatch	

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
CERTHIIDAE		
Certhia americana	Brown creeper	*
TROGLODYTIDAE		
Salpinctes obsoletus	Rock wren	*
Catherpes mexicanus	Canyon wren	
Troglodytes aedon	House wren	*
Cistothorus palustris	Marsh wren	
CINCLIDAE		
Cinclus mexicanus	American dipper	
REGULIDAE		
Regulus calendula	Ruby-crowned kinglet	
TURDIDAE		
Sialia sialis	Eastern bluebird	
Sialia mexicana	Western bluebird	*
Sialia currucoides	Mountain bluebird	*
Myadestes townsendi	Townsend's solitaire	*
Catharus fuscescens	Veery	*
Catharus ustulatus	Swainson's thrush	*
Catharus guttatus	Hermit thrush	*
Turdus migratorius	American robin	*
Ixoreus naevius	Varied thrush	
MIMIDAE		
Dumetella carolinensis	Gray catbird	*
Mimus polyglottos	Northern mockingbird	
Oreoscoptes montanus	Sage thrasher	*
Toxostoma rufum	Brown thrasher	*
STURNIDAE		
Sturnus vulgaris	European starling	*
MOTACILLIDAE		
Anthus rubescens	American pipit	
Anthus spragueii	Sprague's pipit	
BOMBYCILLIDAE		
Bombycilla garrulus	Bohemian waxwing	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
BOMBYCILLIDAE (cont.)		
Bombycilla cedrorum	Cedar waxwing	*
PARULIDAE		
Mniotilta varia	Black-and-white warbler	
Oreothlypis peregrina	Tennessee warbler	
Oreothlypis celata	Orange-crowned warbler	
Oreothlypis virginiae	Virginia's warbler	
Setophaga petechia	Yellow warbler	*
Setophaga magnolia	Magnolia warbler	*
Setophaga coronata	Yellow-rumped warbler	*
Setophaga ruticilla	American redstart	*
Seiurus aurocapillus	Ovenbird	
Seiurus noveboracensis	Northern waterthrush	
Geothlypis tolmiei	MacGillivray's warbler	
Geothlypis trichas	Common yellowthroat	*
Cardellina pusilla	Wilson's warbler	*
Icteria virens	Yellow-breasted chat	*
THRAUPIDAE		
Piranga ludoviciana	Western tanager	*
Pheucticus ludovicianus	Rose-breasted grosbeak	
Pheucticus meloncephalus	Black-headed grosbeak	*
Passerina caerulea	Blue grosbeak	
Passerina amoena	Lazuli bunting	*
Passerina cyanea	Indigo bunting	
Spiza americana	Dickcissel	
EMBERIZIDAE		
Pipilo chlorurus	Green-tailed towhee	
Pipilo maculatus	Spotted towhee	*
Spizella arborea	American tree sparrow	*
Spizella passerina	Chipping sparrow	*
Spizella pallida	Clay-colored sparrow	
Spizella breweri	Brewer's sparrow	*
Pooecetes gramineus	Vesper sparrow	*
Chondestes grammacus	Lark sparrow	*
Amphispoza belli	Sage sparrow	
Calamospiza melanocorys	Lark bunting	*
Passerculus sandwichensis	Savannah sparrow	*
Ammodramus savannarum	Grasshopper sparrow	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)

Scientific Nomenclature[1]	Common Name	Observed
EMBERIZIDAE (cont.)		
Ammodramus bairdii	Baird's sparrow	
Passerella iliaca	Fox sparrow	
Melospiza melodia	Song sparrow	*
Melospiza lincolnii	Lincoln's sparrow	
Zonotrichia albicollis	White-throated sparrow	
Zonotrichia querula	Harris sparrow	
Zonotrichia leucophrys	White-crowned sparrow	*
Junco hyemalis	Dark-eyed junco	*
CALCARIIDAE		
Rhynchophanes mccownii	McCown's longspur	*
Calcarius lapponicus	Lapland longspur	
Calcarius ornatus	Chestnut-collared longspur	
Plectrophenax nivalis	Snow bunting	
ICTERIDAE		
Dolichonyx oryzivorus	Bobolink	
Agelaius phoeniceus	Red-winged blackbird	*
Sturnella neglecta	Western meadowlark	*
Xanthocephalus	Yellow-headed blackbird	*
Euphagus carolinus	Rusty blackbird	
Euphagus cyanocephalus	Brewer's blackbird	*
Quiscalus quiscula	Common grackle	*
Molothrus ater	Brown-headed cowbird	*
Icterus spurius	Orchard oriole	*
Icterus bullockii	Bullock's oriole	*
Icterus galbula	Baltimore oriole	*
FRINGILLIDAE		
Leucosticte tephrocotis	Gray-crowned rosy-finch	*
Leucosticte atrara	Black rosy-finch	
Pinicola enncleator	Pine grosbeak	*
Carpodacus cassinii	Cassin's finch	
Carpodacus mexicanus	House finch	
Loxia curvirostra	Red crossbill	*
Acanthis flammea	Common redpoll	
Spinus pinus	Pine siskin	
Spinus tristis	American goldfinch	*
Coccothraustes vespertinus	Evening grosbeak	

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL BIRD INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
PASSERIDAE		
Passer domesticus	House sparrow	*
OBSERVED AND POTENTIAL HERPTILE INHABITANTS		
AMBYSTOMATIDAE		
Ambystoma tigrinum	Tiger salamander	*
BUFONIDAE		
Spea bombifrons	Plains spadefoot toad	*
Bufo woodhousei woodhousei	Woodhouse's toad	
RANIDAE		
Lithobates pipiens	Northern leopard frog	*
HYLIDAE		
Pseudacris maculata	Boreal chorus frog	*
TESTUDINIDAE		
Apalone spinifera hartwegi	Western spiny softshell	*
Chrysemys picta belli	Western painted turtle	*
CHELYDRIDAE		
Chelydra serpentina	Snapping turtle	*
IGUANIDAE		
Sceloporus graciosus graciosus	Northern sagebrush lizard	*
Phrynosoma hernandesi	Greater short-horned lizard	*
COLUBRIDAE		
Coluber constrictor flaviventris	Eastern yellowbelly racer	*
Lampropeltis triangulum	Pale milk snake	*
Pituophis catenifer sayi	Bullsnake	*
Thamnophis elegans vagrans	Intermountain wandering	*
Thamnophis sirtalis parietalis	Red-sided gartersnake	*
Thamnophis radix	Plains gartersnake	*
CROTALIDAE		
Crotalus viridis viridis	Prairie rattlesnake	*

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (CONTINUED)

OBSERVED AND POTENTIAL FISH INHABITANTS

Scientific Nomenclature[1]	Common Name	Observed
SALMONIDAE		
Prosopium williamsoni	Mountain whitefish	*
Oncorhynchus clarki	Cutthroat trout	
Oncorhynchus mykiss	Rainbow trout	*
Salmo trutta	Brown trout	*
Salvelinus fontinalis	Brook trout	
ESOCIDAE		
Esox lucius	Northern pike	*
CYPRINIDAE		
Cyprinus carpio	Common carp	*
Carassius auratus	Goldfish	*
Notemigonus crysoleucas	Golden shiner	*
Semotilus atromaculatus	Creek chub	*
Couesius plumbeus	Lake chub	*
Platygobio gracilis	Flathead chub	*
Macrhybopsis gelida	Sturgeon chub	
Rhinichthys cataractae	Longnose dace	*
Notropis stramineus	Sand shiner	*
Hybognathus hankinsoni	Brassy minnow	
Hybognathus placitus	Plains minnow	*
Hybognathus agryritis	Silvery minnow	
Pimephales promelas	Fathead minnow	*
CATOSTOMIDEA		
Carpiodes carpio	River carpsucker	
Moxostoma macrolepidotum	Shorthead redhorse	*
Catostomus commersoni	White sucker	*
Catostomus catostomus	Longnose sucker	*
Catostomus platyrhynchus	Mountain sucker	*
ICTALURIDAE		
Ameiurus melas	Black bullhead	*
Ameiurus naulis	Yellow bullhead	*
Ictalurus punctatus	Channel catfish	*
Noturus flavus	Stonecat	*
GADIDAE		
Lota lota	Burbot	

[1] Nomenclature from WGFD 2012.

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WILDLIFE SPECIES LIST (cont.)

OBSERVED AND POTENTIAL FISH INHABITANTS (cont.)		
Scientific Nomenclature[1]	**Common Name**	**Observed**
CENTRARCHIDAE		
Micropterus dolomieui	Smallmouth bass	*
Micropterus salmoides	Largemouth bass	*
Lepomis cyanellus	Green sunfish	*
Lepomis gibbosus	Pumpkinseed	
Lepomis macrochirus	Bluegill	
Ambloplites rupestris	Rock bass	*
Pomoxis annularis	White crappie	*
Pomoxis nigromaculatus	Black crappie	*
PERCIDAE		
Stizostedion canadense	Sauger	*
Stizostedion vitreum	Walleye	*
Perca flavescens	Yellow perch	*

[1] Nomenclature from WGFD 2012.

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ATTACHMENT D9-1-B

Correspondence

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Intermountain Resources
Permit Preparation • Baseline Inventories • Wildlife • Wetlands • Vegetation • Soils
P.O. Box 1589 • Laramie, Wyoming 82073 (307) 745-3803

December 4, 2013

USDI Fish and Wildlife Service
Wyoming Ecological Services Field Office
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

RE: Proposed Brook Coal Mine Permit Area
USFWS Consultation Tracking Number: 06E13000-2014-SLI-0007 (Attached)

Attached is a brief outline of the proposed wildlife baseline data collection plan for the planned Brook Coal Mine permit area which is located north of Sheridan, Wyoming. Underground auguring will be the primary method of mining so surface disturbance will be kept to a minimum. The enclosed map shows the location of the proposed mine permit area. This mine permit area will be approximately 4550 acres and a substantial amount of the area has been included in past wildlife baseline inventories and monitoring (permit areas and one to two mile perimeters) for one or more of the Youngs Creek Coal Mine, Big Horn Coal Mine and Welch No. 1 Coal Mine (Permit Nos. 407, 213, and 497, respectively).

All habitat types present on the proposed Brook Coal Mine permit area have been sampled during previous wildlife baseline inventories.

Please provide us with any questions, comments or revisions. A response would be greatly appreciated.

Sincerely,

Jim Orpet

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Intermountain Resources
Permit Preparation · Baseline Inventories · Wildlife · Wetlands · Vegetation · Soils
P.O. Box 1589 · Laramie, Wyoming 82073 (307) 745-3803

December 4, 2013

Wyoming Game and Fish Department
Wildlife Habitat Protection Program
5400 Bishop Boulevard
Cheyenne, WY 82006-0001

RE: Proposed Brook Coal Mine Permit Area

Attached is a brief outline of the proposed wildlife baseline data collection plan for the planned Brook Coal Mine permit area which is located north of Sheridan. Underground auguring will be the primary method of mining so surface disturbance will be kept to a minimum. The enclosed map shows the location of the proposed mine permit area. This mine permit area will be approximately 4550 acres and a substantial amount of the area has been included in past wildlife baseline inventories and monitoring (permit areas and one to two mile perimeters) for one or more of the Youngs Creek Coal Mine, Big Horn Coal Mine or Welch No. 1 Coal Mine (Permit Nos. 407, 213, and 497, respectively).

All habitat types present on the proposed Brook Coal Mine permit area have been sampled during previous wildlife baseline inventories.

Please provide us with any questions, comments or revisions. A response would be greatly appreciated.

Sincerely,

Jim Orpet

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Brook Coal Mine

RAMACO – BROOK COAL MINE, SHERIDAN, WYOMING

GENERAL WILDLIFE SURVEY PLAN

November, 2013

Introduction

This wildlife baseline data collection survey plan for the proposed Brook Coal Mine was prepared following review of the substantial amount of wildlife species data collected and provided in the Youngs Creek Coal Mine Permit No. 407, Big Horn Coal Mine Permit No. 213 and the Welch No. 1 Coal Mine Permit No. 497 as well as wildlife monitoring documents on file with the WDEQ-LQD. The proposed Brook Mine Permit area includes portions of the Big Horn Coal Mine permit area and is within about two miles of the Youngs Creek Coal Mine permit area and the Welch No. 1 Coal Mine permit area. Seasonal wildlife surveys were also completed on the proposed Brook Coal Mine and adjacent lands with approved access from April of 2013 through August of 2013. The attached Table 1 provides a summary of the wildlife surveys completed for the approved mine permit areas in the area, Table 2 provides a list of USFWS migratory bird species of conservation concern identified in the area during the 2013 and past surveys, and Table 3 provides a list of wildlife species identified during the 2013 and past surveys and other species with the potential of occurring in the area.

Brook Coal Mine Overview

The proposed Brook Coal Mine is located in Sheridan County, Wyoming, north and west of the town of Sheridan. The specific location is in Township 57 North, Ranges 84 and 85 West and is shown on the attached map. The primary method of mining will be underground through the use of augers. Surface disturbance will be primarily limited to facilities, access roads, haul roads and excavated "slots" from which the auguring will originate. The facilities will most likely be constructed near the existing rail line on land previously disturbed by mining activities or farming activities.

Habitat Mapping and Descriptions

Wildlife habitats will be mapped and defined as required with data included in Appendix D9. Any habitat information presented in Appendix D8 for this area will also be referenced in Appendix D9. Surveys already completed indicate that sagebrush shrubland, upland grassland and rough/scoria breaks are the major habitat types present. Minor types observed include woodland, bottomland grassland/riparian, riverine system and reclaimed lands. These types were surveyed during baseline inventories completed on existing mine permit areas present in the study area.

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Habitat Affinity

Habitat affinities for wildlife species on the area will be determined by data already collected and additional data to be collected for each class of wildlife discussed in the following sections. All wildlife habitat types present have been previously inventoried during surveys completed for the three coal mine permit areas present in the study area.

Big Game

Big game surveys are not planned for this mine permit area. The site does not include any crucial big game ranges. Previous surveys show that the mule deer, white-tailed deer and pronghorn antelope are yearlong residents of the study area. Elk and moose may be uncommon transients through the area.

Upland Game Birds

Lek surveys for sage-grouse and strutting ground surveys for sharp-tailed grouse were completed in April and early May of 2013. The proposed permit area and lands within two miles with approved access were surveyed. Surveys south of I90 were only conducted from legal right-of-ways due to limited access. Previously identified lek locations were surveyed to determine current activity and searches were conducted for new strutting grounds. Lek counts were coordinated with the WGFD and at least three counts were obtained for all leks currently classified as occupied. At least two counts were made on active sharp-tailed grouse strutting grounds identified. Brood surveys are not planned for this project.

Raptors

Raptor nest surveys will be conducted during the breeding season and during all survey periods. Raptor nest surveys began in April of 2013 and will continue through at least March of 2014. Surveys will include the proposed mine permit area and two mile perimeter where access is approved. Surveys south of I90 will primarily be conducted from legal right-of-ways due to limited access. Nest activity and production surveys were completed in March through August of 2013.

Waterfowl and Shorebirds

The proposed Brook Coal Mine permit area contains several small stock ponds, ephemeral streams and small portions of the Tongue River and Goose Creek. Waterfowl use of water bodies in the region has been documented during 2013 and previous surveys conducted for other mines in the area. Additional data will be collected from opportunistic observations and areas of major waterfowl production will be identified if present.

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Passerine Birds

There has been an abundance of breeding bird data collected by the other three coal mines located in the vicinity. Breeding bird transects 1000 meters long by 100 meters wide were sampled on two mornings in June of 2013 in major habitat types on the proposed Brook Coal Mine permit area. The habitat types sampled were upland grassland, sagebrush and breaks. No additional specific surveys are proposed for passerine birds due to the abundance of data already collected on the three mine permit study areas. However, all species of passerine birds observed during the other baseline surveys conducted for this project will be recorded.

Other Mammals – Predators, Small Mammals, Lagomorphs

No specific surveys are proposed for predators or small mammals due to the abundance of data already collected by the Big Horn Coal Mine, the Youngs Creek Coal Mine and the Welch No. 1 Coal Mine located in the vicinity. Lagomorph surveys were completed specifically for this new permit area in July of 2013.

Threatened or Endangered Species

The required surveys will be completed for T&E wildlife species that have the potential for inhabiting the area. The bald eagle, although no longer listed, is known to winter and nest in the area so winter use, winter roost and nesting surveys will be completed for this species. Black-tailed prairie dog towns are present in the area and provide habitat for the black-footed ferret. These prairie dog towns will be mapped, however black-footed ferret surveys are not required based on the USFWS memorandum of 2004 that stated ferret surveys are no longer recommended for black-tailed prairie dog towns in Wyoming. Lynx and wolves are not expected to reside within the area.

USFWS Migratory Bird Species of Conservation Concern (MBHFI)

The attached Table 2 provides a list of the MBHFI species recorded in the area during the other baseline inventories and the expected occurrence on the proposed Brook Coal Mine permit area. Surveys will be completed as required for species that have habitat present on the area. For example prairie dog towns provide habitat for the burrowing owl and mountain plover so surveys for those species were conducted in April through July of 2013. Surveys completed on adjacent mine permit areas will provide the basis for initial determinations of which species are already present. Surveys for specific wildlife species will be implemented when warranted.

Reptiles and Amphibians

No specific surveys are proposed for these species based on limited results of survey techniques available. Surveys completed for the three mine permit areas present have documented most of the reptile or amphibian species that may be present on the proposed Brook Coal Mine permit area as shown in the attached wildlife species list. The

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proposed mine permit area is not expected to have high densities of these species. Any reptile or amphibian species observed during other baseline surveys completed on the area will be documented.

Fish and Macroinvertebrates

Surveys for fish and other aquatic life are not proposed for the Brook Mine permit area. Habitats frequented by these species such as the Tongue River and Goose Creek will not be disturbed by this mine operation. Table 1 shows that several such surveys have already been completed in the general area. The wildlife species list indicates that these aquatic surveys have been fairly thorough by the number and diversity of fish species identified. Most of the fish species were found in Goose Creek and the Tongue River. Other water bodies in the proposed mine permit area are generally ephemeral and would not support fish species. Mine activities will not affect Goose Creek or the Tongue River.

Agency and File Searches

Additional wildlife data should be available from other surveys and inventories completed in the area. Databases will be searched for other data that may be available for the area including that contained by state and federal agencies. This information will be obtained, reviewed and applicable data will be included with the study report as Appendix D9 of the mine permit.

Appendix D9 Wildlife Report Preparation

The applicable results of the previous three baseline inventories (Youngs Creek Coal Mine, Big Horn Coal Mine and Welch No. 1 Coal Mine) will be included in the report for this baseline inventory as required to describe wildlife and habitat affinities for this mine permit area. Data from the additional field surveys conducted in 2013 and 2014 and other available data (file and agency searches) will also be included in the baseline wildlife report for the Brook Coal Mine permit area.

Wetlands

Wetland surveys will be completed as directed by the Corps and will be included in Appendix D10 as required.

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Brook Coal Mine

Brook Coal Mine Proposed Permit Area

Table 1. Summary of past wildlife baseline and monitoring surveys completed by the Youngs Creek Coal Mine Permit No. 407, the Big Horn Coal Mine Permit No. 213 and the Welch No. 1 Coal Mine Permit No. 497.

Surveys Conducted	Youngs Creek* Coal Mine	Big Horn Coal* Mine	Welch No. 1 Coal Mine
Big Game	Yes	Yes	Yes
Upland Game Birds	Yes	Yes	Yes
Raptors	Yes	Yes	Yes
Waterfowl and Shorebirds	Yes	Yes	Yes
Passerine Birds (Belt or Point Transects)	Yes	Yes	Yes
Predators	Yes	Yes	Yes
Lagomorphs	Yes	Yes	Yes
Small Mammal Trapping	Yes	Yes	Yes
Reptiles and Amphibians	Yes	Yes	Yes
Aquatic Sampling	Yes Youngs Creek	Yes Tongue River (Native) Tongue River (Reclaim) Goose Creek Ash Creek Youngs Creek	Yes Tongue River
T&E	Yes	Yes	Yes
MBHFI and Species of Concern	Yes (Included with other bird surveys.)	Yes (Included with other bird surveys.)	Yes (Included with other bird surveys.)
Yearly Wildlife Monitoring Conducted to Date	Yes	Yes	No

* - Wildlife monitoring surveys were completed through 2013 for the Youngs Creek Mine and Big Horn Coal Mine.

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Brook Coal Mine

RAMACO - BROOK Coal Mine proposed Permit Area

Table 2. USFWS Migratory Bird Species of Conservation Concern in Sheridan County, Wyoming, Updated November 2013*.

Species	Regional Seasonal Status	Recorded on Area or in Vicinity	Expected Occurrence On Study Area
American Bittern (*Bataurus lentiginosus*)	Migrant	No	Uncommon
Bald Eagle (*Haliaeetus leucocephalus*)	Winter Migrant/Breeder	Yes	Common/Winter
Brewer's Sparrow (*Spizella breweri*)	Breeder	Yes	Common
Ferruginous Hawk (*Buteo regalis*)	Breeder	Yes	Occasional
Golden Eagle (*Aquila chrysaetos*)	Breeder	Yes	Common
Long-billed Curlew (*Numenius americanus*)	Breeder	Yes	Uncommon
McCown's Longspur (*Calcarius mccownii*)	Breeder	No	Uncommon
Mountain Plover (*Charadrius montanus*)	Breeder	No	Rare
Northern Goshawk (*Accipiter gentilis*)	Migrant	Yes	Rare
Peregrine Falcon (*Falco peregrinus*)	Migrant	No	Rare
Prairie Falcon (*Falco mexicanus*)	Breeder	Yes	Occasional
Sage Sparrow (*Amphispiza belli*)	Breeder	No	Uncommon
Short-Eared Owl (*Asio flammeus*)	Breeder	Yes	Occasional
Swainson's Hawk (*Buteo swainsoni*)	Breeder	Yes	Occasional
Upland Sandpiper (*Batramia longicauda*)	Breeder	Yes	Uncommon
Western Burrowing Owl (*Athene cunicularia hypugea*)	Breeder	Yes	Uncommon

*Based on USFWS Wyoming Ecological Services Field Office, Cheyenne, Wyoming and IPAC (Information, Planning and Conservation System), November, 2013.

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Brook Coal Mine

Table 2. (Continued)

Regional Seasonal Status and expected occurrence compiled from Wyoming Game and Fish Department Atlas of Birds, Mammals, Reptiles and Amphibians in Wyoming, 2012 and Subsequent Revisions

Specific records of observations on area or in the vicinity are from wildlife baseline and monitoring surveys completed for the Youngs Creek Coal Mine Permit No. 407, the Big Horn Coal Mine Permit No. 213 and the Welch No. 1 Coal Mine Permit No. 497.

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WYOMING GAME AND FISH DEPARTMENT
5400 Bishop Blvd. Cheyenne, WY 82006
Phone: (307) 777-4600 Fax: (307) 777-4699
wgfd.wyo.gov

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CHARLES PRICE

December 23, 2013

WER 273.01
Intermountain Resources
Proposed Wildlife Baseline Data Collection Plan
Brook Coal Mine Permit Area
Ramaco, LLC
Sheridan County

Jim Orpet
Intermountain Resources
PO Box 1589
Laramie, WY 82073

Dear Mr. Orpet:

The staff of the Wyoming Game and Fish Department has reviewed the proposed Wildlife Baseline Data Collection Plan for the Brook Coal Mine Permit Area from Intermountain Resources on behalf of Ramaco, LLC in Sheridan County. We offer the following comments for your consideration.

Terrestrial Considerations:

We recommend providing two years of baseline wildlife data for this project. As other surveys have been conducted near this area due other coal mine activity, appropriate data collected from nearby may be used to supplement the baseline for the proposed Brook Coal mine. Although no longer required, we suggest providing general observational data on big game use of this area primarily due to its proximity to the riparian areas provided by the Tongue River and Goose Creek. Otherwise, the data collected are appropriate for this project.

Aquatic Considerations:

To minimize impacts to the aquatic resources of the Tongue River and Goose Creek, we recommend the following:

- Accepted best management practices be implemented to ensure that all sediments and other pollutants are contained within the boundaries of the work area. Disturbed areas that are contributing sediment to surface waters as a result of project activities should be promptly re-vegetated to maintain water quality.

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- Equipment should be serviced and fueled away from streams and riparian areas. Equipment staging areas should be at least 300 feet from riparian areas.

- Preventing the spread of aquatic invasive species (AIS) is a priority for the State of Wyoming, and in many cases, the intentional or unintentional spread of organisms from one body of water to another would be considered a violation of State statute and Wyoming Game and Fish Commission Regulation. To prevent the spread of AIS, the following is required:

  If equipment has been used in a high risk infested water [a water known to contain Dreissenid mussels* (zebra/quagga mussels)], the equipment must be inspected by an authorized aquatic invasive species inspector recognized by the state of Wyoming prior to its use in any Wyoming water.

  Any equipment entering the State by land from March through November (regardless of where it was last used), must be inspected by an authorized aquatic invasive species inspector prior to its use in any Wyoming waters.

  If aquatic invasive species are found, the equipment will need to be decontaminated by an authorized aquatic invasive species inspector.

  Any time equipment is moved from one 4th level (8-digit) Hydrological Unit Code watershed to another within Wyoming, the following guidelines are recommended:

  DRAIN: Drain all water from watercraft, gear, equipment, and tanks. Leave wet compartments open to dry.
  CLEAN: Clean all plants, mud, and debris from vehicle, tanks, watercraft, and equipment.
  DRY: Dry everything thoroughly. In Wyoming, we recommend drying for 5 days in Summer (June - August); 18 days in Spring (March - May) and Fall (September - November); or 3 days in Winter (December - February) when temperatures are at or below freezing.

*A list of high risk infested waters and locations in Wyoming to obtain an AIS inspection can be found at: wgfd.wyo.gov

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Jim Opret
December 23, 2013
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Thank you for the opportunity to comment. If you have any questions or concerns, please contact Paul Mavrakis, Sheridan Region Fisheries Supervisor, at 307-672-7418 Ext. 236.

Sincerely,

Scott Gerow
for Mark Konishi
Deputy Director

MK/mf/gb

cc: USFWS
Paul Mavrakis, Sheridan Region
Tim Thomas, Sheridan Region
Lynn Jahnke, Sheridan Region

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

DEC 12 2013

In Reply Refer To:
06E13000/WY14CPA0035 and WY14SLI0007

Mr. Jim Orpet
Intermountain Resources
P.O. Box 1589
Laramie, Wyoming 82073

Dear Mr. Orpet:

Thank you for your letter of December 4, 2013, received in our office on December 5, regarding the proposed wildlife baseline data collection plan for the planned Brook Coal Mine permit area located in in T57N, R84 and 85W, Sheridan County, Wyoming. The permit area is approximately 4,550 acres and will consist primarily of underground auguring. In your letter, you request the U.S. Fish and Wildlife Service (Service) provide you with comments on the wildlife baseline data collection plan (Plan).

General Comments for General Wildlife Survey Plan

All aspects of mine development need to be considered when conducting surveys. This should include any surface disturbance comprising of, but not limited to, building construction and stock piling of coal, roads and parking lot. If the project includes overhead power lines, these lines should be constructed or retrofitted to meet or exceed the Avian Power Line Interaction Committee (APLIC) guidelines (APLIC 2006), and we encourage the development of a Migratory Bird Conservation Plan (MBCP) or an Avian Protection Plant (APP) as described in the APP Guidelines (APLIC 2006).

Specific Comments for General Wildlife Survey Plan

Habitat Mapping and Description, pg. 1: Surveys completed during baseline inventories on existing mine permit areas that overlap with the proposed mine area may be included in the Plan, but these inventories must be current and the entire permit area of the proposed new mine must be surveyed to ensure that all habitat types are included. These surveys should be conducted at the appropriate time of year for the species surveyed and include surveys for threatened and endangered species which shall be on or within one (1) mile of the permit area pursuant to WDEQ-LQD Coal Mines Rules and Regulations, Chapter 2 § 4(a)(vi)(A). These surveys should also include important habitat types such as the acreage of rough breaks and rocky outcrops that

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are important raptor nesting habitat. These two habitat types in particular should be replaced during reclamation on a one to one ratio.

Raptors, pg. 2: Surveys may be done in winter months to locate raptor nests, but surveys to determine which nests are occupied and what species are occupying the nest as well as the activity of the nest should be conducted at the appropriate time of year. Active nests should be monitored until it has been determined that the young have fledged or the nest has failed.

Waterfowl and Shorebirds, pg. 2: In order to ensure that mining and associated activities do not disrupt waterfowl and shorebirds, the baseline survey should include data collection on these species.

Passerine Birds, pg. 3: Surveys completed during baseline inventories on existing mine permit areas that overlap the proposed mine area may be included in the Plan, but these inventories must be current and the entire permit area of the proposed new mine must be surveyed to ensure that all passerine birds observed are recorded.

Threatened or Endangered Species, pg. 3:

Ute ladies'-tresses - Ute ladies'-tresses (*Spiranthes diluvialis*) is listed as occurring in Sheridan County and should be included in the Plan. This plant is a perennial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. Ute ladies'-tresses typically blooms from late July through August. However, it may bloom in early July or still be in flower as late as early October, depending on location and climatic conditions. Ute ladies'-tresses is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet). Soils where Ute ladies'-tresses have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. Ute ladies'-tresses is not found in heavy or tight clay soils or in extremely saline or alkaline soils. Ute ladies'-tresses typically occurs in small, scattered groups found primarily in areas where vegetation is relatively open.

Many orchid species take 5 to 10 years to reach reproductive maturity; this appears to be true for Ute ladies'-tresses (FR 57 2048). Furthermore, reproductively mature plants do not flower every year. For these reasons and to clear the area for the orchid's presence, two to three years of surveys are necessary to determine presence or absence of Ute ladies'-tresses within the permit area, not just the area disturbed during this permit's term. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys.

Bald Eagle - We appreciate your commitment to perform winter roost and nesting surveys for the bald eagle although it is no longer listed under the Endangered Species Act of 1973, as amended (ESA), 16 U.S.C. 1531 *et seq*.

Northern long-eared bat - As of October 2, 2013, the northern long-eared bat (*Myotis septentrionalis*) was proposed for listing under the ESA as an endangered species (October 2,

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2013; 78 FR 61046). Critical habitat is not proposed at this time. This bat is a medium-sized bat, distinguished from other *Myotis* species by its characteristically large ears and long, pointed tragus (projection of skin in front of the external ear). Northern long-eared bats are found throughout eastern and central North America and occur in the extreme northeastern portions of Wyoming. Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch in flight using echolocation, or by gleaning (picking) from vegetation. In the summer, male and reproductive female bats roost singly or in colonies in cracks, crevices, cavities, and under the bark of live and dead trees, while other males and non-reproductive females roost in cooler places like caves and mines. Breeding occurs in late summer and fall when bats swarm at entrances of hibernacula; however, females delay fertilization until spring when they emerge from hibernation.

The northern long-eared bat is threatened by white-nose syndrome (WNS), a disease caused by the cold-loving fungus, *Psuedogymnoascus* (*Geomyces*) *destructans*. First observed in New York in 2006, WNS has spread rapidly across the Northeast and into the Midwest and Southeast. Throughout the range of WNS, up to 99 percent of infected bats die from the disease. Although there is uncertainty about the spread of WNS, experts agree that the fungus will likely spread throughout the United States. The northern long-eared bat is also threatened by the loss and degradation of summer habitat caused by human development, and by collision with or barotrauma (injury to the lungs due to a change in air pressure) caused by wind turbines. Mine closures and vandalism of winter roosts and hibernacula also pose threats to this species.

We recommend surveys in areas that may provide potential habitat for the northern long-eared bat such as stands of tall trees, if such habitat exists on the proposed mine area.

USFWS Migratory Bird Species of Conservation Concern (MBHFI), pg. 3: This section states that "Surveys for specific wildlife species will be implemented when warranted." Although it is appropriate to include baseline information from other mining area inventories that overlap with the proposed mine area, this information must be current and must include the entire permit area of the proposed mine to ensure that all MBHFI observed are recorded.

We appreciate your efforts to ensure the conservation of endangered, threatened, and candidate species and migratory birds. If you have further questions regarding this letter or your responsibilities under the Act, please contact Kim Dickerson at the letterhead address or by phone at (307) 772-2374, extension 230.

Sincerely,

For R. Mark Sattelberg
Field Supervisor
Wyoming Field Office

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cc: WDEQ-LQD, District Supervisor, Sheridan, WY (M. Rogaczewski)
WGFD, Non-game Coordinator, Lander, WY (B. Oakleaf)
WGFD, Statewide Habitat Protection Coordinator, Cheyenne, WY (M. Flanderka)

References

Avian Power Line Interaction Committee (APLIC). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, CA.

Avian Protection Plan Guidelines . 2005. Edison Electric Institute's Avian Power Line Interaction Committee and U.S. Fish and Wildlife Service.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
WYOMING ECOLOGICAL SERVICES FIELD OFFICE
5353 Yellowstone Rd, Suite 308A
CHEYENNE, WY 82009
PHONE: (307)772-2374 FAX: (307)772-2358
URL: www.fws.gov/wyominges/

Consultation Tracking Number: 06E13000-2014-SLI-0007 November 06, 2013
Project Name: RAMACO BROOK COAL MINE, Sheridan, Wyoming

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project.

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the Environmental Conservation Online System-Information, Planning, and Conservation System (ECOS-IPaC) website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Please feel free to contact us if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. We also encourage you to visit the Wyoming Ecological Services website at http://www.fws.gov/wyominges/Pages/Species/Species_Endangered.html for more information about species occurrence and designated critical habitat.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to use their authorities to carry out programs for the conservation of threatened and endangered

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species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A biological assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a biological assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a biological assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the biological assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

We also recommend that you consider the following information when assessing impacts to federally listed species, as well as migratory birds, and other trust resources:

Colorado River and Platte River Systems: Consultation under section 7 of the Act is required for projects in Wyoming that may lead to water depletions or have the potential to impact water quality in the Colorado River system or the Platte River system, because these actions may affect threatened and endangered species inhabiting the downstream reaches of these river systems. In general, depletions include evaporative losses and/or consumptive use of surface or groundwater within the affected basin, often characterized as diversions minus return flows. Project elements that could be associated with depletions include, but are not limited to: ponds, lakes, and reservoirs (e.g., for detention, recreation, irrigation, storage, stock watering, municipal storage, and power generation); hydrostatic testing of pipelines; wells; dust abatement; diversion structures; and water treatment facilities.

Species that may be affected in the Colorado River system include the endangered bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) and their designated critical habitats. Projects in the Platte River system may impact the endangered interior population of the least tern (*Sterna antillarum*), the endangered pallid sturgeon (*Scaphirhynchus albus*), the threatened piping plover (*Charadrius melodus*), the threatened western prairie fringed orchid (*Platanthera praeclara*), as well as the endangered whooping crane (*Grus americana*) and its designated critical habitat. For more information on consultation requirements for the Platte River species, please visit http://www.fws.gov/platteriver.

Migratory Birds: The Migratory Bird Treaty Act (16 U.S.C. 703-712), prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations, and does not require intent to be proven. Except for introduced species and some upland game birds, almost all birds occurring in the wild in the United States are protected (50 CFR 10.13). Guidance for

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minimizing impacts to migratory birds for projects that include communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm.

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. Eagle nests are protected whether they are active or inactive. Removal or destruction of nests, or causing abandonment of a nest could constitute a violation of one or both of the above statutes. Projects affecting eagles may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

If nesting migratory birds are present on or near the project area, timing of activities is an important consideration and should be addressed in project planning. Activities that could lead to the take of migratory birds or eagles, their young, eggs, or nests, should be coordinated with our office prior to project implementation. If nest manipulation (including removal) is proposed for the project, the project proponent should contact the Migratory Bird Office in Denver at 303-236-8171 to see if a permit can be issued for the project. If a permit cannot be issued, the project may need to be modified to protect migratory birds, eagles, their young, eggs, and nests.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

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United States Department of Interior
Fish and Wildlife Service

Project name: RAMACO BROOK COAL MINE, Sheridan, Wyoming

Official Species List

Provided by:

WYOMING ECOLOGICAL SERVICES FIELD OFFICE
5353 Yellowstone Rd, Suite 308A

CHEYENNE, WY 82009
(307) 772-2374
http://www.fws.gov/wyominges/

Consultation Tracking Number: 06E13000-2014-SLI-0007
Project Type: Mining
Project Description: Coal Mine, Primarily underground auger mining. Located in Sheridan County, Wyoming in Sections 7, 8, 9, 10, 15, 17, 18, 19, 20 and 22, T57N, R84W and Sections 10, 11, 12, 13, 14, 15, 23 and 24, T57N, R85W.

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United States Department of Interior
Fish and Wildlife Service

Project name: RAMACO BROOK COAL MINE, Sheridan, Wyoming

Project Counties: Sheridan, WY

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United States Department of Interior
Fish and Wildlife Service

Project name: RAMACO BROOK COAL MINE, Sheridan, Wyoming

Endangered Species Act Species List

Species lists are not entirely based upon the current range of a species but may also take into consideration actions that affect a species that exists in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Please contact the designated FWS office if you have questions.

Canada Lynx *(Lynx canadensis)*

Population: (Contiguous U.S. DPS)

Listing Status: Threatened

Greater sage-grouse *(Centrocercus urophasianus)*

Population: entire

Listing Status: Candidate

Ute ladies'-tresses *(Spiranthes diluvialis)*

Listing Status: Threatened

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U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Wyoming Ecological Services Field Office
5353 YELLOWSTONE ROAD, SUITE 308A
CHEYENNE, WY 82009
(307) 772-2374
http://www.fws.gov/wyominges/

Project Name:

Brook Mine

Project Counties:

Sheridan, WY

Project Type:

Mining

Endangered Species Act Species List (USFWS Endangered Species Program).

There are a total of 3 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fishes may appear on the species list because a project could cause downstream effects on the species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section below for critical habitat that lies within your project area. Please contact the designated FWS office if you have questions.

Species that should be considered in an effects analysis for your project:

Birds	Status		Has Critical Habitat	Contact

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Trust Resources List

Greater sage-grouse (*Centrocercus urophasianus*) Population: entire	Candidate	species info		Wyoming Ecological Services Field Office
Flowering Plants				
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	species info		Wyoming Ecological Services Field Office
Mammals				
Canada Lynx (*Lynx canadensis*) Population: (Contiguous U.S. DPS)	Threatened	species info	Proposed critical habitat Final designated critical habitat	Wyoming Ecological Services Field Office

If a species' status is Candidate, please also contact the Wyoming Game & Fish Department for additional information regarding State conservation concerns for these species. Wyoming Game & Fish can be reached at Wyoming Game & Fish Department Headquarters, 5400 Bishop Blvd. Cheyenne, WY 82006 or (307) 777-4600.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

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Trust Resources List

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Migratory birds of concern that may be affected by your project:

More information on migratory birds, including eagles and raptors in Wyoming can be found at:
http://www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/BirdsConsvConcern.html.

There are 16 birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion time of Fall 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Breeding
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Black Rosy-Finch (*Leucosticte atrata*)	Yes	species info	Year-round
Brewer's Sparrow (*Spizella breweri*)	Yes	species info	Breeding
Burrowing Owl (*Athene cunicularia*)	Yes	species info	Breeding
Calliope Hummingbird (*Stellula calliope*)	Yes	species info	Breeding
Cassin's Finch (*Carpodacus cassinii*)	Yes	species info	Year-round
Ferruginous hawk (*Buteo regalis*)	Yes	species info	Breeding
Golden eagle (*Aquila chrysaetos*)	Yes	species info	Year-round

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Trust Resources List

Grasshopper Sparrow (*Ammodramus savannarum*)	Yes	species info	Breeding
Greater sage-grouse (*Centrocercus urophasianus*)	Yes	species info	Year-round
Mountain plover (*Charadrius montanus*)	Yes	species info	Breeding
Pinyon Jay (*Gymnorhinus cyanocephalus*)	Yes	species info	Year-round
Prairie Falcon (*Falco mexicanus*)	Yes	species info	Year-round
Williamson's Sapsucker (*Sphyrapicus thyroideus*)	Yes	species info	Breeding
Willow Flycatcher (*Empidonax traillii*)	Yes	species info	Breeding

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

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The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Emergent Wetland	PEMF	48.2977
Freshwater Emergent Wetland	PEMA	105.7378
Freshwater Emergent Wetland	PEMC	265.749
Freshwater Emergent Wetland	PEMB	364.8414
Freshwater Emergent Wetland	PEMAd	5.5182
Freshwater Emergent Wetland	PEMCh	52.5189
Freshwater Emergent Wetland	PEMAh	76.0035
Freshwater Emergent Wetland	PEMCd	9.5057
Freshwater Emergent Wetland	PEMCb	10.9562

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Freshwater Emergent Wetland	PEMCx	3.9807
Freshwater Emergent Wetland	PEMFh	7.3181
Freshwater Forested/Shrub Wetland	PFOB	20.8694
Freshwater Forested/Shrub Wetland	PFOA	2.9652
Freshwater Forested/Shrub Wetland	PFOC	2.3145
Freshwater Forested/Shrub Wetland	PSSAh	0.9365
Freshwater Forested/Shrub Wetland	PSSCb	13.1704
Freshwater Forested/Shrub Wetland	PSSA	67.0921
Freshwater Forested/Shrub Wetland	PSSB	131.521
Freshwater Forested/Shrub Wetland	PSSC	21.5969
Freshwater Forested/Shrub Wetland	PFOAh	0.2614
Freshwater Pond	PUBFx	11.8798
Freshwater Pond	PABFh	116.8332
Freshwater Pond	PUSCh	30.7848
Freshwater Pond	PABKx	1.0565
Freshwater Pond	PABGh	0.1848
Freshwater Pond	PABG	52.9075
Freshwater Pond	PABF	2.4865
Freshwater Pond	PUBHh	16.8928
Freshwater Pond	PABGb	4.9311
Other	PUSC	0.0983
Other	PUSAh	14.0874
Riverine	R3UBH	7.4084
Riverine	R2UBF	965.9167
Riverine	R2USC	76.58
Riverine	R2USA	15.9438

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U.S. Fish and Wildlife Service

Trust Resources List

Riverine	R3USA	7.4382

Wyoming State Natural Resources of Concern

There may be resources of concern to the State of Wyoming that are not specifically addressed here. The Service recommends that users access the Wyoming Interagency Spatial Database & Online Management (WISDOM) System, which allows users to visually explore the distribution of important Wyoming wildlife habitat, identify potential stressors to wildlife, and review other relevant data that will assist in wildlife conservation planning in the State of Wyoming.

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LEGEND

- BROOK MINE PERMIT BOUNDARY
- INTACT RAPTOR NEST
- INTACT RAPTOR PLATFORM NEST
- FORMER RAPTOR NEST
- LAGOMORPH SURVEY ROUTE
- BREEDING BIRD SURVEY TRANSECT

- BE - BALD EAGLE
- GE - GOLDEN EAGLE
- RT - RED TAILED HAWK
- GH - GREAT HORNED OWL
- BO - BURROWING OWL
- OS - OSPREY

- SAGE-GROUSE LEK
- SHARP-TAILED GROUSE LEK
- BLACK-TAILED PRAIRIE DOG COLONY

- PG - PRAIRIE DOG TOWN GRASSLAND
- UG - UPLAND GRASSLAND
- SS - SAGEBRUSH SHRUBLAND
- RC - RECLAIMED LANDS
- RB - ROUGH BREAKS/JUNIPER
- RW - RIPARIAN WOODLAND

N

0 1,000 2,000 3,000 4,000
GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
06/15	ROUND 1 COMMENTS

ADDENDUM D9-1
EXHIBIT 1

WILDLIFE INVENTORY

TFN 6 2/025
RECD JUL 30, 2015

Drawn By: MBM/RET
Checked By: JGB/JEO
Date: 10/6/14

WWC ENGINEERING
www.wwcengineering.com

FILE: ADDENDUM_D9-1_WILDLIFE_INVENTORY.dwg

K:\Sheridan\RAMACO\13139\ACAD_WY83EC\DWGS_D9_RESPONSE\ADDENDUM_D9-1_WILDLIFE_INVENTORY.dwg 6/30/2015 8:15:37 AM dave johnson

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Table D10.2-1. Total Wetland and Other Aquatic Resources (OAR) Acreages for the Brook Mine Permit Area D10-T1

LIST OF EXHIBITS

Exhibit D10.2-1 Aquatic Resources Inventory

LIST OF ADDENDA

Addendum D10-1 2013 Baseline Aquatic Resources Inventory

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WETLANDS

Appendix D10

Prepared by:
WWC Engineering

October 2014

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RECD NOV 14, 2014

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D10 WETLAND INVENTORY

Wetland inventory of RAMACO's Brook Mine were conducted by BKS Environmental Associates, Inc. (BKS) of Gillette, Wyoming in 2013. Wetlands inventory by BKS are reported in Addendum D10-1 (2013 Baseline Aquatic Resources Inventory – Brook Mine).

D10.1 Methodology

The wetland inventory of the project areas were conducted in accordance with the U.S. Army Corps of Engineers (USACE) Regional Supplement to the Corps of Engineers Delineation Manual (Version 2.0) and Regulatory Guidance Letter No. 05-05 (USACE 2005). All potential Waters of the U.S. (WUS), and Other Waters of the U.S. (OWUS) were assessed during the aquatic resources inventory. Potential wetlands, WUS, and OWUS were initially identified via review of multiple mapping data sources. Those areas identified as potential aquatic resources were field-verified. Identification of potential wetlands was based on visual assessment of vegetation and hydrology indicators. Intrusive soil sampling was conducted to determine the presence of wetland criteria indicators. Hydrology and soils were evaluated whenever indicators suggested the potential presence of a seasonal wetland under normal circumstances.

Identification of potential WUS and OWUS was based on review of available imagery on onsite assessment of ordinary high water mark (OHWM) indicators. Physical characteristics outlined in USACE Regulatory Guidance Letter No. 05-05 were evaluated whenever NAIP True Color aerial imagery or onsite inspection indicated the presence of a potential WUS or OWUS. Potential WUS and OWUS boundaries were delineated based on the OHWM. Field sample locations and resulting wetland boundaries were recorded with a Trimble GeoXT in GCS NAD83. Addendum D10-1 provides a detailed description of the methodology for this study at each respective location.

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D10.2 Results

The results of wetlands found at the Brook Mine are discussed in detail in Addendum D10-1. Other Aquatic Resources (OAR) were also found in the Brook Mine Permit Area. The acreages for wetland and Other Aquatic Resources types are provided in Table D10.2-1 and are illustrated on Exhibit D10.2-1.

Additionally, OAR were identified within the Brook Mine Permit Area associated with man-made reservoirs or impoundments. RAMACO will request a jurisdictional determination from the USACE based on the aquatic resource inventory in Addendum D10-1.

D10.3 References

Environmental Laboratory. (1987). *"Corps of Engineers Wetlands Delineation Manual" Technical Report Y-87-1.* Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station.

U.S. Army Corps of Engineers (USACE). (2010). *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0).* Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD). (2002). *Guideline No. 18 Coal Compensatory Wetland Mitigation.* Cheyenne, Wyoming: Wyoming Department of Environmental Quality/Land Quality Division.

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Table D10.2-1. Total Wetland and Other Aquatic Resources (OAR) Acreages for the Brook Mine Permit Area

Type	Acreages within the Brook Mine Permit Area
Palustrine Aquatic Bed-Impoundment (PABh)	5.4
Palustrine Emergent Vegetation (PEM)	7.3
Palustrine Emergent Vegetation-Impoundment (PEMh)	1.7
Palustrine Unconsolidated Bed (PUB)	1.5
Total Wetland Acreage	15.8
Off-channel Reservoir	2.8
OAR Ephemeral Creeks or Draws (R6)	9.2
OAR Ephemeral Creeks-Artificial (R6r)	0.2
Total OAR Acreage	12.2
Total Aquatic Resources Acreage[1]	27.9

[1]Individual acreages do not sum to the illustrated total due to rounding errors.

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TWN57N, RNG85W

TWN57N, RNG84W

Slater Creek

Dan Draw

East Fork Earley Creek

Earley Creek

Unnamed Tributary to Slater Creek A

Unnamed Tributary to Tongue River Ditch A

Off Channel Reservoir F

Unnamed Tributary to Tongue River Ditch B

Off Channel Reservoir A

Unnamed Tributary to Slater Creek B

Unnamed Tributary to Slater Creek C

Unnamed Tributary to Slater Creek D

Unnamed Tributary to Slater Creek E

Tongue River Ditch

Tongue River

Unnamed Tributary to Tongue River Ditch C

Unnamed Tributary to Tongue River Ditch D

North Dry Creek

South Dry Creek

Hidden Water Creek

Unnamed Tributary to Tongue River A

Unnamed Tributary to Tongue River B

Off Channel Reservoir G

Off Channel Reservoir B

Off Channel Reservoir C

Off Channel Reservoir D

Off Channel Reservoir E

Goose Creek

Unnamed Tributary to Goose Creek-B

Unnamed Tributary to Goose Creek-A

Coordinate System: NAD 1983 UTM Zone 13N, 2012 NAIP True Color Imagery Scale: 1 in = 1,000 ft

0 1,450 2,900 5,800 Feet

0 0.2 0.4 0.8 Kilometers

TWN57N, RNG85W TWN57N, RNG84W

Legend

- ARI Sample Location
- Off-Channel Reservoir Aquatic Resource Boundary
- PABh Aquatic Resource Boundary
- PEM Aquatic Resource Boundary
- PEMh Aquatic Resource Boundary
- PUB Aquatic Resource Boundary
- R6 Aquatic Resource Boundary
- R6fr Aquatic Resource Boundary
- R6UBx Aquatic Resource Boundary
- NWI Wetland Boundary
- Permit Boundary
- Section Boundary
- Township/Range Boundary

General Location Map

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
7/30/13	BKS/JB
1/22/14	BKS/JB
8/5/14	BKS/TS
10/30/14	BKS/JB
06/15	Round 1 Comments

EXHIBIT D10.2-1

TFN 6 2/025
RECD JUL 30.2015

AQUATIC RESOURCES INVENTORY

Drawn By: BKS/TS
Checked By: BKS/MK
Date: 7/7/2015

FILE: EX_D10-2-1_Ramaco_Brook_Mine_ARI_1000

RKR Environmental Associates, Inc.

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ADDENDUM D10-1

2013 Baseline Aquatic Resources Inventory

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Attachment D10-1-A Tables

Attachment D10-1-B Maps

Attachment D10-1-C Plant Species List

Attachment D10-1-D Photographs

Attachment D10-1-E Wetland Determination Data Forms Great Plains Region (Version Two)

Attachment D10-1-F Letter of Request for USACE Jurisdictional Determination

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RECD JUL 30,2015

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D10-1 2013 BASELINE AQUATIC RESOURCES INVENTORY

D10-1.1 Introduction

RAMACO, LLC. (RAMACO) (Sheridan, Wyoming) contracted BKS Environmental Associates, Inc. (BKS) (Gillette, Wyoming) to conduct an aquatic resources inventory for the proposed Brook Mine in October 2013. The purpose of the inventory is to document aquatic resources within the proposed Brook Mine Permit Area. Findings will be used by RAMACO to obtain jurisdictional determination from the U.S. Army Corps of Engineers, and will also be used to obtain a Wyoming Department of Environmental Quality Mine Permit.

The Brook Mine Permit Area proposed by RAMACO for the Wyoming Mine Permit Application includes approximately 4,548.8 acres. The proposed Brook Mine Permit Area is located in north-central Sheridan County approximately 15 miles northwest of Sheridan, Wyoming. The proposed Brook Mine Permit Area includes all or portions of Sections 7, 8, 9, 10, 15, 17, 18, 20, 21, 22, and 27 Township 57N, Range 84W and Sections 10, 11, 12, 13, 14, and 15, Township 57N, Range 85W.

An aquatic resources inventory was conducted within the proposed Brook Mine Permit Area on October 21, 22, and 23, 2013, by BKS employees C. Wood, A. Ide, M. Kasten, and S. Winters. Additional sampling occurred on October 15, 2014, by BKS employees D. Gardner and M. Kasten. Maps illustrating the proposed Brook Mine Permit Area, sample locations, and aquatic resources inventoried within the proposed permit area are located in Attachment D10-1-B.

D10-1.2 Methods

An inventory of aquatic resources was conducted in accordance with the U.S. Army Corps of Engineers (USACE) Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0) and Regulatory Guidance Letter No. 05-05 (USACE 2005). All potential Waters of

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the U.S. (WUS) and other waters of the U.S. (OWUS) were assessed during the aquatic resources inventory. Aquatic resources were inventoried through review of the imagery outlined above and pedestrian reconnaissance. The routine wetland delineation approach with onsite inspection was utilized when potential wetlands were observed during field evaluations.

Potential wetlands, WUS, and OWUS were initially identified via review of the following mapping data:

1. U.S. Fish and Wildlife Service (USFWS) digital National Wetland Inventory (NWI) mapping
2. 2011 NAIP True Color ortho aerial imagery
3. 2009 CIR imagery

No flow data, stream gauge information, or historical information of flow was reviewed or gathered for the purposes of this aquatic resources inventory. Natural Resource Conservation Service (NRCS) soils data was reviewed for general soils information (NRCS 2014).

Identification of potential wetlands was based on visual assessment of vegetation and hydrology indicators, as well as intrusive soil sampling to determine the presence of wetland criteria indicators. Hydrology and soils were evaluated whenever a plant community met hydrophytic vegetation parameters or whenever indicators suggested the potential presence of a seasonal wetland under normal circumstances. USACE Wetland Determination Data Form-Great Plains Region (Version 2.0) was utilized. Wetland indicator categories were identified for each dominant plant species noted through use of the 2014 National Wetland Plant List – Great Plains Region (Lichvar 2014).

Identification of potential WUS and OWUS was based on review of available imagery as outlined above and onsite assessment of ordinary high water mark (OHWM) indicators. Physical characteristics outlined in USACE Regulatory Guidance Letter No. 05-05 were evaluated whenever NAIP True Color ortho aerial imagery or onsite inspection indicated the presence of a potential WUS or OWUS. Potential WUS and OWUS boundaries were

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delineated based on the OWHM. Aquatic resources which were not wetlands were annotated as Other Aquatic Resources for the purposes of this report.

Field sample locations and resulting wetland boundaries were recorded with a Trimble GeoXT in GCS NAD83. Boundaries of OAR were recorded with a Trimble GeoXT in GCS NAD83.

D10-1.3 Results and Discussion

D10-1.3.1 Proposed Permit Area Description

The majority of the proposed Brook Mine Permit Area is characterized by rolling topography composed of upland ridges. Ridges are drained by incised draws and intersected by seasonally flooded drainages with relatively flat floodplains, which have historically acted as ephemeral tributaries to the Tongue River, located south and outside of the proposed Brook Mine Permit Area. Elevation ranges from approximately 3,590 feet near the southeastern boundary of the proposed permit area near the Tongue River to approximately 4,110 feet on a ridge in the central portion of the proposed permit area. Precipitation averages approximately 14 inches per year. The primary land use within the proposed Brook Mine Permit Area is grazing; however, the south-east portion of proposed Brook Mine Permit Area was previously mined for coal and is currently reclaimed, while the south-central portion contains an active gravel pit.

The proposed Brook Mine Permit Area is approximately 4,548.8 acres. Of these acres, agricultural lands occupied approximately 0.1%, reclaimed areas occupied approximately 13.1%, and native areas occupied 84.1%. Disturbed areas, defined as lands disturbed by human activities, encompassed approximately 2.4% and water covered approximately 0.3%.

Dominant shrub species included big sagebrush (*Artemisia tridentata*) and fringed sagewort (*Artemisia frigida*). Western wheatgrass (*Pascopyrum smithii*), bluebunch wheatgrass (*Elymus spicatus*), and crested wheatgrass (*Agropyron cristatum*) were the dominant upland perennial grasses. The

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dominant upland perennial forb species were scarlet globemallow (*Sphaeralcea coccinea*), American vetch (*Vicia americana*), western yarrow (*Achillea millefolium*), and slimflower scurfpea (*Psoralidium tenuiflorum*). Vegetation within the areas identified as wetlands consisted primarily of western wheatgrass, common snowberry (*Symphoricarpos albus*), Nebraska sedge (*Carex nebrascensis*), and crested wheatgrass.

Drainages within the proposed Brook Mine Permit Area are within the Tongue River Drainage Basin and generally occur within Riparian Woodland and Bottomland Sagebrush Grassland vegetation communities according to the associated vegetation assessment. The proposed Brook Mine Permit Area is drained to the south and southeast to the Tongue River primarily by the Tongue River Ditch, Hidden Water Creek, and Slater Creek. Tongue River Ditch occurs in approximately the S 1/2 of Section 13 and the S 1/2 of Section 14, Township 57 North, Range 85 West, but runs outside the proposed permit area in a complex ditch and culvert system along U.S. Interstate 90. Hidden Water Creek occurs in approximately the S 1/2 of Section 9 and the NW 1/4 of Section 15, Township 57 North, Range 84 West. The drainage pattern of Hidden Water Creek as it nears the Tongue River has been modified by historic mining reclamation. A berm has been built on Hidden Water Creek and flowing water has been redirected along a man-made ditch in approximately the NW 1/4 of Section 15, Township 57 North, Range 84 West. Slater Creek occurs in approximately the SW 1/4 of Section 12 and the NE 1/4 of Section 13, Township 57 North, Range 85 West and the SW 1/4 of Section 18, Township 57 North, Range 84 West. Areas in the southeast portion of the proposed permit area are drained to the west and into Goose Creek. Goose Creek crosses a narrow portion of the proposed permit area under a bridge in approximately the NW 1/4 of the NW 1/4 of Section 22, Township 57 North, Township 84 West.

Slater Creek has multiple draws and lesser tributaries which drain into it within the proposed Brook Mine Permit Area. These tributaries include Unnamed Tributary to Slater Creek A, B, C, D, and E. Unnamed Tributary to

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Slater Creek A occurs approximately in the W 1/2 of the SE 1/4 of Section 11, Township 57 North, Range 85 West. Unnamed Tributary to Slater Creek B occurs approximately in the S 1/2 of Section 12, Township 57 North, Range 85 West. Unnamed Tributary to Slater Creek C occurs approximately in the NE 1/4 of the NE 1/4 of Section 13, Township 57 North, Range 85 West. Unnamed Tributary to Slater Creek D occurs approximately in the NW 1/4 of the SW 1/4 of Section 18, Township 57 North, Range 84 West. Unnamed Tributary to Slater Creek E occurs approximately in the NW 1/4 of Section 18, Township 57 North, Range 84 West.

Lesser tributaries and draws also drain the proposed permit area. The East Fork of Earley Creek occurs approximately in the W 1/2 of Section 10, Township 57 North, Range 85 West. Most other tributaries in the western portion of the proposed permit area have been cut-off from their historic drainage patterns by U.S. Interstate 90 and redirected and utilized for agricultural development by the Tongue River Ditch. These tributaries, referred to as Unnamed Tributaries to Tongue River Ditch A, B, C, and D occur approximately in the NW 1/4 of Section 14, Township 57 North, Range 85 West and the E 1/4 Section 14, Township 57 North, Range 85 West and the SW 1/4 of Section 17, Township 57 North, Range 84 West. Two other tributaries, Unnamed Tributaries to Tongue River A and B drain directly into the Tongue River. Unnamed Tributary to Tongue River A occurs approximately in the SW 1/4 of Section 16 and the NE 1/4 of Section 17, Township 57 North, Range 84 East. Unnamed Tributary to Tongue River B occurs approximately in the SE 1/4 of Section 17, Township 57 North, Range 84 West. The Unnamed Tributaries to Goose Creek within the proposed permit area are man-made ditches between a railroad and road which offers access to Big Horn Coal reclamation off of Decker Road. Unnamed Tributary to Goose Creek A occurs approximately in the NW 1/4 of Section 27, Township 57 North, Range 84 West. Unnamed Tributary to Goose Creek B occurs approximately in the SW 1/4 of Section 22 and the NW 1/4 of Section 27, Township 57 North, Range 84 West.

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Several off-channel reservoirs are located within the proposed Brook Mine Permit Area. Two were identified in the western portion of the proposed permit area. These are referred to as Off-channel Reservoir A, occurring in approximately the NE 1/4 of the NE 1/4 of Section 13, Township 57 North, Range 85 West and Off-channel Reservoir F, occurring in approximately the NW 1/4 of the NW 1/4 of Section 14, Township 57 North, Range 85 West. The remaining off-channel reservoirs occur in the eastern portion of the proposed permit area on historic Big Horn Coal reclamation. Big Horn Coal reclamation drains to the north into the Tongue River and to the west into Goose Creek. The Tongue River occurs south and outside of the proposed permit area, except where it crosses the Tongue River to access Big Horn Coal reclamation at approximately the SE 1/4 of the NW 1/4 of the SE 1/4 of Section 15, Township 57 North, Range 84 West. Off-channel reservoirs occurring within Big Horn Coal reclamation are referred to and approximately occur as follows:

- Off-channel Reservoirs B and C in the SW 1/4 of the SE 1/4 of Section 15, Township 57 North, Range 84 West
- Off-channel Reservoirs D and E in the SE 1/4 of the SE 1/4 of Section 15, Township 57 North, Range 84 West
- Off-channel Reservoir G in the SW 1/4 of the NW 1/4 of Section 15, Township 57 North, Range 84 West.

These off-channel reservoirs were constructed without drainage patterns and act as sinks, capturing surface run-off on the reclamation as it flows downslope by over-land flow to the Tongue River.

D10-1.3.2 NRCS Soil Survey

NRCS soil mapping data for Sheridan County, Wyoming, was utilized for this project. The following NRCS soil mapping units are associated with the drainages within the proposed Brook Mine Permit Area (USDA 2014):

- Bidman-Ulm, Dry Complex, 0 to 6 Percent Slopes
- Cushman-Forkwood association, 3 to 15 percent slopes
- Haverdad-Draknab complex, 0 to 3 percent slopes
- Haverdad very fine sandy loam, 0 to 3 percent slopes

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- Haverdad-Worthenton complex, 0 to 3 percent slopes
- Kishona-Cambria complex, 3 to 6 percent slopes
- Shingle-Rock Outcrop complex, 30 to 50 percent slopes
- Shingle-Samday clay loams, 6 to 60 percent slopes
- Shingle-Wibaux complex, 0 to 60 percent slopes
- Worfka-Shingle-Samday complex, 6 to 30 percent slopes
- Worthenton clay loam, 0 to 3 percent slopes
- Ustic Torriorthents-Pits complex, 0 to 100 percent slopes
- Zigweid-Cambria loams, 0 to 6 percent slopes
- Zigweid-Kishona-Cambria complex, 6 to 15 percent slopes

Of these soil mapping units, the following four are classified as hydric soils in Sheridan County (USDA NRCS 2014): Haverdad very fine sandy loam, 0 to 3 percent slopes, Haverdad-Draknab complex, 0 to 3 percent slopes, Haverdad-Worthenton complex, 0 to 3 percent slopes, and Worthenton clay loam, 0 to 3 percent slopes.

D10-1.3.3 Wetlands

Approximately 15.8 total acres of wetlands were identified within the proposed Brook Mine Permit Area. Wetlands were identified in ten drainages within the proposed permit area: Slater Creek; Unnamed Tributaries to Slater Creek A, B, C, and D; Unnamed Tributaries to Tongue River Ditch A and B; Hidden Water Creek; and Unnamed Tributaries to Goose Creek A and B. Types of wetlands found within the proposed permit area include 5.4 acres of Palustrine Aquatic Bed-Impoundment (PABh), 7.3 acres of Palustrine Emergent Vegetation (PEM), 1.7 acres of Palustrine Emergent Vegetation-Impoundment (PEMh), and 1.5 acres of Palustrine Unconsolidated Bed (PUB).

Of the total figure, approximately 5.2 acres of wetlands were found along or within Slater Creek. All wetlands delineated in association with Slater Creek were identified as PEM wetlands.

Approximately 2.5 acres of wetlands were found within Unnamed Tributaries to Slater Creek. Of those 2.5 acres identified, 1.0 acres were PEM, and 1.5 acres were PUB wetlands. Unnamed Tributary to Slater Creek A

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included approximately 0.4 acres of PEM wetlands and 1.3 acres of PUB wetlands. Unnamed Tributary to Slater Creek B included approximately 0.4 acres of PEM wetlands. Unnamed Tributary to Slater Creek C included approximately 0.1 acres of PUB wetlands. Unnamed Tributary to Slater Creek D included approximately 0.2 acres of PEM wetlands.

Unnamed Tributaries to Tongue River Ditch contained approximately 7.7 acres of wetlands. Of those 7.7 acres, 5.4 acres were identified as PABh wetlands, 1.0 acres were identified as PEM wetlands, and 1.3 acres were identified as PEMh wetlands. Unnamed Tributary to Tongue River Ditch A included approximately 4.3 acres of PABh, 0.6 acres of PEM, and 1.0 acres of PEMh wetlands. Unnamed Tributary to Tongue River Ditch B included approximately 1.1 acres of PABh, 0.4 acres of PEM, and 0.4 acres of PEMh wetlands.

Approximately <0.1 acres of wetlands were associated with Hidden Water Creek. All wetlands delineated along Hidden Water Creek were identified as PEM wetlands.

Unnamed Tributaries to Goose Creek contained approximately 0.4 acres of wetlands. All wetlands delineated along Unnamed Goose Creek Tributaries were identified as PEMh wetlands. Unnamed Tributary to Goose Creek A included approximately <0.1 acres of PEMh wetlands. Unnamed Tributary to Goose Creek B included approximately 0.3 acres of PEMh wetlands.

Refer to Table D10-1 and D10-2 for a summary of aquatic resource acres within the proposed Brook Mine Permit Area. For a comprehensive list of plant species observed during the aquatic resources inventory refer to Attachment D10-1-C. Refer to Attachment D10-1-D for photographs. Refer to Attachment D10-1-E for wetland data sheets.

D10-1.3.4 Other Aquatic Resources

Other Aquatic Resources (OAR) are aquatic features which did not meet the parameters required to be delineated as wetlands. Those found in the

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proposed Brook Mine Permit Area were generally located in ephemeral creeks or draws and in off-channel reservoirs. BKS conducted various sampling for other resources on the proposed permit area in April, June, July, and October of 2013. No flowing water was observed in any creek channels or draws throughout that period. Standing or pooled water was generally observed intermittently along Slater Creek. Water was observed in all reservoirs throughout the entire sampling time listed above with the exception of Off-channel Reservoirs C and G.

Approximately 12.2 total acres of OAR were identified within the proposed Brook Mine Permit Area which includes OAR and off-channel reservoirs. OAR were identified in the proposed permit area within seven drainages while six off-channel reservoirs were identified. Drainages containing OAR included the East Fork of Earley Creek, Hidden Water Creek, Slater Creek, Unnamed Tributaries to Goose Creek A and B, Unnamed Tributary to Tongue River A, and Unnamed Tributaries to Tongue River Ditch A and B. The Off-channel Reservoirs containing OAR included Off-channel Reservoirs A, B, C, D, E, and F. Types of other aquatic resources identified included approximately 9.2 acres of Ephemeral Creeks or Draws (R6), 0.2 acres of Ephemeral Creeks-Artificial (R6r), and 2.8 acres of Off-channel Reservoirs. R6r was used to describe the portion of Hidden Water Creek which was rerouted by historic mining reclamation.

Approximately 0.2 acres of OAR were identified along the East Fork of Earley Creek. All 0.2 acres associated with the East Fork of Earley Creek were identified as R6.

Approximately 2.6 acres of OAR were identified along Hidden Water Creek. Of those 2.6 acres, 2.3 acres were identified as R6 and 0.2 were identified as R6r.

Approximately 5.9 acres of OAR were identified along Slater Creek. All 5.9 acres associated with Slater Creek were identified as R6.

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Approximately 0.2 acres of OAR were identified along Unnamed Tributary to Tongue River A. All 0.2 acres associated with Unnamed Tributary to Tongue River A were identified as R6.

Approximately 0.4 acres of OAR were identified along Unnamed Tributary to Tongue River Ditch A. All 0.4 acres associated with Unnamed Tributary to Tongue River Ditch A were identified as R6.

Approximately 0.1 acres of OAR were identified along Unnamed Tributary to Tongue River Ditch B. All 0.1 acres associated with Unnamed Tributary to Tongue River Ditch B were identified as R6.

D10-1.4 Conclusion

A total of 15.8 acres of wetlands were identified within the proposed Brook Mine Permit Area. A total of 12.2 acres of OAR, including 2.8 acres of off-channel reservoirs, were identified within the proposed Brook Mine Permit Area. A combined total of 27.9 acres of aquatic resources were identified within the proposed Brook Mine Permit Area. Approximately 7.1 acres of wetlands (of the total 15.8 acres or 44.7%) and 3.0 acres of OAR (of the total 12.2 acres or 24.6%) identified during the 2013 aquatic resources inventory were found in association with man-made reservoirs or impoundments.

BKS, on behalf of RAMACO, requested concurrence and jurisdictional determination from the USACE based on this 2013 aquatic resource inventory of the proposed Brook Mine Permit Area on May 29, 2015 (Attachment D10-1-F).

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D10-1.5 References

Cowardin, L.M., V. Carter, F.C. Goblet and E.T. LaRoae. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* U.S. Fish and Wildlife Service, OBS-79/31, Washington, D.C.

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Robert W. Lichvar. 2014. The National Wetland Plant List. U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH. ERDC/CRREL TR-12-11. 224 pp.

U.S. Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0).* ERDC/EL TR-10-01. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

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U.S. Department of the Interior, Fish and Wildlife Service. 2012. National Wetlands Inventory. http://107.20.228.18/Wetlands/Wetlands Mapper.html#. Accessed May 2012.

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ATTACHMENT D10-1-A

Tables

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Table D10-1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area

Drainage Area	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
East Fork Earley Creek	1Wet	Sec. 10, T57N, R85W	1-4	Ephemeral Creek	R6	0.2
Hidden Water Creek	32Wet	Sec. 9, T57N, R84W	121-124	Ephemeral Creek	R6	2.3
	33Wet	Sec. 9, T57N, R84W	125-128			
	34Wet	Sec. 9, T57N, R84W	129-132			
	35Wet	Sec. 15, T57N, R84W	133-136			
	41Wet	Sec. 15, T57N, R84W	58-59	Wetland	PEM	<0.1
	R6r	Sec. 15, T57N, R84W	---	Artificial Creek	R6r	0.2
Off-channel Reservoir A	15Wet	Sec. 13, T57N, R85W	53-56	Off-channel reservoir	---	0.1
Off-channel Reservoir B	36Wet	Sec. 15, T57N, R84W	137-140	Off-channel reservoir	---	0.1
Off-channel Reservoir C	37Out	Sec. 15, T57N, R84W	141-143	Off-channel reservoir	---	0.6
Off-channel Reservoir D	38Wet	Sec. 15, T57N, R84W	144-147	Off-channel reservoir	---	0.3
Off-channel Reservoir E	39Wet	Sec. 15, T57N, R84W	148-151	Off-channel reservoir	---	1.5
Off-channel Reservoir F	5Wet	Sec. 14, T57N, R85W	16-18	Off-channel reservoir	---	0.1
Off-channel Reservoir G	40Out	Sec. 15, T57N, R84W	57	Non-aquatic	---	---

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Table D10-1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area (Cont.)

Drainage Feature	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
Slater Creek	17Wet	Sec. 12, T57N, R85W	64-67	Wetland	PEM	0.5
	18Wet	Sec. 12, T57N, R85W	68-70	Wetland	PEM	0.1
	18aWet	Sec. 12, T57N, R85W	71-73	Wetland	PEM	0.2
	22Wet	Sec. 13, T57N, R85W	85-88	Ephemeral Creek	R6	5.9
	23Wet	Sec. 13, T57N, R85W	89-92			
	27Wet	Sec. 18, T57N, R84W	104-107	Wetland	PEM	4.5
Unnamed Tributary to Goose Creek A	---	Sec. 27, T57N, R84W	---	Wetland	PEM	<0.1
Unnamed Tributary to Goose Creek B	42Wet	Sec. 22 & 27, T57N, R84W	60-62	Wetland	PEM	0.3
Unnamed Tributary to Slater Creek A	10Wet	Sec. 11, T57N, R85W	34-36	Wetland	PUB	1.3
	10aWet	Sec. 11, T57N, R85W	37-39	Wetland	PEM	0.4
Unnamed Tributary to Slater Creek B	19Wet	Sec. 12, T57N, R85W	75-78	Non-aquatic	---	---
	20Out	Sec. 12, T57N, R85W	79-81	Non-aquatic	---	---
	21Wet	Sec. 12, T57N, R85W	82-84	Wetland	PEM	0.4
Unnamed Tributary to Slater Creek C	24Wet	Sec. 18, T57N, R84W	93-96	Wetland	PUB	0.1
Unnamed Tributary to Slater Creek D	26Wet	Sec. 17, T57N, R84W	100-103	Wetland	PEM	0.2
Unnamed Tributary to Slater Creek E	25Out	Sec. 18, T57N, R84W	97-99	Non-aquatic	---	---
Unnamed Tributary to Tongue River A	30Wet	Sec. 17, T57N, R84W	114-116	Ephemeral Tributary	R6	0.2
Unnamed Tributary to Tongue River B	31Out	Sec. 17, T57N, R84W	118-120	Non-aquatic	---	---

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Table D10-1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area (Cont.)

Drainage Feature	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
Unnamed Tributary to Tongue River Ditch A	2Wet	Sec. 10, T57N, R85W	5-8	Wetland	PABh	1.9
					PEMh	0.1
	3Wet	Sec. 14, T57N, R85W	9-12	Wetland	PEM	0.3
	4Wet	Sec. 14, T57N, R85W	13-15	Wetland	PABh	2.4
	6Wet	Sec. 14, T57N, R85W	20-23	Ephemeral Tributary	R6	0.4
	7Wet	Sec. 14, T57N, R85W	24-25	Wetland	PEM	0.1
	8Wet	Sec. 14, T57N, R85W	26-29	Wetland	PEM	0.2
	9Wet	Sec. 14, T57N, R85W	30-33	Wetland	PEMh	0.9
Unnamed Tributary to Tongue River Ditch B	11Wet	Sec. 11, T57N, R85W	41-44	Wetland	PEM	0.4
	12Wet	Sec. 13, T57N, R85W	45-48	Wetland	PABh	1.1
	13Wet	Sec. 14, T57N, R85W	49-52	Wetland	PEMh	0.4
	14Wet	Sec. 13, T57N, R85W	---			
	---	Sec. 13, T57N, R85W	---	Ephemeral Tributary	R6	0.1
Unnamed Tributary to Tongue River Ditch C	28Out	Sec. 17, T57N, R84W	108-110	Non-aquatic	---	---
Unnamed Tributary to Tongue River Ditch D	29Out	Sec. 20, T57N, R84W	111-113	Non-aquatic	---	---
					Total[1]	**27.9**

[1]Individual acreages do not sum to the illustrated total due to rounding errors.

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RECD NOV 14, 2014

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Table D10-2. Total Wetland and Other Aquatic Resources (OAR) Acreages within the Proposed Brook Mine Permit Area

Type	Permit Area Acreage
PABh	5.4
PEM	7.3
PEMh	1.7
PUB	1.5
Total Wetland Acreage	**15.8**
Off-channel Reservoir	2.8
R6	9.2
R6r	0.2
Total OAR Acreage	**12.2**
Total Aquatic Resources Acreage[1]	**27.9**

[1] Individual acreages do not sum to the illustrated total due to rounding errors.

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ATTACHMENT D10-1-B

Maps

TFN 6 2/025
RECD NOV 14, 2014

Coordinate System: NAD 1983 UTM Zone 13N, 2011 NAIP True Color Imagery Scale: 1 in = 700 ft

0 1,000 2,000 4,000 Feet

0 0.125 0.25 0.5 Kilometers

TWN57N, RNG85W TWN57N, RNG84W

Legend

- ARI Sample Location
- Interstate
- Highway
- Off-Channel Reservoir Aquatic Resource Boundary
- PABh Aquatic Resource Boundary
- PEM Aquatic Resource Boundary
- PEMh Aquatic Resource Boundary
- PUB Aquatic Resource Boundary
- R6 Aquatic Resource Boundary
- R6r Aquatic Resource Boundary
- R6UBx Aquatic Resource Boundary
- NWI Wetland Boundary
- Proposed Permit Boundary
- Section Boundary
- Township/Range Boundary

General Location Map

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1105 SUGARVIEW DR, STE 200
SHERIDAN, WY 82801

REVISIONS	
Date	Description
10/2013	BHSUB
1/2014	BHSUB
5/8/14	BHSITE

ADDENDUM: D10
MAP: 1

TFN 6 2/025
RECD NOV 14 2014

2013 BASELINE AQUATIC RESOURCES INVENTORY - 2011 NAIP TRUE COLOR IMAGERY

Drawn By	BHSITE
Checked By	BHSMK
Date	10/14/14

FILE: Ramaco_Brook_Mine_ARI_10142014.mxd

RES Environmental Associates, Inc.

Coordinate System: NAD 1983 UTM Zone 13N. 2009 NAIP CIR Imagery

Scale: 1 in = 700 ft

0 1,000 2,000 4,000 Feet

0 0.125 0.25 0.5 Kilometers

TWN57N, RNG85W

TWN57N, RNG84W

Legend

- ARI Sample Location
- Interstate
- Highway
- Off-Channel Reservoir Aquatic Resource Boundary
- PABh Aquatic Resource Boundary
- PEM Aquatic Resource Boundary
- PEMh Aquatic Resource Boundary
- PUB Aquatic Resource Boundary
- R6 Aquatic Resource Boundary
- R6r Aquatic Resource Boundary
- R6UBx Aquatic Resource Boundary
- NWI Wetland Boundary
- Proposed Permit Boundary
- Section Boundary
- Township/Range Boundary

General Location Map

Richchester | TWN R85W | Sheridan | TWN R84W | Map Extent | Sheridan County

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1105 SUGAR RD SW DR, STE. 205
SHERIDAN, WY 82801

REVISIONS	
Date	Description
7/30/13	BKS/JB
1/22/14	BKS/JB
9/5/14	BKS/TS

TFN 8 7/025
REC'D NOV 14, 2014

ADDENDUM: D10
MAP: 2

2013 BASELINE AQUATIC RESOURCES INVENTORY - 2009 NAIP CIR IMAGERY

Drawn By:	BKS/TS
Checked By:	BKS/MW
Date:	10/14/14

FILE: Ramaco_Brook_Mine_ARI_10142014.mxd

REI Environmental Associates, Inc.

DEQ Ex. 4-709

Coordinate System: NAD 1983 UTM Zone 13N, 1978-79 USGS Topo DRG Scale: 1 in = 700 ft
1,000 2,000 4,000 Feet
0 0.125 0.25 0.5 Kilometers

TWN57N, RNG85W TWN57N, RNG84W

Legend

- ARI Sample Location
- Interstate
- Highway
- Off-Channel Reservoir Aquatic Resource Boundary
- PABh Aquatic Resource Boundary
- PEM Aquatic Resource Boundary
- PEMh Aquatic Resource Boundary
- PUB Aquatic Resource Boundary
- R6 Aquatic Resource Boundary
- R6r Aquatic Resource Boundary
- R6UBx Aquatic Resource Boundary
- NWI Wetland Boundary
- Proposed Permit Boundary
- Section Boundary
- Township/Range Boundary

General Location Map

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SCARLOW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
7/30/13	BKS/JS
1/22/14	BKS/JS
5/5/14	BKS/TS

ADDENDUM: D10
MAP: 3

TFN 6 2/025
REC'D MAY 14, 2014

2013 BASELINE AQUATIC RESOURCES INVENTORY - 1978-79 USGS ACME/MONARCH QUADS TOPO DRG

Drawn By:	BKS/TS
Checked By:	WG/MH
Date:	10/14/14

FILE: Ramaco_Brook_Mine_ARI_10142014.mxd

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ATTACHMENT D10-1-A

Tables

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Table 1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area

Drainage Area	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
East Fork Earley Creek	1Wet	Sec. 10, T57N, R85W	1-4	Ephemeral Creek	R6	0.2
Hidden Water Creek	32Wet	Sec. 9, T57N, R84W	121-124	Ephemeral Creek	R6	2.3
	33Wet	Sec. 9, T57N, R84W	125-128			
	34Wet	Sec. 9, T57N, R84W	129-132			
	35Wet	Sec. 15, T57N, R84W	133-136			
	41Wet	Sec. 15, T57N, R84W	58-59	Wetland	PEM	<0.1
	R6r	Sec. 15, T57N, R84W	---	Artificial Creek	R6r	0.2
Off-channel Reservoir A	15Wet	Sec. 13, T57N, R85W	53-56	Off-channel reservoir	---	0.1
Off-channel Reservoir B	36Wet	Sec. 15, T57N, R84W	137-140	Off-channel reservoir	---	0.1
Off-channel Reservoir C	37Out	Sec. 15, T57N, R84W	141-143	Off-channel reservoir	---	0.6
Off-channel Reservoir D	38Wet	Sec. 15, T57N, R84W	144-147	Off-channel reservoir	---	0.3
Off-channel Reservoir E	39Wet	Sec. 15, T57N, R84W	148-151	Off-channel reservoir	---	1.5
Off-channel Reservoir F	5Wet	Sec. 14, T57N, R85W	16-18	Off-channel reservoir	---	0.1
Off-channel Reservoir G	40Out	Sec. 15, T57N, R84W	57	Non-aquatic	---	---

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Table 1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area (Cont.)

Drainage Feature	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
Slater Creek	17Wet	Sec. 12, T57N, R85W	64-67	Wetland	PEM	0.5
	18Wet	Sec. 12, T57N, R85W	68-70	Wetland	PEM	0.1
	18aWet	Sec. 12, T57N, R85W	71-73	Wetland	PEM	0.2
	22Wet	Sec. 13, T57N, R85W	85-88	Ephemeral Creek	R6	5.9
	23Wet	Sec. 13, T57N, R85W	89-92			
	27Wet	Sec. 18, T57N, R84W	104-107	Wetland	PEM	4.5
Unnamed Tributary to Goose Creek A	---	Sec. 27, T57N, R84W	---	Wetland	PEM	<0.1
Unnamed Tributary to Goose Creek B	42Wet	Sec. 22 & 27, T57N, R84W	60-62	Wetland	PEM	0.3
Unnamed Tributary to Slater Creek A	10Wet	Sec. 11, T57N, R85W	34-36	Wetland	PUB	1.3
	10aWet	Sec. 11, T57N, R85W	37-39	Wetland	PEM	0.4
Unnamed Tributary to Slater Creek B	19Wet	Sec. 12, T57N, R85W	75-78	Non-aquatic	---	---
	20Out	Sec. 12, T57N, R85W	79-81	Non-aquatic	---	---
	21Wet	Sec. 12, T57N, R85W	82-84	Wetland	PEM	0.4
Unnamed Tributary to Slater Creek C	24Wet	Sec. 18, T57N, R84W	93-96	Wetland	PUB	0.1
Unnamed Tributary to Slater Creek D	26Wet	Sec. 17, T57N, R84W	100-103	Wetland	PEM	0.2
Unnamed Tributary to Slater Creek E	25Out	Sec. 18, T57N, R84W	97-99	Non-aquatic	---	---
Unnamed Tributary to Tongue River A	30Wet	Sec. 17, T57N, R84W	114-116	Ephemeral Tributary	R6	0.2
Unnamed Tributary to Tongue River B	31Out	Sec. 17, T57N, R84W	118-120	Non-aquatic	---	---

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Table 1. Summary of Wetlands and Other Aquatic Resources (OAR) within the Proposed Brook Mine Permit Area (Cont.)

Drainage Feature	Map ID	Legal Description	Photo #	Aquatic Resource Type	Cowardin Classification	Permit Area Acreage
Unnamed Tributary to Tongue River Ditch A	2Wet	Sec. 10, T57N, R85W	5-8	Wetland	PABh	1.9
					PEMh	0.1
	3Wet	Sec. 14, T57N, R85W	9-12	Wetland	PEM	0.3
	4Wet	Sec. 14, T57N, R85W	13-15	Wetland	PABh	2.4
	6Wet	Sec. 14, T57N, R85W	20-23	Ephemeral Tributary	R6	0.4
	7Wet	Sec. 14, T57N, R85W	24-25	Wetland	PEM	0.1
	8Wet	Sec. 14, T57N, R85W	26-29	Wetland	PEM	0.2
	9Wet	Sec. 14, T57N, R85W	30-33	Wetland	PEMh	0.9
Unnamed Tributary to Tongue River Ditch B	11Wet	Sec. 11, T57N, R85W	41-44	Wetland	PEM	0.4
	12Wet	Sec. 13, T57N, R85W	45-48	Wetland	PABh	1.1
	13Wet	Sec. 14, T57N, R85W	49-52	Wetland	PEMh	0.4
	14Wet	Sec. 13, T57N, R85W	---			
	---	Sec. 13, T57N, R85W	---	Ephemeral Tributary	R6	0.1
Unnamed Tributary to Tongue River Ditch C	28Out	Sec. 17, T57N, R84W	108-110	Non-aquatic	---	---
Unnamed Tributary to Tongue River Ditch D	29Out	Sec. 20, T57N, R84W	111-113	Non-aquatic	---	---
					Total[1]	**27.9**

[1]Individual acreages do not sum to the illustrated total due to rounding errors.

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Table 2. Total Wetland and Other Aquatic Resources (OAR) Acreages within the Proposed Brook Mine Permit Area

Type	Permit Area Acreage
PABh	5.4
PEM	7.3
PEMh	1.7
PUB	1.5
Total Wetland Acreage	**15.8**
Off-channel Reservoir	2.8
R6	9.2
R6r	0.2
Total OAR Acreage	**12.2**
Total Aquatic Resources Acreage[1]	**27.9**

[1] Individual acreages do not sum to the illustrated total due to rounding errors.

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ATTACHMENT D10-1-B

Exhibits

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ATTACHMENT D10-1-C

Plant Species List

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Scientific Name	Common Name	Indicator Status
Acer negundo	Ash-leaf maple	FAC
Achillea millefolium	Common yarrow	FACU
Agoseris glauca	Pale goat-chicory	FACU
Agropyron cristatum	Crested wheatgrass	UPL
Alyssum desertorum	Desert madwort	UPL
Artemisia cana	Silver sagebrush	FACU
Artemisia frigida	Prairie sagewort	UPL
Artemisia ludoviciana	White sagebrush	UPL
Artemisia tridentata	Big sagebrush	UPL
Atriplex canescens	Four-wing saltbush	UPL
Bassia scoparia	Fireweed summercypress	FACU
Bromus arvensis	Japanese brome	UPL
Bromus inermis	Smooth brome	UPL
Bromus tectorum	Cheatgrass	NL
Camelina microcarpa	Little-Pod False Flax	UPL
Carex nebrascensis	Nebraska sedge	OBL
Carex prairea	Silver sedge	OBL
Chenopodium album	Lamb's-quarters	FACU
Cirsium arvense	Canadian thistle	FACU
Convolvulus arvensis	Field bindweed	UPL
Chrysothamnus viscidiflorus	Yellow rabbitbrush	UPL
Cyrtorhyncha cymbalaria	Alkali buttercup	OBL
Distichlis spicata	Inland saltgrass	FACW
Eleocharis acicularis	Needle spikerush	OBL
Eleocharis palustris	Common spikerush	OBL
Elymus cinereus	Basin wildrye	UPL
Elymus elymoides	Bottlebrush squirreltail	UPL
Elymus lanceolatus	Thickspike wheatgrass	FACU
Elymus trachycaulus	Slender wheatgrass	FACU
Equisetum laevigatum	Smooth horsetail	FAC
Ericameria nauseosa	Rubber rabbitbrush	UPL
Gaura coccinea	Scarlet gaura	UPL
Glycyrrhiza lepidota	Wild licorice	FACU
Gnaphalium palustre	Western marsh cudweed	OBL
Grindelia squarrosa	Curly-cup gumweed	UPL
Gutierrezia sarothre	Broom snakeweed	UPL
Hordeum jubatum	Fox-tail barley	FACW
Juncus balticus	Baltic rush	FACW
Juncus interior	Inland rush	FACW
Juncus torreyi	Torrey's rush	FACW

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Scientific Name	Common Name	Indicator Status
Koeleria macrantha	Prairie Junegrass	UPL
Machaeranthera canescens	Hoary tansyaster	UPL
Medicago sativa	Alfalfa medic	UPL
Melissa officinalis	Yellow sweetclover	UPL
Opuntia polyacantha	Plains pricklypear	UPL
Pascopyrum smithii	Western wheatgrass	FACU
Phalaris arundinacea	Reed canarygrass	FACW
Phlox hoodii	Hoods phlox	UPL
Poa pratensis	Kentucky bluegrass	FACU
Poa secunda	Curly bluegrass	FACU
Polypogon monspeliensis	Annual rabbitfoot grass	FACW
Populus deltoides	Eastern cottonwood	FAC
Potamogeton foliosus	Leafy pondweed	OBL
Potentilla recta	Sulphur cinquefoil	UPL
Pseudoroegneria spicata	Bluebunch wheatgrass	UPL
Ratibida columnifera	Prairie coneflower	UPL
Rhus aromatica	Skunkbush sumac	UPL
Rosa woodsii	Woods' rose	FACU
Rumex crispus	Curly dock	FAC
Salix amygdaloides	Peachleaf willow	FACW
Salix exigua	Narrow-leaf willow	FACW
Schoenoplectus acutus	Hardstem clubrush	OBL
Schoenoplectus maritimus	Cosmopolitan bulrush	OBL
Schoenoplectus pungens	Common threesquare	OBL
Sphaeralcea coccinea	Scarlet globemallow	UPL
Sporobolus airoides	Alkali sacaton	FAC
Symphoricarpos occidentalis	Western snowberry	UPL
Taraxacum officinale	Common dandelion	FACU
Thlaspi arvense	Field pennycress	FACU
Tragopogon dubius	Goat's beard	UPL
Trifolium pratense	Red clover	FACU
Typha latifolia	Broad-leaf cat-tail	OBL
Xanthium strumarium	Rough cocklebur	FAC

Indicator Status Key:
OBL (Obligate Wetland Plant Species) – Almost always is a hydrophyte, rarely in uplands.
FACW (Facultative Wetland Plant Species) – Usually is a hydrophyte, but occasionally found in uplands
FAC (Facultative Plant Species) – Commonly occurs as either a hydrophyte or non-hydrophyte
FACU (Facultative Upland Plant Species) – Occasionally is a hydrophyte, but usually occurs in uplands
UPL (Obligate Upland Plant Species) – Rarely is a hydrophyte, almost always in uplands

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ATTACHMENT D10-1-D

Photographs

TFN 6 2/025
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Photo1: 1Wet Upstream

Photo 2: 1Wet Downstream

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

Photo 3: 1Wet Soil Profile

Photo 4: 1Out Soil Profile

TFN 6 2/025
RECD NOV 14, 2014

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Photo 5: 2Wet Upstream

Photo 6: 2Wet Downstream

TFN 6 2/025
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Photo 7: 2Wet Soil Profile

Photo 8: 2Out Soil Profile

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Photo 9: 3Wet Upstream

Photo 10: 3Wet Downstream

TFN 6 2/025
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Photo 11: 3Wet Soil Profile

Photo 12: 3Out Soil Profile

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Photo 13: 4Wet Upstream

Photo 14: 4Wet Downstream

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Photo 15: 4Wet Soil Profile

Photo 16: 5Wet Upstream

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Photo 17: 5Wet Downstream

Photo 18: 5Wet Soil Profile

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Photo 19: 5Out Soil Profile

Photo 20: 6Wet Upstream

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Photo 21: 6Wet Downstream

Photo 22: 6Wet Soil Profile

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Photo 23: 6Out Soil Profile

Photo 24: 7Wet Soil Profile

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Photo 25: 7Out Soil Profile

Photo 26: 8Wet Upstream

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Photo 27: 8Wet Downstream

Photo 28: 8Wet Soil Profile

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Photo 29: 8Out Soil Profile

Photo 30: 9Wet Upstream

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Photo 31: 9Wet Downstream

Photo 32: 9Wet Soil Profile

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Photo 33: 9Out Soil Profile

Photo 34: 10Wet Upstream

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Photo 35: 10Wet Downstream

Photo 36: 10Wet Soil Profile

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Photo 37: 10aWet Upstream

Photo 38: 10aWet Downstream

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Photo 39: 10aWet Soil Profile

Photo 40: 10Out Soil Profile

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Photo 41: 11Wet Upstream

Photo 42: 11Wet Downstream

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Photo 43: 11Wet Soil Profile

Photo 44: 11Out Soil Profile

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Photo 45: 12Wet Upstream

Photo 46: 12Wet Downstream

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Photo 47: 12Wet Soil Profile

Photo 48: 12Out Soil Profile

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Photo 49: 13Wet Upstream

Photo 50: 13Wet Downstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 51: 13Wet Soil Profile

Photo 52: 13Out Soil Profile

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Photo 53: 15Wet Upstream

Photo 54: 15Wet Downstream

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Photo 55: 15Wet Soil Profile

Photo 56: 15Out Soil Profile

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Photo 57: 40Out General

Photo 58: 41Wet Upstream

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Photo 59: 41Wet Downstream

Photo 60: 42Wet Upstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 61: 42Wet Downstream

Photo 62: 42Wet Soil Profile

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Photo 63: 42Out Soil Profile

Photo 64: 17Wet Upstream

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Photo 65: 17Wet Downstream

Photo 66: 17Wet Soil Profile

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Photo 67: 17Out Soil Profile

Photo 68: 18Wet Upstream

TFN 6 2/025
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Photo 69: 18Wet Downstream

Photo 70: 18Wet Soil Profile

TFN 6 2/025
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Photo 71: 18aWet Upstream

Photo 72: 18aWet Downstream

TFN 6 2/025
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Photo 73: 18aWet Soil Profile

Photo 74: 18Out Soil Profile

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Photo 75: 19Wet Upstream

Photo 76: 19Wet Downstream

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Photo 77: 19Wet Soil Profile

Photo 78: 19Out Soil Profile

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Photo 79: 20Out Upstream

Photo 80: 20Out Downstream

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RECD NOV 14, 2014

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Photo 81: 20Out Soil Profile

Photo 82: 21Wet Upstream

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Photo 83: 21Wet Downstream

Photo 84: 21Wet Soil Profile

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Photo 85: 22Wet Upstream

Photo 86: 22Wet Downstream

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Photo 87: 22Wet Soil Profile

Photo 88: 22Out Soil Profile

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Photo 89: 23Wet Upstream

Photo 90: 23Wet Downstream

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Photo 91: 23Wet Soil Profile

Photo 92: 23Out Soil Profile

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Photo 93: 24Wet Upstream

Photo 94: 24Wet Downstream

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Photo 95: 24Wet Soil Profile

Photo 96: 24Out Soil Profile

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Photo 97: 25Out Upstream

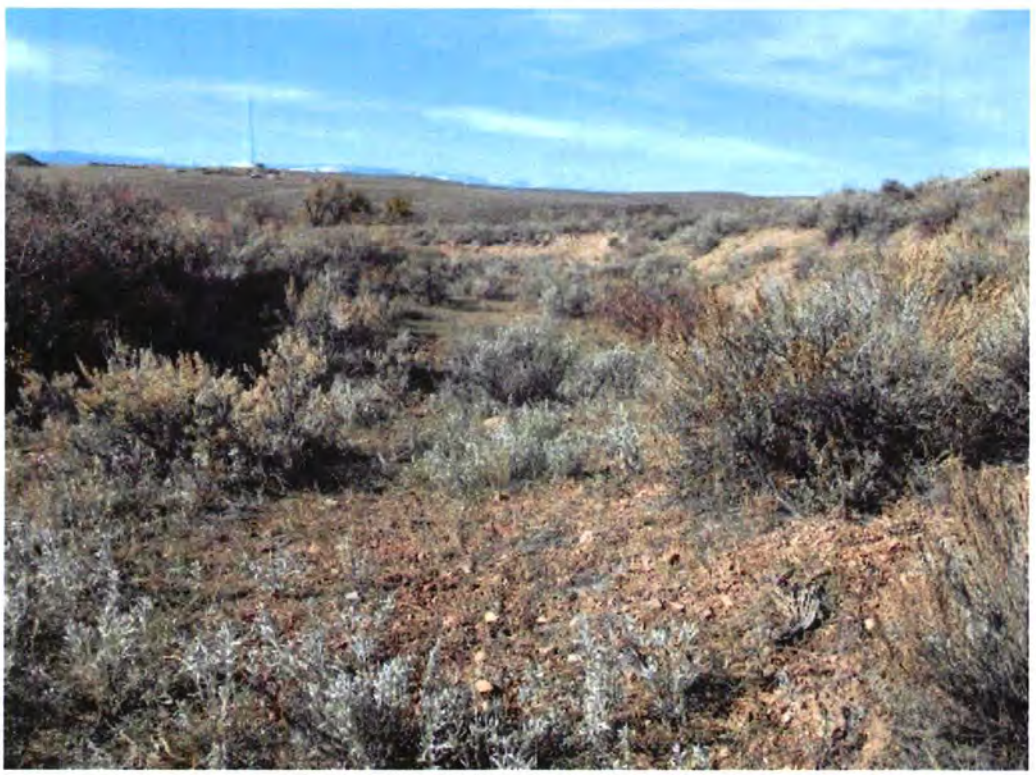

Photo 98: 25Out Downstream

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Photo 99: 25Out Soil Profile

Photo 100: 26Wet Upstream

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Photo 101: 26Wet Downstream

Photo 102: 26Wet Soil Profile

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Photo 103: 26Out Soil Profile

Photo 104: 27Wet Upstream

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Photo 105: 27Wet Downstream

Photo 106: 27Wet Soil Profile

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Photo 107: 27Out Soil Profile

Photo 108: 28Out Upstream

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Photo 109: 28Out Downstream

Photo 110: 28Out Soil Profile

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Photo 111: 29Out Upstream

Photo 112: 29Out Downstream

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Photo 113: 29Out Soil Profile

Photo 114: 30Wet Upstream

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Photo 115: 30Wet Downstream

Photo 116: 30Wet Soil Profile

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Photo 117: 24Wet Downstream

Photo 118: 31Out Upstream

TFN 6 2/025
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Photo 119: 31Out Downstream

Photo 120: 31Out Soil Profile

TFN 6 2/025
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Photo 121: 32Wet Upstream

Photo 122: 32Wet Downstream

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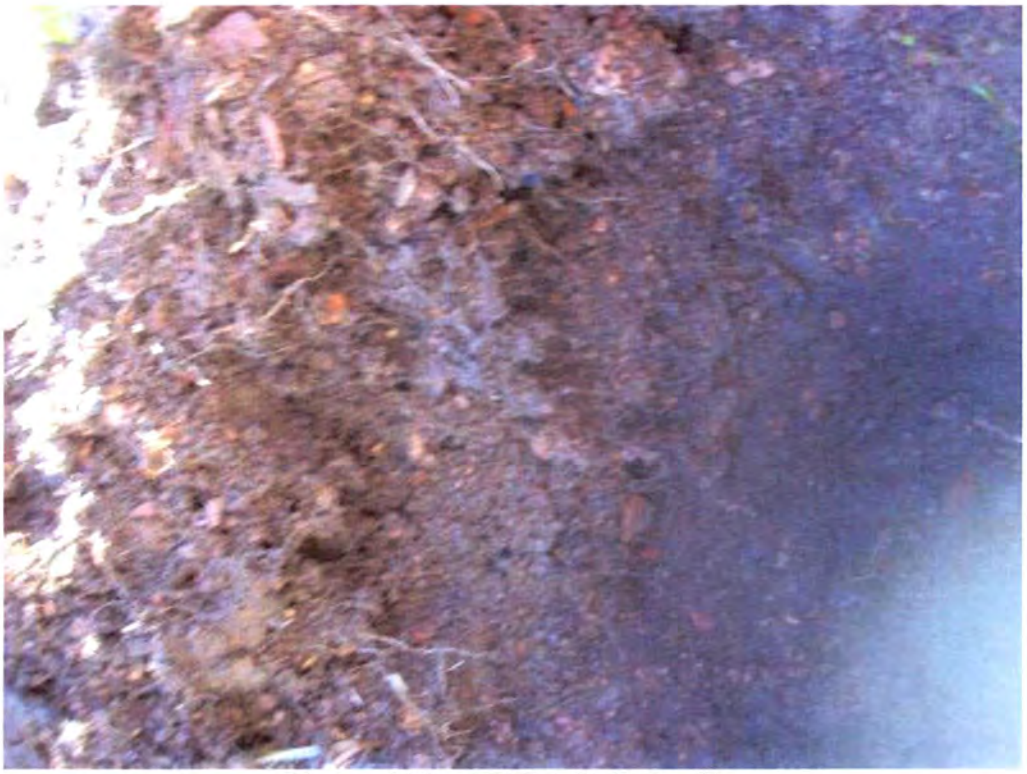

Photo 123: 32Wet Soil Profile

Photo 124: 32Wet Soil Profile

TFN 6 2/025
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Photo 125: 33Wet Upstream

Photo 126: 33Wet Downstream

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RECD NOV 14, 2014

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Photo 127: 33Wet Soil Profile

Photo 128: 33Out Soil Profile

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Photo 129: 34Wet Upstream

Photo 130: 34Wet Downstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 131: 34Wet Soil Profile

Photo 132: 34Out Soil Profile

TFN 6 2/025
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Photo 133: 35Wet Upstream

Photo 134: 35Wet Downstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 135: 35Wet Soil Profile

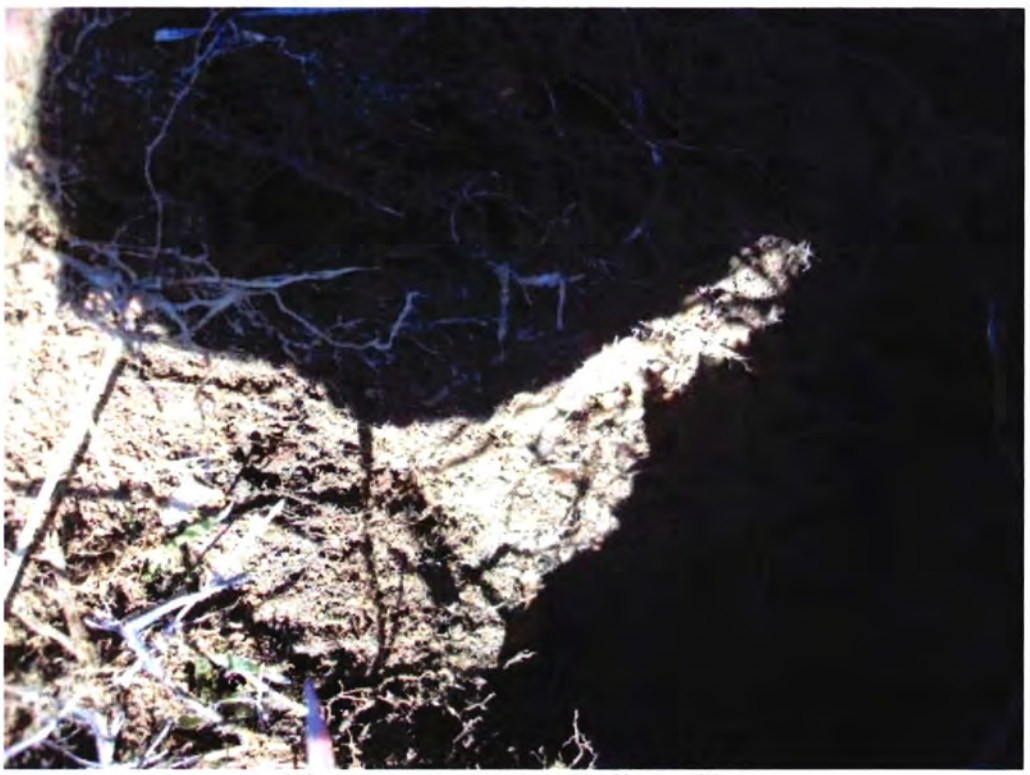

Photo 136: 35Out Soil Profile

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Photo 137: 36Wet Upstream

Photo 138: 36Wet Downstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 139: 36Wet Soil Profile

Photo 140: 36Out Soil Profile

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Photo 141: 37Out Upstream

Photo 142: 37Out Downstream

TFN 6 2/025
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Photo 143: 37Out Soil Profile

Photo 144: 38Wet Upstream

TFN 6 2/025
RECD NOV 14, 2014

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Photo 145: 38Wet Downstream

Photo 146: 38Wet Soil Profile

TFN 6 2/025
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Photo 147: 38Out Soil Profile

Photo 148: 39Wet Upstream

TFN 6 2/025
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Photo 149: 39Wet Downstream

Photo 150: 39Wet Soil Profile

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Photo 151: 39Out Soil Profile

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ATTACHMENT D10-1-E

Wetland Determination Data Forms
Great Plains Region (Version 2.0)

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 1OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 10, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9272825745 Long: -107.110878861 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P4-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Gutierrezia sarothre*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	35	Yes	FACU
2. *Poa secunda*	10	No	FACU
3. *Taraxacum officinale*	8	No	FACU
4. *Achillea millefolium*	7	No	FACU
5.			
6.			
7.			
8.			
	60 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 30			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	60	x 4 =	240
UPL species	10	x 5 =	50
Column Totals:	70 (A)		290 (B)

Prevalence Index = B/A = 4.1

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 1OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/2	100					Clay loam	
4-9	10YR 3/2	100					Clay loam	
9-14	10YR 5/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: Compacted layer
Depth (inches): 14"

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches):	
Water Table Present?	Yes____	No X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches):	

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 1WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 10, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9272089679 Long: -107.110964867 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: R6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes X	No			

Remarks: P1-UP, P2-DOWN, P3-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia ludoviciana*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Glycyrrhiza lepidota*	15	No	FACU
2. *Pascopyrum smithii*	60	Yes	FACU
3. *Rumex crispus*	10	No	FAC
4. *Taraxacum officinale*	10	No	FACU
5. *Achillea millefolium*	5	No	FACU
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 0			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	90	x 4 =	360
UPL species	10	x 5 =	50
Column Totals:	110 (A)		440 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 1WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	100					Clay loam	
6-10	10YR 3/2	100					Sandy clay loam	
10-20	10YR 4/2	95	5YR 5/6	5	C	PL	Sandy clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	10-12"
Water Table Present?	Yes ___	No X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available.

Remarks:
Water in channel not flowing. Likely from recent snow melt.

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 2OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 10, T57N R83W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 5-10%

Subregion (LRR): Western Great Plains Lat: 44.926635017 Long: -107.100109534 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P8 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia tridentata*	15	Yes	UPL
2. *Ericameria nauseosa*	15	Yes	UPL
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa secunda*	15	Yes	FACU
2. *Bromus arvensis*	5	No	FACU
3. *Equisetum laevigatum*	10	Yes	FAC
4.			
5.			
6.			
7.			
8.			
	30 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 40

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	20	x 4 =	80
UPL species	30	x 5 =	150
Column Totals:	60 (A)		260 (B)

Prevalence Index = B/A = 4.33

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 2OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-6	10YR 5/3	100					Clay loam	
6-20	10YR 4/2	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes____ No X Depth (inches): ____
Water Table Present? Yes____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes____ No X Depth (inches): ____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 2WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 10, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.926881403 Long: -107.09992844 Datum: NAD 1983 HARM

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: PEMh & PABh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
P5 - Upstream, P6 - Downstream, P7 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Hordeum jubatum*	20	No	FACW
2. *Rumex crispus*	10	No	FAC
3. *Convolvulus arvensis*	10	No	UPL
4. *Juncus balticus*	70	Yes	FACW
5.			
6.			
7.			
8.			
	110 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	90	x 2 =	180
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	110 (A)		260 (B)

Prevalence Index = B/A = 2.36

Hydrophytic Vegetation Indicators:

- ____ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- ____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 2WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 4/1	70	7.5YR 5/6	30	C	PL	Clay loam	
7-20	10YR 3/2	95	10YR 6/8	5	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- X Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	6"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:
Water much deeper in reservoir.

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 3OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 3-7%

Subregion (LRR): Western Great Plains Lat: 44.9219938133 Long: -107.089106939 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P12 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²-)			
1. *Artemisia tridentata*	25	Yes	UPL
2. *Opuntia polyacantha*	20	Yes	UPL
3.			
4.			
5.			
	45 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus tectorum*	30	Yes	UPL
2. *Pascopyrum smithii*	20	Yes	FACU
3. *Poa pratensis*	15	Yes	FACU
4. *Bassia sieveriana*	3	No	UPL
5.			
6.			
7.			
8.			
	68 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	78	x 5 =	390
Column Totals:	113 (A)		530 (B)

Prevalence Index = B/A = 4.7

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 3OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-6	10YR 4/2	100					Clay loam	
5-20	10YR 4/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes_____	No__X__	Depth (inches): _____
Water Table Present?	Yes_____	No__X__	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes_____	No__X__	Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 3WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9219682155 Long: -107.089029986 Datum: NAD 1938 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: **Dammed upstream**
P9 - Upstream, P10 - Downstream, P11 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Carex nebrascensis*	95	Yes	OBL
2. *Juncus balticus*	2	No	FACW
3. *Machaeranthera canescens*	3	No	UPL
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	95	x 1 =	95
FACW species	2	x 2 =	4
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	3	x 5 =	15
Column Totals:	100 (A)		114 (B)

Prevalence Index = B/A = 1.14

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 3WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/2	90	5YR 4/6	10	C	PL	Silt loam	
5-20	2.5Y 5/1	85	7.5YR 4/6	15	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- X Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- X Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	5"
Water Table Present?	Yes X	No ___	Depth (inches):	10"
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 4OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 0-3%

Subregion (LRR): Western Great Plains Lat: 44.9215535347 Long: -107.089231939 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
No photo of Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Elymus lanceolatus*	50	Yes	FACU
2. *Poa pratensis*	40	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	90	x 4 =	360
UPL species	0	x 5 =	0
Column Totals:	90 (A)		360 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 4OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-7	10YR 4/2	100					Clay loam	
7-20	10YR 5/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	____
Water Table Present?	Yes ____	No X	Depth (inches):	____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches):	____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 4WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Shore Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9215629819 Long: -107.089321336 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: PABh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation Yes, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: **Heavily grazed. Dammed upstream. Sampled area is a wetland. Vegetation is problematic due to overgrazing.**
P13 - Upstream, P14 - Downstream, P15 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Convolvulus arvensis*	20	Yes	UPL
2. *Elymus elymoides*	50	Yes	UPL
3. *Medicago sativa*	20	Yes	UPL
4.			
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	90	x 5 =	450
Column Totals:	90 (A)		450 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- X Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:
Problematic Hydrophytic Vegetation due to overgrazing resulting in decreased hydrophytic and increased upland species.

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SOIL Sampling Point: 4WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 5/2	100					Clay loam	
8-20	10YR 4/2	80	7.5YR 4/8	20	C	PL	Sandy clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>1
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:
Much deeper water in reservoir.

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 5OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Toeslope Local relief (concave, convex, none): Concave Slope (%): 25%

Subregion (LRR): Western Great Plains Lat: 44.9225931902 Long: -107.087836248 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation Yes, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P19 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²)			
1. *Rhus trilobata*	50	Yes	UPL
2.			
3.			
4.			
5.			
	50 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Bromus arvensis*	75	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 1

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	50	x 5 =	250
Column Totals:	125 (A)		550 (B)

Prevalence Index = B/A = 4.4

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 5OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	100					Clay loam	
12-20	2.5Y 5/2	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 5WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Ephemeral stream bottom Local relief (concave, convex, none): Concave Slope (%): 0%

Subregion (LRR): Western Great Plains Lat: 44.922636781 Long: -107.087913852 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: Off-channel reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: **Vegetation on west side of pond is bare. Soils disturbed by excessive grazing. Hydrology disturbed by dam.**
P16 - Upstream, P17 - Downstream, P18 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²)			
1. *Populus deltoides*	10	Yes	FAC
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Bromus arvensis*	50	Yes	FACU
2. *Agropyron cristatum*	45	Yes	UPL
3. *Rumex crispus*	5	No	FAC
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 0			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 33 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	50	x 4 =	200
UPL species	45	x 5 =	225
Column Totals:	110 (A)		470 (B)

Prevalence Index = B/A = 4.27

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 5WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 6/2	93	5YR 5/8	7	C	PL	Clay loam	
6-20	10YR 6/2	70	5YR 4/6	30	C	PL	Clay loam/Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- X Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	5"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 6OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9208950181 Long: -107.087660683 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P23 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²)			
1. *Populus deltoides*	10	Yes	FAC
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Poa pratensis*	75	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 2

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	85 (A)		330 (B)

Prevalence Index = B/A = 3.88

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks: ***Populus deltoids*** **present above channel.**

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SOIL Sampling Point: 6OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100					Loam	
2-5	10YR 5/2	100					Clay loam	
5-20	10YR 5/2	70	10YR 3/6	30	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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TFN 6 2/025
RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 6WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9209233956 Long: -107.087585689 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: R6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
P20 - Upstream, P21 - Downstream, P22 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa pratensis*	20	Yes	FACU
2. *Elymus elymoides*	55	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 7

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	20	x 4 =	80
UPL species	55	x 5 =	275
Column Totals:	75 (A)		355 (B)

Prevalence Index = B/A = 4.73

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 6WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 5/2	90	10YR 5/4	10	C	PL	Clay loam	
16-20	10YR 3/1	97	10YR 5/8	3	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	0"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0-8"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 7OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9185089023 Long: -107.088676522 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P25 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Agropyron cristatum*	50	Yes	UPL
2. *Pascopyrum smithii*	25	Yes	FACU
3. *Medicago sativa*	3	No	UPL
4.			
5.			
6.			
7.			
8.			
	78 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 6

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	25	x 4 =	100
UPL species	53	x 5 =	265
Column Totals:	78 (A)		365 (B)

Prevalence Index = B/A = 4.67

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 7OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y 6/1	70	7.5YR 6/8	30	C	PL	Clay	
8-20	2.5Y 2.5/1	100					Clay loam	Coal fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 7WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Basin Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9185589401 Long: -107.088893724 Datum:

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: **Trampled by cattle**
P24 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Juncus interior*	35	Yes	FACW
2. *Pascopyrum smithii*	30	Yes	FACU
3. *Rumex crispus*	5	No	FAC
4.			
5.			
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 12

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	35	x 2 =	70
FAC species	5	x 3 =	15
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	70 (A)		205 (B)

Prevalence Index = B/A = 2.93

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 7WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 6/1	75	10YR 5/8	25	C	PL	Clay	
4-20	10YR 5/2	95	10YR 5/8	5	C	PL	Clay	Alluvial coal seam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>1"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0-20"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 8OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 15-20%

Subregion (LRR): Western Great Plains Lat: 44.9183044145 Long: -107.087060038 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P29-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Ericameria nauseosa*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Agropyron cristatum*	50	Yes	UPL
2. *Pascopyrum smithii*	10	No	FACU
3. *Achillea millefolium*	20	Yes	FACU
4. *Alyssum desertorum*	5	No	UPL
5. *Elymus lanceolatus*	5	No	FACU
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	65	x 5 =	325
Column Totals:	100 (A)		465 (B)

Prevalence Index = B/A = 4.65

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 8OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-14	2.5Y 3/1	100					Clay	
14-20	2.5Y 4/1	85	5Y 5/1	15	C	M	Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:
Soils moist throughout profile

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 8WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9184326743 Long: -107.086937984 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P26-UP, P27-DOWN, P28-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa pratensis*	20	Yes	FACU
2. *Hordeum jubatum*	20	Yes	FACW
3. *Schoenoplectus maritimus*	17	No	OBL
4. *Carex nebrascensis*	40	Yes	OBL
5. *Carex prairea*	2	No	OBL
6. *Rumex crispus*	1	No	FAC
7. *Sporobolus airoides*	5	No	FAC
8.			
	105 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 2			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 66 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	59	x 1 =	59
FACW species	20	x 2 =	40
FAC species	6	x 3 =	18
FACU species	20	x 4 =	80
UPL species		x 5 =	
Column Totals:	105 (A)		197 (B)

Prevalence Index = B/A = 1.88

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 8 WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	5Y 4/1	70	5YR 4/6	30	C	M	Clay loam	
8-9	2.5Y 2.5/1	100					Clay loam	Mucky material
9-12	2.5Y 2.5/1	100					Clay loam	Coarse fragments
12-16	2.5Y 2.5/1	85	5YR 4/6	15	C	PL	Clay loam	Coal throughout
16-20	5Y 3/1						Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:
Lots of coarse fragment.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-3"	
Water Table Present?	Yes ___	No X	Depth (inches):	___	
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	6-8"	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:
Point taken at developed spring.

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 9OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10-15%

Subregion (LRR): Western Great Plains Lat: 44.9166442005 Long: -107.08431398 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P33-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²)			
1. *Ericameria nauseosa*	20	Yes	UPL
2. *Artemisia tridentata*	5	No	UPL
3. *Rosa woodsii*	5	No	FACU
4. *Gutierrezia sarothrae*	5	No	UPL
5.			
	35 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Pascopyrum smithii*	10	Yes	FACU
2. *Poa secunda*	10	Yes	FACU
3. *Achillea millefolium*	15	Yes	FACU
4. *Elymus lanceolatus*	5	No	FACU
5. *Agropyron cristatum*	5	No	UPL
6.			
7.			
8.			
	45 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 20			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	45	x 4 =	180
UPL species	35	x 5 =	175
Column Totals:	80 (A)		355 (B)

Prevalence Index = B/A = 4.44

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 9OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					Clay loam	
3-10	7.5YR 5/8	100					Clay loam	
10-20	2.5Y 5/2	100					Clay	Blocky structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 9WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 5-10%

Subregion (LRR): Western Great Plains Lat: 44.9168176691 Long: -107.084180889 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-KISHONA-CAMBRIA COMPLEX, 6 TO 15 PERCENT SLOPES NWI classification: PEMh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P30-UP, P31-DOWN, P32-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Xanthium strumarium*	70	Yes	FAC
2. *Rumex crispus*	5	No	FAC
3. *Hordeum jubatum*	5	No	FACW
4. *Taraxacum officinale*	2	No	FACU
5.			
6.			
7.			
8.			
	82 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 20			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	75	x 3 =	225
FACU species	2	x 4 =	8
UPL species	0	x 5 =	0
Column Totals:	82 (A)		243 (B)

Prevalence Index = B/A = 2.96

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 9WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	7.5YR 4/1	90	5YR 4/3	10	C	M	Clay	
6-9	7.5YR 4/1	95	7.5YR 5/8	5	C	PL	Clay	Coarse fragments
9-20	10YR 5/2	90	2.5Y 2.5/1	10	C	M	Sandy clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- X Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	___
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 10OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 11, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-1%

Subregion (LRR): Northern Great Plains Lat: 44.9271261429 Long: -107.080169342 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-SAMDAY CLAY LOAMS, 6 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P40-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Ericameria nauseosa*	10	Yes	UPL
2. *Gutierrezia sarothre*	10	Yes	UPL
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	60	Yes	FACU
2. *Phlox hoodii*	5	No	UPL
3. *Bromus tectorum*	2	No	UPL
4. *Polypogon monspeliensis*	5	No	FACW
5.			
6.			
7.			
8.			
	72 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 8

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	60	x 4 =	240
UPL species	27	x 5 =	135
Column Totals:	92 (A)		385 (B)

Prevalence Index = B/A = 4.18

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 10OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-4	10YR 3/2	100					Clay loam	
4-9	7.5YR 3/1	100					Clay	
9-15	2.5Y 4/1	100					Clay loam	
15-20	2.5Y 5/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 10WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 11, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9279300263 Long: -107.080020961 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-SAMDAY CLAY LOAMS, 6 TO 60 PERCENT SLOPES NWI classification: PUB

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P34-UP, P35-DOWN, P36-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Hordeum jubatum*	20	Yes	FACW
2. *Rumex crispus*	10	Yes	FAC
3. *Cirsium arvense*	5	No	FACU
4. *Juncus balticus*	5	No	FACW
5. *Convolvulus arvensis*	2	No	UPL
6.			
7.			
8.			
	42 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 60

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	25	x 2 =	50
FAC species	10	x 3 =	30
FACU species	5	x 4 =	20
UPL species	2	x 5 =	10
Column Totals:	42 (A)		110 (B)

Prevalence Index = B/A = 2.62

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 10WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 4/2	100					Clay loam	
2-4	5Y 5/2	100					Clay loam	
4-18	Gley 5/N	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:
Lots of rock at surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>12"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 10aWET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 11, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 2-8%

Subregion (LRR): Western Great Plains Lat: 44.927235938 Long: -107.080566133 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-SAMDAY CLAY LOAMS, 6 TO 60 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P37-UP, P38-DOWN, P39-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Hordeum jubatum*	75	Yes	FACW
2. *Rumex crispus*	5	No	FAC
3. *Convolvulus arvensis*	5	No	UPL
4. *Potentilla recta*	3	No	UPL
5. *Chenopodium album*	2	No	FACU
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	75	x 2 =	150
FAC species	5	x 3 =	15
FACU species	2	x 4 =	8
UPL species	8	x 5 =	40
Column Totals:	90 (A)		213 (B)

Prevalence Index = B/A = 2.37

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 10aWET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-2	2.5Y 4/2	100					Clay loam	
2-4	5Y 5/2	100					Clay loam	
4-18	Gley 5/N	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 11OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 11, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 10%

Subregion (LRR): Northern Great Plains Lat: 44.9232418125 Long: -107.074973393 Datum: NAD 1983 HARN

Soil Map Unit Name: WORFKA-SHINGLE-SAMDAY COMPLEX, 6 TO 30 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P44-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²)			
1. *Artemisia tridentata*	20	Yes	UPL
2.			
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1 *Pascopyrum smithii*	20	Yes	FACU
2. *Grindelia squarrosa*	10	No	UPL
3. *Taraxacum officinale*	10	No	FACU
4. *Gaura coccinea*	15	Yes	UPL
5. *Achillea millefolium*	15	Yes	FACU
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	45	x 4 =	180
UPL species	45	x 5 =	225
Column Totals:	90 (A)		405 (B)

Prevalence Index = B/A = 4.5

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 11OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-12	7.5YR 3/1	100					Clay loam	
12-16	5Y 6/1	95	5YR 6/2	5	C	PL	Clay	
16-20	7.5YR 3/2	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 11WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 11, T57N, R85W

Landform (hillslope, terrace, etc.): Spring/Drainage Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Northern Great Plains Lat: 44.9233050156 Long: -107.074962998 Datum: NAD 1983 HARN

Soil Map Unit Name: WORFKA-SHINGLE-SAMDAY COMPLEX, 6 TO 30 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P41-UP, P42-DOWN, P43-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Polypogon monspeliensis*	10	No	FACW
2. *Schoenoplectus maritimus*	10	No	OBL
3. *Schoenoplectus pungens*	10	No	OBL
4. *Bromus inermis*	5	No	UPL
5. *Carex nebrascensis*	70	Yes	OBL
6. *Hordeum jubatum*	10	No	FACW
7.			
8.			
	115 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	90	x 1 =	90
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	115 (A)		155 (B)

Prevalence Index = B/A = 1.35

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 11WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5Y 4/1	100					Clay	
2-5	2.5YR 3/2	60	5YR 5/8	40	C	PL	Clay loam	
5-12	2.5Y 6/1	75	5YR 5/6	25	C	PL	Clay loam	
12-20	5Y 3/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2"	
Water Table Present?	Yes ___	No X	Depth (inches):	___	
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0-20"	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 12OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9189543596 Long: -107.071144706 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P48 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Pascopyrum smithii*	7	Yes	FACU
2. *Grindelia squarrosa*	5	Yes	UPL
3. *Achillea millefolium*	1	No	FACU
4. *Juncus balticus*	3	No	FACW
5.			
6.			
7.			
8.			
	16 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 55

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	3	x 2 =	6
FAC species	0	x 3 =	0
FACU species	8	x 4 =	32
UPL species	5	x 5 =	25
Column Totals:	16 (A)		63 (B)

Prevalence Index = B/A = 3.94

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 12OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-4	10YR 3/1	100					Clay loam	
4-15	2.5Y 3/1	100					Clay loam	
15-20	10YR 6/3	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 12WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9189273711 Long: -107.071143736 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: PABh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
P45 - Upstream, P46 - Downstream, P47 - Soil Profile
Hydrology disturbed due to dam.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Xanthium strumarium*	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 90

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	10 (A)		30 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:
Salix spp. present around reservoir.

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SOIL Sampling Point: 12WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/2	95	7.5YR 4/6	5	C	PL	Clay loam	
5-20	10YR 4/2	90	7.5YR 5/8	10	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	10-12"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 13OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 10%

Subregion (LRR): Western Great Plains Lat: 44.9171083777 Long: -107.072167949 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P52 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa secunda*	35	Yes	FACU
2. *Bassia scoparia*	3	No	FACU
3. *Sphaeralcea coccinea*	0.5	No	UPL
4.			
5.			
6.			
7.			
8.			
	38.5 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 40			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	38	x 4 =	152
UPL species	0.5	x 5 =	2.5
Column Totals:	38.5 (A)		154.5 (B)

Prevalence Index = B/A = 4.01

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 13OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 6/4	100					Loam	
6-20	2.5Y 5/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches):	____
Water Table Present?	Yes____	No X	Depth (inches):	____
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches):	____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 13WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 14, T57N, R85W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9171916413 Long: -107.072044247 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: PEMh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
Hydrology disturbed by dam upstream of point.
P49 - Upstream, P50 - Downstream, P51 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Schoenoplectus acutus*	30	Yes	OBL
2. *Carex nebrascensis*	60	Yes	OBL
3. *Juncus balticus*	25	Yes	FACW
4. *Potamogeton foliosus*	5	No	OBL
5.			
6.			
7.			
8.			
	120 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	95	x 1 =	95
FACW species	25	x 2 =	50
FAC species	0	x 3 =	
FACU species	0	x 4 =	
UPL species	0	x 5 =	
Column Totals:	120 (A)		145 (B)

Prevalence Index = B/A = 1.21

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 13WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-3	Gley 2 5/N	100			RM		Silt loam	On horizon saturated
3-20	2.5Y 5/2	60	Gley 2 5/10B	40	D	M	Silt loam	Mineral soil

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- X Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	10"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	20"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 14OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9156470232 Long: -107.071342581 Datum: NAD 1983 HARN

Soil Map Unit Name: KISHONA-CAMBRIA COMPLEX, 3 TO 6 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
No photos

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1 m²-)			
1. *Artemisia frigida*	5	Yes	UPL
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 1 m²)			
1. *Poa pratensis*	45	Yes	FACU
2. *Medicago sativa*	2	No	UPL
3. *Taraxacum officinale*	1	No	FACU
4.			
5.			
6.			
7.			
8.			
	48 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 15

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	46	x 4 =	184
UPL species	7	x 5 =	35
Column Totals:	53 (A)		219 (B)

Prevalence Index = B/A = 4.13

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, u nless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 14OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	5Y 5/2	100					Clay loam	
4-16	2.5Y 6/1	90	2.5Y 5/6	10	C	PL	Clay loam	
16-20	2.5Y 6/3	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 14WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Basin between two dams Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9156283417 Long: -107.071379917 Datum: NAD 1983 HARN

Soil Map Unit Name: KISHONA-CAMBRIA COMPLEX, 3 TO 6 PERCENT SLOPES NWI classification: PEMh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
Dammed upstream and downstream
No photos

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Taraxacum officinale*	30	Yes	FACU
2. *Carex nebrascensis*	30	Yes	OBL
3. *Elymus elymoides*	15	Yes	UPL
4.			
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 30

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 33 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	15	x 5 =	75
Column Totals	75 (A)		225 (B)

Prevalence Index = B/A = 3.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 14WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	2.5Y 6/2	80	10YR 7/6	20	C	PL	Clay loam	
12-20	2.5Y 6/3	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- X Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	3-6
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 15OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 5-8%

Subregion (LRR): Western Great Plains Lat: 44.9141110855 Long: -107.063698685 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P56-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia tridentata*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	50	Yes	FACU
2. *Poa secunda*	10	No	FACU
3. *Alyssum desertorum*	3	No	UPL
4. *Bromus tectorum*	5	No	UPL
5. *Bromus arvensis*	2	No	FACU
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 20

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	62	x 4 =	248
UPL species	18	x 5 =	90
Column Totals:	80 (A)		338 (B)

Prevalence Index = B/A = 4.23

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 15OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/2	100					Clay loam	
3-13	5YR 4/3	100					Clay loam	
13-20	5YR 4/4	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes_____ No__X__ Depth (inches): _____
Water Table Present? Yes_____ No__X__ Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes_____ No__X__ Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 15WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-5%

Subregion (LRR): Western Great Plains Lat: 44.9141286202 Long: -107.063724651 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Off-channel reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P53-UP, P54-DOWN, P55-SOIL PROFILE
Dammed reservoir

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia ludoviciana*	15	Yes	UPL
2.			
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Grindelia squarrosa*	40	Yes	UPL
2. *Convolvulus arvensis*	13	Yes	UPL
3. *Pascopyrum smithii*	2	No	FACU
4.			
5.			
6.			
7.			
8.			
	55 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 30

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	2	x 4 =	8
UPL species	68	x 5 =	340
Column Totals:	70 (A)		348 (B)

Prevalence Index = B/A = 4.97

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 15WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/2	80	5YR 4/6	20	C	PL	Clay loam	
4-10	10YR 4/2	90	5YR 4/6	10	C	PL	Clay loam	
10-14	7.5YR 4/3	100					Clay	
14-20	5YR 4/4	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:
GLASS SHARDS IN SOIL PROFILE AND ON SURFACE SURROUNDING AREA.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>12"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 17OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0%

Subregion (LRR): Western Great Plains Lat: 44.9256982155 Long: -107.066103114 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P 67-SOIL

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia cana*	15	Yes	FACU
2. *Artemisia frigida*	5	Yes	FACU
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	65	Yes	FACU
2. *Taraxacum officinale*	10	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	95	x 4 =	380
UPL species	0	x 5 =	0
Column Totals:	95 (A)		380 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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US Army Corps of Engineers
SOIL

Great Plains – Version 2.0
Sampling Point: 17OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					Clay loam	
3-11	10YR 5/2	100					Clay loam	
11-20	10YR 5/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes_____	No__X__	Depth (inches):	_____
Water Table Present?	Yes_____	No__X__	Depth (inches):	_____
Saturation Present? (includes capillary fringe)	Yes_____	No__X__	Depth (inches):	_____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 17WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0%

Subregion (LRR): Western Great Plains Lat: 44.925815681 Long: -107.066576172 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P64-UP, P65-DOWN, P66-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Carex nebrascensis*	45	Yes	OBL
2. *Hordeum jubatum*	20	Yes	FACW
3. *Distichlis spicata*	30	Yes	FACW
4. *Chenopodium album*	3	No	FACU
5.			
6.			
7.			
8.			
	98 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 2

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column Totals:	98 (A)		157 (B)

Prevalence Index = B/A = 1.6

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL — Sampling Point: 17WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	2.5Y 4/1	60	5YR 4/6	40	C	PL	Clay loam	
4-14	5Y 5/1	75	5YR 4/6	25	C	PL	Clay loam	CaCO3
14-20	5Y 6/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- X Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2"
Water Table Present?	Yes ___	No X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 18OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10%

Subregion (LRR): Western Great Plains Lat: 44.9246281852 Long: -107.066533579 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P74-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m² -)			
1. *Symphoricarpos occidentalis*	10	Yes	UPL
2. *Artemisia tridentata*	15	Yes	UPL
3.			
4.			
5.			
	25 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Taraxacum officinale*	10	No	FACU
2. *Pascopyrum smithii*	45	Yes	FACU
3. *Achillea millefolium*	15	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	0	x 2 =	
FAC species	0	x 3 =	
FACU species	70	x 4 =	280
UPL species	25	x 5 =	125
Column Totals:	95 (A)		405 (B)

Prevalence Index = B/A = 4.26

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is $\leq 3.0^1$
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 18OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					Clay loam	
3-8	10YR 5/2	100					Clay loam	
8-20	2.5Y 4/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 18WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Below dam Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9245524915 Long: -107.066239425 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P68-UP, P69-DOWN, P70-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Carex nebrascensis*	80	Yes	OBL
2. *Juncus balticus*	10	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		100 (B)

Prevalence Index = B/A = 1.11

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point 18WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	5Y 3/1	90	2.5YR 3/6	10	C	PL	Clay loam	
4-8	Gley 3/N	80	Gley 2.5/5PB	15	D	M	Clay loam	
			10YR 4/6	5	C	PL	Clay loam	
8-20	5Y 4/1	95	2.5YR 3/6	5	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- X Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2"
Water Table Present?	Yes X	No ___	Depth (inches):	18"
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0-20"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 18aWET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9249104473 Long: -107.065859451 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P71-UP, P72-DOWN, P73-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Carex nebrascensis*	80	Yes	OBL
2. *Hordeum jubatum*	15	No	FACW
3. *Convolvulus arvensis*	5	No	UPL
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	15	x 2 =	30
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	100 (A)		135 (B)

Prevalence Index = B/A = 1.35

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:
***Schoenoplectus maritimus* present in water.**

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SOIL Sampling Point: 18aWET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	2.5Y 4/1	70	5YR 5/6	30	C	PL	Clay loam	
7-12	5Y 2.5/1	90	5YR 5/8	10	C	PL	Clay loam	
12-20	2.5Y 3/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- X Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>24"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 19OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 5-10%

Subregion (LRR): Western Great Plains Lat: 44.9283884649 Long: -107.062195218 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P78-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Gutierrezia sarothre*	20	Yes	UPL
2.			
3.			
4.			
5.			
	20 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	20	Yes	FACU
2. *Trifolium pratense*	10	No	FACU
3. *Agropyron cristatum*	25	Yes	UPL
4. *Bromus arvensis*	5	No	FACU
5. *Sphaeralcea coccinea*	8	No	UPL
6. *Alyssum desertorum*	2	No	UPL
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	0	x 2 =	
FAC species	0	x 3 =	
FACU species	35	x 4 =	140
UPL species	55	x 5 =	275
Column Totals:	90 (A)		415 (B)

Prevalence Index = B/A = 4.61

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 19OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-8	10YR 4/2	100					Clay loam	
8-16	10YR 5/4	100					Clay loam	
16-20	10YR 6/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- _____ Histosol (A1)
- _____ Histic Epipedon (A2)
- _____ Black Histic (A3)
- _____ Hydrogen Sulfide (A4)
- _____ Stratified Layers (A5) **(LRR F)**
- _____ 1 cm Muck (A9) **(LRR F, G, H)**
- _____ Depleted Below Dark Surface (A11)
- _____ Thick Dark Surface (A12)
- _____ Sandy Mucky Mineral (S1)
- _____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- _____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- _____ Sandy Gleyed Matrix (S4)
- _____ Sandy Redox (S5)
- _____ Stripped Matrix (S6)
- _____ Loamy Mucky Mineral (F1)
- _____ Loamy Gleyed Matrix (F2)
- _____ Depleted Matrix (F3)
- _____ Redox Dark Surface (F6)
- _____ Depleted Dark Surface (F7)
- _____ Redox Depressions (F8)
- _____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- _____ 1 cm Muck (A9) **(LRR I, J)**
- _____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- _____ Dark Surface (S7) **(LRR G)**
- _____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- _____ Reduced Vertic (F18)
- _____ Red Parent Material (TF2)
- _____ Very Shallow Dark Surface (TF12)
- _____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes _____ No X

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- _____ Surface Water (A1)
- _____ High Water Table (A2)
- _____ Saturation (A3)
- _____ Water Marks (B1)
- _____ Sediment Deposits (B2)
- _____ Drift Deposits (B3)
- _____ Algal Mat or Crust (B4)
- _____ Iron Deposits (B5)
- _____ Inundation Visible on Aerial Imagery (B7)
- _____ Water-Stained Leaves (B9)
- _____ Salt Crusts (B11)
- _____ Aquatic Invertebrates (B13)
- _____ Hydrogen Sulfide Odor (C1)
- _____ Dry-Season Water Table (C2)
- _____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- _____ Presence of Reduced Iron (C4)
- _____ Thick Muck Surface (C7)
- _____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- _____ Surface Soil Cracks (B6)
- _____ Sparsely Vegetated Concave Surface (B8)
- _____ Drainage Patterns (B10)
- _____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Geomorphic Position (D2)
- _____ FAC-Neutral Test (D5)
- _____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches):	_____
Water Table Present?	Yes _____	No X	Depth (inches):	_____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches):	_____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 19WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 2-10%

Subregion (LRR): Western Great Plains Lat: 44.9283736751 Long: -107.062017279 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P75-UP, P76-DOWN, P77-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia tridentata*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Xanthium strumarium*	20	Yes	FAC
2. *Grindelia squarrosa*	25	Yes	UPL
3. *Thlaspi arvense*	15	Yes	FACU
4. *Elymus lanceolatus*	15	Yes	FACU
5.			
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 15

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 20 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	30	x 4 =	120
UPL species	35	x 5 =	175
Column Totals:	85 (A)		355 (B)

Prevalence Index = B/A = 4.2

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 19WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/2	100					Clay loam	20% Scoria fragments
2-14	10YR 3/2	100					Clay loam	40% Scoria fragments
14-20	2.5Y 3/2	100					Clay loam	20% Scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks: **Scoria heavy below 6 8".**

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	8-12"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 20OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0-5%

Subregion (LRR): Western Great Plains Lat: 44.9264859924 Long: -107.062862075 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P79-UP, P80-DOWN, P81-SOIL PROFILE
Intermittent stream

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia cana*	15	No	FACU
2. *Artemisia ludoviciana*	10	No	UPL
3. *Artemisia tridentata*	70	Yes	UPL
4.			
5.			
	95 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Elymus cinereus*	40	Yes	UPL
2. *Achillea millefolium*	10	No	FACU
3. *Taraxacum officinale*	15	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	65 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 10			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	40	x 4 =	160
UPL species	120	x 5 =	600
Column Totals:	160 (A)		760 (B)

Prevalence Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 20OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/1	100					Clay loam	50% Scoria fragments
10-20	10YR 5/2	100					Clay	40% Scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes_____ No__X__ Depth (inches): _____
Water Table Present? Yes_____ No__X__ Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes_____ No__X__ Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 21OUT

Investigator(s): Clay Wood, Aaron Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9259605254 Long: -107.064541248 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: No photos taken

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	50	Yes	FACU
2. *Grindelia squarrosa*	10	No	UPL
3. *Poa secunda*	10	No	FACU
4. *Achillea millefolium*	15	No	FACU
5.			
6.			
7.			
8.			
	85 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 15

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	10	x 5 =	50
Column Totals:	85 (A)		350 (B)

Prevalence Index = B/A = 4.12

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 21OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					Clay loam	
3-10	10YR 3/2	100					Clay	
10-20	2.5Y 6/1	95	2.5Y 6/6	5	C	PL	Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes____ No X Depth (inches): ____
Water Table Present? Yes____ No X Depth (inches): ____
Saturation Present? Yes____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 21WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 12, T57N, R85W

Landform (hillslope, terrace, etc.): Seep on hillslope Local relief (concave, convex, none): Concave Slope (%): 2-20%

Subregion (LRR): Western Great Plains Lat: 44.9259529033 Long: -107.064464946 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P82-UP, P83-DOWN, P84-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Carex nebrascensis*	70	Yes	OBL
2. *Distichlis spicata*	20	Yes	FACW
3. *Juncus balticus*	10	No	FACW
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	30	x 2 =	60
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		130 (B)

Prevalence Index = B/A = 1.30

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 21WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	Gley 2.5/N	100					Silt loam	
3-8	Gley 2.5/N	100					Clay loam	
8-20	5Y 2.5/1	100					Clay loam	Scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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TFN 6 2/025
RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 22OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0%

Subregion (LRR): Western Great Plains Lat: 44.9215712457 Long: -107.062344014 Datum: NAD 1983 HARN

Soil Map Unit Name: BIDMAN-ULM, DRY, COMPLEX 0 TO 6 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P88-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1. *Symphoricarpos occidentalis*	5	Yes	UPL
2. *Artemisia cana*	20	Yes	FACU
3.			
4.			
5.			
	25 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1 *Agropyron cristatum*	80	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	80 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	20	x 4 =	80
UPL species	85	x 5 =	425
Column Totals:	105 (A)		505 (B)

Prevalence Index = B/A = 4.81

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 22OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-20	10YR 3/2	100					Sandy clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes____ No X Depth (inches): _____

Water Table Present? Yes____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes____ No X Depth (inches): _____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 22WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9215110172 Long: -107.062189812 Datum: NAD 1983 HARN

Soil Map Unit Name: BIDMAN-ULM, DRY, COMPLEX 0 TO 6 PERCENT SLOPES NWI classification: R6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes X	No			

Remarks: P85-UP, P86-DOWN, P87-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 3m²)			
1. *Populus deltoides*	20	Yes	FAC
2.			
3.			
4.			
	20 = Total Cover		
Sapling/Shrub Stratum (Plot size: 3m²)			
1. *Symphoricarpos occidentalis*	30	Yes	UPL
2.			
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa pratensis*	5	No	FACU
2. *Agropyron cristatum*	60	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	65 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 33 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	5	x 4 =	20
UPL species	90	x 5 =	450
Column Totals:	115 (A)		530 (B)

Prevalence Index = B/A = 4.61

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 22WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-6	7.5YR 3/2	100					Clay loam	Very gravelly
6-20	10 YR 3/2	100					Clay loam	Very gravelly

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches):	8-12"
Water Table Present?	Yes X	No ____	Depth (inches):	18-20"
Saturation Present? (includes capillary fringe)	Yes X	No ____	Depth (inches):	18-20"

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013
Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 23OUT
Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W
Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0%
Subregion (LRR): Western Great Plains Lat: 44.9203659759 Long: -107.06079311 Datum: NAD 1983 HARN
Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource
Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)
Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No
Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P92-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 1m²)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus deltoides*	40	Yes	FAC
2.			
3.			
4.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Symphoricarpos occidentalis*	50	Yes	UPL
2.			
3.			
4.			
5.			
	50 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Poa pratensis*	30	Yes	FACU
2. *Achillea millefolium*	5	No	FACU
3. *Elymus trachycaulus*	5	No	FACU
4. *Agropyron cristatum*	10	Yes	UPL
5.			
6.			
7.			
8.			
	50 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 25 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	40	x 4 =	160
UPL species	60	x 5 =	300
Column Totals:	140 (A)		580 (B)

Prevalence Index = B/A = 4.14

Hydrophytic Vegetation Indicators:

_____ 1 - Rapid Test for Hydrophytic Vegetation
_____ 2 - Dominance Test is >50%
_____ 3 - Prevalence Index is ≤ 3.0[1]
_____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
_____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 23OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	10YR 3/2	100					Clay loam	
5-8	10YR 4/3	100					Clay loam	
8-18	10YR 4/3	95	5 YR 3/4	5	C	PL	Loam	
18-20	10YR 3/3	100					Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes_____	No__X__	Depth (inches): _____
Water Table Present?	Yes_____	No__X__	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes_____	No__X__	Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 23WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 13, T57N, R85W

Landform (hillslope, terrace, etc.): Oxbow Local relief (concave, convex, none): Concave Slope (%): 2%

Subregion (LRR): Western Great Plains Lat: 44.9204028751 Long: -107.060743748 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: R6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P89-UP, P90-DOWN, P91-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 1m²)			
1. *Populus deltoides*	30	Yes	FAC
2.			
3.			
4.			
	30 = Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Symphoricarpos occidentalis*	30	Yes	UPL
2.			
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Xanthium strumarium*	10	No	FAC
2. *Sporobolus airoides*	15	Yes	FAC
3. *Poa pratensis*	15	Yes	FACU
4. *Agoseris glauca*	10	No	FACU
5. *Taraxacum officinale*	5	No	FACU
6.			
7.			
8.			
	55 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	55	x 3 =	165
FACU species	30	x 4 =	120
UPL species	30	x 5 =	150
Column Totals:	115 (A)		435 (B)

Prevalence Index = B/A = 3.78

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks: **Point and channel in an oxbow with gravel bottom.**

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SOIL Sampling Point: 23WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-4	7.5YR 3/1	100					Sandy loam	
4-6	10YR 3/2	90	2.5YR 3/6	10	C	PL	Sandy loam	
6-12	7.5YR 3/2	95	5 YR 3/4	5	C	PL	Clay loam	
12-20	7.5YR 3/1	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/ Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 24OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2

Subregion (LRR): Western Great Plains Lat: 44.9203041557 Long: -107.052732584 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P96-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia tridentata*	5	No	UPL
2. *Artemisia frigida*	40	Yes	UPL
3.			
4.			
5.			
	45 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	30	Yes	FACU
2. *Gnaphalium palustre*	3	No	OBL
3. *Bromus tectorum*	10	Yes	UPL
4. *Taraxacum officinale*	5	No	FACU
5. *Camelina microcarpa*	2	No	UPL
6.			
7.			
8.			
	50 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 5			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	3	x 1 =	3
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	57	x 5 =	285
Column Totals:	95 (A)		425 (B)

Prevalence Index = B/A = 4.47

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 24OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-6	7.5YR 4/2	100					Loam	
6-12	10YR 2/2	100					Clay loam	
12-20	7.5YR 4/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 24WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 5-15%

Subregion (LRR): Western Great Plains Lat: 44.9203565395 Long: -107.052823142 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: PUB

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes X** **No**
Hydric Soil Present?	Yes X	No		
Wetland Hydrology Present?	Yes X	No		

Remarks: P 93-UP, P 94-DOWN, P95-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Salix exigua*	10	Yes	FACW
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Xanthium strumarium*	20	Yes	FAC
2. *Grindelia squarrosa*	10	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	30 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 60

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 66 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	40 (A)		130 (B)

Prevalence Index = B/A = 3.25

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X** **No**

Remarks:

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SOIL

Great Plains – Version 2.0
Sampling Point: 24WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 4/1	80	5YR 5/8	20	C	PL	Clay	
3-10	2.5Y 4/1	100					Clay loam	
10-15	2.5Y 5/1	100					Clay loam	
15-20	5Y 5/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes X No ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): >12"
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 25OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0-5

Subregion (LRR): Western Great Plains Lat: 44.9169001497 Long: -107.048291017 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P97-UP, P98-DOWN, P99-SOIL

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia ludoviciana*	15	Yes	UPL
2.			
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Taraxacum officinale*	20	Yes	FACU
2. *Achillea millefolium*	10	No	FACU
3. *Pascopyrum smithii*	40	Yes	FAC
4. *Gaura coccinea*	5	No	UPL
5. *Trifolium pratense*	5	No	FACU
6.			
7.			
8.			
	80 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 33 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	35	x 4 =	140
UPL species	20	x 5 =	100
Column Totals	95 (A)		360 (B)

Prevalence Index = B/A = 3.79

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 25OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/2	100					Silty clay	
4-15	10YR 4/1	100					Silty clay	
15-20	7.5 YR 4/2	100					Clay loam	30% SCORIA FRAGS

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- _____ Histosol (A1)
- _____ Histic Epipedon (A2)
- _____ Black Histic (A3)
- _____ Hydrogen Sulfide (A4)
- _____ Stratified Layers (A5) **(LRR F)**
- _____ 1 cm Muck (A9) **(LRR F, G, H)**
- _____ Depleted Below Dark Surface (A11)
- _____ Thick Dark Surface (A12)
- _____ Sandy Mucky Mineral (S1)
- _____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- _____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- _____ Sandy Gleyed Matrix (S4)
- _____ Sandy Redox (S5)
- _____ Stripped Matrix (S6)
- _____ Loamy Mucky Mineral (F1)
- _____ Loamy Gleyed Matrix (F2)
- _____ Depleted Matirx (F3)
- _____ Redox Dark Surface (F6)
- _____ Depleted Dark Surface (F7)
- _____ Redox Depressions (F8)
- _____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- _____ 1 cm Muck (A9) **(LRR I, J)**
- _____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- _____ Dark Surface (S7) **(LRR G)**
- _____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- _____ Reduced Vertic (F18)
- _____ Red Parent Material (TF2)
- _____ Very Shallow Dark Surface (TF12)
- _____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- _____ Surface Water (A1)
- _____ High Water Table (A2)
- _____ Saturation (A3)
- _____ Water Marks (B1)
- _____ Sediment Deposits (B2)
- _____ Drift Deposits (B3)
- _____ Algal Mat or Crust (B4)
- _____ Iron Deposits (B5)
- _____ Inundation Visible on Aerial Imagery (B7)
- _____ Water-Stained Leaves (B9)
- _____ Salt Crusts (B11)
- _____ Aquatic Invertebrates (B13)
- _____ Hydrogen Sulfide Oder (C1)
- _____ Dry-Season Water Table (C2)
- _____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- _____ Presence of Reduced Iron (C4)
- _____ Thick Muck Surface (C7)
- _____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- _____ Surface Soil Cracks (B6)
- _____ Sparsely Vegetated Concave Surface (B8)
- _____ Drainage Patterns (B10)
- _____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- _____ Crayfish Burrows (C8)
- _____ Saturation Visible on Aerial Imagery (C9)
- _____ Geomorphic Position (D2)
- _____ FAC-Neutral Test (D5)
- _____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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TFN 6 2/025
RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 26OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10-15%

Subregion (LRR): Western Great Plains Lat: 44.9127404565 Long: -107.05284326 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P103-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Ericameria nauseosa*	15	Yes	UPL
2. *Artemisia tridentata*	15	Yes	UPL
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 5m²)			
1. *Pascopyrum smithii*	10	Yes	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 60

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	10	x 4 =	40
UPL species	30	x 5 =	150
Column Totals:	40 (A)		190 (B)

Prevalence Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 26OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-2	2.5Y 4/1	100					Clay loam	
2-18	5Y 5/1	95	2.5Y 6/6	5	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 26WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9129354148 Long: -107.053014896 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, 0 TO 60 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	Yes X	No
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P100-UP, P101 DOWN, P102-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 5m^2)			
1. *Typha latifolia*	5	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	5 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 95

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	5 (A)		5 (B)

Prevalence Index = B/A = 1.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is $\leq 3.0^1$
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 26WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	2.5Y 5/2	90	10YR 5/6	10	C	M	Clay	
6-12	2.5Y 4/1	95	2.5Y 3/4	5	C	PL	Clay	
12-20	2.5Y 4/2	90	10YR 5/8	10	C	PL	Clay	Blocky Structure

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>12"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/21/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 27OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 10-12%

Subregion (LRR): Western Great Plains Lat: 44.9129007522 Long: -107.049179581 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P107-SOIL PROFILE

VEGETATION – Use scientific names of plants.

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)				
1.				
2.				
3.				
4.				
		= Total Cover		
Sapling/Shrub Stratum (Plot size: 2m²)				
1	*Symphoricarpos occidentalis*	10	Yes	UPL
2.	*Artemisia cana*	10	Yes	FACU
3.				
4.				
5.				
		20 = Total Cover		
Herb Stratum (Plot size: 2m²)				
1	*Pascopyrum smithii*	50	Yes	FACU
2.	*Camelina microcarpa*	5	No	UPL
3.	*Trifolium pratense*	5	No	FACU
4.				
5.				
6.				
7.				
8.				
		60 = Total Cover		
Woody Vine Stratum (Plot size:)				
1.				
2.				
		= Total Cover		

0

% Bare Ground in Herb Stratum 20

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	65	x 4 =	260
UPL species	15	x 5 =	75
Column Totals:	80 (A)		335 (B)

Prevalence Index = B/A = 4.19

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 27OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/3	100					Loam	
3-20	2.5Y 5/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes_____	No__X__	Depth (inches): _____
Water Table Present?	Yes_____	No__X__	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes_____	No__X__	Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 27WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 18, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9129217828 Long: -107.049264481 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD VERY FINE SANDY LOAM, 0 TO 3 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P104-UP, P105-DOWN, P106-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 2m²)			
1. *Acer negundo*	40	Yes	FAC
2.			
3.			
4.			
	40 = Total Cover		
Sapling/Shrub Stratum (Plot size: 2m²)			
1. *Symphoricarpos occidentalis*	20	Yes	UPL
2. *Acer negundo*	10	Yes	FAC
3. *Artemisia cana*	5	No	FACU
4.			
5.			
	35 = Total Cover		
Herb Stratum (Plot size: 2m²)			
1. *Poa pratensis*	40	Yes	FACU
2. *Xanthium strumarium*	2	No	FAC
3. *Sporobolus airoides*	10	No	FAC
4. *Hordeum jubatum*	15	Yes	FACW
5.			
6.			
7.			
8.			
	67 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

0

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 60 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	62	x 3 =	186
FACU species	45	x 4 =	180
UPL species	20	x 5 =	100
Column Totals:	142 (A)		496 (B)

Prevalence Index = B/A = 3.49

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 27WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5YR 4/2	100					Sandy loam	Small coarse fragments
4-6	7.5YR 4/1	100					Sandy loam	Large coarse fragments
6-12	7.5YR 3/1	90	10 YR 5/8	10	C	PL	Sandy loam	
12-20	7.5YR 3/1	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- X Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:
High water marks on rocks at edge of stream channel.

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 28OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 17, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9087502886 Long: -107.031330646 Datum: NAD 1983 HARN

Soil Map Unit Name: SPEARMAN-WIBAUX ASSOCIATION, 6 TO 25 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P108-UP, P109-DOWN, P110-SOIL PROFILE
Intermittent drainage, not a wetland.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Artemisia ludoviciana*	5	Yes	UPL
2. *Rosa woodsii*	10	Yes	FACU
3.			
4.			
5.			
	15 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	10	No	FACU
2. *Bromus tectorum*	60	Yes	UPL
3. *Taraxacum officinale*	10	No	FACU
4. *Ratibida columnifera*	5	No	FACU
5. *Gaura coccinea*	15	No	UPL
6. *Tragopogon dubius*	5	No	UPL
7.			
8.			
	105 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	85	x 5 =	425
Column Totals:	120 (A)		565 (B)

Prevalence Index = B/A = 4.71

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 28OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-10	7.5YR 3/1	100					Clay loam	
10-20	5YR 5/3	100						95% Scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 29OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 20, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9071403976 Long: -107.025674926 Datum: NAD 1983 HARN

Soil Map Unit Name: SPEARMAN-WIBAUX ASSOCIATION, 6 TO 25 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P111-UP, P112-DOWN, P113-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Symphoricarpos occidentalis*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus tectorum*	100	Yes	UPL
2. *Tragopogon dubius*	2	No	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	102 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	112	x 5 =	560
Column Totals:	112 (A)		560 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 29OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	7.5YR 3/2	100					Clay loam	
5-15	10YR 4/2	100					Clay loam	
15-20	2.5YR 3/1	100					Clay loam	30% Scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 30OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 17, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9176330961 Long: -107.014691632 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, COOL, 15 TO 80 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P117-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Gutierrezia sarothre*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Agropyron cristatum*	30	Yes	UPL
2. *Bromus tectorum*	20	Yes	UPL
3. *Achillea millefolium*	18	Yes	FACU
4. *Alyssum desertorum*	2	No	UPL
5.			
6.			
7.			
8.			
	70 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 20

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	18	x 4 =	72
UPL species	62	x 5 =	310
Column Totals:	80 (A)		382 (B)

Prevalence Index = B/A = 4.78

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 30OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	5YR4/4	100					Clay loam	
3-6	7.5YR 5/1	100					Clay loam	
6-20	5YR 4/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 30WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 17, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-5%

Subregion (LRR): Western Great Plains Lat: 44.9176391875 Long: -107.014856552 Datum: NAD 1983 HARN

Soil Map Unit Name: SHINGLE-WIBAUX COMPLEX, COOL, 15 TO 80 PERCENT SLOPES NWI classification: R6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes X	No			

Remarks: P114-UP, P115-DOWN, P116-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus tectorum*	60	Yes	UPL
2. *Pascopyrum smithii*	35	Yes	FACU
3. *Camelina microcarpa*	2	No	UPL
4. *Alyssum desertorum*	3	No	UPL
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	0	x 2 =	
FAC species	0	x 3 =	
FACU species	35	x 4 =	140
UPL species	65	x 5 =	325
Column Totals:	100 (A)		465 (B)

Prevalence Index = B/A = 4.65

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 30WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	2.5YR 5/2	100					Clay	
5-12	10YR 4/2	100					Clay loam	
12-20	10YR 5/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ____	Depth (inches):	6-12"
Water Table Present?	Yes ____	No X	Depth (inches):	____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches):	____

Wetland Hydrology Present? Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 31OUT

Investigator(s): C. Wood, A. Ide, M. Kasten, S. Winters Section, Township, Range: Sec. 17, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9081872561 Long: -107.012803382 Datum: NAD 1983 HARN

Soil Map Unit Name: CLARKELEN LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: **No out point taken because this point was not a wetland.**
P118 - Upstream, P119 - Downstream, P120 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1. *Symphoricarpos occidentalis*	5	Yes	UPL
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus inermis*	80	Yes	UPL
2. *Poa pratensis*	30	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	110 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	85	x 5 =	425
Column Totals:	115 (A)		545 (B)

Prevalence Index = B/A = 4.74

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 31OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	10YR 2/1	100					Loam	
5-20	2.5Y 5/3	100					Sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	___
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 32OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9303089831 Long: -107.012080834 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P124 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	30	Yes	FACU
2. *Camelina microcarpa*	5	No	UPL
3. *Bromus tectorum*	60	Yes	UPL
4.			
5.			
6.			
7.			
8.			
	95 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	65	x 5 =	325
Column Totals:	95 (A)		445 (B)

Prevalence Index = B/A = 4.68

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 32OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	10YR 4/3	100					Loam	
5-20	10YR 5/3	100					Fine sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches): ____
Water Table Present?	Yes____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 32WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 0-3%

Subregion (LRR): Western Great Plains Lat: 44.9303737793 Long: -107.012024671 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: R6 & R6r

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P121 - Upstream, P122 - Downstream, P123 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 1m²)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Populus deltoides*	100	Yes	FAC
2.			
3.			
4.			
	100 = Total Cover		
Sapling/Shrub Stratum (Plot size:-)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	15	No	FACU
2. *Poa pratensis*	100	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	115 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	115	x 4 =	460
UPL species	0	x 5 =	0
Column Totals:	215 (A)		760 (B)

Prevalence Index = B/A = 3.53

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:
P41 - Upstream, P42 - Downstream, P43 - Soil Profile

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SOIL Sampling Point: 32WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	10YR 4/2	100					Loam	
5-20	10YR 3/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 33OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9 ,T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): Western Great Plains Lat: 44.9270063377 Long: -107.001777374 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P128 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Agropyron cristatum*	90	Yes	UPL
2. *Alyssum desertorum*	5	No	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	95 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	95	x 5 =	475
Column Totals:	95 (A)		475 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 33OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	100					Loam	
6-20	2.5Y 5/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	___
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 33WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9270665342 Long: -107.001424655 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: R6 & R6r

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
P125 - Upstream, P126 - Downstream, P127 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 1m²)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix exigua*	50	Yes	FACW
2.			
3.			
4.			
	50 = Total Cover		
Sapling/Shrub Stratum (Plot size: -)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Convolvulus arvensis*	5	No	UPL
2. *Agropyron cristatum*	15	No	UPL
3. *Poa pratensis*	90	Yes	FACU
4. *Rumex crispus*	25	No	FAC
5. *Cirsium arvense*	5	No	FACU
6.			
7.			
8.			
	140 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 50 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	50	x 2 =	100
FAC species	25	x 3 =	75
FACU species	95	x 4 =	380
UPL species	20	x 5 =	100
Column Totals:	190 (A)		655 (B)

Prevalence Index = B/A = 3.45

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 33WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/1	100					Loam	
2-10	10YR 4/1	100					Clay loam	
10-20	10YR 5/3	98	10YR 8/8	2	C	PL	Clay loam	Very gravelly

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	___
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 34OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace of oxbow Local relief (concave, convex, none): Concave Slope (%): 0-3%

Subregion (LRR): Western Great Plains Lat: 44.9229864969 Long: -106.996404636 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P132 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Ericameria nauseosa*	10	Yes	UPL
2.			
3.			
4.			
5.			
	10 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Agropyron cristatum*	30	Yes	UPL
2. *Alyssum desertorum*	2	No	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	32 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 65

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	42	x 5 =	210
Column Totals:	42 (A)		210 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 34OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-3	10YR 4/3	100					Clay loam	
3-10	10YR 5/4	100					Clay loam	
10-20	10YR 6/4	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches): ____	
Water Table Present?	Yes____	No X	Depth (inches): ____	
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches): ____	**Wetland Hydrology Present?** Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 34WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 9, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9230412488 Long: -106.9964239 Datum: NAD 1983 HARN

Soil Map Unit Name: HAVERDAD-WORTHENTON COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: R6 & R6r

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P129 - Upstream, P130 - Downstream, P131 - Soil Profile

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 1m²)			
1. *Atriplex canescens*	40	Yes	UPL
2.			
3.			
4.			
5.			
	40 = Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	20	Yes	FACU
2. *Convolvulus arvensis*	5	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
	25 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 40			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	0	x 2 =	
FAC species	0	x 3 =	
FACU species	20	x 4 =	80
UPL species	45	x 5 =	225
Column Totals:	65 (A)		305 (B)

Prevalence Index = B/A = 4.69

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 34WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 5/3	100					Clay loam	20% CF
3-20	10YR 6/3	100					Gravely clay loam	40% scoria coarse fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) (LRR F)
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches): ____
Water Table Present?	Yes____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 35OUT

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-3%

Subregion (LRR): Western Great Plains Lat: 44.9195889581 Long: -106.988368086 Datum: NAD 1983 HARN

Soil Map Unit Name: CUSHMAN-FORKWOOD ASSOCIATION, 3 TO 15 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P136 - Soil Profile

VEGETATION – Use scientific names of plants.

		Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)				
1.				
2.				
3.				
4.				
		= Total Cover		
Sapling/Shrub Stratum (Plot size:)				
1.				
2.				
3.				
4.				
5.				
		= Total Cover		
Herb Stratum (Plot size: 1m²)				
1.	*Alyssum desertorum*	5	No	UPL
2.	*Taraxacum officinale*	20	No	FACU
3.	*Pascopyrum smithii*	10	No	FACU
4.	*Bromus tectorum*	60	Yes	UPL
5.	*Bromus arvensis*	20	No	FACU
6.				
7.				
8.				
		115 = Total Cover		
Woody Vine Stratum (Plot size:)				
1.				
2.				
		= Total Cover		

% Bare Ground in Herb Stratum 15

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	50	x 4 =	200
UPL species	65	x 5 =	325
Column Totals:	110 (A)		525 (B)

Prevalence Index = B/A = 4.77

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 35OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-4	10YR 4/3	100					Loam	Scoria gravel throughout
4-20	10YR 5/3	100					Loam	profile

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ____
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Odor (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): ____
Water Table Present?	Yes ____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/23/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 35WET

Investigator(s): M. Kasten, S. Winters Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Concave Slope (%): 0-3%

Subregion (LRR): Western Great Plains Lat: 44.9196615928 Long: -106.988332582 Datum: NAD 1983 HARN

Soil Map Unit Name: CUSHMAN-FORKWOOD ASSOCIATION, 3 TO 15 PERCENT SLOPES NWI classification: R6 & R6r

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
P133 - Upstream, P134 - Downstream, P135 - Soil Profile

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	75	Yes	FACU
2. *Convolvulus arvensis*	2	No	UPL
3. *Tragopogon dubius*	5	No	UPL
4.			
5.			
6.			
7.			
8.			
	82 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 18			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	75	x 4 =	300
UPL species	7	x 5 =	35
Column Totals:	82 (A)		335 (B)

Prevalence Index = B/A = 4.09

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 35WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/3	100					Loam	Scoria gravel throughout
5-20	10YR 5/3	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: _____
Depth (inches): _____

Hydric Soils Present? Yes_____ No__X__

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes_____ No__X__ Depth (inches): _____
Water Table Present? Yes_____ No__X__ Depth (inches): _____
Saturation Present? (includes capillary fringe) Yes_____ No__X__ Depth (inches): _____

Wetland Hydrology Present? Yes_____ No__X__

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 36OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9090325515 Long: -106.97990921 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P140-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1 *Pascopyrum smithii*	50	Yes	FACU
2. *Bromus tectorum*	30	Yes	UPL
3. *Bromus arvensis*	10	No	FACU
4.			
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 10

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	
FACW species	0	x 2 =	
FAC species	0	x 3 =	
FACU species	60	x 4 =	240
UPL species	30	x 5 =	150
Column Totals:	90 (A)		390 (B)

Prevalence Index = B/A = 4.33

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 36OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-5	10YR 5/4	100					Clay	
5-15	Gley 2 5/N	100					Sandy loam	
15-18	10YR 4/3	100					Clay loam	Very blocky. Some scoria fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present?	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 36WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9092636108 Long: -106.980081828 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Off-channel reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P137-UP, P138-DOWN, P139-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Grindelia squarrosa*	20	Yes	UPL
2. *Hordeum jubatum*	10	No	FACW
3. *Bromus arvensis*	30	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	60 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 40

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	20	x 5 =	100
Column Totals:	60 (A)		240 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:
***Populus deltoides* present in water.**

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SOIL Sampling Point: 36WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-18	2.5Y 5/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>24"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 37OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-5%

Subregion (LRR): Western Great Plains Lat: 44.9113286754 Long: -106.976757648 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes	No X			

Remarks: P141-UP, P142-DOWN, P143-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus inermis*	60	Yes	UPL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	60 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 40

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	60	x 5 =	300
Column Totals:	60 (A)		300 (B)

Prevalence Index = B/A = 5.0

Hydrophytic Vegetation Indicators:

_____ 1 - Rapid Test for Hydrophytic Vegetation

_____ 2 - Dominance Test is >50%

_____ 3 - Prevalence Index is ≤ 3.0[1]

_____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

_____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 37OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 4/2	100					Clay loam	
3-5	5Y 7/3	50	5YR 4/6	50	C	PL	Clay	
5-14	2.5Y 5/1	90	5 YR 4/6	10	C	PL	Clay	
14-16	10YR 3/2	70	5YR 5/6	30	C	PL	Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: Compacted layer/Coal
Depth (inches): 16"

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

TFN 6 2/025
RECD NOV 14, 2014

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 38OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9108270523 Long: -106.976613764 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P147-SOIL PROFILE

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1 *Pascopyrum smithii*	45	Yes	FACU
2 *Trifolium pratense*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	50 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 50

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	50 (A)		200 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 38OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	100					Clay loam	
6-8	10YR 5/1	100					Clay loam	
8-10	5YR 3/3	100					Clay loam	40% Scoria

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matirx (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: Rock
Depth (inches): 10"

Hydric Soils Present? Yes____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes____	No X	Depth (inches): ____
Water Table Present?	Yes____	No X	Depth (inches): ____
Saturation Present? (includes capillary fringe)	Yes____	No X	Depth (inches): ____

Wetland Hydrology Present? Yes____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC. State: Wyoming Sampling Point: 38WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 0-2%

Subregion (LRR): Western Great Plains Lat: 44.9111041867 Long: -106.976205213 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Off-channel reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P144-UP, P145-DOWN, P146-SOIL PROFILE
Off channel reservoir

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Bromus inermis*	60	Yes	UPL
2. *Bromus arvensis*	30	Yes	FACU
3. *Trifolium pratense*	5	No	FACU
4. *Taraxacum officinale*	5	No	FACU
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 0

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	40	x 4 =	160
UPL species	60	x 5 =	300
Column Totals:	100 (A)		460 (B)

Prevalence Index = B/A = 4.6

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 38WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 5/2	95	5YR 6/8	5	C	PL	Clay loam	
16-20	10YR 3/2	90	5YR 5/6	10	C	PL	Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	12-18"
Water Table Present?	Yes ___	No X	Depth (inches):	___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 39OUT

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 0-5%

Subregion (LRR): Western Great Plains Lat: 44.9087818546 Long: -106.973592048 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Non-aquatic resource

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks: P151-SOIL PROFILE

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Pascopyrum smithii*	45	Yes	FACU
2. *Bromus arvensis*	30	Yes	FACU
3. *Trifolium pratense*	15	No	FACU
4. *Poa secunda*	5	No	FACU
5.			
6.			
7.			
8.			
	95 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	95	x 4 =	380
UPL species	0	x 5 =	0
Column Totals:	95 (A)		380 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 39OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	7.5YR 4/3	100					Clay loam	
4-14	10YR 4/3	100					Clay	
14-18	7.5YR 4/2	100					Clay	
18-20	2.5Y 4/1	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present? Yes ___ No X Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan/Sheridan Sampling Date: 10/22/2013

Applicant/Owner: Ramaco LLC State: Wyoming Sampling Point: 39WET

Investigator(s): C. Wood, A. Ide Section, Township, Range: Sec. 15, R57N, R84W

Landform (hillslope, terrace, etc.): Reservoir Local relief (concave, convex, none): Concave Slope (%): 2-5%

Subregion (LRR): Western Great Plains Lat: 44.9086654929 Long: -106.973457097 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0 TO 100 PERCENT SLOPES NWI classification: Off-channel reservoir

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks: P148-UP, P149-DOWN, P150-SOIL PROFILE
Off channel reservoir

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1m²)			
1. *Hordeum jubatum*	30	Yes	FACU
2. *Juncus balticus*	30	Yes	FACU
3. *Melissa officinalis*	10	No	UPL
4. *Carex nebrascensis*	20	Yes	OBL
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 10			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 33 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	60	x 4 =	240
UPL species	10	x 5 =	50
Column Totals:	90 (A)		310 (B)

Prevalence Index = B/A = 3.44

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** **No X**

Remarks:

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SOIL Sampling Point: 39WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	95	5YR 6/6	5	C	PL	Clay loam	
4-11	2.5Y 5/1	85	5YR 5/6	15	C	PL	Clay loam	
11-16	10YR 5/2	80	5YR 5/6	20	C	PL	Clay	
16-20	5Y 4/1	100					Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: ___
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- X Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	>24"
Water Table Present?	Yes X	No ___	Depth (inches):	18"
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	18"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan Sampling Date: 10/15/2014

Applicant/Owner: Ramaco State: Wyoming Sampling Point: 40 OUT

Investigator(s): D. Gardner, M. Kasten Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Man-made depression Local relief (concave, convex, none): Concave Slope (%): 0-10

Subregion (LRR): Western Great Plains Lat: 44.915893 Long: -106.988149 Datum: NAD 1983 HARN

Soil Map Unit Name: USTIC TORRIORTHENTS-PITS COMPLEX, 0-100 PERCENT SLOPES NWI classification: Non-wetland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes X	No			

Remarks:
Point located in depression formed from reclamation

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 2 m²)			
1. *Bromus inermis*	70	Yes	UPL
2. *Pascopyron smithii*	15	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	85 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	15	x 4 =	60
UPL species	70	x 5 =	350
Column Totals:	85 (A)		410 (B)

Prevalence Index = B/A = 4.8

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, u nless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 40 Out

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-2	10YR 3/1	100					Loam	
2-3	10YR 5/3	100					Loam	
3-12	N 2.5/0	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: None
Depth (inches): ___

Hydric Soils Present? Yes ___ No X

Remarks:
3-12 inches: Likely derived from carbonaceous shale, some visible coal, visible salt/carbonate accumulations

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- X Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	None	
Water Table Present?	Yes ___	No X	Depth (inches):	None	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	None	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan Sampling Date: 10/15/2014

Applicant/Owner: Ramaco State: Wyoming Sampling Point: 41 OUT

Investigator(s): D. Gardner, M. Kasten Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 25-70

Subregion (LRR): Western Great Plains Lat: 44.915575 Long: 106.986953 Datum: NAD 1983 HARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: Non-wetland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	**Yes**	**No X**
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:
Point within channel of drainage. Large head-cut upstream of point. Rocky and organic bottom. Possible stream-fed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft²)			
1. *Artemisia tridentata*	30	Yes	UPL
2. *Chrysothamnus viscidiflorus*	15	Yes	UPL
3.			
4.			
5.			
	45 = Total Cover		
Herb Stratum (Plot size: 15 ft²)			
1. *Pseudoroegneria spicata*	40	Yes	UPL
2. *Poa secunda*	20	Yes	FACU
3. *Achillea millefolium*	5	No	FACU
4. *Agropyron cristatum*	7	No	UPL
5. *Koeleria macrantha*	3	No	UPL
6.			
7.			
8.			
	75 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 10			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	25	x 4 =	100
UPL species	95	x 5 =	475
Column Totals:	120 (A)		575 (B)

Prevalence Index = B/A = 4.8

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, u nless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 41 OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-10	2.5Y 6/3.5	100					Sandy loam	
10-14	2.5Y 5/4	100					Sandy loam	Contains decomposing coarse fragments

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ____ Histosol (A1)
- ____ Histic Epipedon (A2)
- ____ Black Histic (A3)
- ____ Hydrogen Sulfide (A4)
- ____ Stratified Layers (A5) **(LRR F)**
- ____ 1 cm Muck (A9) **(LRR F, G, H)**
- ____ Depleted Below Dark Surface (A11)
- ____ Thick Dark Surface (A12)
- ____ Sandy Mucky Mineral (S1)
- ____ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ____ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ____ Sandy Gleyed Matrix (S4)
- ____ Sandy Redox (S5)
- ____ Stripped Matrix (S6)
- ____ Loamy Mucky Mineral (F1)
- ____ Loamy Gleyed Matrix (F2)
- ____ Depleted Matrix (F3)
- ____ Redox Dark Surface (F6)
- ____ Depleted Dark Surface (F7)
- ____ Redox Depressions (F8)
- ____ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ____ 1 cm Muck (A9) **(LRR I, J)**
- ____ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ____ Dark Surface (S7) **(LRR G)**
- ____ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ____ Reduced Vertic (F18)
- ____ Red Parent Material (TF2)
- ____ Very Shallow Dark Surface (TF12)
- ____ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: None
Depth (inches): ____

Hydric Soils Present? Yes ____ No X

Remarks:
Digging impeded by rocks.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ____ Surface Water (A1)
- ____ High Water Table (A2)
- ____ Saturation (A3)
- ____ Water Marks (B1)
- ____ Sediment Deposits (B2)
- ____ Drift Deposits (B3)
- ____ Algal Mat or Crust (B4)
- ____ Iron Deposits (B5)
- ____ Inundation Visible on Aerial Imagery (B7)
- ____ Water-Stained Leaves (B9)
- ____ Salt Crusts (B11)
- ____ Aquatic Invertebrates (B13)
- ____ Hydrogen Sulfide Oder (C1)
- ____ Dry-Season Water Table (C2)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ____ Presence of Reduced Iron (C4)
- ____ Thick Muck Surface (C7)
- ____ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ____ Surface Soil Cracks (B6)
- ____ Sparsely Vegetated Concave Surface (B8)
- ____ Drainage Patterns (B10)
- ____ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ____ Crayfish Burrows (C8)
- ____ Saturation Visible on Aerial Imagery (C9)
- ____ Geomorphic Position (D2)
- ____ FAC-Neutral Test (D5)
- ____ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches):	None
Water Table Present?	Yes ____	No X	Depth (inches):	None
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches):	None

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan Sampling Date: 10/15/2014

Applicant/Owner: Ramaco State: Wyoming Sampling Point: 41 WET

Investigator(s): D. Gardner, M. Kasten Section, Township, Range: Sec. 15, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0-7

Subregion (LRR): Western Great Plains Lat: 44.915653 Long: -106.986966 Datum: NAD 1983 NARN

Soil Map Unit Name: ZIGWEID-CAMBRIA LOAMS, 0 TO 6 PERCENT SLOPES NWI classification: PEM

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes X** **No**
Hydric Soil Present?	Yes X	No		
Wetland Hydrology Present?	Yes X	No		

Remarks:
Point within channel of drainage. Large head-cut upstream of point. Rocky and organic bottom. Possible stream-fed.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 3 m²)			
1. *Salix amygdaloides*	5	Yes	FACW
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 3 m²)			
1. *Juncus torreyi*	30	Yes	FACW
2. *Polypogon monspeliensis*	25	Yes	FACW
3. *Cyrtorhyncha cymbalaria*	20	No	OBL
4. *Eleocharis acicularis*	20	No	OBL
5. *Eleocharis palustris*	5	No	OBL
6. *Typha latifolia*	5	No	OBL
7. *Schoenoplectus spp.*	3	No	---
8. *Hordeum jubatum*	2	No	FACW
	110 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 5

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes X** **No**

Remarks:

US Army Corps of Engineers Great Plains – Version 2.0

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SOIL Sampling Point: 41 WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	2.5Y 6/2	70	N 2.5/0	20	D	M	Clay	
			7.5YR 6/8	10	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: None
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:
Digging impeded by rocks.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- X Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches):	1-2	
Water Table Present?	Yes ___	No X	Depth (inches):	None	
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches):	0-8	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan Sampling Date: 10/15/2014

Applicant/Owner: Ramaco State: Wyoming Sampling Point: 42 OUT

Investigator(s): D. Gardner, M. Kasten Section, Township, Range: Sec. 22, T57N, R84W

Landform (hillslope, terrace, etc.): Toeslope Local relief (concave, convex, none): Convex Slope (%): 30

Subregion (LRR): Western Great Plains Lat: 44.894144 Long: -106.983904 Datum:

Soil Map Unit Name: HAVERDAD-DRAKNAB COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: Non-wetland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X	**Is the Sampled Area within a Wetland?**	Yes	No X
Hydric Soil Present?	Yes	No X			
Wetland Hydrology Present?	Yes	No X			

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft²)			
1. *Symphoricarpos occidentalis*	25	Yes	UPL
2. *Rosa woodsia*	5	No	FACU
3.			
4.			
5.			
	30 = Total Cover		
Herb Stratum (Plot size: 15 ft²)			
1. *Bromus inermis*	85	Yes	UPL
2. *Thlaspi arvense*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	90 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 2

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 0 (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	10	x 4 =	40
UPL species	110	x 5 =	550
Column Totals:	120 (A)		590 (B)

Prevalence Index = B/A = 4.9

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, u nless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

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SOIL Sampling Point: 42 OUT

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-7	10YR 5/3	100					Loam	
7-12	2.5Y 5/2	100					Clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matirx (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: None
Depth (inches): ___

Hydric Soils Present? Yes ___ No X

Remarks:
Digging impeded by rocks.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- X FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	None
Water Table Present?	Yes ___	No X	Depth (inches):	None
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	None

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM-Great Plains Region

Project/Site: Brook Mine City/County: Sheridan Sampling Date: 10/15/2014

Applicant/Owner: Ramaco State: Wyoming Sampling Point: 42 WET

Investigator(s): D. Gardner, M. Kasten Section, Township, Range: Sec. 22, T57N, R84W

Landform (hillslope, terrace, etc.): Drainage Local relief (concave, convex, none): Concave Slope (%): 0-5

Subregion (LRR): Western Great Plains Lat: 44.894184 Long: -106.983759 Datum:

Soil Map Unit Name: HAVERDAD-DRAKNAB COMPLEX, 0 TO 3 PERCENT SLOPES NWI classification: PEMh

Are climatic/hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No	**Is the Sampled Area within a Wetland?**	**Yes** X	**No**
Hydric Soil Present?	Yes X	No			
Wetland Hydrology Present?	Yes X	No			

Remarks:
Multiple culverts from road and railroad bring water into area.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size:)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: 1 m^2)			
1. *Phalaris arundinacea*	100	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		
% Bare Ground in Herb Stratum 5			

Dominance Test Worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Area OBL, FACW, or FAC: 100 (A/B)

Prevalence Index Worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤ 3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, u nless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No

Remarks:

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SOIL Sampling Point: 42 WET

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators).

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	2.5Y 3/1	100					Loam	
3-7	2.5Y 5/1	85	7.5YR 6/8	15	C	M	Loam	
7-16	2.5Y 6/1	50	7.5YR 6/6	45	C	M	Silt loam	
			N 2.5/0	5	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted).

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR F)**
- ___ 1 cm Muck (A9) **(LRR F, G, H)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- ___ 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) **(MLRA 72 & 73 or LRR H)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR I, J)**
- ___ Coast Prairie Redox (A16) **(LRR F, G, H)**
- ___ Dark Surface (S7) **(LRR G)**
- ___ High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):
Type: None
Depth (inches): ___

Hydric Soils Present? Yes X No ___

Remarks:
Digging impeded by rocks.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required, check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crusts (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Oder (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where not tilled)**
- ___ Presence of Reduced Iron (C4)
- ___ Thick Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Oxidized Rhizospheres along Living Roots (C3) **(where tilled)**
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- X FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) **(LRR F)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches):	None	
Water Table Present?	Yes ___	No X	Depth (inches):	None	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches):	None	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspection), if available:

Remarks:

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ATTACHMENT D10-1-F

Letter of Request for USACE Jurisdictional Determination

TFN 6 2/025
RECD JUL 30, 2015

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BKS Environmental Associates, Inc.

May 29, 2015

Mike Happold
United States Army Corps of Engineers Wyoming Regulatory Office
2232 Dell Range Blvd. Suite 210
Cheyenne, WY 82009

Dear Mr. Happold,

On behalf of Ramaco, LLC. (Ramaco), BKS Environmental Associates, Inc. (BKS) requests the United States Army Corps of Engineers (USACE) to complete a Jurisdictional Determination (JD) of the aquatic resources within the proposed Brook Mine Permit Area located approximately 15 miles northwest of Sheridan, (Sheridan County) Wyoming. The permit area encompasses all or portions of Sections 7, 8, 9, 10, 15, 17, 18, 20, 21, 22, and 27 Township 57 N, Range 84W and Sections 10, 11, 12, 13, 14, and 15, Township 57N, Range 85W.

BKS, on behalf of Ramaco, submits the enclosed Aquatic Resources Inventory Report, completed by BKS, for use in the JD process. The report presents the type and amount of each aquatic resource identified within the proposed Brook Mine Permit Area, including illustrative maps.

BKS requests the USACE to review the aquatic resources inventory results for concurrence of findings and to determine if aquatic resources within the proposed permit area are jurisdictional waters of the United States.

Please let me know if there are any questions or if further information is required. I can be reached by phone at 307-686-0800 or by email at mkasten@bksenvironmental.com

Sincerely,

Michael Kasten
BKS Environmental Associates, Inc.

Enclosure

cc: Jeff Barron, WWC Engineering
Katie Wilson, BKS Environmental Associates, Inc.

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(307) 686-0880 Fax

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Exhibit D11.3-1 Surficial Geology
Exhibit D11.3-2 Alluvial Transect Geologic Cross Sections
Exhibit D11.4-1 Irrigated Lands and Point of Use
Exhibit D11.6-1 Potential and Declared Alluvial Valley Floor Extents

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Exhibit D11.7-1 Drill Hole Location and Alluvial Isopach Map of the Big Horn Mine Permit

LIST OF ADDENDA

Addendum D11-1 Brook Mine AVF Preliminary Identification (WDEQ/LQD)

Addendum D11-2 State Decision Documents (SDD 213-T1 and SDD 213-T2)

Addendum D11-3 Borehole and Monitor Well Logs

Addendum D11-4 SEO Water Rights

Addendum D11-5 WDEQ Documentation for the AVF Declaration for Brook Mine

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DEQ Ex. 4-955

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ALLUVIAL VALLEY FLOORS

Appendix D11

Prepared by:

WWC Engineering

February 2019

TFN 6 2/025
RECD MAR 04, 2019

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D11 ALLUVIAL VALLEY FLOORS

Alluvial Valley Floor sections for RAMACO's Brook Mine were prepared by WWC Engineering of Sheridan, Wyoming.

D11.1 Introduction

RAMACO is proposing to develop the Brook Mine. The mine will be located approximately 8 air miles northwest of Sheridan, Wyoming. The alluvial valley floor (AVF) status of the streams that drain the permit area and areas adjacent to the proposed permit area, have not yet been declared by the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD). This Appendix has been prepared as a comprehensive initial application containing all required information pertaining to alluvial valley floors. This Appendix was developed based on WDEQ/LQD Guideline No. 9 to contain sufficient information for WDEQ/LQD to make an AVF declaration of the drainages within and adjacent (1/2 mile) the baseline study area described herein. To assist in development of this Appendix, an Alluvial Valley Floor Preliminary Identification report was prepared and submitted to WDEQ/LQD District III on February 5, 2014. The WDEQ/LQD staff reviewed this report and provided questions and comments in a letter returned to RAMACO on March 25, 2014. A copy of this letter is included in Addendum D11-1. The location of the proposed mine site is presented on Figure D11.1-1.

Based on data presented herein, the Tongue River valley in the areas studied by RAMACO, appears to be an AVF. Portions of these areas are within the Permit area; however, no surface disturbance or mining is proposed there. As such, no material damage is anticipated to this AVF. Further discussion and investigation of the Brook Mine's probable hydrologic impacts on the Tongue River AVF are found in the Mine Plan, Section MP.6, and no further discussion or investigation of this area is included in this study.

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A large portion of the study area for the Goose Creek and Tongue River valleys was previously investigated as part of the Big Horn Coal Mine permit and Welch No. 1 North Mine Permit (Sheridan Enterprises). A portion of Hidden Water Creek was evaluated as a portion of the Big Horn Mine Permit No. 213. These investigations led to the declaration of areas as AVFs on the Tongue River and Goose Creek, but a negative declaration on Hidden Water Creek. These declarations can be found in the Big Horn Mine State Decision Documents (WDEQ/LQD, 1981) and the Sheridan Enterprises State Decisions Documents (WDEQ/LQD, 1989). The areas declared as AVFs are shown on Exhibit D11.1-1 and no further investigation of these areas has been included in Appendix D11. Copies of the State Decision Document are included in Addendum D11-2. As these areas have previously been studied and declarations of AVF or negative declarations of AVF have been made via the State Decision Documents, no additional investigation of these areas was completed as part of this study.

Potential AVF's may exist on the other drainages within and adjacent to the permit. The methods used to determine if the potential AVF's contain alluvial deposits bearing water of a width that may be significant to farming are discussed in the following sections.

D11.2 Purpose and Scope

In a decision by the U.S. District Court for the District of Columbia, Civil Action Number 69-1144 in 1980 (known as the Flannery Decision), the court noted that an AVF must satisfy both geologic criteria (unconsolidated stream laid deposits) and hydrologic criteria (water sufficient to sustain agriculture). Therefore, the court emphasized that the key to the existence of an AVF is the presence of both geologic and water availability characteristics which together sustain agricultural activities.

The Wyoming Environmental Quality Act (W.S § 35-11-103(e)(xviii) defines an AVF as follows:

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"Alluvial valley floor" means the unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas, which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits.

It is understood that surface and underground coal mining operations fall under the Surface Mining Control and Reclamation Act ("SMCRA"). Furthermore it is understood that mining will only be prohibited where there is an alluvial valley floor for three reasons: (1) where mining will interfere with or preclude farming; (2) where mining will materially damage the water supply to an alluvial valley floor; or (3) where the essential hydrologic functions cannot be restored after mining.

RAMACO is proposing to conduct both surface and auger mining operations within the proposed permit boundary (see Figure D11.1-1). Auger and/or highwall mining is a hybrid of surface and underground mining. A high wall is excavated to expose the coal to be mined and then a remotely operated continuous miner is sent to excavate the seam without removal of the adjacent overburden. A tunnel is mined to the maximum extent allowed by the equipment and geology. Once the tunnel is completed the equipment is retracted and then begins a new tunnel down the highwall parallel to the tunnel that was just constructed. The miner leaves web pillars between tunnels and it leave barrier pillars between groups of tunnels for safety and to minimize settlement. This method of mining will limit the amount of surface disturbance.

The goal of the investigation performed was to adequately characterize the hydrologic functions within the study area to determine if they meet the formal definitions required for AVF determination and what functions, if any, are essential to the hydrologic system that would require special consideration in order to restore the hydrologic balance if the drainages were to be mined and

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reclaimed. Additionally information is included to allow assessment of material damage to water supplies on alluvial valley floors important to farming, namely the Tongue River valley floor.

D11.3 Stream Laid Deposits

AVFs must be composed of unconsolidated stream laid deposits; therefore, the following illustrates areas which contain stream laid materials within the study area based on publicly available data and data from coring and monitor well construction. The valleys in the study area are made of debris left by stream flow, slope wash, wind and/or land sliding. Previous studies have been conducted which outline those areas of deposition that are the result of stream flow.

The areas within and adjacent to the permit boundary have been studied by B.E. Barnum 1983, S.P. Kanizay 1978, Big Horn Coal Company (Big Horn Mine Permit No. 213-T) and Sheridan Enterprises (Welch No. 1 North Mine Permit No. 497-T1). The study conducted by Kanizay is presented in Exhibit D11.3-1. It is important to identify topographic valleys containing unconsolidated deposits overlain by flood plains or terraces with side slopes underlain by alluvium. Several topographic valleys exist within and adjacent to the proposed permit boundary (Exhibit D11.3-1). The valleys include: Earley Creek valley, East Fork of Earley Creek valley, Slater Creek valley, Hidden Water Creek valley and other minor valleys. The valleys contain mostly ephemeral stream channels except Slater Creek which is described as an intermittent stream.

As seen on Exhibit D11.3-1, the Earley Creek, East Fork of Earley Creek, Slater Creek, Hidden Water Creek, and some of the other minor tributaries contain stream laid deposits but also tend to have slopewash, local terrace and/or alluvial fan deposits. It is apparent that within and adjacent to the proposed permit boundary that geologic characteristics are present which meet the criteria of an AVF. Mapping units that may meet the criteria of AVFs are Alluvium (Qal), Alluvial and Colluvial Deposits (Qac), and Stream Terrace

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Deposits and Alluvium Undifferentiated (Qat). Mapping units that do not meet AVF criteria are Colluvial Deposits (Qc), Stream Terrace Deposits Uncorrelated (Qt), Pediment Deposits (Qp), Tongue River Member (Tft), and Lebo Shale Member (Tfl). The approximate location boundaries of the Area Disturbed By Surface Mining (af) indicate historic mine workings that have either been reclaimed or contain remnants of previous debris piles, road, and ponded water.

Unconsolidated stream laid deposits are often associated with geomorphic characteristics including channel bars, splays, abandoned meanders, modern flood plains, and terraces. Geomorphic characteristics such as channel bars, abandoned meanders, and modern flood plains are only found in the channels of the Tongue River and Goose Creek in the study area. There are no substantial splays visible in either the Tongue River or Goose Creek channels. None of these geomorphic characteristics are present in Earley Creek, East Fork Earley Creek, Slater Creek, Hidden Water Creek, or the other minor tributaries. The stream channels are essentially straight with slopes too steep to form these geomorphic characteristics. Exhibit D11.3-1 shows the approximate locations of the Stream Terrace Deposits and Alluvium Undifferentiated (Qat) mapping unit. As can be seen on Exhibit D11.3-1, the Qat mapping unit is not present within the study area. The Stream Terrace Deposits Uncorrelated (Qt) mapping unit is found within the study area. However, as mentioned before, the Qt mapping unit does not qualify for AVF criteria.

In addition to the mapping that has been provided herein, information from coring and monitor well construction is included in Addendum D11-3. This addendum includes three alluvial wells which were constructed along Slater Creek and six boreholes constructed perpendicular to the Slater Creek channel to assist with preparation of transects. The alluvial transects are presented on Exhibit D11.3-2. As shown by these transects, colluvial material overlays alluvial material in all boreholes and monitor wells. Also, the colluvial

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material is generally greater than 10 feet thick. The locations of the boreholes were selected as those that best represent the natural extent of the potential alluvial material of the channel and those that could be reasonably accessed by the drilling equipment. The presence of scoria colluvial/alluvial material was used as an identifier for the purpose of identifying the natural extent of the channel.

Three bore holes were also constructed along Hidden Water Creek, which are included in AddendumD11-3. The locations of these boreholes are shown on Exhibit D11.3-1. These boreholes show that the Hidden Water Creek valley fill is predominantly angular scoria in a colluvial, silty matrix. Also, the two boreholes (HW-BH-1 and HW-BH-2) located in the channel bottom show that bedrock is shallow at a depth of 3 feet. The third borehole (HW-BH-3) was taken on a terrace approximately 8 feet above the channel bottom. This borehole also had scoria in a silty matrix, but also includes sands and clays. These findings are similar to those found in the Big Horn Mine Permit No. 213-T8, Appendix D6, pages D6-157 to D6-158. Test pits completed within the stream channel of Hidden Water Creek shared the following characteristics:

> "One to two and one-half feet of fine-grained, relatively homogeneous, sediments (silt to very fine sand) overlie coarser, nonhomogeneous, stratified layers of subangular to rounded cobbles and gravel, indicating a decrease in the overall energy environment in more recent times.
>
> Most of these stratified cobbles and gravels were made up of scoria and sandstone chips often with horizontal orientation in a matrix of sand to sandy clay. Weathered coal chips were also evident in some of the stratified layers.
>
> The conclusion verified from the pit observations is that these deposits are unconsolidated and stream laid. Small isolated patches of colluvium or bedrock can be found throughout the alluvial deposits, but these characteristics do not exclude the deposit from being stream laid."

The location of these test pits can be seen in Exhibit D11.3-1. These results show that the materials in the Hidden Water Creek valley do meet the definition of unconsolidated stream laid deposits near the confluence of Hidden Water Creek and the Tongue River, and do not meet the definition of unconsolidated stream laid deposits further upstream. Addendum D11-2 contains the State Decision Documents (SDD) for T1 and T2 of the Bighorn

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Coal Permit No. 213. Under the heading "Determination" on page 52 of SSD 213-T2 (page Addendum D11-2-96), the document states "No other drainages are of significant size or lack the stream laid deposits necessary to be an Alluvial Valley Floor within the renewal and/or amendment areas."

D11.4 Water Resources

D11.4.1 Water Quantity

Subirrigation and/or natural or flood irrigation occurs on lands within and adjacent to the proposed permit boundary. The following discusses water availability for agricultural practices.

D11.4.2 Extent of Subirrigation

Subirrigation can be inferred from late season color infrared photography. It is assumed if evapotranspiration is occurring late in the season when water is available for plant growth. Color infrared photography measures evapotranspiration and is an indicator of irrigated and subirrigated lands. Potentially subirrigated lands have been identified by RAMACO and are depicted on Exhibit D11.1-1. The boundaries that have been drawn are an interpretation of zones that show late season plant growth within those zones of potential subirrigation. Exhibit D11.1-1 also illustrates the relationship of these subirrigated lands and the geologic criteria discussed previously. Water levels were measured at three monitor wells along or near the thalweg of the Slater Creek channel. These wells are depicted on Exhibit D11.3-1. Data for these wells are presented in Table D11.4-1.

As shown by Exhibit D11.1-1, potential subirrigation appears to occur along the Tongue River, Earley Creek, and Slater Creek within and adjacent to the proposed permit. In addition to infrared aerial photography, the Big Horn Mine Permit No. 213-T8, concluded that "no subirrigation is present during the entire growing season" along Hidden Water Creek. Infrared aerial photography shows that subirrigation does not appear to occur along the East Fork of Earley Creek. This is supported by the existence of a prairie dog town in the drainage

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channel of the East Fork of Earley Creek as indicated on Exhibit D8.2-1 as symbol PDMG.

As shown by Exhibit D11.3-2, the typical alluvial/colluvial potentiometric surface in the materials along Slater Creek is below the root depth necessary for subirrigation that will contribute to the useful production of grass and hay vegetation, though it may allow these plants to survive. This depth is typically only sufficient for water use by trees and shrubs located along the Slater Creek valley. Table D11.4-1 shows that there is little to no seasonal variability to the water levels in the alluvial wells. In this case, subirrigation does not exist in a regulatory sense because no increased production results from the available groundwater, except during years with above average precipitation. This indicates that limited subirrigation in conjunction with precipitation events are the water sources being used by vegetation. The Slater Creek drainage contains several locations of burn, scoria, or clinker material overlying coal that were the result of previous coal fires. The interface between the coal and the scoria is a zone of partially metamorphosed coal ash. This ash band acts as an aquaclude preventing water from entering or escaping the coal. Infiltration of precipitation into the burn and then slow release of the stored water acts as a water source for the subirrigation and surface flow of Slater Creek.

D11.4.3 Extent of Natural and Artificial Flood Irrigation

Flood irrigation with respect to AVFs can be defined as, "supplying water to plants by natural overflow or the diversion of flows, so that the irrigated surface is largely covered by a sheet of water". If overbank flows occur with sufficient frequency and duration to significantly increase forage production adjacent to a stream, this natural flood irrigation can be considered a flood irrigation agricultural activity. Historically, the 2-year runoff event occurs with sufficient frequency and duration to be considered agriculturally useful if it inundates a significant area.

The ephemeral drainages, within and adjacent to the permit area, flow in response to precipitation events that come in the form of rain and snow. Snow

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accumulation typically begins in October and melts in early spring. This snow melt along with the spring rains contribute the most to the peak flows observed in late May and early June. Precipitation for the proposed permit area is taken from NOAA Atlas 2 and can be seen in Table D11.4-2. A more in-depth discussion on the project area hydrology is included in Appendix D6. Appendix D6 contains a HEC-RAS analysis of Slater Creek for the 2-year, 24-hour runoff event. The area inundated by this storm event is shown on Exhibit D11.4-1. As shown on the Exhibit D11.4-1, the width of the 2-yr inundation area is approximately 200 feet wide including the channel. This width minimizes the effectiveness of this valley for agricultural purposes using natural flood irrigation.

Exhibit D11.4-1 also shows the locations of permitted water rights within and adjacent to the proposed permit area. Exhibit D11.4-1 also depicts the point of use for the water rights listed in Addendum D11-4. This is an illustration of the artificially irrigated lands, some of which may be naturally subirrigated. As shown by the exhibit most of the artificial irrigation practices that are within or are adjacent to the permit are on the Tongue River valley.

D11.4.4 Water Quality

Wyoming Department of Environmental Quality classifies the Tongue River as a 2AB stream and Earley Creek, Slater Creek, and Hidden Water Creek as 3B streams. Waters classified as 2AB are to be maintained suitable for use as Drinking water, Game Fish, Non-Game Fish, Fish consumption, other aquatic life, recreation, wildlife, agriculture, industry and scenic value. Waters classified 3B streams are to be maintained suitable for use of other aquatic life, recreation, wildlife, agriculture, industry, and scenic value.

Water quality was measured for the Tongue River in water years 2001-2005 by the USGS in report 2007-5146 as site T4. The sample site is near the Montana state line at Decker, presumably at the USGS gaging station

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06306300 as depicted on Figure D11.1-1. Table D11.4-3 provides a summary of the water quality from this site. For further discussion of the water quality of the alluvial materials within the permit area refer to Appendix D6.

D11.5 Agriculture Practices

The primary land use within and adjacent to the permit area in recent history has been agricultural such as grazing, irrigated hay meadows or cropland, and other associated ranching activities. The upper hills within the permit boundary are typical rangeland for Wyoming suitable for cattle grazing. However, the dry, hilly nature of these areas does not lend itself to other forms of agriculture, such as irrigated cropland. Portions of the proposed permit adjacent to the Tongue River are suitable for irrigating hay meadows and cropland through the use of center pivot irrigation, lateral move irrigation (side rolls or wheel lines), and flood irrigation (natural and artificial). These areas can be seen clearly on Exhibits D11.1-1 and D11.4-1. As shown by these exhibits, stream valleys in this area, namely the Tongue River provide the necessary water supply to support farming to hay meadows and cropland.

The Hidden Water Creek valley and the Earley Creek valley do not currently include any hay meadows or cropland inside of the study area as shown on Exhibits D11.1-1, D11.4-1, and Exhibit D8.2-1. Natural or artificial flood irrigation is not feasible on the Hidden Water Creek drainage as a result of unreliable and low flow patterns. While an adjudicated water right does exist on East Fork Earley Creek (Early Creek Ditch No.1), the lack of irrigation is demonstrated by the absence of a culvert or other type of conveyance structure under Interstate 90 at the location East Fork Earley Creek intersects the interstate. This suggests the East Fork Earley Creek drainage does not supply sufficient water for consistent agricultural practices. In addition, the water right point of use acres for East Fork Earley Creek Ditch No. 1 presented in the SEO permit in Addendum D11-4 do not appear to be irrigated in recent times as depicted in the imagery for Exhibit D11.4-1. The adjudicated acres in Section 10 and 15 of T.57N., R.84W. appear to be comprised of mostly Prairie Dog Modified Grassland and Bottomland Sagebrush Grassland as presented in Appendix D8. This suggests the water right has not been used for irrigation purposes for some time and is likely abandoned.

The Slater Creek valley contains limited hay meadows located within the valley floor north of the permit boundary, as shown in areas marked

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Agricultural Land (AG) in Exhibit D8.2-1. Comparison of Exhibits D8.2-1, D11.1-1, and D11.4-1 within the study area shows that portions of the hay meadows in Sections 2, 3, 11, and 12 of Township 57 North, Range 85 West are located within the boundaries of subirrigation or natural flood irrigation. However, the majority of the areas marked AG are not within the boundaries of subirrigation or the natural floodplain, and as such may be supplied with water through SEO water rights. These water rights are included in Addendum D11-4. The Landen and Williams ditches (shown on Exhibit D11.4-1) appear to be currently unused for production of agricultural vegetation, and are either indistinguishable from the surrounding landscape or are in poor condition. The Hall Ditch, a pipeline, is the only diversion structure that appears to be in use. The Hall Ditch receives its water from the Hall Reservoir which stores year round runoff from a tributary of Slater Creek. The inactivity and poor condition of the ditches (Landen and Williams) that draw water directly from Slater Creek suggests that sufficient surface water is not consistently available for use in agricultural production. The remaining southeast portion of the Slater Creek valley within the permit boundary does not include SEO water rights and water is supplied to vegetation through precipitation events, limited subirrigation, and natural flood irrigation as described in sections D11.4.2 and D11.4.3. Typical widths of these areas range from 100 feet to 500 feet for subirrigation and 80 feet to 450 feet for natural flood irrigation. These widths are generally not economical for farming practices.

The remnants of the former Conable Reservoir dam exist on Slater Creek within the permit area in Section 12 Township 57 North, Range 85 West According to SEO records, the Conable Reservoir permit was filed in 1901 and was originally intended to store water from precipitation events on Slater Draw for irrigation purposes. The Conable Ditch and Lateral, also permitted in 1901, was originally intended to irrigate a hundred acre area encompassing areas of Section 12 and 13 of Township 57 North, Range 85 West using stored water from the Conable Reservoir. Both water rights were cancelled in 1906 furthermore suggesting the areas lack of water as reasoning for the irrigation attempt failure.

Addendum D11-2 provides the SDD for the declared AVFs within and adjacent to the permit area, within these documents the significance to farming is addressed. Irrigated lands within the permit area and adjacent lands are depicted in Exhibit D11.4-1 and ownership of these lands is found in Adjudication. As discussed in Appendix D7, no prime farmlands exist within the permit area.

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D11.6 Extent of Alluvial Valley Floor

RAMACO is providing the materials included in this AVF study to assist WDEQ/LQD with making a determination as to the existence and extents of AVFs within the study area. Both the East Fork Earley Creek and Earley Creek valleys are located a sufficient distance from the mining area such that no material damages are anticipated based on RAMACO's mining methods.

The potential AVFs determined by this study and declared AVFs are shown on Exhibit D11.6-1. The extents of the potential AVFs were determined to be the portion of the Tongue River valley bottom consisting of unconsolidated stream laid deposits having or capable of supporting subirrigation or flood irrigation agricultural activities. The extents of the unconsolidated stream laid deposits were as identified on Exhibit D11.3-1. The extents of the subirrigation or flood irrigation were as determined by Exhibits D11.1-1 and D11.4-1 respectively.

The Slater Creek valley, Hidden Water Creek valley, and both the East Fork Earley Creek and Earley Creek valleys were not included as an identified AVF on Exhibit D11.6-1. Slater Creek valley was not included for the following reasons:

- A thick layer of colluvial material overlays alluvial material in all boreholes and monitor wells sampled. However, Exhibit D11.3-1 does show that undifferentiated alluvium and colluvium are present.
- The potentiometric surface in the valley is generally too deep for use by grasses and hay crops to enhance production, and
- The width of natural flood irrigation and subirrigation in the valley within the study area are generally insufficient to provide for economical agricultural practices. However, irrigated hayfields can be seen upstream of the permit boundary.

Hidden Water Creek valley was not included for the following reasons:

- All boreholes taken in the valley showed only colluvial material with shallow bedrock, and
- No subirrigation or flood irrigation agricultural activities are identified in the valley.

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In addition, the Big Horn Coal Permit No. 213-T2 State Decision Documents (SDD) provided in Addendum D11-2 determined the limits of the AVF to the areas referred to as the inferred Alluvial Isopach, as shown in Exhibit D11.7-1, which depicts the "Drill Hole Location and Alluvial Isopach Map" of the Big Horn Mine Permit. The 213-T2 SDD states "No other drainages are of significant size or lack the stream laid deposits necessary to be an Alluvial Valley Floor within the renewal and/or amendment areas." The permit boundary for the Big Horn Mine Permit No. 213-T can be seen in Exhibit D11.1-1, and shows that the downstream section of Hidden Water Creek was determined not to be an AVF. The Big Horn Mine Permit also concluded that this area, being near the Tongue River, has the best and most reliable flow conditions of any irrigable tract in the Hidden Water Creek watershed, but was still determined not to be an AVF. Thus, the remainder of Hidden Water Creek was not included within the potential AVF shown in Exhibit D11.6-1.

The East Fork Earley Creek valley was not included for the following reasons:

- Lack of subirrigation and surface water sufficient for natural or artificial flood irrigation that would enhance the production of agriculturally useful vegetation.

The WDEQ/LQD evaluated the AVF's within the Brook Mine and presented their findings in a letter. The letter and supporting documentation has been included in Addendum D11-5. The findings indicate there are 6.6 acres of AVF on Slater Creek, no AVF was declared on Hidden Water Creek within the Permit Boundary. In December of 2019, WDEQ/LQD prepared both an AVF determination letter and a memorandum on the AVF Verification Survey of materials provided by Brook Mine; Tongue River Valley and upper Slater Creek. The AVF determination letter and memorandum are included in Addendum D11-5.

The area on Slater Creek was determined to be an AVF due to past agricultural practices within the area included alfalfa hay production. The area had sufficient surface water flow (surface and subsurface) from the return flow of upstream artificial flood irrigation practices to support agricultural activities. WDEQ/LQD also determined even though they were not able to conduct site visits to the areas within a one-half mile buffer adjacent to the permit (due to

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limited landowner consent), the area along the Tongue River is assumed to be an AVF. This was due to the valley floor being conducive to artificial flood irrigation. This would be similar to what DEQ/LQD indicated for the adjacent one-half mile buffer upstream on Slater Creek, where the land owner is actively artificially irrigating along Slater Creek. DEQ/LQD has not made a declaration for either area, but has assumed that the conditions could meet the definition of an AVF due to the agricultural activities.

No area within the permit would be considered significant to farming, since all the area within the permit is rangeland and not actively being farmed.

D11.6.1 Essential Hydrologic Functions

As defined in WDEQ LQD R&R Chapter 1 the essential hydrologic functions means with respect to alluvial valley floors, those conditions of surface and groundwater hydrology that make water of a suitable quality and quantity usefully available for subirrigation or flood irrigation agricultural activities. These conditions may include, but are not limited to, the erosional state of the stream, the surface water balance, the groundwater balance, the physical and chemical properties of the soils, water and substrata, and topographic configuration.

The essential hydrologic function of Slater Creek within the permit area is:

1. Slater Creek surface water is of suitable quality for agriculture see Table D6.1-13.
2. Slater Creek groundwater is not of suitable quality for agriculture and exceeds suitability criteria for Iron, Sulfate, and TDS see Table D6.2-8.
3. Slater Creek surface water may at very limited times be of enough quantity, usefully available for subirrigation or flood irrigation agricultural activities (see Table D6.1-13). In Wyoming a basic water right is 1 cfs for 70 acres. Slater Creek has an average

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flowrate of 0.63 cfs and is capable of supporting 44 acres in May and June (see Addendum D6-4 Table D6-1).

4. Slater Creek groundwater may at limited times be of enough quantity, usefully available for subirrigation (see Table D6.2-3), however as discussed in item 2 it does not meet suitability criteria.
5. Slater Creek is incised among unconsolidated stream laid deposits.
6. Slater Creek is a gaining reach in May and a losing reach in June and subsequent months. Base flow is supported by groundwater in the alluvium and spring flows from elevated clinker deposits (see Addendum D6-4 Table D6-1).

The function of Slater Creek is to convey flows both on the surface, subsurface and between the surface and subsurface to maintain the water balance during time of high and low rainfall and snowmelt.

D11.7 Mining of Alluvial Valley Floor

No mining is planned on the AVFs located in the Tongue River as indicated in Exhibit D11.6-1 (Aerial Extent of Declared Alluvial Valley Floors). Therefore; a significance to farming determination is not required as mining will not result in material damage to water supplied to the AVF, the essential hydrologic function will be protected and preserved and operational monitoring will occur and Goose Creek valleys; however minor disturbance of the declared AVF in Section 21 of Township 57 North, Range 84 West is anticipated. Further discussion of the AVF disturbance is presented in Mine Plan Section MP.25. Reclamation of the disturbed AVF is described in Reclamation Plan Section RP.10. The areas previously determined to be AVFs by the SDD provided in Addendum D11-2 for the Big Horn Mine Permit 213-T8 can be seen in Exhibit D11.6-1. The SDD provided in Addendum D11-2 states that the following are the

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essential hydrologic functions of the areas determined to be AVFs within the Tongue River and Goose Creek valleys:

1. "Availability of surface waters of suitable quality and quantity for flood irrigation.
2. Adequate soil, slope, and land-form conditions to permit flood irrigation activities.
3. Ability to transmit groundwaters of suitable quality and quantity, to support subirrigation of certain areas."

The essential hydrologic functions described above are the same for the potential AVF of the Tongue River that has not been declared (as shown in Exhibit D11.6-1). The remaining potential AVF's (those drainages that are tributaries to Tongue River and Goose Creek) essential hydrologic function would be to transmit groundwaters of suitable quality and quantity to support subirrigation of certain areas. A detailed discussion of the Brook Mine's impact on these essential hydrologic functions of the Tongue River is located in Mine Plan Section MP.25. Since no mining is planned in the AVFs located in the Tongue River and Goose Creek valleys, the mining operation will not interfere with the ability of tributaries to Tongue River and Goose Creek to transmit groundwaters from upstream areas to their confluences. Due to the methods of mining at the Brook Mine, no material damage to the declared AVFs is expected.

D11.7.1 AVF Monitoring System

To ensure that the essential hydrologic functions of the AVFs are maintained, a monitoring system will be implemented during mining and reclamation. The monitoring system consists of analysis of periodic infrared aerial photography, monitoring of existing alluvial wells, and monitoring of existing surface water stations. Water levels and water quality samples will be obtained at the alluvial monitor wells in the Tongue River, Goose Creek and Slater Creek at the frequencies described in the Mine and Reclamation Plans. Also, monitoring of surface water stations will continue at the locations and frequency described in the Mine and Reclamation Plans.

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D11.8 References

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ADDENDUM D11-5

WDEQ Documentation for the AVF Declaration for Brook Mine

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RAMACO

Brook Mine

Department of Environmental Quality

To protect, conserve, and enhance the quality of Wyoming's environment for the benefit of current and future generations

Matthew H. Mead, Governor

Todd Parfitt, Director

February 24, 2016

Mr. Randall Atkins
c/o WWC Engineering
1849 Terra Ave.
Sheridan, WY 82801

RE: AVF Determination, Brook Mine Coal Mine Permit Application, TFN 6 2/025

Dear Mr. Atkins

The Land Quality Division has evaluated potential Alluvial Valley Floor (AVF) lands within the proposed permit boundary of the Brook Mine. An AVF determination was initiated on September 24, 2015 when a group of LQD personnel visited the proposed mine site for a field evaluation of one drainage, Slater Creek. The entire length of the stream within the permit boundary was walked for evaluation purposes. The geomorphology, vegetation, and hydrology of the drainage was observed. Photos were taken to assist in AVF characterization. Upon completing the field examination of Slater Creek and evaluation of aerial photography, Big Horn Coal Permit 213 AVF assessments, historic geologic maps, available literature, and personal communication within LQD, a determination of the AVF characteristics of the drainage within the Brook Mine proposed permit boundary has been made. The analysis of the potential Slater Creek AVF has determined that 13.11 acres within the Brook Mine Permit Boundary are considered to be AVF and have been declared as such. The declaration statement was crafted as a memorandum to file and placed within the active TFN for the Brook Mine permit application, TFN 6 2/025. The document is available for review at the Sheridan LQD office as well as the LQD office in Cheyenne.

Further determination of the status of AVF potential for Slater Creek one-half mile upstream from the proposed Brook Mine permit boundary is pending. The acreage in question is owned by Mr. Tony Bocek and permission to access his property to complete the AVF determination is required at this time. It is the responsibility of the mine permit applicant to obtain written permission to facilitate the final AVF determination. Upon receipt of written permission for LQD personnel to access Mr. Bocek's property, a field evaluation of the acreage in question will be scheduled. An invitation will be extended to your representative to accompany LQD personnel on the site analysis. LQD will provide the name of the staff member or members who will be present at the field evaluation.

An evaluation of the lands within one-half mile of the proposed Brook Mine permit boundary that may qualify as AVF has concluded. The Hidden Water Creek valley floor is located to the north of the proposed permit boundary as well as within the acreage in the northeastern quadrant of the projected

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permit. It has been determined that the Hidden Water Creek streambed materials do not qualify as AVF at this time.

The lands south of and adjacent to the Brook Mine submittal, within one-half mile, are located along the valley of the Tongue River. Previous AVF analyses were made for the Big Horn Coal Company (BHC) coal mining permit (No. 213) in 1981 and the Tongue River flood plain was determined to be AVF at that time. This determination covered affected lands downstream from BHC as well as all acreage upstream, terminating at the west section line of section 21, T57N, R84W. The Tongue River bottom lands need to have a field survey for AVF characteristics from that location in section 21 to a distance of approximately four miles upstream of the Interstate 90 Bridge which crosses the Tongue River. The acreage in question is all fee surface ownership and permission to access the properties is required prior to AVF evaluation. Unfortunately, there are 27 owners of record who would need to be approached for permission to trespass. This places AVF determination in a difficult position as it is strongly expected that some of the property owners will not grant LQD access to perform their studies. These positions have been indicated in personal communication to LQD staff by some of the landowners.

Because of this, final declaration of the Tongue River valley as an AVF cannot yet be completed. The acreage within one-half mile of the proposed Brook Mine permit boundary was defined as potential AVF by the Brook Mine permit application, Appendix D-11, Alluvial Valley Floors. This characterization is corroborated by LQD analysis. Because of this, the Tongue River acreage within one-half mile of the southern boundary of the proposed permit is assumed to be AVF at this time.

A tributary of the Tongue River, Goose Creek, is also located within one-half mile of the proposed Brook Mine permit boundary. This was determined to be AVF and was included in the previously mentioned Big Horn Coal mine permit 213. Since the acreage adjacent to Goose Creek has already been declared AVF, no further declaration needs to be made unless the Brook Mine permit boundary is modified in future amendments to include lands south of the present permit application.

This letter serves as notification that Appendix D11, and other relevant sections of the submitted coal mine permit application must be updated to reflect the findings of AVF by LQD. Please contact Bj Kristiansen or Mark Rogaczewski at the LQD District 3 office with questions or comments.

Sincerely,

Bjarne Kristiansen, PG
Natural Resources Program Principal
WDEQ-LQD District III

Cc: Cheyenne LQD files

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MEMORANDUM

TO: File, Ramaco Brook Mine TFN 6 2/025
FROM Bj Kristiansen, PG
RE: Brook Mine AVF Determination, Slater Creek
DATE: January 7, 2016

The following narrative is created for the determination of Alluvial Valley Floor (AVF) potential **within** the proposed permit boundary of the Brook Mine.

Ramaco Coal Company has submitted a permit application to LQD for a surface coal mine, to be operated in Sheridan County, Wyoming. The mine has been named the Brook Mine and is found on acreage located within T.57N., R.84W and R.85W. An AVF determination was initiated on September 24, 2015 when a group of LQD personnel visited the mine site for a field evaluation of one drainage, Slater Creek (Map, below). The entire length of the stream within the permit boundary was walked for evaluation purposes. The geomorphology, vegetation, and hydrology of the drainage was observed. Photos were taken to assist in AVF characterization.

Map 1 - Slater Creek topography within the proposed Brook Mine permit boundary.

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Upon completing the field examination of Slater Creek and evaluation of aerial photography, Big Horn Coal Permit 213 AVF assessments, historic geologic maps, available literature, and personal communication within LQD, a determination of the AVF characteristics of the drainage within the Brook Mine proposed permit boundary has been made. The analysis of the Slater Creek AVF has determined that:

1. That portion of Slater Creek occurring in the SW ¼ sec.12, N ½ sec.13, T.57N., R.85W, and the W ½ sec.18, T.57N., R.84W. is classified at this time as an intermittent stream that has segments of perennial flow during wet years. (Figure 1).

2. Acreage directly upstream of the proposed Brook Mine permit boundary has been farmed in the recent past (1 to 2 years) along the margins of Slater Creek, northwest of the abovementioned land, for a distance of approximately 4 ½ miles. The primary crop has been hay used as feedstock for cattle. The farmed lands have historically been watered by flood irrigation methods from a ditch system fed by the North Branch of Slater Creek, originating in the SE1/4 SE1/4, sec.29,T.58N., R.85W. (Figure 2).

3. A segment of the Slater Creek drainage, from the SW ¼ sec.12, T.57N., R85W. to the SW ¼ sec. 18, T.57N., R.84W., has been examined and mapped by LQD staff with a goal of classification of AVF characteristics. **It was determined that 13.11 acres within the Brook Mine Permit Boundary are considered to be AVF** (Figure 3), based on the following criteria:
   a. This acreage is located in the SW ¼ SW¼ sec. 12, T.57N., R.85W., within the northern zone of **perennial flow**. (Figures 1 and 3). Water was present and flowing during the field examination on September 24, 2015.
   b. The streambed is underlain by 16 feet of unconsolidated stream laid deposits, as exemplified by a Ramaco alluvial monitor well, number 578512-AL. (Figure 4). Additionally, there is evidence of abandoned meanders and minor terracing (left). The channel bottom in this location does not occur within bedrock material, as it does further downstream where the channel is deeply incised. There is sufficient alluvial fill in the AVF area to present a relatively flat, unincised geomorphology.

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c. Subirrigation or natural flood irrigation occurring on the stream laid deposits is of sufficient extent to provide for flood irrigation agricultural activities. Artificial flood irrigation has been or is presently practiced on the valley bottom immediately adjacent

to the northwest corner of the area under study where alfalfa hay has been grown in the past. There are significant quantities of subirrigated indicator plant species in the form of grasses, sedges and rushes, and wetland shrubs (above). Subirrigated vegetation is also evident when viewing color-infrared aerial photography (2001) and seasonal, conventional imagery.

d. Identification of a water table exhibiting diurnal fluctuations as a result of transpirational losses is not yet possible due to the short baseline presently submitted by Ramaco for the Brook Mine permit application. The water levels in 578512-AL (below) have been

recorded and presented in a hydrograph running from September, 2013 through May, 2014, where the hydrostatic surface has increased by 0.4 feet. This would indicate a gaining system, as would be expected during the fall and winter when vegetation is dormant and transpiration is not occurring. The static water level in the monitor well is approximately 4 feet below ground level. This depth would indicate that potential subirrigation is available for some perennial grass species used as forage by ranchers.

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e. Neither natural nor artificial flood irrigation occurs on Slater Creek within the Brook Mine permit boundary. The aforementioned adjacent hay meadows farmed by the neighboring rancher are artificially flood irrigated through a system of ditches and diversions. The hay meadows along Slater Creek upstream of the permit area have been irrigated for decades by the resident land owners. Since the stretch of Slater Creek under examination exhibited water flow in late September (below), it is assumed that the flow existed during the summer months. There have been no large rainfall

events during the summer of 2015 to contribute to flows so they are assumed to be perennial. Artificial flood irrigation within the studied acreage has potential to be performed at the same time that the upstream pastures are irrigated but water quantities are unknown at this time. Further research is needed to quantify available surface water. Miller Regression Analyses crafted for Slater Creek in the Brook Mine permit application indicates that the estimated 2-Year Annual Peak Flow for Slater Creek is 80 cubic feet per second (cfs).

f. Water analyses from the alluvial well indicates that the water is slightly saline in nature. The pH averages 8.0, Conductivity is 5,180 µmhos/cm, Total Dissolved Solids (TDS) is 5,210 mg/L, and Sodium Adsorption ratio (SAR) is 4.0. Use of this water in flood irrigation would be effective for forage crops as long as the salts were allowed to move downward through the alluvial materials and exit the system through sub-flow. Water quality samples were collected by Ramaco from a surface water monitoring station located on Slater Creek in the perennial flow section under study. The sample indicates a water type of magnesium-calcium sulfate. In this sample the pH was 8.58, Conductivity was 1,504 µmhos/cm, TDS equals 1,220 mg/L, and SAR was 1.9. Again, the sample indicates some salinity but would suffice for the production of forage crops, such as alfalfa.

g. Soils in the study area are fairly homogenous, with a very fine, sandy loam (NRCS map symbol 154) occurring along the bottom lands along Slater Creek. The closest soil

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determined to be a Prime Farmland Soil by the NRCS (Figure 5) is located approximately 1 mile upstream from the AVF acreage.

h. The AVF acreage is located on lands that are characterized as undeveloped rangeland, no improvements to the land's productivity or management have occurred. The AVF acreage is not significant to farming.

i. None of the land within the Brook Mine permit boundary determined to be AVF will be affected by mining, according to the mine plan presented in the permit application.

4. Based on the analysis performed on the upper part of Slater Creek mentioned above, the tentative classification of the AVF is a "Case X" alluvial valley floor, as defined in Guideline 9, page 14. This is defined as:
   a. A stream for which the alluvial saturated zone storage capacity is great enough to contribute to stream flow. The stream is dry at some periods of the year.
   b. It is further identified by subirrigated vegetation that appears intermittently down the channel length (below).

   c. Hydrograph analyses for the comparison of alluvial water levels and stream stage are available in the Brook Mine permit application to identify baseflow and interflow components. At this time the baseline period of data collection is insufficient for definitive, long-term evaluation. Further investigation of the flow components is recommended.

5. A backhoe pit in the alluvial material proximate to the channel is necessary to identify the alluvial saturated zone. This activity can be enabled when the permit to mine is issued and affected area bond has been submitted.

6. Alluvial Valley Floor determinations on acreages along Tongue River and Goose Creek have been made in the past for the Big Horn Coal Company mining permit 213 (Figure 6). The extent of the AVF definitions were included in the State Decision Document (SDD) crafted for

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the first Term of the Big Horn Coal permit in 1981. Finding No. 11 of the T-1 SDD for the Big Horn Mine permit issued AVF determinations for the Big Horn Mine based on two Exhibits in the permit, Exhibits D11-7 and D11-10. Exhibit D11-7, Drill Hole Location and Alluvial Isopach Map, is no longer valid since the acreages mapped at that time have subsequently been mined and reclaimed. Their essential hydrologic characteristics have been compromised and no longer function as originally defined. Exhibit D11-10, Potential Subirrigated Areas, was not affected by mining by Big Horn Coal and remains a valid AVF determination. That acreage is shown on Figure 5 as the yellow areas along Tongue River and Goose Creeks.

7. Since the Tongue River AVF is not planned to be disturbed by mining, additional in-depth classification for lands adjacent to the proposed Brook Mine permit boundary is unwarranted at this time. A separate determination will be made, supplemental to this document.

The AVF determination of the acreage along the upper reach of Slater Creek within the proposed Brook Mine permit boundary has reached an impasse. LQD has performed as much of the analysis as is possible at this time. Potential AVF lands on Slater Creek upstream and adjacent to the northern permit boundary must remain as future evaluations due to inaccessibility at this time. A proposed plan for AVF determination for these lands will be crafted by the end of February, 2016.

Bj Kristiansen, PG
Natural Resources Program Principal
LQD – District 3

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EXHIBITS

DEQ Ex. 4-983

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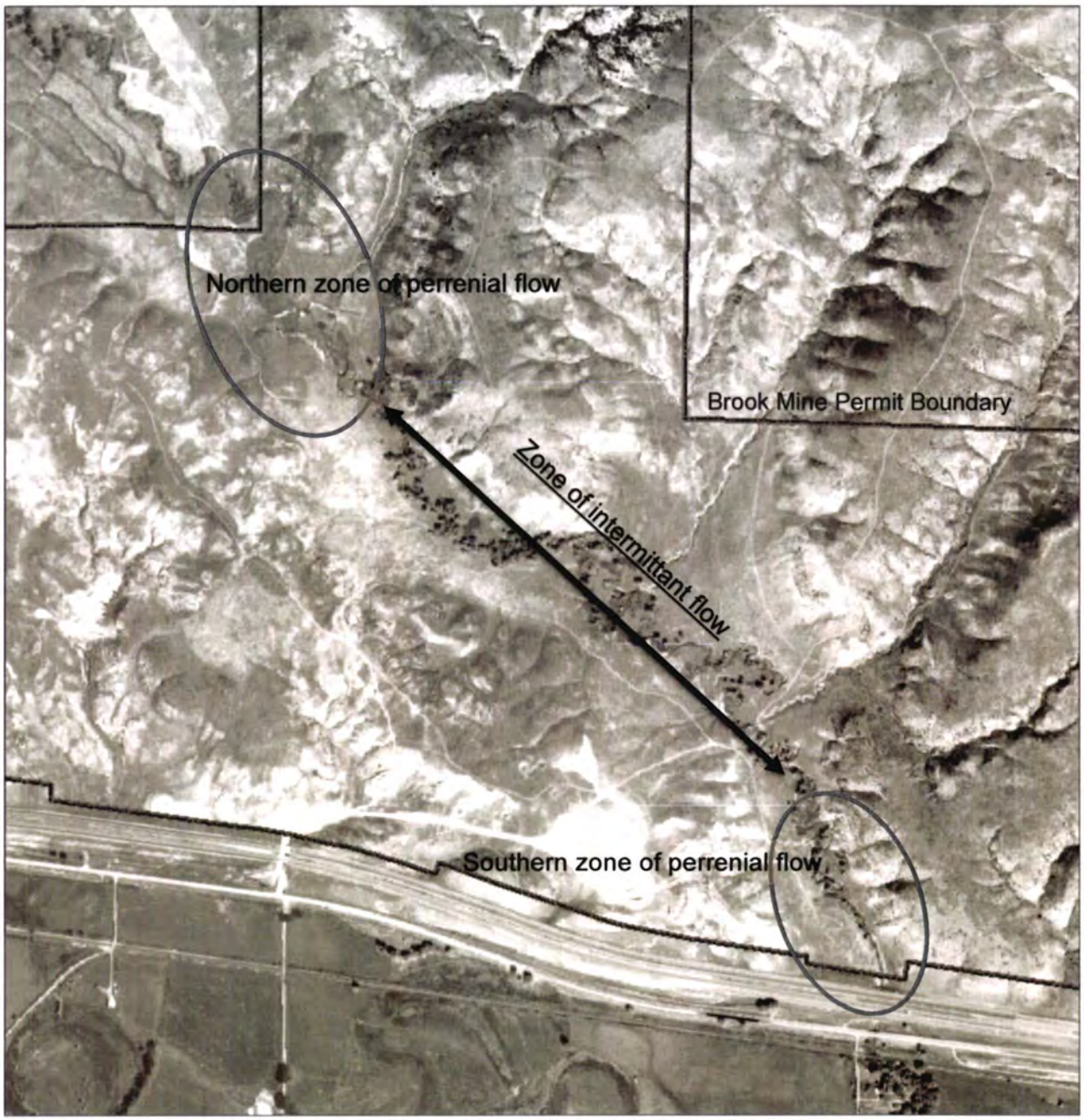

Figure 1 - Zones of perennial and intermittent flow, Slater Creek. Flows were observed on September 24, 2015 and are assumed to be constant throughout the summer months as well as the spring and fall. Color-Infrared imagery May 1, 2004.

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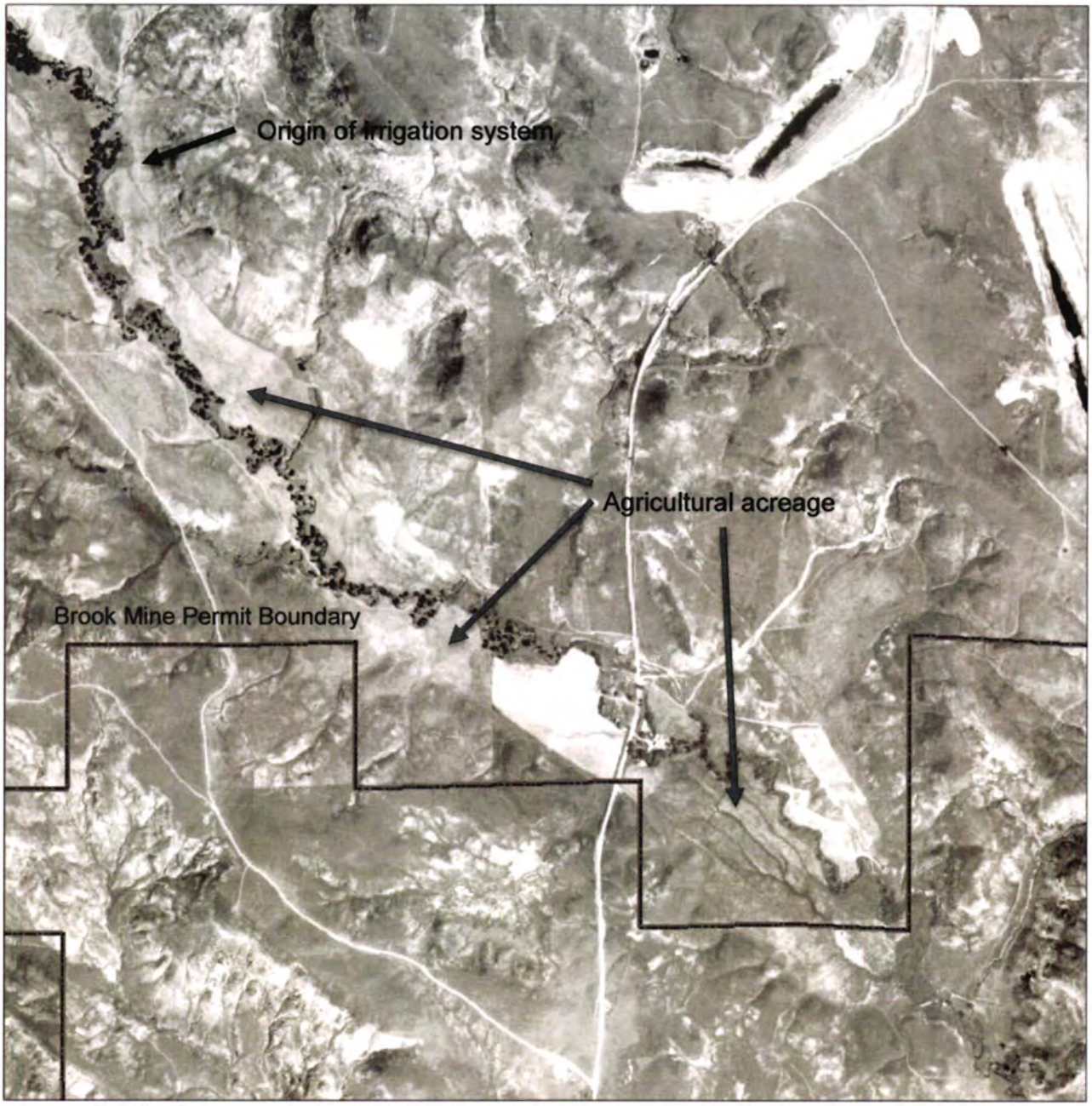

Figure 2 - Upstream section of Slater Creek showing agricultural acreage and irrigation system origination.

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Figure 3 - Slater Creel AVF location, consisting of 13.11 acres.

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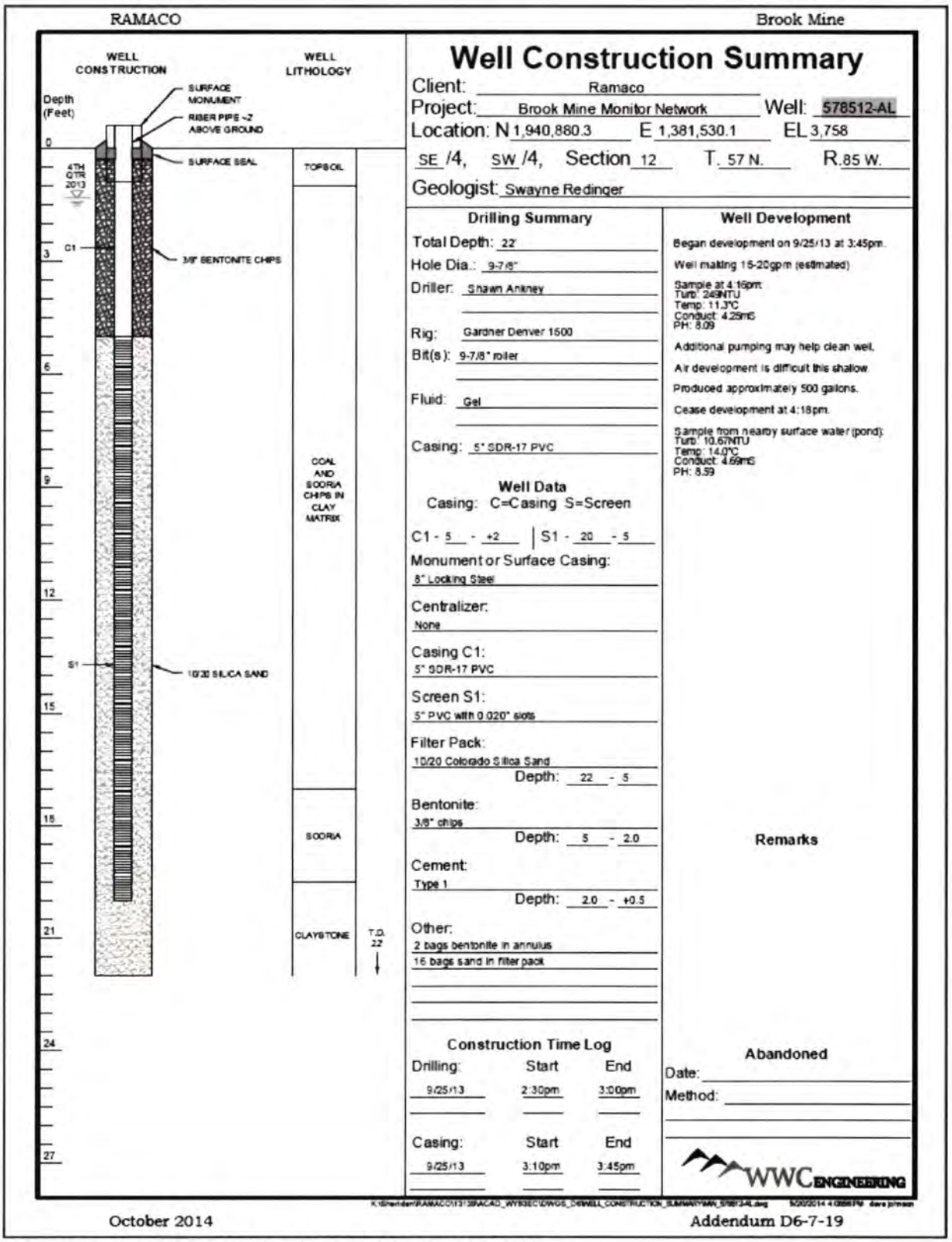

Figure 4 - Lithologic log for Alluvial Well 578512-AL

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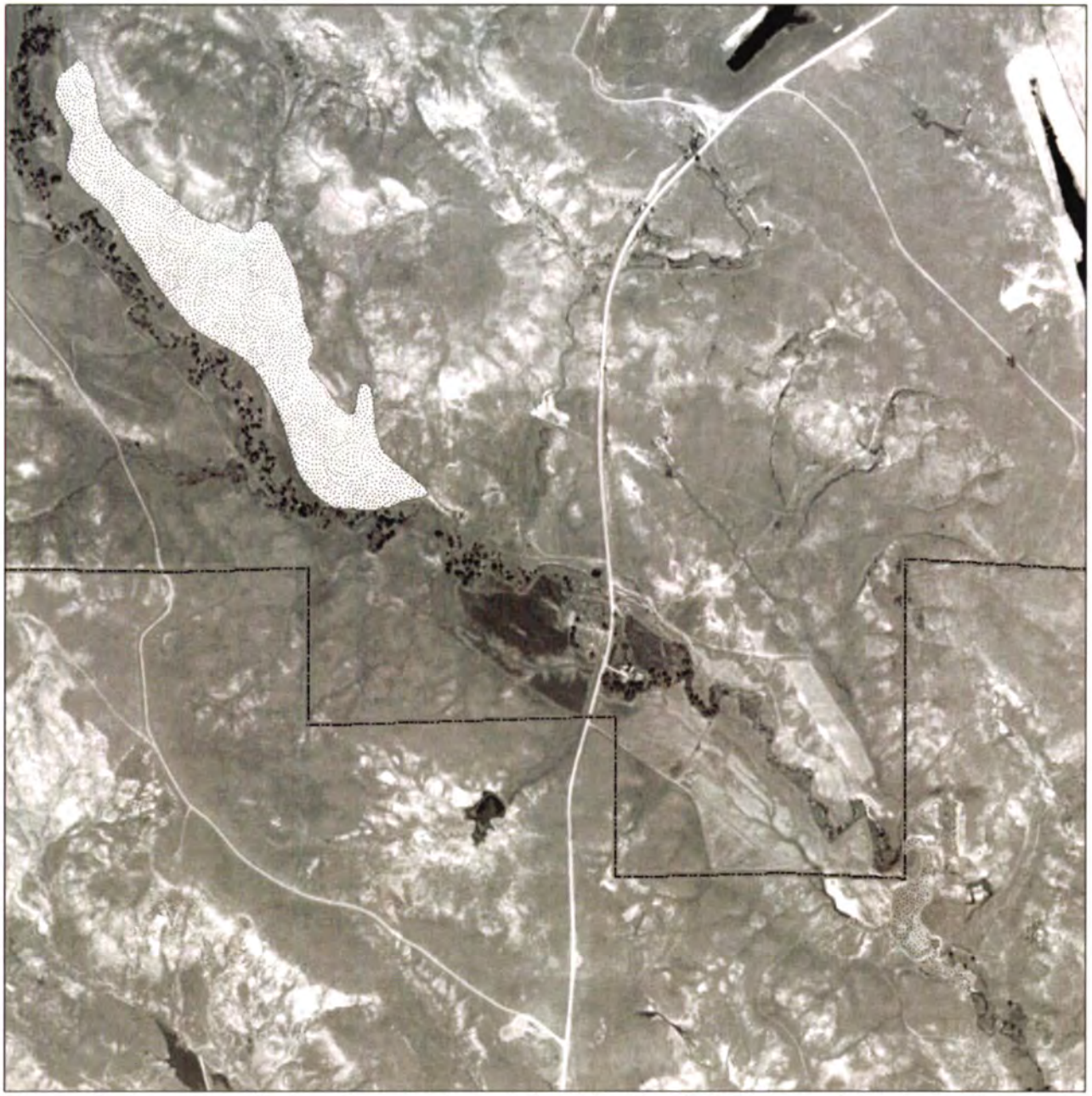

Figure 5 - Location of Prime Farmland, as defined by the NRCS, approximately 1 mile upstream from the study area.

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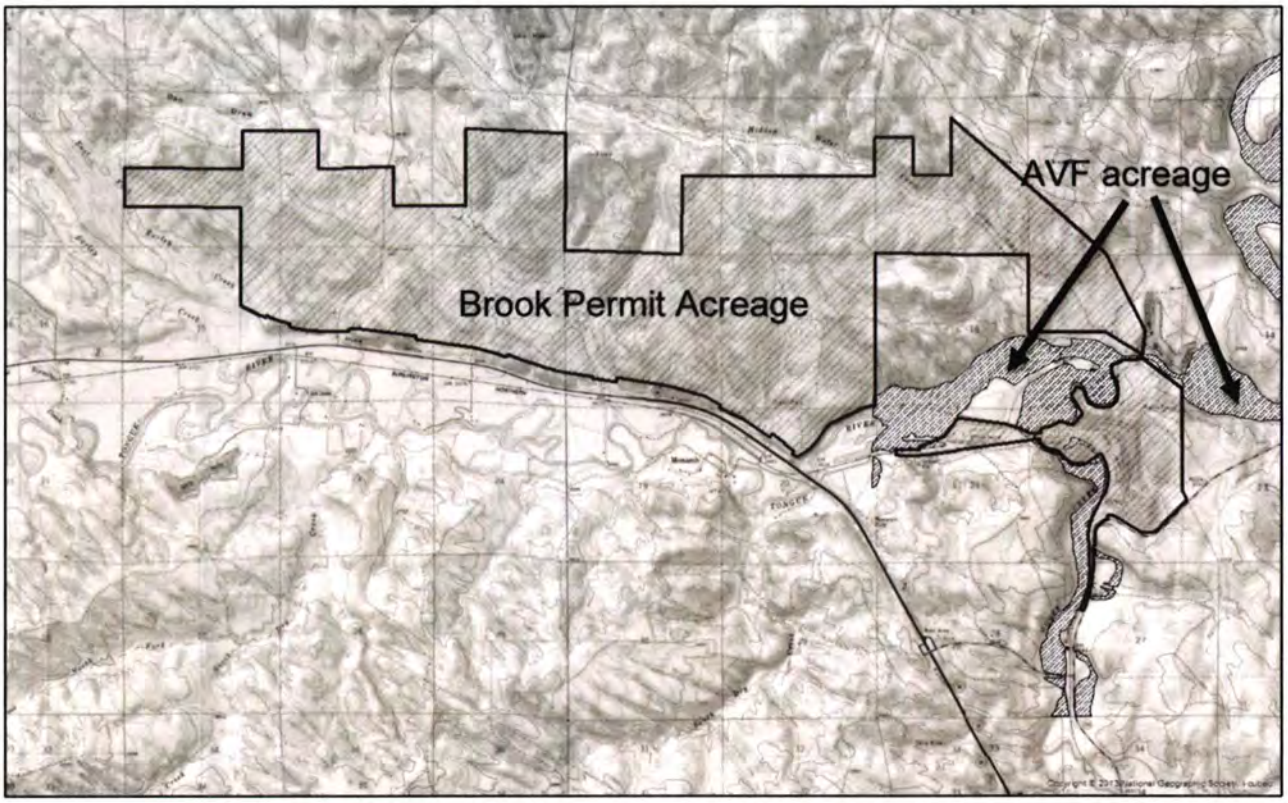

Figure 6 - AVF determinations along Tongue River (TR) and Goose Creek performed for the Big Horn Coal Company Mine Permit 213 T-1, 1981. Declared AVF in yellow stipple pattern.

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Table D11.4-1. Slater Creek Alluvial Water Levels

Station Name	October 2013		December 2013		March 2014		May 2014		July 2014	
	Depth to Water (ft)	Height of Water in Well (ft)	Depth to Water (ft)	Height of Water in Well (ft)	Depth to Water (ft)	Height of Water in Well (ft)	Depth to Water (ft)	Height of Water in Well (ft)	Depth to Water (ft)	Height of Water in Well (ft)
SM578418-AL1	20.65	3.85	20.78	3.72	20.60	3.90	20.15	4.35	20.03	4.47
SM578512-AL1	4.03	17.18	3.81	17.40	3.67	17.54	3.61	17.60	3.84	17.40
SM578513-AL1	9.51	11.26	9.36	11.41	7.66	13.11	6.18	14.59	7.80	12.97

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Table D11.4-2. Precipitation Frequency and Depth

Recurrence Interval	Rainfall Depth (inches)
2-yr, 24-hr	1.5
10-yr, 24-hr	2.35
25-yr, 24-hr	2.83
100-yr, 24-hr	3.57

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RECD NOV 14, 2014

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Table D11.4-3. Water Quality Summary for Site T4

Parameter	Units	25 percentile	Mean	75 percentile	WDEQ Agriculture Standard
Water Temp	Celsius	1	12	18.5	---
Specific Conductance @ 25 degrees C	microsiemens/ Centimeter	550	620	720	---
pH	standard	8.1	8.3	8.5	4.5 - 9.0
Dissolved Oxygen	mg/L	8	9.5	11	---
Dissolved magnesium	mg/L	29	38	40	---
Dissolved Potassium	mg/L	2.2	2.9	3.2	---
Dissolved Sodium	mg/L	25	31	38	---
SAR ratio	standard	0.7	0.8	0.9	8
Alkalinity as $CaCo_3$	mg/L	195	205	211	---
Dissolved fluoride	mg/L	0.22	0.28	0.31	---
Dissolved Silica	mg/L	4.9	6.1	7	---
Dissolved Sulfate	mg/L	90	110	150	200
Dissolved Solids	mg/L	320	390	470	2000
Dissolved Manganese	mg/L	0.1	0.011	0.02	0.02
Arsenic	mg/L	0.0004	0.0005	0.0007	0.1
Beryllium	mg/L	0.00003	0.00004	0.00006	0.1
Iron	mg/L	0.01	0.017	0.028	5
Selenium	mg/L	0.0003	0.0005	0.0006	0.02
Chloride	mg/L	3.9	4	5	100

Source: Clark, Melanie L. and Mason, Jon P., 2007

TFN 6 2/025
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R.85 W. R.84 W.

T. 58 N.

T. 57 N.

BIG HORN CO

MONTANA
WYOMING

BIG HORN CO
SHERIDAN CO

BIG HORN CO
SHERIDAN CO

06306300

06299980

06298000

Ranchester

Dayton

Monarch

Kleenburn

Sheridan

Drawing Coordinates: WY83ECF

TFN 6 2/025
RECD NOV 14, 2014

LEGEND

BROOK MINE PERMIT BOUNDARY

06298000 USGS GAGING STATION

0 1 2 3 4

GRAPHIC SCALE (MILES)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

FIGURE D11.1-1

GENERAL AREA MAP

Drawn By: MBM
Checked By: JGB
Date: 12/13/13

WWC ENGINEERING
www.wwcengineering.com

FILE: GEN_LOC_GAGING

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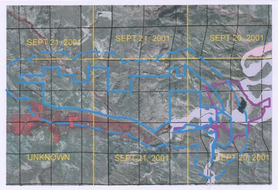
R.85 W. R.84 W.

T. 58 N.
T. 57 N.

HIDDEN WATER CREEK
EAST FORK EARLEY CREEK
EARLEY CREEK
SLATER CREEK
TONGUE RIVER
GOOSE CREEK

R.85 W. R.84 W.



FLIGHT DATES FOR INFRARED PHOTOS

PREVIOUSLY DECLARED AVF'S

- DECLARED AVF AS PART OF STATE DECISION DOCUMENT FOR PERMIT 213-T1
- NEGATIVE AVF DECLARATION AS PART OF STATE DECISION DOCUMENT FOR PERMIT 213-T2
- DECLARED AVF AS PART OF STATE DECISION DOCUMENT FOR PERMIT 497-T1

POTENTIAL SUBIRRIGATED LANDS

- POTENTIALLY SUBIRRIGATED LANDS BASED ON SEPT 2001 INFRARED PHOTOGRAPHY

GEOLOGY

- ALLUVIUM (HOLOCENE)--Silt, sand, gravel, and clay on active valley floor of Tongue River; 0-40 ft thick. Largely composed of detritus derived from sedimentary and igneous rocks exposed on flanks of Bighorn Mountains west of map area; may include low terrace deposits (See Exhibit D11.3-1).
- ALLUVIAL AND COLLUVIAL DEPOSITS (HOLOCENE AND PLEISTOCENE)--Clay, silt, sand, and gravel; 0-40 ft thick. Largely valley fill composed mostly of near-source detritus; includes slopewash and local terrace and alluvial-fan deposits (See Exhibit D11.3-1).
- AREA DISTURBED BY SURFACE MINING--Bedrock geology largely obscured by debris piles, roads, and ponded water. Boundary approximately located based on available mapping.

Geology Digitized From
Geologic Structure Maps Of The Monarch Quadrangle, Sheridan County, Wyoming (e.p. Kanizay, 1978), And Big Horn County, Montana
By B.E. Barnum (1983)

LEGEND

- BROOK MINE PERMIT BOUNDARY
- BIG HORN COAL PERMIT BOUNDARY (PERMIT NO. 213-T7)
- AVF STUDY AREA BOUNDARY

N

0 500 1,000 1,500 2,000
GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

EXHIBIT D11.1-1

TFN 6 2/025
RECD JUL 30,2015

POTENTIALLY SUBIRRIGATED LANDS

Drawn By:	RAV
Checked By:	JGB
Date:	8/25/2014

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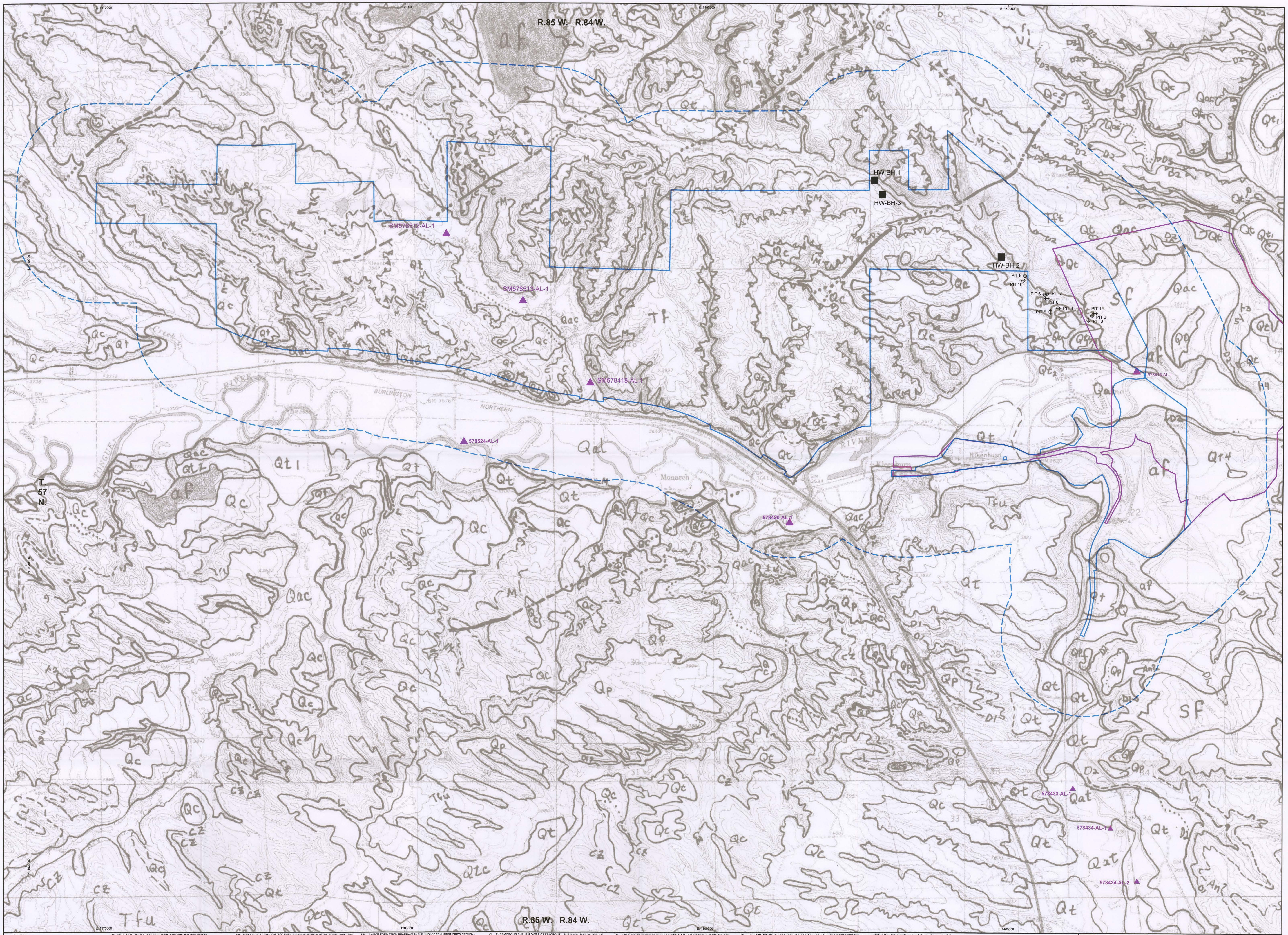
www.wwcengineering.com

FILE: D11-1-1_SUBIRR_LANDS_R1.dwg



BASEMAP:
GEOLOGIC STRUCTURE MAPS OF THE MONARCH QUADRANGLE, SHERIDAN COUNTY, WYOMING (S.P. KANIZAY, 1978), AND BIG HORN COUNTY, MONTANA By B.E.Barnum (1983)

LEGEND

- BROOK MINE PERMIT BOUNDARY
- 1/2 MILE BUFFER BOUNDARY
- BIG HORN COAL PERMIT BOUNDARY (PERMIT NO. 213-T7)
- ALLUVIAL WELL — SM578418-AL-1
- HIDDEN WATER CREEK BOREHOLE — HW-BH-2
- HIDDEN WATER CREEK TEST PIT — PIT 4

af ARTIFICIAL FILL (HOLOCENE) - Mainly spoil from coal mine stripping
sf Subsidence features - Related to old underground coal mines; extent unknown

SURFICIAL DEPOSITS (HOLOCENE AND PLEISTOCENE)
Qal Alluvium - Unconsolidated clay, silt, and sand; locally includes lenses of gravel and contains much organic matter
Qc Colluvium - Unconsolidated heterogeneous aggregates of rock detritus deposited on steep to gentle slopes, usually thick enough to obscure underlying bedrock. Includes slope wash and talus
Qac Alluvium and Colluvium undifferentiated
Qls Landslide deposits - Unconsolidated masses of clay, silt, and sand which have moved downslope as slumps and slides. May include exotic blocks of limestone, sandstone, and conglomerate
Qt Stream terrace deposits uncorrelated
Qt_1 Stream terrace deposits - Unconsolidated stratified and crossbedded silt, sand, and gravel. Divided into 6 deposits (Qt_1, Qt_2, Qt_3, Qt_4, Qt_5, and Qt_6); Qt_1 deposits are lowest topographically and youngest in age
Qat Stream terrace deposits and alluvium undifferentiated - Includes alluvium and gravel deposits on terraces about 12 ft (3.6 m) above present stream levels
Qtc Stream terrace deposits and colluviam undifferentiated - upslope or downslope colluvial material which is gradational with terraces and not distinct on airphotos
Qp Pediment deposits - Unconsolidated silt, sand, and gravel locally derived, stratified and crossbedded. Surfaces usually wedge against Tensleep Sandstone (Pt) to west. Gradient of deposits decrease basinward and merges with stream terraces at intermediate levels

Tw WASATCH FORMATION (EOCENE) - Lenticular interbeds of gray to light-brown, fine to coarse-grained, locally conglomeratic, feldspathic to arkosic, crossbedded sandstone; dark to light-gray or brown or greenish-gray shale, claystone, and siltstone; and subbituminous and lignitic coal beds which grade laterally into carbonaceous shales. Locally coal beds have burned, altering the overlying units to distinctive, dusky-red, resistant clinker outcrops. Base of formation overlies Roland Coals. About 1,000 ft (305 m) exposed east of Little Goose Creek
Tfu FORT UNION FORMATION (PALEOCENE) - Not divided into members south of tongue River where the coals are interbedded with carbonaceous shale and are not as well exposed. In Beaver Creek area west of Bighorn, Wto., several 6 ft (1.8 m) thick conglomerate beds consisting chiefly of carbonate cobble are considered basal Fort Union and appear to be correlative with basal Fort Union of the Mowry Basin area to the south. Contact with the underlying Lance and Bearpaw Formations (Klb) in conformable.
Tft Tongue River Member - Top is marked by Roland coal beds. Pale yellowish-gray sandstone, fine to medium-grained, lenticular, and crossbedded, with light-gray shale and mudstone. Coal and carbonaceous shale common. Extensive burning of coal has produced characteristic fused red clinker and pink to red baked shale beds north and east of the Tongue River
Tfl Lebo Shale and Tullock Members undivided - Lebo Member at top light olive-gray and greenish-gray shale, mudstone, and siltstone interbedded with pale yellowish-brown, fine to medium-grained, lenticular and crossbedded thin sandstone layers. Coal and carbonaceous shale beds are not as well developed. Tullock Member at base is pale yellowish-brown, fine to medium-grained, thick-bedded, massive sandstone and has lenticular thin coal seams and carbonaceous shale

Klb LANCE FORMATION BEARPAW SHALE UNDIVIDED (UPPER CRETACEOUS) - Shales and interbedded sandstone, siltstones, and mudstones. Shales, light olive gray and greenish gray, containing carbonaceous seams and lenses. Siltstone and mudstone, light gray and brown, thin to medium bedded. Sandstone, calcareous, light gray, fine grained, massive, lenticular, and crossbedded. In west central part of map area Bearpaw occurs as slope-valley former between more resistant teapot Sandstone Member of Mesaverde and massive sandstone of Lance. Contact with overlying Fort Union Formation placed at base of cobble conglomerate in Jackson-beaver Creek area and near top of massive crossbedded sandstone at Wolf Creek. Fox Hills Sandstone is mapped with the Lance Formation
Kmv MESAVERDE FORMATION (UPPER CRETACEOUS) - Characteristically consists of two sandstone units separated by shale. Upper member, the Teapot Sandstone Member is very light gray, speckled, medium grained, thick bedded, massive, crossbedded. Middle unit is an unnamed greenish-gray shale. lower member, the Parkman Sandstone Member in yellowish gray, medium grained, thick bedded, massive, crossbedded; contains limonitic concretions. Outcrops of steeply dipping sandstones form knobs along strike. Thickness 700-1,000 ft (213-305 m)
Kcf CODY SHALE AND FRONTIER FORMATION UNDIVIDED (UPPER CRETACEOUS) - Consists chiefly of gray and brown shales; poorly exposed. A 60 ft (18m) zone of bentonitic shale at base, grayish, yellow, green to very light gray. Minor sandstone; 3 ft (1 m) septarian concretions. and black chert pebbles weather out in lower part. Forms major topographic lowland between Mowry Shale (km) and Mesaverde Formation (kmv). Thickness 4,000 ft (1,220 m)
Km MOWRY SHALE (LOWER CRETACEOUS) - Upper part is a light-gray, resistant, brittle, fissile, siliceous shale; weathers silvery gray; contains few thin light-gray to yellowish-gray bentonite beds and commonly fish scales. Lower part is a black nonresistant shale; locally conains thin beds of ligh-gray bentonite. Thickness 300 ft (90 m)

Kt THERMOPOLIS SHALE (LOWER CRETACEOUS) - Mainly olive-black, grayish-red, dusky-yellowish-brown, and dark-gray shale. Variegated claystone 15 ft (6 m) thick, very fine to medium grained, about 265 ft (80 m) below top of formation, is correlated with the Muddy Sandstone in central Wyoming and Newcastle Sandstone in eastern Wyoming. Grayish-black ironstone concretions; cone-in-cone and spherulitic dahllite concretions, 1.5 in. (38 mm) in diameter in lower middle of formation. The base of the Thermopolis is taken at Cloverly Formation (kcv) overlying the Morrison (Jm) at Wolf Creek. Thus, the zone of dahllite concretions is placed in the Thermopolis Formation; Ramsey (1955) also placed the dahllite in Buffalo, Wyo., area (Mapel, 1959); however, shows the zone of dahllite concretions assigned to the Cloverly (Kcl). Thickness approximately 700 ft (215 m); Ramsey (1955 measured 726 ft (221 m)
Kcl CLOVERLY FORMATION (UPPER JURASSIC) - Consists of a 44 ft (13m) thick very light gray sandstone at top, weathers yellowish gray; cherty, crossbedded, lenticular, thick bedded; local thin coal seams. Lower part gray and brown shale and mudstone, poorly exposed. Forms hogback. Thickness 100 ft (30 m)
Jm MORRISON FORMATION (UPPER JURASSIC) - Dominatly varicolored, light-gray, red, green, and purplish-gray claystone and shale with a 32 ft (10m) thick prominent sandstone near base, light gray, fine grained, angular to subangular, crossbedded, friable. Thickness 200 ft (60 m)
Js SUNDANCE FORMATION (UPPER AND MIDDLE JURASSIC) - Grayish-green calcareous shale and sandy shale interbedded with light yellowish-gray to white glauconitic, fine-grained, calcareous sandstone and gray fossiliferous oolitic limestone. Forms valleys below Cloverly (Kcl) hogback with minor ridges of limestone and sandstone. Thickness 290 ft (88 m)
Jgs GYPSUM SPRING FORMATION (MIDDLE JURASSIC) - Reddish brown shale, claystone, and siltsone, thin and medium bedded, with interbeds of thin, light-gray, gypsiferous, vuggy, argillaceous limestone; in places the gypsum is replaced by a brown limestone breccia. Conformable with overyling Sundance Formation (Js). Thickness 174 ft 953 m)

Tc CHUGWATER FORMATION (UPPER AND LOWER TRIASSIC) - Reddish-brown to dusky-red lenticular shale, siltstone, and fine to medium-grained, poorly sorted, crossbedded sandstone. Thickness 613 ft (187 m)
Pge GOOSE EGG FORMATION (PERMIAN) - Interbedded gypsum, red shale, siltstone, and thin beds of light-gray limestone. Upper part is dominantly gypsum with interbedded red siltstone. Mostly covered by soil and colluvium. Thickness 250 ft (76 m)
Pt TENSLEEP SANDSTONE (PENNSYLVANIAN) - Grayish-orange-pink, very fine to medium-grained, well-sorted, thick-bedded, massive to crossbedded, quartz sandstone with thin beds of pink or grayish-yellow dolomite containing nodules and stringers of chert in lower part. Forms prominent upturned flatirons along flanks of Bighorn Mountains. Thickness 190 ft (58 m)
Pa AMSDEN FORMATION (PENNSYLVANIAN) - Upper part consists chiefly of very light gray cherty dolomite, light-brown sandstone, and pale-red shale. Includes at top a unit of medium-crystalline, pale red-purple dolomite. Lower part is light-gray dolomite and red shale. Dolomite contains abundant red, gray and brown chert nodules and stringers. Basal few feet is pale reddish-brown sandstone and siltstone. Thickness 275 ft (84 m)
Mm MADISON LIMESTONE (UPPER AND LOWER MISSISSIPPIAN) - Light-gray, finely cystalline, locally bioclastic, thin-bedded but mainly massive, cavernous, cliff-forming limestone, dolomitic limestone, and dolomite with abundant gray chert nodules in upper part. Basal few feet is light-gray, sandy, dolomitic limestone. Thickness 1,150 ft (350 m)

Ob BIGHORN DOLOMITE (UPPER AND MIDDLE ORDOVICIAN) - Upper part is light-gray to white, massive to medium-bedded, finely crystalline, fossiliferous dolomite and dolomitic limestone. About 300 ft (91 m) thick, cliff forming, contains chert nodules and lenses, weathers to rough, pitted surface. The lower part, about 90 ft (27 m) thick, includes 35 ft (11 m) of light-gray to white, relatively nonresistant, mostly very fine grained, crossbedded quartz sandstone. Lower contact of the sanstone sharp; upper contact grads ino the massive dolomite. Thickness 400 ft (122 m)
Cg GALLATIN AND GROS VENTRE FOMATION UNDIVIDED (UPPER AND MIDDLE CAMBRIAN) - The upper unit, about 150 ft (46 m) thick, is mainly resistant, very pale orange, medium-crystalline, slabby, silt, glauconitic, thick bedded and massive. The lower unit is slope forming, about 430 ft (131 m) thick, of dominantly graysish green micaceous shale with interbedded thin, light-gray, silty, ripple-marked, flat-pebble limestone conglomerate and limestone. Thickness 680 ft (207 m) measured by Ramsey (1955)
Cf FLATHEAD SANDSTONE (MIDDLE CAMBRAIN) - Light-brown to pale yellowish-orange, greenish-gray, fine to coarse-grained, friable but locally quartzitic, thin to thick-bedded, crossbedded quartz sandstone, glauconitic, folliliferous; thin interbeds of green micaceous siltstone and shale. The basal unit is a pebbly arkosic conglomerate. Thickness 532 ft (162 m) measured by Ramsey (1955)
pCr PRECAMBRIAN ROCKS - Dominantly red and gray granitic gneisses cut by dikes of aplite, diabase, olivine gabbro, hornblende diorite and peridotite

CONTACT - Approximately located; dotted where concealed
FAULT - Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side
ANTICLINE - Approximately located
SYNCLINE - Approximately located
STRIKE AND DIP BEDS
- Normal
- Vertical
- Apparent - Strike undetermined

COAL MINE
GRAVEL PIT OR CLINKER QUARRY
SHALLOW DRILL HOLE, CORED - Drilled in Sheridan, Wyo., by USGS. (Farrow, written commun., 1976)
VERTEBRATE FOSSIL LOCALITIES
COAL BED OR ZONE OUTCROP, SHOWING NAME SYMBOL
Approximately located, barbed where outcrop has burned. Names of beds in descending stratigraphic order are abbreviated as follows: U_2, Lower Ulm bed; D, Dow bed; Ar, Arkansas bed; PK, PK bed; N, Bar N bed; B, Burgess bed; H, Heppner bed; W, Wyarno bed; DT, Double top bed; RB, Roland bed (of Baker 1929); SC, Squirrel Creek bed; RT, Roland bed (of Taff, 1909); AS, Above Smith 1 bed; S, Smith bed; An, Anderson bed; D_1, Dietz 1 bed (highest); D_2, Deitz 2 bed; D_3, Deitz 3 bed; M, Monarch bed; M1, Monarch bed, lower bench; S1, Slater Creek bed; C, Carney bed; g, g bed; f, f bed; e, e bed; d, d bed; b, b bed; a, a bed; L, local bed; and cz, carbonaceous shale

0 500 1,000 1,500 2,000
GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
06/15	ROUND 1 COMMENTS
08/18	ROUND 7 COMMENTS
09/19	ROUND 10 COMMENTS

EXHIBIT D11.3-1

TFN 6 2/025
RECD 09-20-19

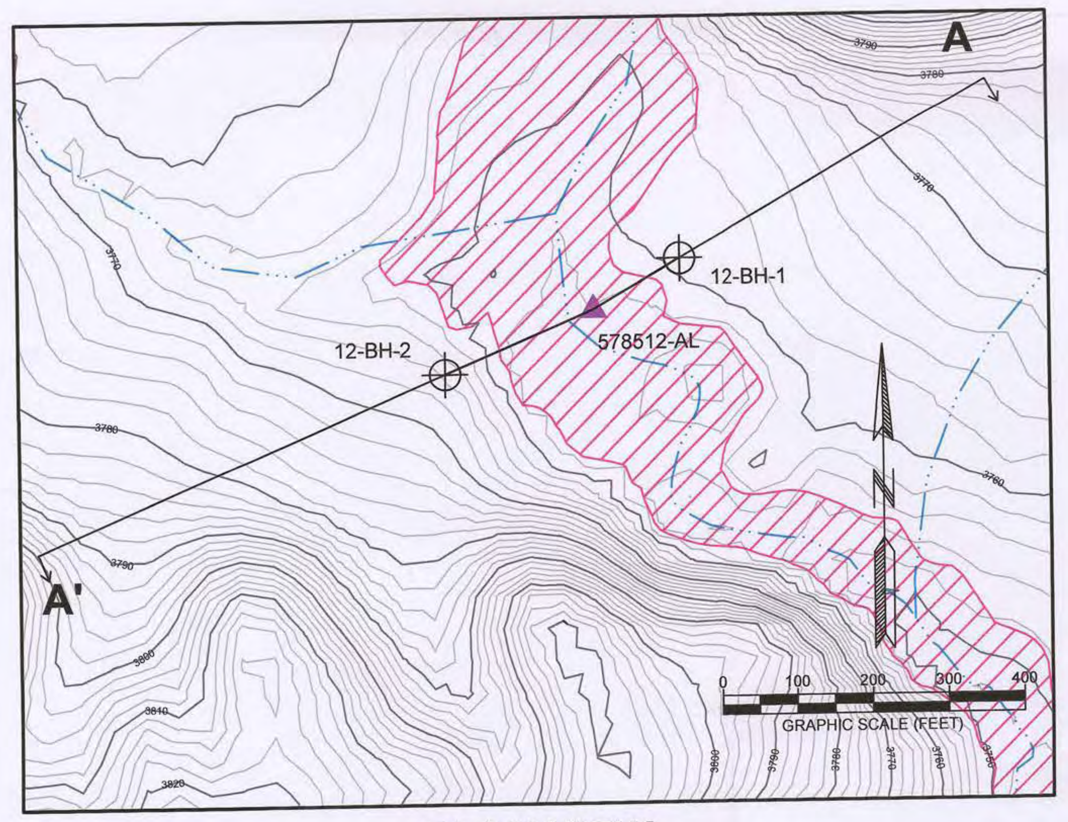
SURFICIAL GEOLOGY

Drawn By: RAV
Checked By: JGB
Date: 1/15/14

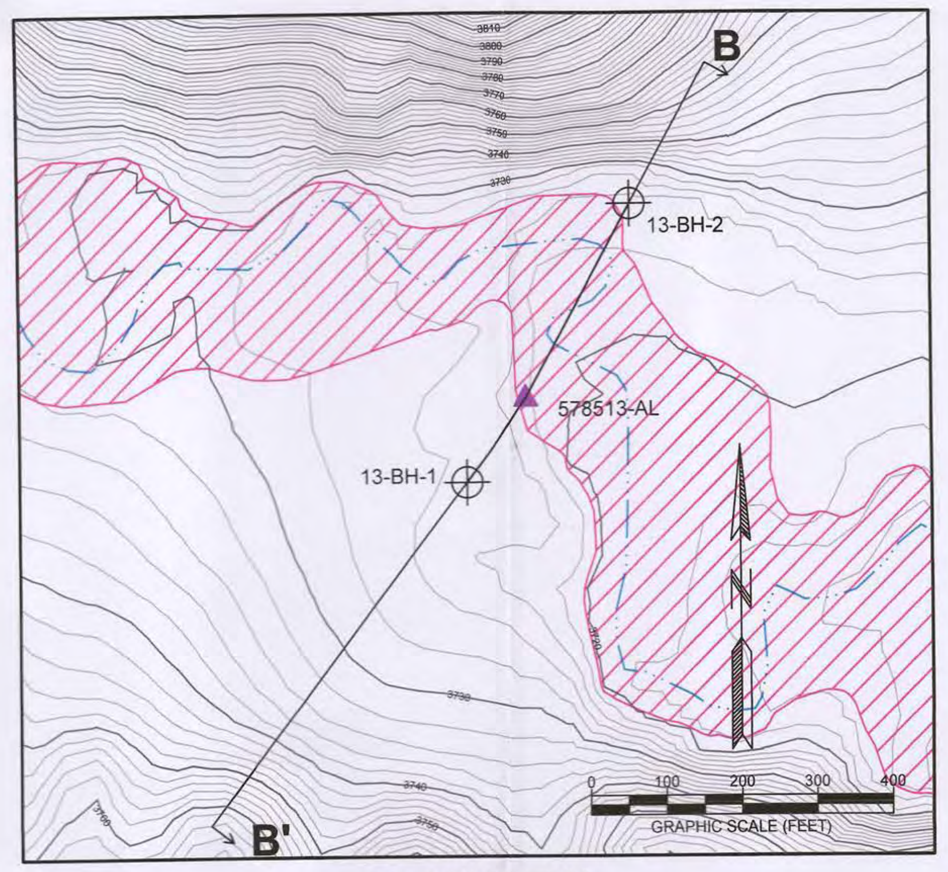
FILE: D11-3-1_SURF_GEO.dwg

WWC ENGINEERING
www.wwcengineering.com

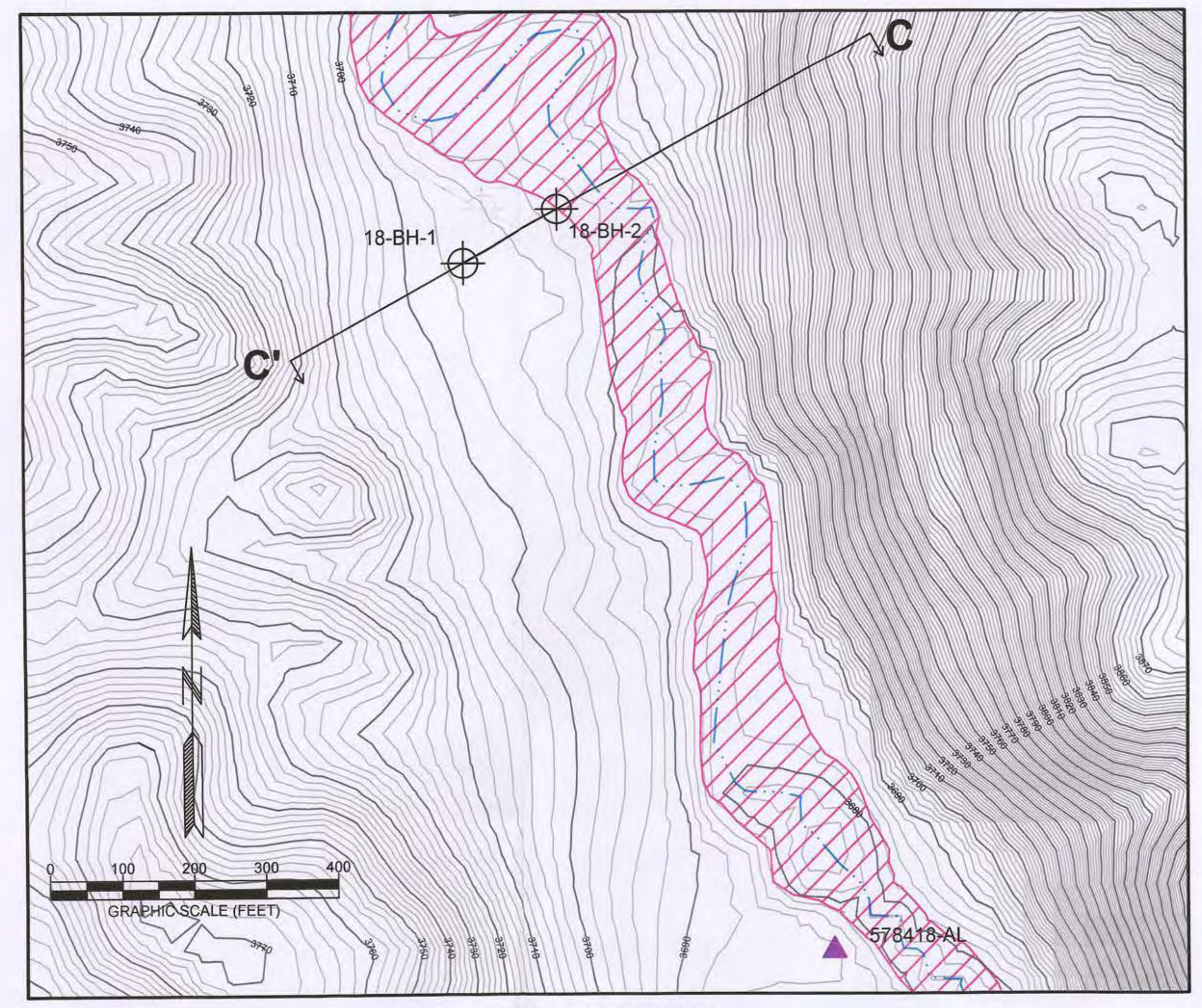
K:\Sheridan\RAMACO\13139\ACAD_WY83EC\DWGS\DWGS_D11\ROUND_10_COMMENTS\D11-3-1_SURF_GEO.dwg 9/20/2019 2:06:54 PM dave johnson



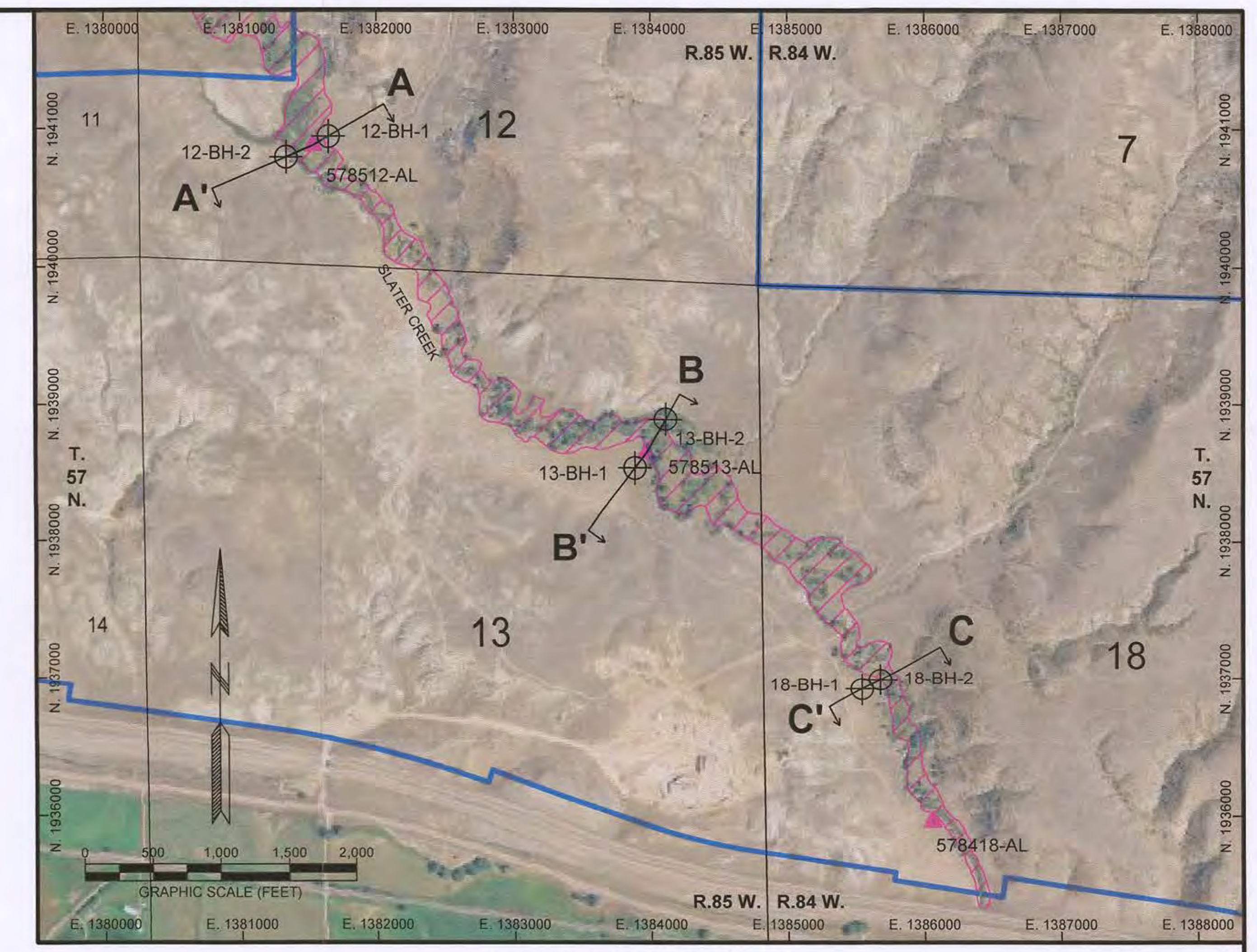
PLAN VIEW



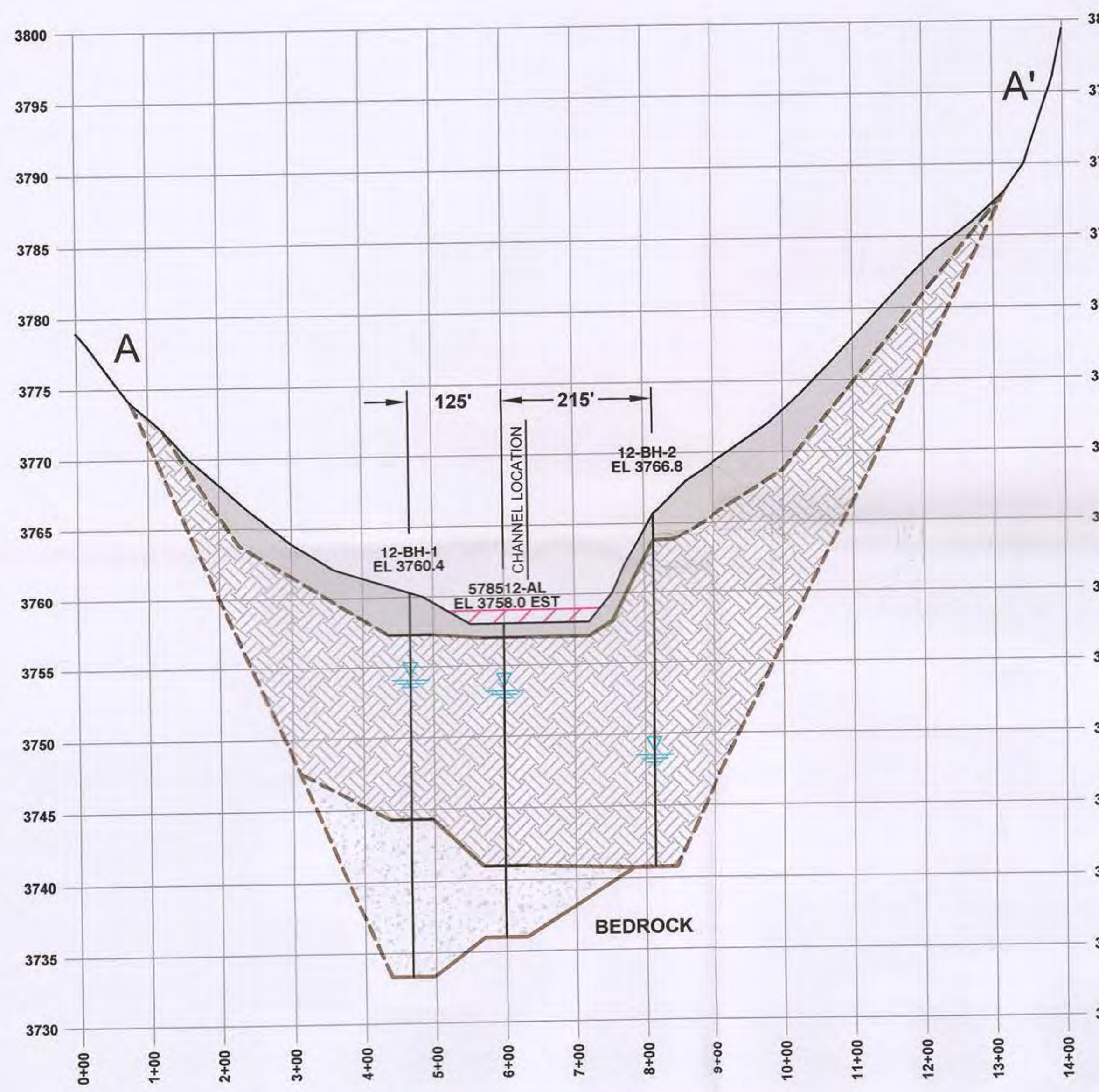
PLAN VIEW



PLAN VIEW

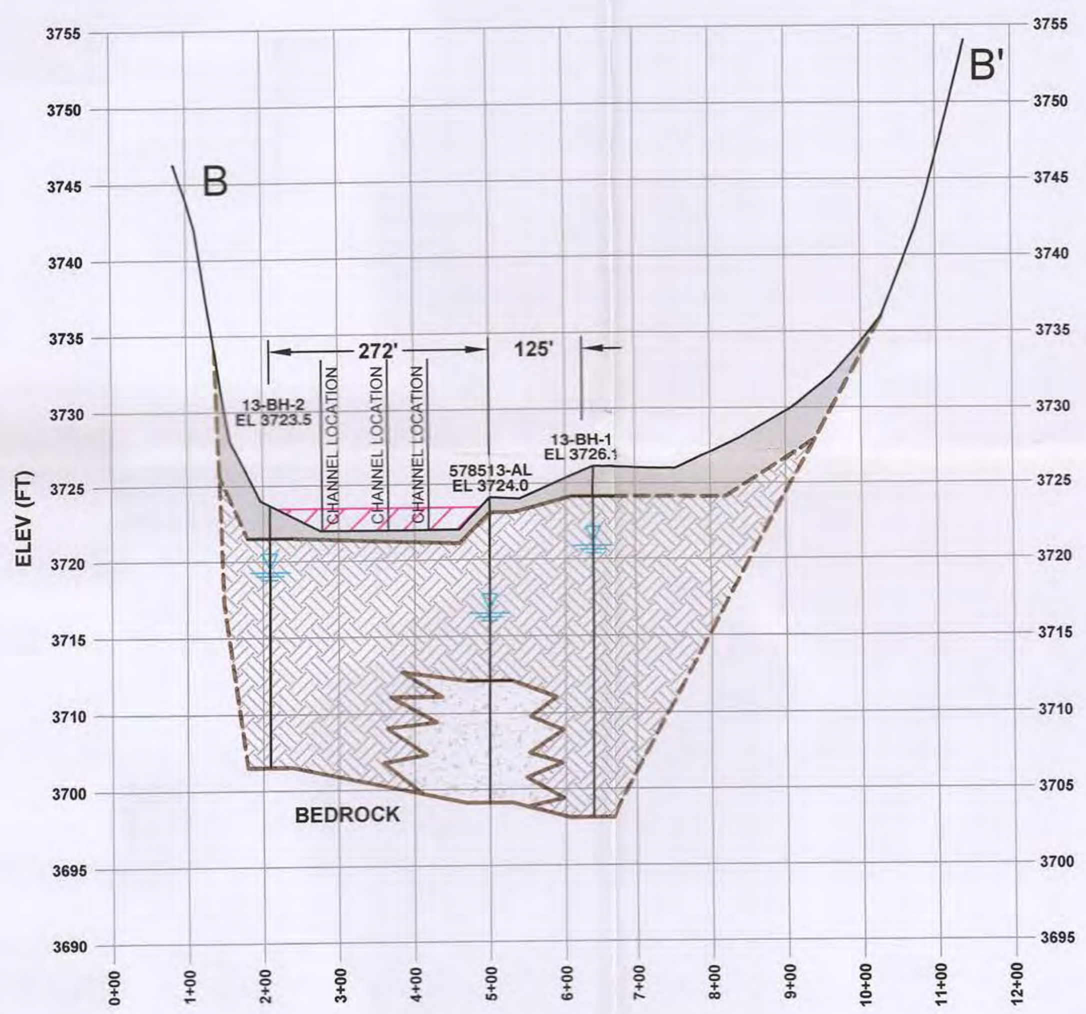


LOCATION VIEW



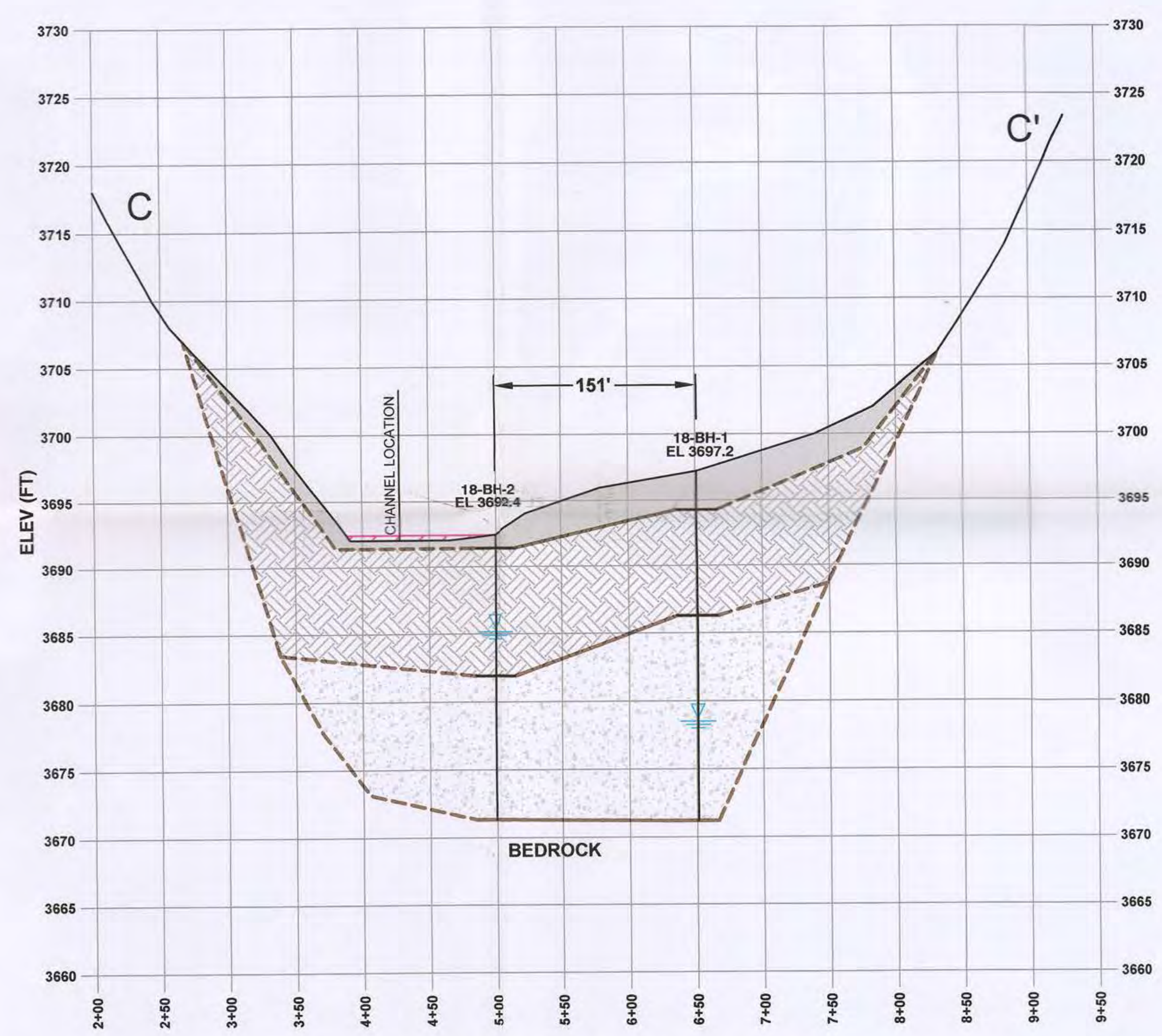
CROSS SECTION A-A'

SCALE: HORIZ. 1" = 200', VERT. 1" = 10'



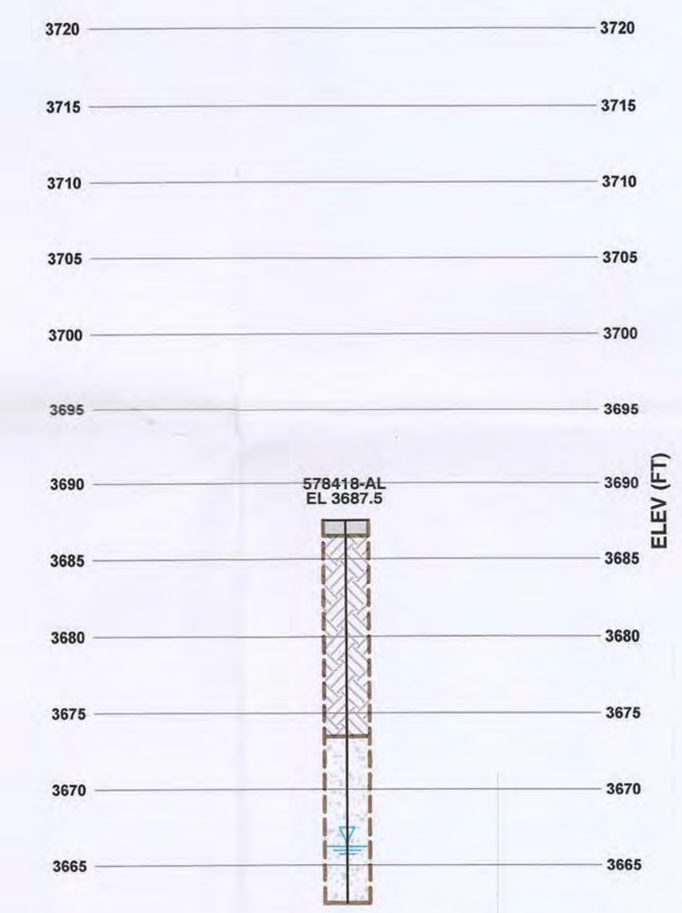
CROSS SECTION B-B'

SCALE: HORIZ. 1" = 200', VERT. 1" = 10'



CROSS SECTION C-C'

SCALE: HORIZ. 1" = 100', VERT. 1" = 10'



578418-AL

SCALE: HORIZ. 1" = 200', VERT. 1" = 10'

LEGEND

- BROOK MINE PERMIT BOUNDARY
- CROSS SECTION LOCATION
- STREAMS
- WATER LEVEL
- ALLUVIAL BORE HOLE
- ALLUVIAL MONITORING WELL
- EXISTING GROUND PROFILE
- TOPSOIL
- COLLUVIUM
- ALLUVIUM/COLLUVIUM
- 2-YR, 24-HR FLOOD INUNDATION AREA

NOTES: 1) REFER TO ADDENDUM D11-3 FOR BOREHOLE AND MONITORING WELL LOGS.
2) CONTACTS DASHED WHERE INFERRED.

CERTIFICATE OF GEOLOGIST

I, Michael J. Evers, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST
MICHAEL J. EVERS
PG 91
WYOMING
7-9-15

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

EXHIBIT D11.3-2

TFN 6 2/025
RECD JUL 30, 2015

ALLUVIAL TRANSECT GEOLOGIC CROSS SECTIONS

Drawn By: CIG
Checked By: MJE
Date: 10/23/14

WWC ENGINEERING
www.wwcengineering.com

FILE: D11-3-2_ALLUVIAL_TRANSECTS_R1.dwg

K:\Sheridan\RAMACO\13139\ACAD_WY83EC\DWGS_D11_RESPONSE\D11-3-2_ALLUVIAL_TRANSECTS_R1.dwg 7/9/2015 8:24:00 AM dave johnson

R.85 W. R.84 W.

T. 58 N.

T. 57 N.

WILLIAMS DITCH

EAST SIDE DITCH NO. 2

BROTHERS DITCHES

BALDWIN DITCH

PERRS DITCH

LANDEN DITCH

HALL DITCH

HIDDEN WATER CREEK

BADGER DITCH

RAGNER NO. 3 DITCH

BOWER DITCH

EARLEY CR. DITCH NO. 1

EAST FORK EARLEY CREEK

EARLEY CREEK

SLATER CREEK

EARLEY CR. DITCH NO. 2

SMITH DOMESTIC PUMP

TONGUE RIVER

DOMESTIC PUMP DIVERSION

MCPHILLAMEY DITCH

KODI COAL MINING CO.'S WATER SUPPLY DITCH

VANNOY PIPELINE

JOHNSON DOMESTIC PUMP

SHERIDAN COUNTY ELECTRIC COMPANY TUNNEL

PADLOCK SPRINKLER SYSTEM #9-T

PADLOCK SPRINKLER SYSTEM #6-T, #7-T AND #8-T

MONROE & WILLIAMS

MCKINNEY DITCH

PADLOCK SPRINKLER SYSTEM #5-G

PADLOCK SPRINKLER SYSTEM #1-T AND #2-T

MONARCH PIPE LINE

WYOMING COAL MINING CO.'S WATER SUPPLY DITCH

LONG'S DITCH #1

ADDLEMAN SPRINKLER

VANESSA DOMESTIC PUMP

JANE BUYOK DOMESTIC PUMP

BUYOK IRRIGATION SYSTEM

LONG'S DITCH NO. 1 ENLARGEMENT

LONG'S DITCH #2

BIRCHLY DITCH (ENL. OF)

BIRCHBY DITCH

DR41299 WATER HAUL

YORK DITCH ENL. OF

HOWD DITCH

PADLOCK SPRINKLER SYSTEM #3-G AND #4-G

GOOSE CREEK

PADLOCK SPRINKLER SYSTEM #1-G AND #2-G

B134035 & B134036 OB WATER HAUL

LAST PROSPECT DITCH

KUZARA SPRINKLER SYSTEM NO. 5

KUZARA SPRINKLER SYSTEM NO. 4

KUZARA SPRINKLER SYSTEM NO. 3

ROSA M. DITCHES

SOURCE: USDA/NAIP 2012 AERIAL PHOTOGRAPHY.

LEGEND

- BROOK MINE PERMIT BOUNDARY
- BIGHORN COAL PERMIT BOUNDARY (PERMIT NO. 213-T7)
- IRRIGATED LANDS
- IRRIGATED LANDS LESS THAN 40 ACRES
- 2-YR, 24-HR FLOOD INUNDATION AREA
- BIRCHBY DITCH (PERMITTED POINT OF DIVERSION)

N

0 500 1,000 1,500 2,000

GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description

EXHIBIT D11.4-1

TFN 6 2/025
RECD JUL 30,2015

IRRIGATED LANDS AND POINT OF USE

Drawn By: RAV
Checked By: JGB
Date: 1/17/14

WWC ENGINEERING
www.wwcengineering.com

FILE: D11-4-1_IRRIGATION_R1.dwg

K:\Sheridan\RAMACO\T57\BACAD_MYSELF\DWGS\D11_RESPONSE\D11-4-1_IRRIGATION_R1.dwg 7/9/2015 8:21:08 AM dave.johnson

R.85 W. R.84 W.

T. 58 N.

T. 57 N.

R.85 W. R.84 W.

SOURCE: USDA/NAIP 2012 AERIAL PHOTOGRAPHY.

LEGEND

- BROOK MINE PERMIT BOUNDARY
- 1/2 MILE BUFFER BOUNDARY
- AERIAL EXTENT OF DECLARED ALLUVIAL VALLEY FLOORS
- DECLARED AVF AS PART OF STATE DECISION DOCUMENT FOR PERMIT 213-T1
- DECLARED AVF AS PART OF STATE DECISION DOCUMENT FOR PERMIT 497-T1

NOTES:
1. MINING WILL NOT AFFECT THE AVF'S AS INDICATED ON THE MAP IN THE TONGUE RIVER.
2. A SIGNIFICANCE TO FARMING DETERMINATION IS NOT REQUIRED AS NO MATERIAL DAMAGE TO THE AVF WILL OCCUR AND THE ESSENTIAL HYDROLOGIC FUNCTION WILL BE PROTECTED AND PRESERVED.

N

0 500 1,000 1,500 2,000
GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY
1101 SUGARVIEW DR, STE. 201
SHERIDAN, WY 82801

REVISIONS	
Date	Description
02/19	ROUND 8 COMMENTS
04/19	ROUND 9 COMMENTS
09/19	ROUND 10 COMMENTS
12/19	ROUND 11 COMMENTS

EXHIBIT D11.6-1

POTENTIAL AND DECLARED ALLUVIAL VALLEY FLOOR EXTENTS

TFNS 2/025
RECD DEC 13, 2019

Drawn By: RAV
Checked By: JGB
Date: 8/26/2014

WWC ENGINEERING
www.wwcengineering.com

FILE: D11-6-1_AERIAL_AVF.dwg

1/4 Section Corner

Section Corner

213 · TI Boundary

Amendment One

Affected Area

ALLUVIAL ISOPACH

INFERRED ALLUVIAL ISOPACH

DESIGNATES AREAS OF SUBSURFACE DISTURBANCE

380-78 DRILL HOLE NUMBER

(4.0) THICKNESS OF ALLUVIUM (SAND & GRAVEL)

C DESIGNATES THERE IS NO ALLUVIUM PRESENT, THICKNESS IS OF COLLUVIUM (SLOPE WASH MATERIAL) ONLY

AC DESIGNATES THERE IS BOTH ALLUVIUM AND COLLUVIUM PRESENT, THICKNESS IS OF COLLUVIUM OVERLAYING ALLUVIUM

LEGEND

BROOK MINE PERMIT BOUNDARY

N

0 250 500 750 1,000

GRAPHIC SCALE (FEET)

RAMACO

BROOK MINE
SHERIDAN COUNTY, WY

1101 SUGARVIEW DR. STE. 201
SHERIDAN, WY 82801

REVISIONS

Date	Description

EXHIBIT D11.7-1

TFN 6 2/025
RECD JUL 30, 2015

BIG HORN COAL DRILL HOLE LOCATION AND ALLUVIAL ISOPACH MAP

Drawn By: DCJ
Checked By: JGB
Date: 7/15

WWC ENGINEERING
www.wwcengineering.com

FILE: D11-7-1_IRRIGATION_R1.dwg

K:\Brennan\RAMACO\131\BRACAD_WY\SECD\WG\D11_RESPONSE\D11-7-1_IRRIGATION_R1.dwg 7/9/2015 2:01:45 PM dawn johnson

Scanned, 02/28/2020

ADDENDUM D11-1

Brook Mine AVF Preliminary Identification (WDEQ/LQD)

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

Tuesday, March 25, 2014

Mr. Randall Atkins
RAMACO Wyoming Coal Company, Inc.
1101 Sugarview Drive
Sheridan, WY 82801

RE: Brook Mine AVF Preliminary Identification, CN160, TFN 6 2/025

Dear Mr. Atkins,

The LQD District III office received your Brook Mine Alluvial Valley Floor (AVF) Preliminary Identification on February 5, 2014. We have reviewed the document for technical accuracy and have made an assessment of the merits of the study. The primary reason for your submittal is to determine if sufficient data has been provided for LQD to make an AVF declaration on the drainages within and adjacent (½ mile) to the proposed Brook Mine Permit Boundary. The study was reviewed by myself and Larry Barbula, Program Principal for coal operations in District III. Our questions and comments are as follows:

Review by Larry Barbula

1. On Exhibit D11-2 show the boundary which delineates adjacent lands included in the study area within ½ mile of the proposed Permit Boundary.

2. In Appendix D11 of the future Permit Application RAMACO should include a map which shows all AVFs (not potential AVFs) within and adjacent to the permit area.

3. The areas noted as irrigated and/or subirrigated compare favorably to areas designated in the draft OSM "Reconnaissance Map of Potential AVF, Sheridan Area" authored by Earth Resource Associates.

4. Does RAMACO want a specific decision of presence or absence of AVFs within or adjacent to the proposed permit area as allowed in WDEQ/LQD Rules and Regulations, Chapter 12, Section 1? Please discuss and make a specific statement on what is requested.

TFN 6 2/025
RECD NOV 14, 2014

3/26/14

Scanned, 02/28/2020

5. Preliminarily, all area denoted as "Potential Subirrigated Lands" on Exhibit D11-2 not previously declared AVF appear to qualify as AVF, including Slater Creek, based on this study. **RAMACO can conduct studies to <u>disprove</u> the presence of AVF if so desired.**

6. If RAMACO, within their mining plans, intends to disturb any AVFs, they must first show that these AVFs are not "significant to farming". LQD Guideline No. 9 addresses this formal process. AVFs that are significant to farming may not be disturbed and must be preserved. AVFs not significant to farming must be fully reconstructed if disturbed.
   Based on my review of the materials in this submittal and OSM mapping of potential AVFs, it appears that the areas denoted as "Potential Subirrigated Lands" in Exhibit D11-2 not previously designated AVF appear to qualify for AVF designation, including Slater Creek.

<u>Review by Bj Kristiansen, Project Geologist</u>

Technical Observations

1. Table D11-1 – Please indicate the height (H) of the water column in the well, either in this table or another table somewhere in the narrative. How thick is the saturated zone?

2. Page 8, first paragraph, second sentence – "...observed in late May and early June Precipitation for on the proposed permit area..."
   a. There should be a period between the words June and Precipitation.
   b. The new sentence beginning with the word Precipitation does not make sense. Please clarify that sentence.

<u>CONCLUSION</u>

The stated purpose of this submittal is to determine if sufficient data was presented for LQD to make an AVF Declaration for the drainages within and adjacent to the proposed Brook Mine permit boundary. It is our opinion that the material and narrative presented in the document are not sufficient to make an AVF Determination for any of the stream courses within the study area. There is, however, enough information to warrant a full-scale AVF study of the proposed permit area, particularly within the Hidden Water and Slater Creek drainages. As mentioned by Mr. Barbula, RAMACO can undertake to ***disprove*** the presence of an AVF if so desired. None of the ephemeral tributaries of these drainages appear to have any agricultural value other than to provide dry-land forage to cattle and sheep during the spring and summer. That land use does not qualify for an AVF classification.

A comprehensive AVF study can be a time consuming and confusing experience. It is our purpose to assist you in your endeavors to define and mitigate environmental impacts you may create

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

by mining coal in Wyoming. We will work with you to guide you through the statutory process and help define the regulatory requirements that need to be met in order to issue a Mining Permit.

A well crafted AVF study may contain some of the following informational materials that help define an AVF and subsequent mitigation and reclamation activity:

1. AVF determination narrative –
    a. Presence or absence of an AVF.
    b. Extent of AVF(s).
    c. Evaluation of essential hydrologic functions.
    d. Restoration of essential hydrologic functions to the AVF, if mined.
    e. Material damages within and adjacent to the Mine Plan boundary.
    f. Significance to farming.
    g. Productivity of croplands and mitigation for replacement during mining.
    h. Other site-specific issues as they are determined at the time of implementation of the study.

2. Informational Tables -
    a. Extents of unconsolidated stream-laid deposits; acreages, distances, etc...
    b. Evapotranspiration calculated for the area.
    c. Summary of consumptive use of water.
    d. Climatological data.
    e. Extents of vegetative species; acreages, species types, buffer zones, etc...
    f. Estimates of mean annual flows and agriculturally useful flood flows.
    g. Acreages that could be artificially flood irrigated, sprinkler irrigated.
    h. Federal and State guidelines for interpretation of water quality used for irrigation.
    i. Observed surface water, alluvial, and groundwater quality.
    j. Mechanical analyses of bed and bank materials.
    k. Valley fill hydrologic balances.
    l. Universal Soil Loss Equations.
    m. Post-mining changes to items defined above.
    n. Vegetation productivity comparisons pre and post mining.
    o. Other tabulations of numerical data specific to the study area.

3. Figures –
    a. Water table fluctuations and diurnal fluctuations in alluvial wells.
    b. Alluvial well draw-down curves.
    c. Valley and fill cross sections and profiles.
    d. Generalized stratigraphic columns for coal and interburden.
    e. Figures appropriate to the study area illustrating site specific issues.

4. Maps –
    a. Limits of stream-laid deposits identifying unconsolidated stream deposits and subirrigated/natural flood irrigated lands.

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b. Surficial Geology.
c. Topography.
d. Slopes.
e. Potentiometric surface contour maps for spring and fall.
f. Maximum drawdown contours in alluvial aquifers.
g. Areal extent of irrigation of any type.
h. Color and Color Infrared photographs.
i. Pre-mining cross section locations.
j. Classification of farmland and rangeland.
k. Soils.
l. Vegetation communities.
m. Wildlife study area.
n. Maps relevant to the proposed permit area.

5. Addenda –
   a. Auger hole data.
   b. Drill hole data.
   c. Backhoe data.
   d. Alluvial well continuous recorder data.
   e. Soil moisture data.
   f. Salinity potential and profiles.
   g. Soil quality data.
   h. Water rights as recorded with the State Engineer.
   i. Published studies pertinent to the lands under investigation.

This list is only a suggested guideline to assist you in understanding the potential topics of investigation that may be assessed in defining and mitigating AVFs. Obviously, the information you provide will be site specific to the proposed mine and may not include some of the issues listed above.

Once we have received your responses to our comments itemized earlier and the Preliminary AVF identification has been approved, we can assist you in beginning the AVF study. Though it may appear a daunting task at first, many mines have already undergone the process and a wealth of information is available to you as publicly accessible permit information. The long-term benefits of beginning the Mine Plan AVF analysis at this stage of the permitting process can not be overemphasized. The appropriate work performed now becomes a part of the permit later and serves as an effective baseline to overall permit approval when the time comes.

We commend your intentions to asses environmental impacts from the mining process and your commitment to acquire a mining permit in a proactive manner. One of our functions is to assist you in the regulatory process, insuring that you understand the statutes and guidelines and are able to follow them to the best of your ability. Proactive planning and environmental assessment partnered with responsible stewardship of the natural resources benefit everyone in the long run. Please feel free to contact me anytime with questions or comments regarding any phase of your permitting process. I will be happy to assist you in any way I can.

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Sincerely,

Bjarne D. Kristiansen, PG
Project Geologist
LQD District III

\bk

cc: Cheyenne LQD Files
WWC Engineering, c/o Jeff Baron, 1849 Terra Ave., Sheridan, WY 82801

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ADDENDUM D11-2

State Decision Documents

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STATE DECISION DOCUMENT
BIG HORN COAL COMPANY
PERMIT 213-T1

General Description of Operation:

Big Horn Coal Company is the operator of the Big Horn Mine which is located about 8 miles north of Sheridan, Wyoming. Access to the mine is by State Highway 338.

Big Horn Coal Company has been operating surface coal mines since 1943 in the Sheridan, Wyoming coal fields. Operations at the present mine site, which now occur in Sections 21, 22, 23, 16, 15, 14, 9, 10 and 11 of T57N, R84W, began in about 1948 and have continued to the present. Much of the early mining occurred in the valley bottoms of the Tongue River and Goose Creek. More recent operations have advanced into adjacent upland areas moving out of the creek bottoms. Big Horn Coal was authorized continued operations under the Environmental Quality Act by Permit No. 213C. Considerable underground mining has occurred in the area of the mine site, beginning at the turn of the century and ending in the early 1950's.

Mining at the Big Horn Mine is by truck/shovel or scraper. Five known coal seams exist within the mine area, in descending order: Dietz 2B (Armstrong), Dietz 3 (Upper Monarch), Monarch (Lower Monarch), Carney and Masters. The Carney and Masters seams cannot be economically mined. The approval permit will allow for 5 more years of mining.

FINDINGS

On the basis of information set forth in the application or from information otherwise available, (documented in Appendix A), which has been made available to the applicant, I Walter C. Ackerman find that the applicant has affirmatively demonstrated that:

No. 1. The application is accurate and complete. The applicant has provided LQD with a sworn statement stating that all information contained in the permit application is true and correct to the best of his knowledge. In addition, to the extent necessary and appropriate, independent agency verification supports the accuracy of the application. All information required by the Act and regulations is contained in the application, including:

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Identification of interests	Mining operation plan
Compliance information	Reclamation plan
Resource information	License information
Land use information	Insurance information
Maps and plans	Proof of publication
Permit fee	Required verification

Other agency approvals

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No. 2. The reclamation plan can accomplish reclamation as required by the Act.

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a. The applicant states that the post-mining topography will blend into the adjacent topography and will be consistent with the post-mining land use of rangeland and wildlife habitat. The applicant has provided pre- and post-mining slope comparisons (Tables DE 1-5, RP-5, 9 and 10), contour maps (Exhibit DE 6, RP-4), and backfilling information (Tables RP-6, 7, and 11) to support these statements.

The slope comparisons indicate that the majority of the post-mining topography will have slopes of less than 20 percent as was the pre-mining case. Although total acreage figures do not agree between the slope comparisons an evaluation of the contour maps indicate pre- and post-mining slope distribution will be similar except for Pit 4. Since the slopes are generally fairly flat stability should not be a problem.

Except for the pit 4 area, the applicant should have sufficient backfill material available to achieve the proposed reclaimed contours. In the Pit 4 area, calculations indicate that a 28% swell factor is necessary to achieve the proposed contours. Typically swell factors above 20% are unlikely, therefore, material will need to be borrowed or the contours adjusted to reflect actual conditions. This could be handled by a stipulation in the approved document since Pit 4 is a rather small area, and it is likely that sufficient material is available to achieve a reasonable post-mining topography.

The acceptability of the proposed post-mining topography from a hydrologic standpoint is discussed in Sections 2.c. and 3. of this document.

Pre-mining uses within the permit area since the late 1880's included agriculture (beef production), mining, transportion corridor, and wildlife habitat. The Sheridan Area Planning Agency has classified the area as rural agricultural land. The lowland areas have been used for hay production. A small portion of the upland area has been used for dryland farming (wheat and barley). Underground mining occurred in the area from the late 1890's to the early 1950's. The area is privately owned.

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In accordance with Chapter II Sec. 3.b.(4)(a) and (b), and Chapter IV Sec. 2.a.(2), Sec. 3.a.(2), Sec. 3.p.(1), Sec. 3.e.(2)(b), Sec. 3.j.(1)(c) and (d), Sec. 3.k., and Sec. 3.j.(5)(a)(i), the applicant must submit a mine plan that will minimize disturbance to fish and wildlife resources and a reclamation plan that will restore habitat to a level commensurate with or superior to that which existed before mining began. Pre-mining habitat consist primarily of

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sagebrush-grassland types with shrublands and pine - juniper areas interspersed. Riparian vegetation occurs along the Tongue River and Goose Creek. Topography surrounding the permit area is more abrupt than that occurring within most of the permit area has been left unaltered for the most part.

The proposed seed mixes (Tables RP1-RP3, pages RP-7 through RP-9) for permanent revegetation are acceptable for the post-mining land uses of rangeland and wildlife habitat. The hayland and croplands in the area will be restored as improved pasture with the potential for possible future use as hayland.

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Table RP1 Permanent Reclamation Seed Mixture

Upland Mixture

Common Name	Rate lbs PLS/Ac
Thickspike wheatgrass	4.0
Western wheatgrass	4.0
Pubescent wheatgrass	1.0
Slender wheatgrass	3.0
Whitmar beardless wheatgrass	3.0
Green needlegrass	3.0
Smooth bromegrass	1.0
Sainfoin	2.0
Total lbs PLS/Ac:	21.0

Shrubs and forbs for Upland seed mixture*

Common Name	Rate lbs PLS/Ac
Rubber rabbitbrush	0.5
Four-wing saltbush	0.5
Common winterfat	0.5
Skunkbush sumac	0.25
Purple prairie clover	0.5
Big sagebrush	0.25
Total lbs PLS/Ac:	2.50

Lowland Mixture

Common Name	Rate lbs PLS/Ac
Thickspike wheatgrass	4.0
Western wheatgrass	4.0
Pubescent wheatgrass	1.0
Slender wheatgrass	3.0
Green needlegrass	3.0
Smooth bromegrass	1.0
Sainfoin	2.0
Canada wildrye	3.0
Total lbs PLS/Ac:	21.0

Shrubs and forbs for lowland mixture*

Common Name	Rate lbs/Ac
Silver sage	0.25
Perennial sweetpea	0.5
Northern sweetvetch	0.5
Wild rose	0.25
Western snowberry	0.25
Total lbs/ac:	1.75

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Table RP2 Improved Pasture Land Seed Mixture

Common Name	Rate lbs PLS/ac
Russian wildrye	10.0
Pubescent wheatgrass	7.0
Smooth bromegrass	5.0
Sainfoin	3.0
Total lbs PLS/ac:	25.0

Table RP3 Selected Trees for Permanent Reclamation

Common Name
Box elder
Green ash
Plains cottonwood
Chokecherry
Native plum
Peach leaf willow
Rocky mountain juniper
Ponderose pine

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A variety of measures have been proposed to restore wildlife habitat diversity. Four (4) seed mixtures will be interspersed on reclaimed lands (Exhibit RP2). Two of these, an upland mixture and a bottomland mixture, contain native shrub species important to wildlife species. Selected areas will be intensively seeded with shrub species and planted with shrub tubelings and rooted stock (Exhibit RP2). Tree species will also be planted in favorable locations and the applicant has committed to a survival density of forty (40) trees per acre (Exhibit RP2). Rock piles will be established on certain slopes and ridge tops to provide denning habitat (exhibit RP2). Kestrel and mountain blue bird nest boxes be constructed. A final impoundment is proposed for pit 1 to provide wildlife habitat and a sport fishery. Design of the impoundment is being coordinated with Wyoming Game and Fish Department staff at Buffalo to ensure proper design for support of a productive bass population.

After the land is successfully revegetated with these mixes, it will be capable of supporting the post-mining land uses which will be equal to the pre-mining uses. The Game and Fish Department has offered to supply suitable species of fish to stock and maintain a fishery in the final impoundment if its open to public fishing.

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The concerns in reclamation are: Cover (protection of the soil resource), production (quality and quantity to support the approved post-mining land uses), and density (of woody plants for forage and shelter).

Ecology of the important species to be used for reclamation.

1. Grasses.

Thickspike wheatgrass (Agropyron dasystachym) is a very effective soil binder. Although its a valuable forage plant its major use us for soil stabilization. Thickspike wheatgrass initiates growth almost three weeks earlier in the spring than western wheatgrass (Agropyon smithii)).

Western wheatgrass is the most important and most successfully established species used for reclamation in the Northern Great Plains. In many areas of Wyoming it occurs as the dominant species under natural conditions. Both Western and thickspike wheatgrass have excellent seedling vigor and are easily established.

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Green needlegrass (Stipa viridula) has been used extensively in range seeding and reclamation in the northern plains with good success. Seedling vigor is excellent and rate of growth is good. It has a high food value to songbirds and small rodents. Green needlegrass has a high forage quality and produces a good forage yield.

Slender wheatgrass (Agropyron trachycaulum) is used as a rapid-developing species in seed mixes in the Northern Great Plains. Its useful as a short-lived species in reclamation plantings and is easily established. The seeds of this wheatgrass germinate quickly, and the seedlings are vigorous and fast growing. Beardless wheatgrass (Agropyron spicatum; formerly A. inerme) has good germination, is fairly easy to establish and is highly palatable.

Grasses to be used in the reestablished pastures are: Russian wildrye (Elymus junceus) which is highly palatable, has good germination, and provides midsummer succulance (provides mid-summer grazing potential); Pubescent wheatgrass (Agropyron trichophorum) a rhizomatous, sodformer, with good palatability and is easily established; Smooth bromegrass (Bromus inermis) also a rhizomatous, sodformer which is highly palatable and is good for wind and water erosion control; and Sainfoin (Onobrychis viciaefolia) a long-lived

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legume which provides forage without causing bloat and fixes nitrogen in the soil. Sainfoin is also being used in the other seed mixes as a nitrogen fixer. Smooth brome grass is also included in the other seed mixes as a minor component in order to add additional cover in the early stages of revegetation. The proposed forbs to be used in the various seed mixes will add diversity to the reclaimed landscape.

The shrubs contained within the seed mixes will provide wildlife with food and shelter. Big sagebrush (Artemisia tridentata) and silver sagebrush (A. cana) are both important browse plants for wildlife. Big sagebrush has a fair ease of establishment, good germination and good persistence and natural spread once established. The palatability of big sagebrush is good. Silver sagebrush is used extensively by livestock and wildlife. In the western Great Plains silver sage is an important antelope survival food during periods when other food sources are scarce.

The seed germination of rubber rabbitbrush (Chrysothomnus nauseosus) is excellent. One of its uses in erosion control is the control of mass soil slippage. Rubber rabbitbrush is easily established and its vigorous seedlings have rapid growth once established. It is an agressive pioneer species and spreads rapidly from seeds.

Four-wing saltbush (Atriplex cancsens) is fairly easily established with good growth rate and persistence. Nitrogen-fixing microorganisms (endotropic mycorrhizae) may occur on the roots of four-wing saltbush. This shrub is highly nutritious and palatable and is a valuable plant for soil stabilization and range restoration.

Winterfat (Ceratoides lanata) is readily established from seed and exhibits excellent seedling vigor. Winterfat has good persistence and palatability and is long-lived. This is a valuable plant in arid lands and can compete with grasses.

Other shrubs that will be used for revegetating the mine site include: skunkbush sumoc (Rhus triobata; wildlife value, soil stabilization), wild rose (Rosa woodsii; erosion control, food for wildlife), and western snowberry (Symphoricarpos occidentalis; livestock and wildlife browse, seeds are utilized by several species of birds).

Several species of native trees will be used for revegetating appropriate portions of the reclaimed mine. These tree species are the following: box elder (Acer negundo), green ash (Fraxinus pennsylvanica), plains cottonwoods (Populus deltoides), chokecherry (Prunus virginiana), native plum

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(Prunus americana), peach leaf willow (Salix amygdaloides), rocky mountain juniper (Juniperus scopulorum), and ponderosa pine (Pinus ponderosa). These trees will provide shelter and/or forage for both livestock and wildlife. Some examples follow. Hoofed browsers feed quite extensively on the twigs, foliage, and bark of wild cherries. Birds are also quite fond of wild cherries. Numerous birds and mammals eat the berries of junipers. In addition to their food value junipers provide protective and nesting cover. The seeds, buds, and flowers of the boxelder provide food for many kinds of birds and other animals.

The applicant has committed to stripping all suitable topsoil from the unaffected areas prior to disturbance. The recommended stripping depths in the Soil Survey (Appendix D-7) were determined to be too shallow by the DEQ soil scientists. Therefore, Big Horn Coal Company has agreed to reevaluate the soil stripping depths and will report the increased volumes, replacement depths and volumes of topsoil to be directly replaced in the 1981 annual report. Preliminary estimates concerning the increased topsoil volumes have been provided in Appendix D-7.

Prior to stripping, the area will be staked according to topsoil depth, to serve as a guide to the scraper operator. Visual inspection and additional samples, if necessary, will be used to determine the correct stripping depths. If possible, topsoil will be directly replaced on graded areas rather than stockpiled (page MP-25). The practice of directly replacing topsoil has been determined to maintain nutrients and seed sources, therefore, successful revegetation is accomplished much sooner. All other topsoil will be stored in stockpiles.

Erosion and sediment control methods for the stockpiles are the planting of temporary vegetation and the construction of sediment ditches, if necessary, at the base until the stockpile is stabilized (page MP-26). These procedures should minimize wind and water erosion as required in Chapter IV, Section 2.c. of the Rules and Regulations.

During reclamation the topsoil removed from each pit will be spread evenly over that pit area. Replacement depths have not been established at this time, due to Big Horn Coal Company's reevaluation of the stripping depths and volumes. This information will be contained in the 1981 annual report. Soil analysis will be conducted for N, P, and K on topsoil stockpiled in excess of one year and the appropriate fertilizers will be applied as required by Chapter IV, Section 2.c. of the Wyoming Rules and Regulations.

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Prior to topsoil application, graded areas are to be scarified on the contour. Topsoil will then be distributed in thick lifts in order to minimize compaction. Topsoil will not be replaced in excess of 120 days before seeding (page RP-4). The methods and practices listed above will aid in returning the capability of the soil materials in supporting an equal or better land use as pre-mining conditions.

No known problems exist with any of the proposed reclamation species which could prevent revegetation from being achieved within a reasonable period of time following mining.

Prior to seeding seed beds will be scarified, disced, and harrowed. Drill seeding will be conducted between the dates of October 15, and April 15. A cover crop of either barley or winter wheat will be used during spring seeding to protect the area from soil erosion. This cover crop will be moved prior to seed set in order to prevent volunteer growth. Fall seeded areas will be mulched with a wood fiber slurry (1 ton/acre) or dry native hay (2 tons/acre). Areas will be fertilized, prior to harrowing, at rates determined by soil analyses.

The above revegetation practices and characteristics and values of the various plant species to be seeded provide evidence to support the applicants claim that the post-mining land uses will be equal to the pre-mining uses.

Revegetated areas will be monitored on a yearly basis after the initial seeding. Monitoring will be conducted at approximately the same time each year and compared to control areas and baseline data in order to determine the success of the revegetation efforts. The WDEQ/LQD Guideline No. 2 for vegetation will be followed in determining revegetation success. Monitoring on a yearly basis will enable the Big Horn Coal Company to keep accurate and precise records for bond release information. Big Horn Coal Company expects to apply for partial bond release on areas that are graded and revegetated on a yearly basis. The following table summarizes areas and dates for expected final bond release on affected areas.

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Table RP4 Final Bond Release

Area	Acres	Date for release
Pit One	375.5	1996
Pit Two	58.4	1997
Pit Three Scraper and Pit Three Truck/Shovel	372.0	1997
Pit Four	38.4	1993
Pit Four	11.4	1996
Pit Five	519.9	1996

Before bond release can be applied for cover and productivity for two consecutive years must at least meet the requirements described in WDEQ/Land Quality Division Guideline 2, Vegetation. Species diversity and composition will be considered satisfactory in reclaimed areas if species measured in post-mining sampling are predominantly those which were seeded in the three reclamation seed mixes. These plant species will allow the land use requirements to be achieved (see discussion in 2 above).

The primary post-mining land use will be rangeland for domestic livestock and wildlife habitat. These were also the pre-mining land uses. The single land use change is that of a single final water impoundment in the SE 1/4 of Section 15, T57N, R84W and NE 1/4 Section 22, T57N, R84W (Exhibit RP3). The application includes letters of approval for this land use change from Dale Pernula, Sheridan County Planner and from Louis Rockett, Fishery Biologist for the Buffalo Office of the Wyoming Game and Fish Department. The letter from the Game and Fish Department includes design specifications that the Department would like to have incorporated into the impoundment design.

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b. The applicant has submitted reclamation plans (Appendix RP), which include reclamation sequence maps and detailed narrative discussions. They are required to show that backfilling, contour in topsoil replacement, hydrologic restoration and revegetation will proceed in a timely manner, as soon as possible after mining.

Two of the pits (1 and 2) contain areas which were disturbed prior to 1977. The backfilling of these pits is proceeding and will be completed soon for Pit 2 and in 1986 for Pit 1. Bond release for pits 1 and 2 is scheduled for 1996 and 1997, respectively. Since most of the mine facilities are located in the Pit 2 area, final reclamation and bond release cannot be completed until mining in other pits is completed and the facilities are no longer needed. For Pits 1 and 2 recla-

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mation is proceeding in a manner and time schedule which reflects the method of mining, the laws in effect when the pits and mine sequence were designed, and the available equipment. Approval is recommended.

Pits 3, 4, and 5 were opened after 1977 and are subject to different regulations than Pits 1 and 2. The applicant should be able to commence rough backfilling within 180 days after coal removal, as required by Chapter IV.3.a.(1)(b). The method of mining is straight forward and, considering the mining equipment and topography of the area, is conducted in such a way as to minimize disturbance and reclaim in a timely manner. Mining will be completed in Pits 3, 4, and 5 in 1987, 1983 and 1986, respectively. Final bond release is scheduled for 1997 on pit 3, 1993 and 1996 on Pit 4 and 1996 on Pit 5.

No permanent spoil piles are proposed. All highwalls will be eliminated. In some cases, the 180-day requirement to commence rough backfilling will not be met. This is due to equipment and pit layout and safety requirements, mainly when a boxcut is opened and when the final cut is backfilled. The areas are relatively small and, in any case, rough backfilling will occur as soon as practicable. Backfilling will be by direct haulback wherever possible.

c. INTRODUCTION

The Wyoming Environmental Quality Act requires that the reclamation plan can accomplish reclamation as required by that act and minimize disturbances to the prevailing hydrologic balance (W.S. 35-11-406). The following is the Administrator's finding of impacts which may occur to the hydrologic balance, and reclamation practices which will be implemented by Big Horn Coal to mitigate these impacts. The finding is divided into sections on groundwater and surface water. (See also discussions on Cumulative Hydrologic Impacts under finding #3).

GROUNDWATER

Geology and Aquifers

The Tongue River Member of the Fort Union Formation which comprises the stratigraphic units to be disturbed at the Big Horn Mine area dip to the east-southeast at approximately 1.5 - 3.0 . The units which function as aquifers include the coal seams and alluvial deposits of the Tongue River and Big Goose Creek.

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The Dietz 2B coal seam is virtually dry in the areas to be mined since the seam outcrops above the Tongue River, which is the major recharge mechanism to the coal seams in the area. The Monarch and Dietz 3 coal seams which are presently being mined downdip of the Tongue River, are viable aquifers, and contain an extensive amount of water. The Carney Coal seam which also comprises a viable aquifer, is below mineable limits and should not be affected by the mining operations since it appears to be sufficiently separated by sequences of tight interbedded shales and sandstones (Appendix DF).

The alluvial aquifers of the Tongue River and Big Goose Creek, which have been mined through and disturbed in prior operations, will not be directly impacted by the forthcoming mining operations except in the Pit 3 area where approximately 200,000 cubic yards of alluvial gravels have been stockpiled from the Pit 3 area. Before mining, these gravels comprised part of an alluvial aquifer, which resulted from a historic meander loop of the Tongue River. The pre-mining function of the gravel was to act as a storage medium during peak flow events with subsequent release of water during low flow periods (baseflow).

Recharge and Potentiometric Levels

Recharge to the aquifers of concern should not be overly disturbed after reclamation is completed, since those units downdip from the Tongue River and alluvium should receive more than adequate amounts of water to fully recharge the groundwater system. Considering the relatively high transmissivity values of the coal aquifers, potentiometric surfaces that have been drawn down in adjacent areas should quickly recover to near pre-mining conditions after mining ceases. Monitoring wells completed in reclaimed spoils at the Big Horn Mine have shown that the spoils do have the ability to transmit water and recharge the system.

Recharge to disturbed areas which are stratigraphically above the Tongue River is primarily by surface infiltration through adjacent unsaturated burn areas, as well as direct vertical percolation. These adjacent recharge areas will not be disturbed, thereby preserving the major recharge mechanism. As stated earlier, it appears that spoil hydraulic characteristics are sufficient to transmit water. In areas stratigraphically above the Tongue River, potentiometric surfaces will probably take longer to reach equilibrium, with much of the water coming from adjacent abandoned underground mine workings and other adjacent recharge areas.

Van Voast, Hedges and McDermott (1978) found that the most

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permeable portion of mine spoils is along the old mine floors, which leads to characteristics of a confined aquifer. This phenomenon appears to be occuring at the Big Horn Mine. Since the aquifer is being re-established at approximately the same elevation, the projected potentiometric surface is expected to have the same general gradient and elevation that was present in the Monarch Coal seam before mining (FD-53). The post-mining potentiometric surface is depicted in Exhibit DF-10.

Groundwater Quality

The quality of groundwater at the Big Horn Mine Area varies within and between aquifers. Water quality data is found in Appendix DF-3. The best quality waters are found within the coal seams where TDS values are approximately 1000 mg/l. The alluvial aquifers produce waters which vary greatly both temporarily and spatially in direct response to the Tongue River and Big Goose Creek. Alluvial water is usually of poorer quality, with TDS values ranging from several hundred to several thousand mg/l.

The Big Horn Coal Company has a plan to identify unsuitable (toxic) materials, such as those containing high SAR values, high EC values, low pH values, etc. (Appendix DE (Geology)). The applicant has committed to burying unsuitable materials at least four feet below the regraded surface, above the post-reclamation potentiometric surface, and not in the proximity of any drainage channels, to minimize adverse impacts to groundwater quality (DF-58). Additional information pertaining to toxic material is contained in Finding 2.c.

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The quality of groundwater within reclaimed spoils also varies both temporarily and spatially (Van Voast, et. al., 1978). Work done by Van Voast at the Decker Coal Mine in Southeast Montana, approximately 18 miles from the Big Horn Mine, showed that the quality of groundwater in reclaimed spoils approached the quality of that found in the overburden aquifers. This amounted to about a 3 fold increase in TDS over that found before mining within the coal aquifers.

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Two wells completed in reclaimed spoils at the Big Horn Mine (Pit 1) have been sampled for water quality and it appears that trends are similar to those discussed above (Table DF-11). It should also be noted that a substantial increase in sulfate concentrations was evident. Available literature also suggests that increases in calcium and sodium may also result.

The impact that spoil waters will have on down gradient

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waters is speculative. However, it is expected that as the spoil waters move down gradient, spread-out and encompass larger areas, and mix with unperturbated groundwater, elevated concentrations of dissolved solids, etc. will become diluted and decrease. As time elapses and more pore volumes of water pass through the reclaimed spoil aquifer, the leaching of the soluble materials should reach an equilibrium state and eventually decline.

In summary, it appears reasonable to assume that groundwaters within reclaimed spoils will contain approximately two to three times the TDS concentration as undisturbed coal aquifers. Variable increases in other constituents, such as sulfate and sodium may also occur. With time, these elevated levels should decline as leaching reaches an equilibrium. The impact of changes to water quality and use are discussed in the following section.

Groundwater Rights and Uses

The uses of groundwater at the Big Horn Mine area include livestock watering, domestic uses, and industrial water supply used mostly by the Big Horn mining operation. Mine and private wells are completed in alluvial aquifers along perennial streams and coal aquifers which are regionally significant.

A listing of all valid groundwater appropriations within the Big Horn Coal Company's permit area and a 3 mile radius around it are found in Appendix DF-4 and depicted on Exhibit DF-8. Besides hydrologic monitoring wells belonging to either Big Horn Coal or Peter Kiewit Sons' Company, there are approximately 33 water wells permitted for Sheridan Enterprises, Inc. for hydrologic monitoring, and approximately 62 other wells permitted for livestock and domestic supplies. Of the above 62 wells, most are livestock wells completed in alluvial aquifers.

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Information regarding completion zones is not available so it is difficult to assess which groundwater wells within the area may be potentially impacted. Wells completed in units stratigraphically above or below the coal seams being mined face a remote chance of being affected.

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Wells located to the east and south of the permit area have the greatest potential for being affected since the hydraulic gradient is primarily in a southeast direction for the Dietz 3 coal seam (Exhibit DF-4) and in an east and northeast direction for the Monarch Coal seam (Exhibit DF-5). Wells to the north and west of the permit have the least potential for

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being impacted since they are located up-gradient of the disturbed area, or beyond the coal outcrops. The worst case, life of mine, groundwater drawdown predictions are shown on Exhibit DF-6. It is improbable that any groundwater users in the area will be adversely affected by drawdowns.

Wells completed in alluvial aquifers have little potential for being affected since no alluvial aquifers are proposed for mining and the quantity and quality of water supplying these aquifers should not be disrupted.

Changes to groundwater quality as a result of mining is discussed in the previous section. Since the predominant consumptive use of the groundwater, which may be potentially impacted is livestock watering, it is not likely that changes to water quality that may occur will change this classification (see DEQ, WQD Rules and Regulations Chapter VIII - Quality Standards for Wyoming Groundwaters. As discussed earlier, TDS values can reasonably be assumed to increase two to three fold within spoil aquifers compared to the undisturbed coal aquifers. Even at 3 fold increase, TDS values should still be well within the livestock watering use category of 5000 mg/l. Although sulfate concentrations may dramatically increase, they should remain below the 3000 mg/l standards for livestock watering.

To assure that the mining and reclamation operations do not have an adverse impact on water users, Big Horn Coal Company is monitoring a multitude of wells for water quality and static water levels. Well locations are found on Exhibit DF-9. Well completion details can be found in Appendix DF-1. Monitoring of these wells will continue beyond reclamation, including the implementation and monitoring of wells completed in reclaimed spoils. Anticipated spoil well locations are found in Exhibit DF-11 with details on completions found on page DF-56.

In respect to W.S. 35-11-415(b)(xii) the Big Horn Coal Company has committed to replacing any water right which is affected by the mining operation (page DF-42). Alternate water supplies are available from the Tongue River, Tongue River alluvium and the Carney Coal seam. The Carney Coal seam, which lies about 100 ft. below the Monarch Coal seam, should provide adequate replacement water.

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SURFACE WATER

General Surface Water Hydrology

The pre-mining surface water system within areas to be dis-

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turbed, at the Big Horn Mine is unique in that channelized flows in defined channels are absent, except for the P-5 Draw in the Pit 5 area. The surface hydrology of adjacent areas has, in some places, been drastically altered by past underground mining activities. Any impacts to the surface water system have the potential to impact the Tongue River and Big Goose Creek, both perennial streams which pass through the permit area. Previous mining activities have disturbed the hydrologic system of both Big Goose Creek and the Tongue River to unknown degrees, including the disruption and replacement of sections of both stream channels. The present operation has established adequate stream buffer zones to minimize future disturbances to the Tongue River and Big Goose Creek.

Post-Mining Topography

The post-mining topography is depicted on Exhibits RP-3, RP-3A, RR-8 and RP-10. Exhibit RP-3A contains the alternate backfilling plan for the permanent impoundment shown in Exhibit RP-3. Through-drainage has been achieved in all areas except in the immediate drainage of the permanent impoundment. Through drainage will be achieved in this area in the event that the alternate plan (Exhibit RP-3A) is implemented.

Slope comparisons of the post-mining topography are discussed on pages RP-16, RP-32 and RP-35. Slope classes of the post-mining topography are shown in Exhibits RP-4, RP-9 and RP-11. Proposed slope conditions appear adequate to achieve revegetation and subsequent hydrologic stabilization, except in the southeast corner of the Pit 3 area where slopes adjacent to undisturbed lands approach 20-39% slopes (Exhibit RP-4, SW 1/4 Section 14). The applicant has proposed to stabilize and protect the area from erosion with the use of jute soil netting, which has proved to be successful on much steeper slopes on the mine site.

The reclaimed P-5 Draw drainage basin should be about as hydrologically stable as pre-mining conditions after revegetation becomes established. The present P-5 Draw (channel) is apparently being held in a state of equilibrium by bedrock controls. Although these controls are going to be removed by mining, the following considerations govern the stability of the reclaimed P-5 Draw:

1. The drainage area is being reduced by 9.3% which will reduce flow.
2. The width depth ratio has been increased to reduce velocities.

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3. Good channel revegetation is expected.
4. Channel slope has been reduced.
5. It appears that adequate bedrock control exists both above and below the area to be reclaimed.

It should also be noted that any downstream impacts to the P-5 Draw will be attenuated quickly since the channel downstream of the area to be reclaimed has been drastically disturbed by past underground workings. Most, if not all, runoff passing through areas of the channel that have subsided, enters the underground workings. Therefore, it is doubtful that any adverse surface water impacts generated within the Pit 5 reclamation plan will affect the Tongue River.

Surface water from the P-5 Draw, which enters the groundwater system via the underground workings, should have a negligible effect to the groundwater system since the majority of the suspended sediment will not be transported through the groundwater system and increases in dissolved solids will probably be minimal (see Groundwater Section).

Surface Water Quantity

The quantity of surface water evolving from the reclaimed area may be slightly increased initially after reclamation due to lower infiltration rates. Infiltration rates should eventually return to pre-mining conditions as vegetation becomes more established, organic matter builds-up, and soil structure returns to pre-mining conditions. This change in the runoff regime will be minimal and beyond detection limits in relation to the discharge of the Tongue River. Pit pumpage during the active mining operation, and subsequent discharge via sediment ponds, will add minimal additional flow to the Tongue River. The discharge of pit pumpage water to the Tongue River is expected to be greatest in winter months when the demand for dust abatement water is at a minimum (Appendix MP).

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Surface Water Quality

A complete year of surface water quality data is found in Appendix DF-3. Although this data does not constitute "pre-mining baseline data", since the mine has been operating for many years, it is useful in understanding the system, observing trends, and in predicting impacts from the mining operation.

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The Big Horn Coal Company has committed to burying unsuitable (toxic) materials at least four (4) feet below the regraded surface, above the post-reclamation potentiometric surface,

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and not in the proximity of any drainage channels (DF-58).

The quality of surface waters originating on reclaimed areas should not be much different than pre-mining. There may be a slight increase in suspended solids until vegetation is adequately re-established and runoff returns to pre-mining conditions. Adequate post-mining slope conditions and a history of relatively good revegetation should limit unwarranted sediment production. The presence of stream buffer zones will help attenuate sheet wash sediment delivery to the Tongue River and Big Goose Creek.

During the actual mining operation mine drainage will be controlled through the use of diversions, interceptor ditches, and sedimentation ponds (MP-14). Diversion ditches direct undisturbed area runoff around the operation, while interceptor ditches direct runoff from disturbed areas to sediment ponds for sediment control. Exhibits MP-26, MP-31, and MP-35 show the locations of all diversion and interceptor ditches.

The implementation of sedimentation ponds during the actual mining operation will help in ensuring that receiving waters will not be degraded. Design calculations for sediment ponds are found in Appendix MP-1. Exhibits MP-4 through MP-16 contain the design drawings, and Exhibits MP-2, MP-26, MP-31 and MP-35 show the locations for all existing and proposed sedimentation ponds. All water discharged to the Tongue River will be monitored to ensure that receiving waters are not degraded and effluent criteria, as set forth in E.P.A. N.P.D.E.S. discharge permit WY #0022519 (Appendix MP1), are not exceeded. Sediment ponds will be used to treat runoff until the applicant can demonstrate that runoff from affected lands will not degrade receiving waters.

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Permanent Impoundments

A permanent impoundment is proposed as part of the post-mining topography at the Pit 1 area (NE 1/4 of Section 22, T57N, R84W, and SE 1/4, Section 15, T57N, R84W, Exhibit RP-3). It is estimated that approximately 1250 AF of water will be contained in the impoundment, and it should fill to full stage within one year of final grading (RP-23). Groundwater will constitute the majority of the water within the impoundment.

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The primary use will be for sports fisheries and recreational use. Secondary uses include wildlife habitat and livestock watering. The impoundment has been approved by both the Wyoming Game and Fish Commission and the Wyoming State Engineer. Water quality is expected to be sufficient for fish

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production based on the chemical analysis of five strip mine ponds and 42 fish supporting lakes in Northeastern Wyoming (Exhibit RP-5). Old strip mine ponds just to the north and west of the Big Horn Mine have been documented to support good warm water fisheries, containing both largemouth and smallmouth bass, crappie and green sunfish (KRUMM, 1981 Personal Communications).

Slopes around the impoundment are shown on Exhibit MP-15 and are designed to be 4:1 on the south side, 3:1 on the west and east side and 3:5:1 on the north side. These slopes should not present a hazard to humans, wildlife or livestock.

Impacts to the groundwater system will be minimal since the impoundment will simply act as a transport medium for groundwater flow. No adverse impacts to the surface water are expected since it is doubtful that the impoundment will ever discharge any water to surrounding surface waters (Tongue River). In the event that the impoundment fails; such as the development of inadequate water quality to support the proposed uses or the lack of sufficient water quality, Big Horn Coal Company has committed to implementing an alternative plan (RP-25). The alternate plan includes backfilling the impoundment with approximately 2,370,000 cubic yards of material and providing through-drainage to the area. The post-mining topography incorporating the alternative plan is depicted on Exhibit RP-3A.

Surface Water Rights and Uses

The uses of surface waters at the Big Horn Mine area include; stock watering, irrigation, and industrial water which is used primarily for dust control at the mining operation.

A listing of all valid surface water appropriations (diversions and reservoirs) within 1/2 mile upstream and 3 miles downstream of the permit area is presented in Appendix DF-4 and Exhibit DF-7.

Adverse impacts to surface water quantity and/or quality, which have been previously discussed should be minimal. Olsen and Dettman (1976) of the Argonne National Laboratory studied the water quality effects of the Big Horn Mine, during actual mining, and found that the impact of the mine on concentrations of dissolved constituents was minimal and probably well beyond detection limits.

Surface water quality and quantity monitoring sites have been established both upstream and downstream of the mine site on Big Goose Creek and the Tongue River, on four ephemeral

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stream sites, as well as on all mine discharges. Specifics on the monitoring sites are found in Appendix DF-2. A committment to post-reclamation monitoring for as long as DEQ deems necessary is found on page DF-86. It is not anticipated that any surface water rights will be impacted by the mining operation.

d. The toxic and acid-forming materials identified at the Big Horn Mine Site are materials that are carbonaceous, are saline, high SAR and/or low pH's. The results of the overburden analysis and the handling procedures are discussed on a pit by pit basis in Appendix D-5. Big Horn Coal Company has committed to special handling of any combustible, toxic, acid-forming materials encountered in the mining process. The material will be selectively placed out of the groundwater, buried by at least four feet of suitable material and sealed by compaction (page MP-29). These practices meet the requirements of Chapter IV, Section 3.c.(3), of the Wyoming Rules and Regulations. Additional information pertaining to the above are discussed in Section No. 2.c. of this document.

3. PROBABLE CUMULATIVE HYDROLOGIC IMPACTS

General

Within the general vicinity of the Big Horn Mine, two additional mining operations may, at some time in the future, produce impacts to the hydrologic system which conceivably could be of a cumulative nature. At the present time Sheridan Enterprises, Inc. is seeking LQD approval of the Welch No. 1 - North permit application (LQD TFN 1 4/216). The proposed mine is located adjacent to the northeast part of the Big Horn Mine permit boundary and contains lands in Sections 1, 2, 3 and 4 of T57N, R84W.

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The Ash Creek Mining Company operates the PSO No. 1 Mine (LQD TFN 1 1/214) located in Section 22, T58N, R84W. Currently the mine is not operating and disturbance is limited to a small open pit and several stockpiles. The mine is located about 3 1/2 miles north of the Big Horn permit boundary. It is not known when active mining will resume.

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Groundwater

It is anticipated that some cumulative impacts may result to the groundwater system as a result of the mining operations at the Big Horn, PSO No. 1, and the Welch No. 1 North Mines. This concern is more critical between the Big Horn Mine and the Welch No. 1 North Mine because they may at some point in

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time be virtually adjacent operations and apparently will be mining the same coal seams (Dietz 2, Dietz 3, Monarch).

Quantifying the impacts that both mines, in combination, may have on the groundwater system is not possible due to several contributing factors, such as:

1. It is not known when the Welch No. 1 North Mine will begin operations.
2. The correlation of mining activities between the two mines is unknown (i.e. pit limits, dewatering, backfilling, etc.).
3. The extremely diverse nature of the hydrogeology of the area due to past underground mining, the Tongue River, extensive burn areas (clinker), and discontinuous coal seams, makes it very difficult to assess how extensive impacts may be.

However, it can be reasonably assumed that if both mines are operating at the same time, or recharge to previously reclaimed lands is not complete, that cumulative drawdowns may result. This is evidenced by Figure 2.6-12 of the Welch No. 1 - North Mine (TFN 1 4/216) and Exhibit DF-6 of the Big Horn permit application, which show that worst case drawdown estimates (contours) overlap. Theoretically, this will increase some of the drawdown caused by the Big Horn Mine alone (Exhibit DF-6), especially closer to the Welch No. 1 - North operation. The increases in drawdown probably would not be significant because both individual drawdown estimates exhibit worst case conditions and probably would not occur to the predicted magnitude anyway. Also, the analytical techniques used to generate the predictions are probably not sensitive enough to incorporate this additional factor.

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Cumulative water quality impacts associated with the Big Horn Mine and the Welch No. 1 North Mine are difficult to predict. It appears that the major cumulative impact that could result is simply a larger proportion of aquifer disturbance. It does not appear that water quality parameters, down-gradient of mined areas, will increase in concentration beyond that caused by a single operation since the potentiometric surface maps for both the Big Horn Mine (DF-4, DF-5) and the Welch No. 1 Mine (2.6-1) show flow paths to be in an easterly to southeasterly direction, thereby making the mixing of waters from both sites remote.

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Cumulative impacts to recharge areas will be minimal since recharge is principally along highland areas that have been burned (scoria areas) or through Tongue River alluvium. Figure 2.6-1A of the Welch No. 1 North permit application

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depicts some of these recharge areas. Since disturbance to highland scoria areas will be minimal and no further disturbance of the Tongue River is expected, recharge areas should not be adversely impacted.

Cumulative impacts as a result of the PSO No. 1 Mine, including or excluding the Welch No. 1 Mine and the Big Horn Mine, are expected to be minimal. According to the PSO No. 1 mine plan the Anderson and Dietz coal seams are mined at this site. It is believed that the Anderson seam is synonymous with the Dietz 1A which is located stratigraphically higher than the seams being mined at either the Big Horn or Welch No. 1 North Mines. It appears that the Dietz seam being mined at the PSO No. 1 mine is either the Dietz 1B or Dietz 2 seam specified by the Big Horn Mine permit.

If the Dietz seam being mined at the PSO Mine is correlated to the Dietz 1B, cumulative impacts are unlikely since the Dietz 1B is not being mined at the Big Horn Mine because it is located stratigraphically higher than the seams being mined. If it correlates to the Dietz 2 at the Big Horn Mine, cumulative impacts could be possible but are very remote since the Dietz 2 is unsaturated on most of the Big Horn Mine area. Also, it is improbable that the coal seam is continuous between operations due to much burn and subsidence from past underground mining. In summary, it is very doubtful that the PSO No. 1 Mine will contribute any groundwater impacts of a cumulative nature to the Big Horn operation.

Surface Water

Impacts to surface waters generated at the Big Horn, PSO No. 1 and the Welch No. 1 - North Mines have the potential to cumulatively impact the Tongue River since all are located within the Tongue River drainage basin. Impacts associated with the Big Horn Mine and the Welch No. 1 - North Mine may be more direct because both mines are located adjacent to the Tongue River. At both the Big Horn and Welch No. 1 - North Mines only ephemeral type drainage basins will be directly disturbed by surface mining.

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Surface mining activities at the PSO No. 1 mine will disturb the West Branch of Little Youngs Creek which is ephemeral, and Little Youngs Creek, a small perennial stream tributary to Youngs Creek, which is a tributary of the Tongue River. The confluence of Youngs Creek and the Tongue River is about 5 linear miles downstream from the Big Horn permit boundary.

The connection of post-mining topographies at the various operations is not a concern since mining operations are not

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planned which would lead to disturbed areas immediately adjacent to each other. Also, no drainage channels will be disturbed by more than one of the operations.

Impacts to surface water quantity and quality, as a result of the Big Horn Mine, are discussed in Finding 2.d. of this document. Adverse cumulative impacts to the quantity of runoff contributing to Tongue River stream flow will be minimal and certainly beyond detection limits due to the very large drainage basin of the Tongue River and the relatively small cumulative area of disturbance.

At this time it is not possible to predict the magnitude of these impacts since it is not known when the Welch No. 1 North Mine will begin operations, or when the PSO No. 1 Mine will resume operations. Therefore, the correlation of mining activities (surface water controls, amount of disturbed area, revegetation, etc.) between operations, which will probably have the greatest affects on the magnitude of cumulative impacts to water quality is not known.

Acceptable surface water controls (sediment ponds, treatment ponds, interceptor ditches, diversion ditches, etc.) and adequate reclamation at the Big Horn, PSO No. 1, and the Welch No. 1 North Mines should minimize cumulative impacts to the water quality of the Tongue River. Although cumulative impacts to water quality of the Tongue River may result they will probably be minimal due to the large contributing drainage area of the Tongue River, and other present land use activities occurring, such as grazing and crop irrigation (return flow from flood irrigation).

Material Damage to Hydrologic Balance

The following are impacts of a cumulative nature which may occur to the hydrologic balance:

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1. Decreases in surface water quantity contributing to Tongue River stream flow may occur due to evaporation of water in sediment ponds and use of this water for dust suppression. The subsequent decrease in flow of the Tongue River will probably be insignificant and beyond detection limits. It is possible that pit pumpage may move than adequately replace these waters.

2. Degradation of surface water quality could occur, but it is doubtful that any material damage will result due to the following:

   a. Adequate treatment facilities during mining.

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b. Reclamation and revegetation are expected to be successful.

c. The water quality of the Tongue River has already been degraded, and continued eutrophication and siltation problems from other land use practices are evident.

3. Cumulative drawdowns of groundwater levels may result. This should be a short-term impact and water levels should return to near pre-mining levels once pit pumpage ceases and recharge to backfilled areas is complete.

4. Water quality changes to groundwaters will occur. Material damage to the groundwater system will be minimal since few water supplies are known to utilize these groundwaters and the primary use classification (stock watering) should not change.

No. 4. The area proposed to be mined is not included within an area designated unsuitable for surface coal mining pursuant to W.S. 35-11-425, within an area where mining is prohibited pursuant to section 522(e) of P.L. 95-87, or within an area under review for this designation in an administrative proceeding.

No. 5. The schedule provided in W.S. 35-11-406(a)(xiv) indicates that all surface coal mining operations owned or controlled by the applicant are currently in compliance with this act and all laws referred to in paragraph (a)(xiv) of this section, or that any violation has been or is in the process of being corrected to the satisfaction of the authority, department or agency which has jurisdiction over the violation.

No. 6. Neither the applicant nor operator controls or has controlled mining operations with a demonstrated pattern of willful violations of such nature and duration with such resulting irreparable harm to the environment as to indicate reckless, knowing or intentional conduct.

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No. 7. For the term covered by the permit, the proposed operation will not be inconsistent with other surface coal mining and reclamation operations proposed or contemplated in pending or approved mining permits.

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No. 8. The application provides the rights of entry as required by the act.

No. 9. No threatened or endangered wildlife species are known to reside within the permit area and adjacent lands nor does habitat critical to such species occur in the vicinity of the permit area. Bald eagles are occasionally sighted along the Tongue River which

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flows through a portion of the permit area, but these sightings generally occur during late fall and early winter. Mining is not expected to have adverse impacts on eagle use of the Tongue. Five (5) pairs of golden eagles nest on lands within and adjacent to the permit area. None of these nests will be destroyed during mining and the applicant has committed to monitor possible effects of mine related activities on the nests. As a stipulation, the applicant must report to appropriate state and federal authorities any threatened or endangered species that takes up residence within the permit area or adjacent lands. Upon acceptance of this stipulation, the applicant will be in compliance with Chapter II. Sec. 3.b(4)(b) regarding protection of threatened and endangered species, species of importance, and critical habitat.

No endangered or threatened plant species have been found to exist on the proposed mine site. The activities of the mine will not affect any critical habitat.

No. 10. The existing structures will achieve the performance ensured by applicable design standards and should cause no significant harm to the environment or public health or safety.

No. 11. The operation does qualify as a special category of surface coal mining, (requiring the following findings):

a. ALLUVIAL VALLEY FLOORS

The extent of Alluvial Valley Floors at the Big Horn Mine have been determined to include all those lands within the boundaries of the zero (0) alluvial isopach delineation found on Exhibit DK-7 (Drill Hole Location and Alluvial Isopach Map). Consistent with the definition of Alluvial Valley Floors (W.S. 35-11-103(e)), these lands consist of unconsolidated stream-laid deposits where flood irrigation or subirrigation agricultural activities have, or could have, occurred. Previous mining activity, most of which occurred prior to May 3, 1978, has disturbed much of this area. In accordance with W.S. 35-11-406(n)(v), Big Horn Coal Company has the right to mine said alluvial valley floors. To the extent possible, the operator is required to restore and preserve the essential hydrologic functions of alluvial valley floors in accordance with W.S. 35-11-415(b)(x).

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The amount of Alluvial Valley Floors remaining undisturbed by surface operations is delineated as Potential Subirrigated Areas, Exhibit DK-10. Big Horn Coal Company does not intend to mine any areas delineated as such (DK-84).

Based on available information, the following have been

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determined to be the essential hydrologic functions of Alluvial Valley Floors at the Big Horn Mine:

1. Availability of surface waters of suitable quality and quantity for flood irrigation.

2. Adequate soil, slope, and land-form conditions to permit flood irrigation activities.

3. Ability to transmit groundwaters of suitable quality and quantity, to support subirrigation of certain areas.

Since almost all disturbance, and subsequent reclamation, to Alluvial Valley Floors at the Big Horn Mine occurred before the State Program Submittal, the State is limited by what can be required with respect to restoring and preserving the essential hydrologic functions. However, it appears that the essential hydrologic functions, particularly the ability for flood irrigation, including adequate soil and slope conditions, may have been, or will be adequately reestablished. This should be accomplished by the replacement of topsoil and subsoil material and restoration of acceptable post-mining slope conditions for flood irrigation (Exhibits RP-4 and RP-9). Also in the Pit 3 area, approximately 200,000 cubic yards of alluvial gravels have been stockpiled to aid in the reconstruction of an alluvial aquifer resulting from an old meander loop of the Tongue River. It does not appear that subirrigation was a function of these gravels (Appendix DF). They appear to act as a storage medium during peak flow events, releasing water to the Tongue River during low flow periods. The replacement of adequate soils and slope conditions (Exhibit RP-4), in this area, should reestablish the primary land use of dry land pasture.

b. The Big Horn Coal Company Mine contains no prime farmland as indicated by the Soil Conservation Service letters (Appendix D-7).

No. 12. Two objections to issuance of the mine permit application were received. The owners of property adjacent to the mining operation expressed concern about dust, noise and blasting problems and the devaluation of their property due to the adjacent coal mine (see letter dated August 17, 1981). Sheridan-Wyoming Coal Company expressed concern about maximizing coal recovery and the ability of the permittee to reclaim the property during the term of their lease (see letter dated August 12, 1981). The owners of property adjacent to the permit area withdrew their objection on August 24, 1981 prior to any informal conference or hearing. With respect to the second objection, the Administrator determined the objection to be a property matter outside the scope of

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W.S. 35-11-406(n). This objection was dismissed on this basis (see letter from W.C. Ackerman dated August 27, 1981).

A third party commented on the application, questing why certain leased lands had not been included in the five year area. This comment was also disolved as a property matter (see letter from W.C. Ackerman dated August 27, 1981). No informal conferences or formal hearings were held and no changes were made in the application as a result of these objections and comments.

Dated this 21st day of August, 1981.

W. C. Ackerman

Walter C. Ackerman, Administrator

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STATE DECISION DOCUMENT
SHERIDAN ENTERPRISES
PERMIT NO. 497-T1

In compliance with Article 4 of the Wyoming Environmental Quality Act, Sheridan Enterprises, Inc. has applied for a permit to mine coal at the Welch No. 1 North Mine in Sheridan County, Wyoming.

On the basis of information set forth in the application or from that otherwise available and known to the applicant, I find that the applicant has affirmatively demonstrated that:

No. 1. The application is accurate and complete (W.S. 35-11-406(n)(i)).

The applicant has provided a sworn statement certifying that all of the information contained in the permit application is true and correct to the best of his knowledge. In addition, and to the extent necessary and appropriate, independent agency verification supports the accuracy of the application. All of the information required by the Environmental Quality Act and its implementing regulations is contained in the application. This includes identification of interests, compliance information, resource information, land use information, pertinent maps and plans, the permit fee, other agency applications or approvals, an operations plan, a reclamation plan, license information, insurance information, proof of publication, and proof of public notice.

No. 2. The reclamation plan can accomplish reclamation as required by the Act (W.S. 35-11-406(n)(ii)) and Wyoming Department of Environmental Quality, Land Quality Division Rules and Regulations, Chapter IV, Section 2:

(a) The mined land will be restored to a condition equal to or greater than its highest previous use.

The applicant's reclamation plan and associated seed mixtures have been designed to ensure the establishment of diverse and self-regenerating plant communities which will provide forage and browse for livestock and wildlife. Implementation of this reclamation plan will facilitate the return of the approved post-mining land uses of livestock grazing and wildlife habitat which are identical to those occurring on the pre-mining surface. The applicant has not proposed any alternate land uses or permanent water impoundments for the post-mining surface.

(b) The approximate original contours of the land will be reestablished in a manner consistent with the proposed future use of the land (also Chapter IV, Section 3(a)).

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The Welch I-North Mine will be a truck/shovel surface mining operation that will recover three seams of coal. Over the life of mine approximately 10 million tons of coal will be mined, and approximately 38.6 million cubic yards of overburden and interburden will be moved. Using a swell factor of 15% gives a final to initial thickness ratio of 91%, which places this operation under the thin overburden regulations of Chapter IV. All material must be returned to within the pit limits.

Because of the room needed to mine the three seams, it will be necessary to construct an 8.3 million cubic yard temporary overburden stockpile. This temporary stockpile will be backfilled within the pit limits later in the mines life as described in the mine plan.

The post-mining topography is presented as Figure 4.3-1 of the permit application. As this mine is not an extremely thin overburden operation, the post-mining slopes and landform configurations are similar to the pre-mining conditions identified in Figure 2.5-2. Figures 4.2-1A and 4.2-1B of the permit application show the percentages of pre-mining and post-mining slope intervals that are within various slope categories.

A weighted average method of analysis shows the pre-mining slope = 9.135% and the post-mining slope = 8.48%.

Detailed backfilling and grading plans are discussed in Section 4 of the permit application.

(c) The reclamation plan provides for the removal, segregation, preservation, and replacement of topsoil or an approved substitute, and for the appropriate management of any toxic, acid-forming, or hazardous materials uncovered or created by the mining operation (also Chapter IV, Section 3(b) and (c)).

The applicant has committed to salvage all suitable topsoil including all suitable B and C horizon material (Mine Plan, Section 3.3.1). During soil removal, pedestals will be left at approximately 300 foot spacings to help verify complete salvage. The topsoil replacement depth will average 17 inches over the entire disturbed area (Reclamation Plan, Section 4.2.2). Special soil reconstruction techniques will be employed on about 42 acres for restoration of the Pine/Juniper Woodland communities. Figure 4.3-1 shows the location of the woodland areas. Reclamation Plan, Section 4.2 describes the specialized soil reconstruction plan.

Prior to topsoil and subsoil replacement the spoil surface will be regraded and sampled to a depth of eight feet on two foot intervals. Sample holes will be spaced at one per two acres. The samples will be analyzed for pH, EC, SAR, ABP, TOC, saturation percent, and texture. (Reclamation Plan, Section 4.2).

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Overburden at the Sheridan Enterprises mine site is generally suitable. However, unsuitable lithologies do occur (Mine Plan, Section 3.3.2.4). The parameters of primary concern are acid pH, nitrates, TOC, EC, and SAR. All unsuitable overburden will be placed 8 feet below the reclaimed surface to insure successful revegetation. Special handling practices to protect water quality include mixing, backfill placement above the water table and below the surface 8 feet, and alternate dumping with suitable material (Mine Plan, Section 3.3.2.4). See Finding 2(i) regarding the adequacy of these practices to protect water quality.

Since the proposed burial depth of unsuitable materials is 8 feet, no special burial commitments regarding ephemeral streams are necessary.

(d) Revegetation of all affected lands will be accomplished in a manner consistent with the reclamation plan and the proposed future use of the land (also Chapter IV, Section 3(d)).

The 753 acre permit area is composed of four vegetation types; mixed grassland, big sagebrush shrubland, skunkbush shrubland and pine/juniper woodland. There is no cropland within the permit area. Approximately 329 acres or 44 percent of the permit area will be affected by mining and mining related activities.

The applicant has stated in the Mine Plan that backfilling and contouring of the pit will commence within 180 days of coal removal. In Pit A, rough backfilling will not commence until the Monarch coal seam is removed from each removal block. Once the Monarch seam is removed, backfilling will occur within 180 days of final removal.

The applicant's reclamation plan calls for the reestablishment of the mixed grassland, big sagebrush shrubland and pine/juniper woodland communities. The skunkbush shrubland will not be replaced because the steep south-facing slopes supporting this vegetation type cannot be effectively reconstructed after mining. Instead, species found in this community are included in the three seed mixtures to be applied to the affected area. Each of these three seed mixtures are composed of a diverse variety of native grasses, forbs and shrubs adapted to this area and capable of supporting the post-mining land uses of livestock grazing and wildlife habitat.

The applicant commits to the reestablishment of shrubs and trees as required by Chapter IV, Section 3.(d)(vi)(A) of the Rules and Regulations. The pine/juniper woodland community is the critical area for tree reestablishment. Therefore, the applicant has stated that special measures will be used to prepare the spoil/topsoil substrate to enhance tree establishment. This includes regrading the spoil so that it

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will be compacted as much as possible to form an impermeable layer designed to perch water for tree roots. The next step requires the application of 17 inches of topsoil with 40 to 50 percent sand and no more than 15 percent clay over the compacted spoil. The final step entails the placement of flat rock, 6 to 24 inches in diameter, on the soil surface to cover an average of 20 to 50 percent of the surface.

Reference areas representing each of the four vegetation communities have been established and sampled on this permit area. Appropriate reference areas will be used for direct comparison with the reclaimed vegetation communities at the time of bond release evaluation. The reference area methodology was chosen because of the generally overgrazed condition of the permit area which precluded the use of the baseline data for comparison with the reclaimed vegetation (which is required with the use of a control area). The reference areas were located within a portion of the permit area which will not be affected by mining and which appeared to be less overgrazed than the remainder of the permit area. As a result of these differences in range condition, the applicant was not required to statistically prove comparability between the reference area and its associated community.

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The applicant has proposed using fourwing saltbush (Atriplex canescens) as an alternative species in the big sagebrush shrubland mixture. The seeding rate for this species is 3 lbs. pls/acre. The Wyoming Game and Fish Department has requested that all seeding of this species be kept to a maximum rate of .5 lb. pls/acre. This reduced seeding rate is preferred because it reduces the likelihood that fourwing saltbush will dominate the shrub component of the revegetated communities. The seeding rate of fourwing is only .5 lb. pls/acre in all of the other mixtures proposed for the mine site. However, the existence of the aforementioned elevated rate makes it necessary that the following general condition be attached to the permit:

> **The use of fourwing saltbush (Atriplex canescens) in the Big Sagebrush Shrubland Supplemental Mixture shall be reduced to .5 lb. pls/acre. This same seeding rate for this species shall be maintained in all seed mixtures applied to the reclaimed surface. The table listing supplemental species for seeding on the Big Sagebrush Shrubland type shall be corrected to .5 lb./acre for fourwing saltbush within 60 days of permit approval.**

The applicant states in the Reclamation Plan that the reclaimed area and the appropriate reference area will be sampled two consecutive years prior to bond release using the same sampling methods as described in the vegetation baseline study. Data on vegetation cover, total ground cover, shrub density and total herbaceous/subshrub production will be compared using standard statistical procedures with a confidence level of 80%. Species

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diversity of the pre-mining and post-mining areas will be compared using the Motyka Index of Similarity.

(e) Unchannelized surface water and ephemeral streams will be diverted around the operation or passed through sedimentation ponds to protect the operation and downstream water rights, and to control unnecessary erosion and water pollution (also Chapter IV, Section 3(e), (f), and (g)).

All ephemeral streams and unchannelized surface water will be diverted around the operation. The diversion and retention system is described in Section 3.2.6 of the Mine Plan and shown on Figure 3.2-5. Undisturbed area runoff from the two primary watersheds (Bosworth Draw and Smokey Draw) will be diverted around the west side of the proposed Pit A. The diversion has been designed to convey the 100-year, 24-hour storm event. Surface water runoff on the eastern side of the mine will be less than on the western side and will be handled by drainage ditches around the stockpile area, drainage ditches along access roads and haul roads and collection benches on the high wall of the mine. A total of six sedimentation ponds will be used to retain runoff from disturbed areas. These ponds have been designed to retain the volume of water and sediment contributed from a 10-year, 24-hour flood event with a 24-hour detention time (or until effluent standards are met). The sediment control system will be adequately placed to control sediment from all disturbed areas during this term of permit.

(f) Although the applicant proposes to mine near or through a perennial or intermittent stream, the original stream channel will be reclaimed. During and after the operation, the water quantity and quality of the stream, and its value as wildlife habitat, will be preserved (also Chapter IV, Section 3(p)(ii)).

The applicant proposes to mine near but not through the Tongue River or its associated alluvium. The Tongue River is considered an AVF significant to farming. Because there may be impacts to the ground water quality of the Tongue River alluvium due to Pit A ground water discharge the following condition will be attached:

> **No mining shall take place in the Pit A area until the operator confirms by means of additional pump tests, that the water quality of the Tongue River alluvium will not be degraded.**

(g) All permanent water impoundments will be constructed so as to prevent structural failures, safety hazards, and water contamination, and to accommodate revegetation. They will also meet the design criteria and performance standards outlined in Chapter IV, Section 3(h).

The applicant has not proposed leaving any permanent impoundments.

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(i) The reclamation plan will ensure protection of the quantity, quality, and legal rights to surface water and ground water within and adjacent to the permit area (also Chapter IV, Section 3(i)). Surface water and ground water quality and quantity will be monitored during the course of mining and reclamation operations to determine the extent of the disturbance to the hydrologic balance. The monitoring system is based on the results of the probable hydrologic consequences assessment and monitoring will be adequate to plan for modification of mining activities, if necessary, to minimize adverse effects on the water of the state. Plans for the proper installation, operation, maintenance and removal of all necessary monitoring equipment have been included in the permit application (Chapter II, Section 3(b)(ix)).

The applicant's plans to restore surface water quality and quantity are discussed under 2.(a), (b) and (f) of this SDD.

The applicant has committed to restoring the Smokey Draw and Bosworth Draw drainages and providing adequate topographic diversity to accommodate lower order drainages in other disturbed areas. The designs for the reclaimed drainages will require riprap in selected areas, such as meander bends, for erosion control. The proposed riprap sizing is shown in Table 3.3.10E. The sizing calculations will need to be updated to reflect the final channel designs. Therefore, a permit condition will be added which states:

> **Upon renewal of this permit the sizing of the riprap for the reconstructed reaches of Bosworth Draw shall be redesigned to insure a stable reclaimed channel.**

(j) All constructed or upgraded roads and railroad spurs are included within the permit area from that point where they provide exclusive service and are covered by the reclamation bond (also Chapter IV, Section 3(j)).

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As shown on Figures 3.2-1A and 1B of the permit application, primary access to the mine shall be from Wyoming Highway Route 338. The access road to the facilities area has already been constructed to STA 25+90.

On site haul roads will be from 70 to 100 feet wide for two way traffic and from 40 to 70 feet wide for one way traffic. Maximum grades will be 8%. Road design criteria is given in Section 3.2.2.

(k) All buildings and structures constructed, used, or improved by the operator will be removed and dismantled. All support facilities are designed to achieve the performance required by the applicable standards and should cause no significant harm to the environment or public health and safety (also Chapter IV, Section 3(k)).

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The majority of the facilities have not yet been constructed. The operator's plans are given in Section 3.2.1 of the permit application.

(l) A detailed time schedule for the mining and reclamation progression has been included in the reclamation plan (also Chapter IV, Section 3(a)).

Rough backfilling cannot occur until the Monarch (lowest) seam has been mined. Once the Monarch seam has been removed, rough backfilling and contouring will commence within 180 days of coal removal, and will be accomplished by placement of lifts and compacted by routing equipment.

(o) All exposed surface areas within the permit area will be protected and stabilized to effectively control erosion and air pollution attendant to erosion (also Chapter IV, Section 3(o)).

Air Quality Permit No. CT-214 was issued to Sheridan Enterprises, Inc. on April 19, 1979, a copy of which is included as Appendix IX-F in Volume IX. The permit requires SEI to control fugitive dust emission from roads by treating pit haul roads with asphalt, oil or other suitable chemical dust suppressants. All treated road surfaces are to be maintained on a continuous basis. Fugitive dust emissions from the portable coal crushing facility plant will be controlled by dust suppression sprays located at the dump hopper and primary crusher discharge.

(p) The mining and reclamation plan has been designed to minimize disturbance and adverse impacts on fish, wildlife, and related environmental values, and to achieve enhancement of these resources where practicable (Chapter IV, Section 3(p)).

Baseline Studies

Baseline studies (Section 2.9, Permit Application) were conducted according to specifications in DEQ Guideline 5 and after consultation with the Wyoming Game and Fish Department. The application complies with applicable standards.

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Important Habitats

Important habitats include the Tongue River and adjoining riparian vegetation, 3 acres of surface water, an estimated 10 acres of rock outcrops (Fig. 2.9-1, Appendix D-9), 127 acres of pine/juniper woodland, 257 acres of shrubland (big sagebrush and skunkbush sumac), and a 10 acre prairie dog colony. Mine disturbance will not encroach the Tongue River or adjoining riparian habitat. A 100 ft. buffer zone will be protected along the river (Fig. 3.1-1, Mine Plan). None of the surface water sources will be impacted (Table 2, Section 2.8). The remaining habitats discussed above will be disturbed by mining.

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Fifty-two acres of pine/juniper woodland will be eliminated. Based upon the applicant's tree density information, 8268 ponderosa pines and 2860 Rocky Mountain junipers (214 trees per acre) will be removed. Approximately 2 to 3 acres of rock outcrops and the 10 acre prairie dog colony in NW¼ Section 2 will be eliminated. Affected surfaces also include 58 acres of shrubland vegetation types.

Stream Diversions

A 100 ft. buffer zone has been established along the Tongue River (Fig. 3.1-1, Mine Plan). The only diversions proposed will intersect ephemeral tributaries of the Tongue River.

Mine Fencing

All perimeter and livestock control fences will be constructed according to Guideline 10, Type III design specifications to allow big game passage (pp. VII-19 and VII-64, Mine Plan).

Powerline Designs

Powerline designs are discussed on p. VII-64 of the Mine Plan. All powerlines will be constructed according to specifications in:

Olendorff, R.R., A.D. Miller, and R.N. Lehman. 1981. Suggested Practices for Raptor Protection on Powerlines -- The State of the Art in 1981. Raptor Res. Rep. No. 4, Raptor Research Foundation, Inc. Univ. Minn., St. Paul. 111 pp.

Mine Traffic

None of the mine roads will be located in crucial or unique habitat. To reduce the potential for wildlife/vehicular collisions, a speed limit of 15 mph will be posted on mine access and work area roads (p. VII-64, Mine Plan). Speed limits up to 45 mph are acceptable.

Mine Facilities

The bulk of mine facilities will be situated in upland habitats in NW¼SE¼ Section 2, primarily in mixed grassland, skunkbush sumac, and big sagebrush vegetation types (Fig. 3.1-1, Mine Plan). The area is sufficiently distant from the Tongue River to reduce the potential of accidental chemical or oil contamination. No crucial or unique habitats will be impacted.

Railroads and Conveyors

There will be no railroads or overland conveyors associated with this mine (p. VII-1, Mine Plan).

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Nesting Raptors and Migratory Bird Species of High Federal Interest

All activities impacting migratory bird species are subject to federal jurisdiction. The USFWS requires a mitigation program for raptors and selected non-raptor species of high federal interest.

One great horned owl nest and one red-tailed hawk nest were identified on the permit area during baseline studies in 1980 (Fig. 2.9-3, Appendix D-9). Both are located in SW¼ Section 1. A golden eagle nest occurs immediately north of the permit boundary in NE¼ Section 3. Additional nests within 2 miles include 13 kestrel nests, 2 Cooper's hawk nests, 8 red-tailed hawk nests, 3 great horned owl nests, and 5 golden eagle nests. The applicant has committed to monitor all raptor nests on the permit area and a 1 mile perimeter annually (p. VI-66, Mine Plan); however, no commitment is provided indicating a special purpose permit will be acquired before disturbing any raptor nest nor has a 5-year raptor management plan been approved by the USFWS. Consequently, the following stipulations are attached:

> **The applicant must obtain a special purpose permit from the U.S. Fish and Wildlife Service prior to disturbing the nest of any raptor species. Permit acquisition should be coordinated through the USFWS Ecological Services Office in Cheyenne.**
>
> **The applicant shall contact the U.S. Fish and Wildlife Service to develop a 5-year raptor management plan for this mine. The plan and USFWS letter of concurrence must be submitted within 6 months after permit approval.**

Migratory Bird Species of High Federal Interest observed on and adjacent to the permit area included the bald eagle, double-crested cormorant, Cooper's hawk, golden eagle, and Lewis' woodpecker. Cooper's hawk and golden eagle nests are situated immediately north of the permit area. A cormorant rookery is located 15 miles northwest near Tongue River Reservoir. Two positive identifications of Lewis' woodpecker nests were made in July, 1987. One is on the permit area in SW¼ Section 2. The second is 1/4 mile west of the permit boundary in SW¼ Section 3. A third "probable" nest location is 1/4 mile west of the permit boundary in NE¼ Section 4.

The applicant will submit a detailed mitigation plan for the Lewis' woodpecker nest in SW¼ Section 2 prior to the permit term in which it will be impacted (p. VII-65, Mine Plan). Until that time, feeding, nesting, and behavioral patterns will be studied. The applicant has not documented USFWS approval of this proposal. The following stipulation is attached requiring acquisition of a letter from the USFWS approving the mitigation proposal.

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The applicant shall secure a letter from the U.S. Fish and Wildlife Service approving the Lewis' woodpecker monitoring plan described on page VII-65 of the Mine Plan satisfies Federal requirements. The letter and any necessary plan modifications shall be submitted to the regulatory authority within 6 months of permit approval.

The applicant has indicated no mining activities will take place within a 1/4 to 1/2 mile buffer zone surrounding the golden eagle nest in NE¼ Section 3 until USFWS personnel visit the site and a definitive mitigation plan is developed (p. VII-65, Mine Plan). A stipulation is attached requiring the applicant to secure a letter from the USFWS documenting acceptability of this proposal.

The applicant shall contact the U.S. Fish and Wildlife Service to develop a monitoring and mitigation plan for the golden eagle nest in NE¼ Section 3. The plan, along with a USFWS letter of concurrence, must be submitted within 6 months of permit approval.

Wildlife Monitoring

The applicant's wildlife monitoring program appears on page VII-66 of the mine plan. A winter big game survey will be conducted annually during the January/February period. Annual lek attendance surveys and searches for new or previously undiscovered leks will be conducted in April. Raptor nest status surveys and searches for new or previously undiscovered nests will be conducted in March and April. Production at active nests will be determined in June. Big game, upland gamebird, and raptor surveys will encompass the permit area and 1 mile perimeter. Surveys for Lewis' woodpecker nests will be conducted annually on the permit area and 1/2 mile perimeter. The nest in SW¼ Section 2 will be studied to determine the species habitat requirements and behavior. Use of the permit area by threatened or endangered species will be monitored incidentally during wildlife surveys and other mine activities.

All winter big game surveys should be conducted under acceptable conditions -- clear, calm, 100 percent snow cover if possible. Each upland gamebird lek should be counted at least 3 times at approximate 1 week intervals during April to determine peak attendance. The U.S. Fish and Wildlife Service must approve the applicant's monitoring and mitigation proposal for Lewis' woodpeckers. Stipulations are attached to correct these deficiencies.

Winter big game surveys shall be conducted under optimum conditions if possible. Surveys should be delayed until a clear, calm day with 100 percent snow cover. If suitable conditions have not occurred by the end of the January/February period, the survey shall be conducted

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during the last week of February in the best manner possible.

Upland gamebird lek attendance surveys shall include at least 3 counts of each lek at approximate 1 week intervals to determine peak attendance.

Secondary Impacts

Energy development has been a primary stimulus for local and regional population growth in Wyoming. Such influxes are followed by increased poaching activity and both intentional and unintentional wildlife harassment. The cumulative secondary impact is considered significant. A maximum employment of 96 individuals is anticipated by the second year of mining. To ameliorate this impact, a stipulation is attached requiring the applicant to incorporate a wildlife information segment into the employee orientation program.

The applicant shall include a wildlife information segment within the orientation program for new employees. WGFD district personnel will be available to assist. The Information and Education Division will have a multi-image slide presentation available in the near future.

Habitat Reclamation

Surface disturbance will encompass 329 acres over the 11 year mine life. Affected vegetation communities include 201 acres of mixed grassland, 22 acres of big sagebrush shrubland, 36 acres of skunkbush sumac shrubland, 52 acres of pine/juniper woodland, 8 previously disturbed acres, and a 10 acre prairie dog colony. Average shrub densities include $0.04/m^2$ in the mixed grass community, $1.08/m^2$ in the big sagebrush shrubland, $0.25/m^2$ in skunkbush sumac shrubland, and $0.25/m^2$ in the pine/juniper woodland. These densities are substantially lower than reported for similar communities on mines elsewhere in the state.

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The applicant proposes to restore 3 vegetation types including mixed grassland, big sagebrush shrubland, and pine/juniper woodland (p. 4, Reclamation Plan). No specific acreages have been provided. Species and seed rates are listed in Tables 4.3-1 through 4.3-3 of the Reclamation Plan. In addition, the applicant will establish "high density" shrub patches on 10 percent of reclaimed surfaces (pp. 7 and 9a, Reclamation Plan). A density of 1 shrub per square meter is stated as a reclamation goal. The shrub seed mix is listed in Table 4.3-6. Species, seed rates, and methods are acceptable. However, a stipulation is attached requiring delineation of the proposed shrub mosaic pattern on Figure 4.3-1, Reclamation Plan.

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The applicant shall submit a shrub mosaic pattern on Figure 4.3-1 within 6 months after permit approval. The illustration will be used for reclamation planning and bond release evaluation.

To mitigate loss of rock outcrops and dissected terrain, the applicant will distribute 6 rock piles (1 per 55 acres) on reclaimed surfaces (p. 7, Reclamation Plan). Reclaimed surfaces will also be recontoured with sufficient topographic variability to promote habitat diversification (p. 1, Reclamation Plan).

The applicant proposes a stocking rate of 213 trees per acre within the pine/juniper communities depicted on Figure 4.3-1 of the Reclamation Plan. No acreage is provided. A stipulation is attached requiring the applicant to restore an area commensurate with the pre-mine figure, 52 acres.

The applicant shall restore at least 52 acres of the pine/juniper vegetation type, commensurate with the disturbed acreage.

Collectively, 58 acres of big sagebrush and skunkbush sumac shrubland will be eliminated by mining. The applicant proposes to reclaim a single type, big sagebrush. No acreage is provided. A stipulation is attached requiring the applicant to restore an area commensurate with the pre-mine figure.

The applicant shall restore at least 58 acres of the sagebrush shrubland, commensurate with disturbed acreages of big sagebrush and skunkbush sumac shrublands.

No. 3. The proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area (W.S. 35-11-406(n)(iii)).

Because there are no other mines near the applicant's property there is no cumulative hydrologic impact assessment requirement. The applicant will perform an additional pump test (as discussed in Section 2(f) of this document) to determine the extent of communication between the reclaimed pit and the Tongue River alluvium.

No. 4. The area proposed to be mined is not included within an area designated unsuitable for surface coal mining pursuant to W.S. 35-11-425, within an area where mining is prohibited pursuant to section 522(e) of P.L. 95-87, or within an area under review for this designation in an administrative proceeding (W.S. 35-11-406(n)(iv)).

No. 5. The proposed operation contains an alluvial valley floor within the permit area which is significant to farming. However, it will not interrupt, discontinue, or preclude farming on said alluvial valley floor that is irrigated or naturally subirrigated. The proposed

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operation will not materially damage the quantity or quality of water in surface or underground water systems that supply the alluvial valley floor (W.S. 35-11-406(n)(v)).

DEQ/LQD identified the portion of the Tongue River flowing through the permit area as an alluvial valley floor (AVF) significant to farming. This declaration is made in a letter dated June 17, 1988 from the Administrator to the applicant. A map delineating the extent of the AVF is attached to this letter and is located within Appendix D-11 of the permit application. This area is characterized by riparian areas, developed rangeland fed by subirrigation, subirrigated cropland and flood irrigated cropland. Animal units supported by these areas constituted 40% of the total production of the Welch Ranch. Therefore, this area cannot be mined.

No. 6. The area to be surface mined does not contain prime farmland (W.S. 35-11-406(n)(vi).

The Soil Conservation Service negative prime farmland determination can be found in a letter located in Appendix 2.1-A of Volume II.

No. 7. The schedule required by W.S. 35-11-406(a)(xiv) and the compliance review conducted by WDEQ/LQD indicates that all surface coal mining operations owned or controlled by the applicant are currently in compliance with this act and all applicable State and Federal laws, or that any violation has been or is in the process of being corrected to the satisfaction of the authority, department or agency which has jurisdiction over the violation (W.S. 35-11-406(n)(vii)).

No. 8. Neither the applicant nor operator controls or has controlled mining operations with a demonstrated pattern of willful violations of such nature and duration with such resulting irreparable harm to the environment as to indicate reckless, knowing or intentional conduct (W.S. 35-11-406(o)).

No. 9. The applicant does not qualify for an experimental practice variance (WDEQ/LQD Rules and Regulations Chapter IX).

No. 10. All appropriate Federal, State, and local government agencies with an interest in historic preservation have approved the proposed operation because it will not adversely effect any sites included in, or eligible for inclusion in, the National Register of Historic Places (WDEQ/LQD Rules and Regulations Chapter XIII, Section 1(a)(v)(C)).

Under contract with the applicant, Thomas Lincoln of the University of Montana's Anthropology Department conducted a Class III cultural resources inventory of the proposed permit area in 1977. The survey located 17 prehistoric archaeological sites within the Welch No. 1 Mine permit area boundaries, three of which were recommended for further investigation (48SH96, 97, and 109).

In the Spring of 1979 Western Cultural Resources Management (WCRM) completed the recommended investigations. Based on its test

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excavations of sites 48SH96, 97, and 109, WCRM concluded that none of these sites met eligibility criteria for listing in the National Register of Historic Places. The State Historic Preservation Office (SHPO) concurred with this assessment on November 5, 1981 (see correspondence attached).

At the request of the SHPO, the applicant retained Marvin Hoyt to conduct a second survey of the permit area in 1982 to record any historic sites that may have been overlooked by Mr. Lincoln. Hoyt located two homesteads and a dugout with outbuildings that date to the early twentieth century. After reviewing his report the SHPO determined that none of these sites met National Register eligibility criteria either (see correspondence attached).

No. 11. The operator does not plan to relocate any public roads (WDEQ Rules and Regulations Chapter XIII, Section 1(a)(v)(D)).

No. 12. For the term covered by the permit, the proposed operation will not be inconsistent with other surface coal mining and reclamation operations proposed or contemplated in pending or approved mining permits (WDEQ/LQD Rules and Regulations Chapter XIII, Section 1(a)(iv)).

No. 13. The mining and reclamation activities proposed will not affect the continued existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitats (WDEQ/LQD Rules and Regulations Chapter IV, Section 3(p)(iii)).

Chapter II, Section 3.(b)(iv)(B) requires a plan to protect threatened or endangered species listed under the Federal Endangered Species Act as amended. Chapter IV, Section 3.(p)(i)(E) requires the operator to report to the Administrator any threatened or endangered species in adjacent to the permit area, which was not investigated in the permit application.

Three endangered wildlife species, the bald eagle, peregrine falcon, and black-footed ferret, could potentially occur on the permit area. Bald eagles are common winter residents within the surrounding region. Additionally, a bald eagle nest is located on the Tongue River approximately 3 miles northeast of the permit area. The proposed mine site lies outside a reasonable zone of visual or auditory disturbance to the nest. Since mining will not encroach the Tongue River or adjoining riparian habitat, no impact to the pair's foraging range is anticipated. Because wintering eagles exhibit wide ranging, opportunistic foraging behavior, mining is expected to have no significant impact on wintering populations.

No black-footed ferret sign was encountered during baseline surveys of prairie dog colonies on and adjacent to the permit area. The applicant has stated a ferret survey will be conducted in accordance with accepted techniques within 1 year prior to disturbing any prairie dog colonies. Results will be submitted to the USFWS for review and clearance (p. VII-66, Mine Plan).

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No peregrine falcons were observed during baseline studies or subsequent monitoring activities; however, the species has been documented migrating through the region on rare occasions. No habitat suitable for nesting occurs on or adjacent to the permit area. No impacts are anticipated.

In the event any threatened or endangered species begin using the permit area, the applicant will notify the U.S. Fish and Wildlife Service (p. VII-66, Mine Plan). Given the potential for relocation of breeding activities by the eagle pair 3 miles northeast of the permit area, it will be particularly important to note any use of adjoining surfaces. Therefore, a stipulation is attached extending the area of responsibility for endangered species observations 2 miles from the permit boundary.

The applicant shall extend the area of responsibility for monitoring threatened and endangered species to encompass a 2-mile peripheral zone surrounding the permit area. All observations of use by threatened or endangered species must be reported to the USFWS. This extended coverage is necessary because of the bald eagle nest 3 miles northeast of the permit area. If this pair shifts their nest site closer to the permit area, a mitigation plan may be necessary.

The application, in conjunction with proposed stipulations, complies with applicable standards.

No. 14. No mining or reclamation activities will take place within the boundaries of the National Park System, the National Wildlife Refuge System, the National System of Trails, the National Wilderness Preservation System, the Wild and Scenic Rivers System, or any National Forest (WDEQ/LQD Rules and Regulations Chapter XIII, Section 1(v)(A) and (B)).

No. 15. No mining or reclamation activities will be conducted within three hundred feet of any occupied dwelling, public building, school, church, community, institutional building, or public park, nor within one hundred feet of a cemetery (WDEQ/LQD Rules and Regulations Chapter XIII, Section 1(a)(v)(E), (F), and (G)).

No. 16. Public notice was given in the Sheridan Press from November 28, 1988 to December 19, 1988. No objections to the permit were received (W.S. 35-11-406(j) and (k)).

Sheridan Enterprises, Inc. has demonstrated that the Welch No. 1 North surface coal mine permit application substantially complies with Article 4 of the Wyoming Environmental Quality Act and all other applicable State and Federal Laws and regulations. As authorized by W.S. 35-11-406(n) and in compliance with W.S. 35-11-406(p) I do hereby recommend the issuance of Permit No. 497-T1 to the Sheridan Enterprises, Inc., Welch No. 1 North Mine with the following standard conditions, as required by Wyoming Department of Environmental Quality, Land Quality Division Rules and Regulations Chapter XIII, Section 1(a)(viii):

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(A) All operations shall be conducted in accordance with the approved mining and reclamation plan and any conditions of the permit or license;

(B) The rights of entry shall be provided as described by the Act and any regulations promulgated pursuant thereto;

(C) The operation shall be conducted in a manner which prevents violation of any other applicable State or Federal law, and

(D) All possible steps shall be taken to minimize any adverse impact to the environment or public health and safety resulting from noncompliance with this approved mining and reclamation plan and other terms and conditions of any permit or license, including monitoring to define the nature of the noncompliance and warning of any potentially dangerous condition.

Signed this 7th day of March, 1989.

Roger Shaffer
Administrator, Land Quality Division

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BIG HORN COAL
RENEWAL AND AMENDMENT DECISION DOCUMENT
TFN 1 5/293

I. Description of Operation

The Big Horn Mine is located in Sheridan County, Wyoming, approximately 8 miles north of Sheridan. Access to the mine is by State Highway 338. The mine is operated by the Big Horn Coal Company, a wholy owned subsidiary of Peter Kiewit Sons, Inc.

Big Horn Coal Company has been operating surface coal mines since 1943 in the Sheridan, Wyoming, coal fields. Operations at the present Big Horn mine site began in 1948 and occupy all or portions of Sections 9, 10, 11, 14, 15, 16, 21, 22, 23 and 27, T57N, R84W. Much of the early mining occurred in the valley bottoms of Goose Creek and the Tongue River. More recent operations have included adjacent upland areas.

Mining at the Big Horn site has been with trucks, scrapers and shovels. Five known coal seams exist within the mine area, in descending order: Dietz 2B (Armstrong), Dietz 3 (Upper Monarch), Monarch (Lower Monarch), Carney and Masters. The Carney and Masters seams cannot be economically mined.

The Big Horn Mine was originally permitted under Wyoming's 1969 Open Pit Cut Reclamation Act. Subsequent revisions to the Wyoming Statutes, including approval of the State Program under the federal Surface Mining Control and Reclamation Act of 1977 has resulted in the Big Horn Coal Company receiving permit no. 213-T1 in August, 1981. Permit no. 213-T1 with revisions included 3417.89 acres and authorized disturbances on 1526.5 acres.

Big Horn Coal Company submitted this State Program Permit Renewal Application on December 23, 1982, for the purposes of adding 366.42 acres of new area to the existing area of permit no. 213-T1 and increasing the total permitted disturbance to 1950.5 acres. The area covered in this amendment includes portions of Sections 13 and 14, T57N, R84W. A 40 acre block of federal coal located in the SW1/4NE1/4 of Section 14 is included in this amendment. The applicant holds Federal Coal Lease W-69981 for this parcel of coal.

II. Environmental Setting

a. Geology and Topography

The Big Horn area is located on the western edge of the Great Plains Physiographic Province and is characterized by interstream uplands dissected by the Tongue River and its perennial and ephemeral tributaries. Resistant sandstone beds of the Fort Union and Wasatch Formation form prominent plateaus and ridges while less competent shale and coal beds are expressed as gently rolling hills. Unconsolidated deposits of the Tongue River and

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Goose Creek have formed broad, essentially flat terraces. Typically, coal beds have burned at the outcrop, leaving ridges and knobs of resistant clinker formed by baking of overlying sediments. Elevations in the vicinity of Big Horn Coal Company range from 3500 feet at the Tongue River near the Montana border to around 4800 feet in the upland areas ten miles northwest of the mine. Slopes range from 0 to 60 percent.

The Tongue River member of the Fort Union Formation is composed of interbedded sandstone, shales, siltstone, and coals, representing a fluvial sequence. Coal recovery will be from the Dietz 2B, Dietz 3, and the Monarch (USGS nomenclature) seams.

b. Soils

The majority of soils within the permit area are arid soils of the Torriorthents and Argids. Aridisols are in general well developed. On subirrigated terraces and other areas where moisture accumulates some Alfisols and Mollisols have formed. The majority of soils are fine and fine-loamy with scattered sandy and gravelly areas. Major limitations to topsoil salvage are high E.C., large percentages of coarse fragments, and depth to bedrock. Most soils in the area rate good to fair as a source of topsoil by SCS and Wyoming LQD guidelines.

c. Land Use and Vegetation

The past and present use of the land since the late 1880's has been primarily a combination of agriculture and mining, with secondary uses as a transportation corridor and wildlife habitat. The Sheridan Area Planning Agency has classified the area as "industrial" because of the existing Big Horn Coal mine.

The major agricultural use of the land has been domestic beef production. Livestock carrying capacity for the area has been rated approximately 80 acres per animal unit year. The lowland areas have been used for hay production and grazing. A historical record of the various fields appears in Table D1-2 in Appendix D-1 of the application. Field numbers in this table correspond to field numbers on the Land Use Map, Exhibit D1-1 of the permit document. A small portion of the upland area, field #13, was used for dryland farming with wheat and barley being the major crops.

Underground coal mining began in the area in the late 1890's and ended in the early 1950's. As underground mining operations terminated, surface mining operations started. A history of mining in the area is provided in Appendix D2 of the permit document.

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The native vegetation in this area is dominated by grasses belonging to the genus Agropyron and shrubs of the genus Artemisia. Important native grasses include: western wheatgrass (Agropyron smithii), bluebunch wheatgrass (A. spicatum), needle and thread grass (Stipa comata), green needlegrass (S. viridula), and blue grama (Bouteloua gracilis). Important shrub species include: big sagebrush (Artemisia tridentata), fringed sagebrush (A. frigida), silver sagebrush (A. cana), skunkbush sumac (Rhus trilobata), western snowberry (Symphoricarpos occidentalis), Wood's rose (Rosa woodsii), common winterfat (Ceratoides lanata), and snakeweed (Xanthocephalum sarothrae).

d. Climate.

Total annual precipitation for the Sheridan area is approximately 16 inches. Areas north and east of Sheridan in the vicinity of the Big Horn Mine can be expected to receive slightly less. For example: Decker, Montana, located about seven miles northeast of the Big Horn Mine and about 26 miles from the foothills of the Big Horn Mountains, received an average annual precipitation of 12.27 inches during its 24 full years of record (1950-58, 1960-75); whereas during the same 24 years, the Sheridan airport received an average of 15.72 inches.

The Sheridan area precipitation regime, characterized by a late spring, early summer maximum, receives more than half of the annual mean during the period from April through July. Fifty-three and four tenths percent (53.4%) of the total annual mean fell in this period at the Sheridan airport, while 55.9% of the annual mean was delivered from April through July at the Sheridan field station (Exhibits D4-1 and D4-2 of the permit document).

A secondary precipitation maximum occurs in early fall, during the months of September and October, accounting for about 15% of the total annual precipitation (Exhibits D4-1 and D4-2). Nearly 70% of the year's total precipitation falls during the period from April through September, with nearly 77% falling from March through August.

Mean annual snowfall amounts are heavy; 70 inches at the Sheridan airport and 52 inches at the Sheridan field station. However, the winter season has the lowest total precipitation due to the snow's low moisture content.

Examination of the Sheridan airport STability ARay (STAR) program, 1949-1953, indicates a predominance of northwesterly winds, both annually and seasonally.

The Sheridan area has a relatively cool temperature regime. The average annual temperature at the Sheridan airport is 45 degrees

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F, with an average annual maximum and minimum of 58.5 degrees F and 31.5 degrees F, respectively (Table D4-1 in Appendix D-4 of the permit document). July, the warmest summer month, has a monthly mean temperature of 70.4 degrees F. Furthermore, temperatures of 32 degrees F or below have occurred in the spring as late as June 14 and as early in the fall as August 24. The average length of the growing season (that period when temperatures do not fall below 32 degrees F) is 125 days for the Sheridan airport. Average dates of the first fall and final spring freezing temperatures at the Sheridan airport are September 23 and May 15, respectively.

e. Wildlife

Baseline wildlife studies have been conducted on surfaces surrounding the Big Horn Mine site since 1951. The intensity of these studies increased in 1974 with the formation of the Wyoming State Regulatory Program. The study area, located in Sheridan County, northcentral Wyoming encompassed the 213-T1 permit site (4570 acres) plus a buffer zone extending 2 to 6 miles from the permit boundary (Figure D9-1; Permit Application).

The State of Wyoming owns 880 acres of the permit area. Big Horn Coal Company owns an estimated 1780 acres (Exhibit AB-1; Permit Application). The remainder is owned by various other private interests. The applicant has delineated 12 habitat types plus mined or barren areas, revegetated areas, and buildings. Total and affected acreages are listed in Table 4.A.1.

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Table 4.A.1.

Major Habitat Types - Total and Affected Acreages

Habitat Type	Permit Area	Affected Area
Big Sagebrush-Grassland	885.95	497.85
Ponderosa Pine-Juniper	249.74	133.13
Mixed Shrub-Half Shrub	477.74	141.74
Perennial Grassland	125.98	102.47
Deciduous Streambank	191.99	13.15
Bunchgrass	74.18	4.33
Alfalfa	371.22	55.14
Silver Sagebrush	15.70	9.82
Pasture	65.55	4.35
Silver Sagebrush-Grassland	23.63	17.62
Juniper	38.64	0.00
Annual Forb	156.23	136.81
Mined Areas	630	—
Revegetated Areas	620	—
Buildings	640	—

Habitat components with an important bearing on local carrying capacity include numerous rock outcrops, tough breaks, incised drainages, swales, and diverse slope conditions (Exhibit D9-1; Permit Application). Deciduous forest occurs along the Tongue River and Ponderosa Pine/juniper stands grow on steep slopes within several of the drainages. Dense shrub mosaics occur in favorable sites throughout the permit area. The average shrub cover for vegetation communities throughout the permit area was 10.4 percent and shrub density was 5.7 per square meter.

Surface water within the permit area includes approximately 4.53 miles of the Tongue River and 2.27 miles of Goose Creek. Approximately 1.17 miles of the Tongue occurs within the Amendment 1 boundary and the remainder within the 213-T1 permit area. Typical aquatic habitat is a series of short, fast riffle areas, long runs of moderate depth and velocity, and scattered deep pools. Quiet backwater areas are abundant. Instream cover for fish includes deep pools, cottonwood snags, scattered areas of rubble and boulders, and dense beds of Cladophora spp. which develop each year. Game fish are not overly abundant within the Tongue near Sheridan and this stretch of the river is not considered recreationally important. The most recent disturbance to the river occurred in 1978 when a diversion of approximately 1200 feet was constructed around the Brown-Williams pit in Section 15. The relocated channel has since developed a diverse and stable biological community. Segments of the Tongue River and Goose Creek within the permit area are protected by buffer zones and no

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additional disturbance is planned. All other drainages within the permit area are intermittent or ephemeral and not of recreational importance.

f. Surface Water and Groundwater Regime

Surface Water

The Tongue River, a major perennial stream in the area bisects the Big Horn Mine permit area. Streamflow within the Tongue River originates in the Big Horn mountains west of the Big Horn Mine. The Tongue River is tributary to the Yellowstone River, tributary to the Missouri River. The average discharge of the Tongue River at Acme, Wyoming (from 1939-1957) is 403 CFS.

Goose Creek is another perennial stream included in the permit area. The confluence of Goose Creek and the Tongue River is located approximately in the middle of the permit area. The average discharge of Goose Creek just downstream of Sheridan, Wyoming (from 1941-1975) is 184 cfs. The streamflow regimes of both the Tongue River and Goose Creek are typical of perennial streams with mountainous headwater areas. High peak flows result from snowmelt runoff, with the greatest flows occurring in May or June.

The quality of water within both Goose Creek and the Tongue River is very good, although it deteriorates during low flow periods as a result of return irrigation flow and other agricultural practices in the area. The Wyoming DEQ-WQD has classified both streams as Class II - Coldwater Fisheries. It should be noted that construction of the Sheridan sewage treatment plant will be completed by the fall of 1983 which should further improve the quality of water within Goose Creek and the Tongue River, below the confluence of the two.

Approximately 400 feet of Big Goose Creek was diverted and mined through beginning in 1962. Today, the Blackek Pond is part of this channel. In 1973, near the confluence of Goose Creek and the Tongue River, the Tongue River was temporarily diverted to recover coal in the Pit Two area. The river was returned to a reconstructed channel after mining was completed.

The remainder of the permit area is drained by small ephemeral streams which are tributary to the Tongue River. These ephemeral streams are often deeply incised and controlled by bedrock conditions in upper areas. Several no longer convey streamflow because of subsidence resulting from past underground mining.

Groundwater

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The stratigraphic units within the general Big Horn Mine area that are known to be capable of yielding enough water to be classified as aquifers are the Fort Union coal seams, the Tongue River and Goose Creek alluvium and reclaimed mine spoils. The Fort Union coal seams (Dietz 2 (Armstrong), Dietz 3 (Upper Monarch), Monarch (Lower Monarch), Carney) can usually not be considered aquifers up-dip and to the north of the Tongue River due to the lack of water, extensive burn areas, and past mining activities. Down-dip and to the south of the Tongue River the aquifers are saturated as a result of recharge from the river and constitute viable aquifers which exhibit confined conditions. Groundwater flow within the coal seams is predominately in a southeast direction.

The quality of groundwater within the above aquifers is such that it would not be recommended for domestic consumption. Generally, groundwaters of the aforementioned aquifers are of sufficient quality for livestock uses. Groundwaters within the coal seams contain TDS concentrations of approximately 1000 mg/l. Alluvial groundwater is characterized by being very hard and containing more sulfate than coal seam waters. Spoils water quality is extremely variable and contains highly mineralized water.

g. Cultural Resources

The Northwestern Plains has been isolated by some archeologists as a heuristic device for organizing the prehistoric cultural manifestations of a specific region. This region is defined as: "...the southern one-half of Alberta and Saskatchewan, the eastern two-thirds of Montana, and the northern third of Wyoming (Conner 1968:13)".

The prehistory of the Northwestern Plains is understood within a general chronological frame presented by Mulloy in 1958 and refined by Reeves (1970) through his work in Alberta. In light of this chronological framework, the regional prehistory is divided into a series of broad time periods during which the Native American of the region lived relatively distinctive lifestyles and produced items of material culture which are stylistically distinctive when viewed from the present day (Fig. 2). Archaeological work in the southeastern Montana-northeastern Wyoming border area has yielded results which fit consistently with this general prehistoric outline.

The surveyed area lies within the upper Tongue River drainage. The upper Tongue River drainage may well be viewed as a subregion of the Northwestern Plains, an area bounded by the Bighorn Mountains to the southwest, the Wolf Mountains to the northwest, the Badger Hills to the southeast, and the Tongue River Breaks to the northeast. Archaeological work to date within this subregion

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indicates that we are dealing with perhaps 9,000 years of hunting and gathering societies following the Paleo-Indian, big game hunting period. It is proposed that members of these hunting and gathering societies, with a band level of socio-political organization, moved throughout this subregion on routes which maximized the exploitation of seasonally available food resources and facilitated certain scheduled activities of social, socio-religious, and technological importance. This hypothetical pattern of a prehistoric lifeway for the upper Tongue River drainage remains sketchy and archaeological fieldwork is just beginning to provide evidence for a few parts of a mosaic which will eventually provide a refined picture of specific group activities throughout a typical calendar year.

There area few reports of archaeological excavations for the upper Tongue River drainage and numerous reports of archaeological surveys. Important excavation reports include those for the Kobold Site (Frison 1970), the Goose Creek Site (Frison 1967), the Foss Thomas Site (Fry 1971), Drifter's Shelter (Fredlund and Fredlund 1974) and Benson's Butte (Fredlund and Fredlund 1974, 1976). Test excavations were conducted at the Big Horn Mine Site, just several hundred yards west of the area surveyed by this project. The excavation results are reported by Metcalf (1974).

Development of coal resources has resulted in numerous archeological surveys being performed for cultural resource inventory purposes. Work by Fredlund (1972) about one mile north of Decker, Montana resulted in the find of an Eden Valley style projectile point made from the local porcellanite. This represents one of the few published reports of Early Prehistoric Period finds in the area.

Loendorf, Barnett, and Larson (1972) reported a survey of selected sites in the Tongue River drainage between Decker and Birney, Montana. Haberman (1973) reported survey work for the Dry, Squirrel, Pond, Pearson, and Spring Creek Drainages. Fredlund and Fredlund (1973) present survey findings along the middle latitudes of Youngs Creek. Additional work in the Youngs Creek drainage and in the Tanner and Squirrel Creek drainages is reported by Fredlund (1975a). Work to the east of the Tongue River Reservoir is also reported (Fredlund 1975b). An overview of archaeological sites in the Tongue River drainage, from the high altitudes of the Bighorn Mountains to the Yellowstone River is presented by Carbone (1972).

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The survey work has revealed a variety of prehistoric site types from this subregion: camp or habitation sites, rockshelters, tipi ring sites, lookouts, hunting camps, eagle catching pits, buffalo jumps and surrounds, numerous rock structures of unknown

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function, porcellanite and chert collection-workshop sites, petrographs, and more. Temporarily diagnostic materials from excavations and surface collections indicate occupation of the subregion from the Early Prehistoric through the Late Prehistoric Periods. A pattern of seasonal movement of populations within the upper Tongue River drainage has been suggested by Fredlund and Fredlund (1973: 43-44): summer encampments in the high altitudes of the Big Horn Mountains, and winter-spring encampments in the broken-ridge country at lower elevations. Results from bison kill site excavations demonstrate that multi-family groups were formed in the fall at these lower elevations for communal bison hunting activities (Frison 1972: 18-19; 1970). Archaeologists working in the upper Tongue River drainage area are beginning to look at the variety of site types within such a seasonal round or seasonal transhumance perspective. Other archeologists working in the Northwestern Plains have similarly been working with this concept in explaining settlement patterns in regions of widely varying altitudes (Arthur 1966, 1968; Benedict 1974; Loendorf 1970; O'Brien 1973).

It remains for archeologists working within the upper Tongue River drainages to refine the relative and absolute dating of sites and site components, refine patterns of prehistoric group movement, and integrate the variety of functionally different sites into a coherent pattern of seasonal-round activities.

h. Alluvial Valley Floors

The Tongue River within the amendment area and through the Whitney property to the north of the permit area is an Alluvial Valley Floor. The Tongue is a perennial stream; a major tributary to the Yellowstone River. It is an underfit stream with broad terraces on the valley floor. Large areas of terrace are subirrigated and flood irrigated. The applicant's permit area contains terraces that have been artificially flood irrigated and are quite productive.

III. Description of Renewal Activities:

On August 27, 1981, Big Horn Coal was issued a permit (Permit No. 213-T1) pursuant to the requirements of Wyoming's State Program. Since that time, four permit revisions have been approved and granted for the following changes:

1. An experimental practice variance under the direction of the Abandoned Mine Lands Program.

2. Relocation of the Pit 5 haulroad.

3. Relocation of the Pit 4 haulroad.

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4. Addition of 9.6 acres of disturbance to Pit 4.

This renewal and amendment application includes the following revisions to those activities authorized in Permit 213-T1 and subsequent revisions:

1. Extension of the permit boundary to conduct mining operations in the S1/2 NE1/4 and the SE1/4 of Section 14, and W1/2 SW1/4, SW1/4 and NW1/4 of Section 13. This will add a total of 366.42 acres to the original permit area (see Form 1, Permit to Mine).

2. Expansion of the scoria pit located in the SW1/4 of Section 11 and SE1/4 of Section 10 and the addition of a scoria stockpile in the SE1/4 of Section 10.

3. Additional mining area located in the southern end of the present Pit 3 area in the SW1/4 of Section 14.

4. The addition of a permanent out-of-pit spoil area located in the N1/2 of Section 15 and the S1/2 of Section 10.

5. Numerous sedimentation ponds and ditches are added to provide runoff control on the new areas.

6. The regraded surface for the Pit 3 area has been revised in the W1/2 of Section 14 to accommodate the Amendment One area.

7. A 40-acre block of federal coal is added for the first time. It is located in the SW1/4 NE1/4 of Section 14.

8. A new permanent impoundment located in the SW1/4 of Section 13 and the E1/2 of Section 14 is proposed.

9. Pit 4 will be expanded to include an area in the NW 1/4 of Section 15. This revision was approved in November, 1982, by the DEQ. Also, the method of mining for Pit 4 has changed from a dragline to front-end loader operation.

10. The applicant requests a delay of the reclamation of part of Pit 1 of approximately nine years. TFN 2 3/18

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11. PROPOSED PIT 5 REVISION; INCLUDING A PERMANENT OUT-OF-PIT SPOIL AREA & REDESIGNED P-5 D

Exhibit 1 shows the modifications to the existing 213C boundary and Exhibit E6, both exhibits of the permit application, shows the area disturbed at the Big Horn Coal Mine and the years disturbance did or will take place.

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In 1981, Metcalf-Zier Archeologists, Inc. surveyed the proposed Amendment One area for Big Horn Coal Company (Fig. 1). Eleven cultural resource sites were recorded, none of them prehistoric sites. Seven of these nine prehistoric sites were recommended for limited

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testing in order to provide additional data for evaluating these sites for the National Register. These seven sites are 48SH436, 48SH438, 48SH439, 48SH441, 48SH442, 48SH444 and 48SH445. All of these sites are within Section 14, T57N, R84W, Sheridan County, Wyoming. In addition, approximately twenty acres were surveyed in the NE1/4 of Section 14 in order to locate any additional cultural resource sites (Fig. 1). No additional sites were located.

IV. Description of Impacts and Compliance of Permit Renewal:

a. Topsoil Protection

(1) Evaluation of Compliance

The applicant's topsoil salvage, storage and replacement plan is in compliance with all applicable rules and regulations (See State Decision Document for Permit 213-T1 for detail). There is no significant change in topsoil salvage and replacement over that in permit 213-T1.

(2) Environmental Consequences

The ability of the soil to support plants will not be significantly affected. Mining on the applicant's permit area will have a significant impact on the soils of the Sheridan - Tongue River area. The soils have formed in residuum, colluvium and alluvium from mixed sources. The development of a vertical sequence of soil horizons in response to the 5 soil forming factors of Jenne (1941) in some cases shows long term stability and a high degree of soil development. This development in an undisturbed state is diverse due to differing degrees of influence of the factors.

The postmining soils will be a relatively homogenous mix placed on a monotonous topography. There will be horizon development over the short geologic time scale (1,000's of years). Fertility balances will be disrupted and will take some time to equilibrate. Oxidation due to exposure and drying of soil will cause some loss of organic matter and fertility. These are artificially replaceable losses.

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b. Hydrologic Balance - Surface Water

(1) Evaluation of Compliance

Diversions

Areal Coverage of Diversions

Chapter IV, subsection 2.e. and subsection 3.d., among

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other things, require that surface water be diverted around the operation to protect the on-going operation, control water pollution and unnecessary erosion, and to protect the water rights of downstream users. Permanent diversions shall pass the peak runoff from the 100-year flood event, or larger, as specified by the administrator.

The diversion of unchannelized surface water and ephemeral streams is discussed in the Mining Hydrology section of the proposed Mine Plan (page MP-13). The location of diversions are shown on Exhibits MP-2 and MP-3 of the proposed Mine Plan. No diversions are needed in the Amendment 1 area to divert undisturbed area runoff since no major channels will be affected. At least two "interceptor channels" will be constructed in the Amendment 1 area to direct disturbed area runoff to sediment ponds. No permanent diversions are proposed for the Amendment 1 area.

Areal Coverage of Diversions - Intermittent and Perennial Streams

Chapter IV, subsection 2.e. and subsection 3.e.(2), among other things, require the diversion of intermittent and perennial streams to minimize erosion and degradation of water quality. The Wyoming Game and Fish Department shall be consulted prior to the approval of a diversion of a perennial or intermittent stream. Permanent diversions shall contain a channel and floodplain capable of containing the 100-year flood event, or greater, as specified by the administrator. Permanent diversions shall be designed and constructed to be erosionally stable and consistent with the role of the fluvial system. Permanent diversions shall restore aquatic habitats and stream channel characteristics.

No intermittent or perennial streams are proposed for diversion at the Big Horn Mine.

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Areal Coverage of Sedimentation Control Structures

W.S. 35-11-415(b)(viii) and Chapter IV, subsection 3.g.(1) require that all surface drainage from affected lands, excluding sedimentation ponds, diversion ditches, and road disturbances pass through sedimentation ponds or be sufficiently treated so that drainage from affected lands will not degrade receiving water quality.

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The locations of sediment ponds are discussed in the Mining Hydrology section of the proposed Mine Plan (page MP-43) and shown on Exhibits MP-2 and MP-3. Four sediment ponds (Reservoir Nos. 301, 302, 303, and 307) will be used to treat disturbed area runoff from the Amendment 1 area.

The design methods used by the applicant have not changed since original approval. All sedimentation ponds are designed by using the methods and procedures described in the 213-T1 State Decision Document.

All ponds are designed in accordance with all applicable requirements.

Drainage from Acid and Toxic Materials

Chapter IV, subsection 3., among other things, requires that drainage from acid and toxic materials either be treated or prevented. Acid or toxic material must be covered by at least 4 feet of acceptable material and must not be buried or stored in the proximity of drainage channels or flood plains.

The applicant's hydrologic control plan should be adequate to control any drainage from acid and toxic materials during mining. The applicant has committed to placing at least four feet of acceptable material over reclaimed spoil. This subject is further discussed in Section IV.i. (Backfilling and Grading) of this document.

Stream Buffer Zones

Chapter IV, subsection 3.p.(2) specifies that no land within 100 feet of a perennial or intermittent stream shall be affected unless the administrator specifically authorizes such activities upon a finding that the original stream channel will be restored and that the water quality and quantity of that portion of the stream within 100 feet of mining activities will not be adversely affected. The area not to be affected shall be designated as buffer zone and be marked as such in the field and on a mine plan map.

Stream buffer zones are discussed in the Section entitled "Signs, Markers, and Buffer Zones" page 127 of the proposed Mine Plan. Buffer zones have been established along Goose Creek and the Tongue River. The locations of the buffer zones are shown on Exhibit MP-33. In

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respect to the Amendment 1 area a buffer zone has been established between the Amendment 1 mine area and the Tongue River.

Postmining Landform Stability and Drainage

Chapter IV, subsection 2.b. and 3.c.(1) and 3.e.(2)(b)(iii) requires the reestablishment of erosionally stable drainage systems and landforms on reclaimed lands. Adequate through drainage and erosionally stable stream channels and floodplains must be provided. In the case of excess spoil, all spoil not required to achieve the approximate original contour, shall be graded to the lowest practical grade while maintaining the hydrologic balance and providing for long-term stability.

The reclaimed topography is shown on Exhibits RP-2 and RP-3 of the proposed Reclamation Plan. The postmining topography and landform stability for areas excepting the Amendment 1 area are discussed in Section No. 2.c. of the original State Decision Document (Big Horn Coal Co., Permit 213-T1). No problems with landform stability are expected in the Amendment 1 area. Most of the drainage in the Amendment 1 area is conveyed by overland flow.

SEE ADDENDUM 1 FOR REVISIONS TO THE P-5 DRAW IN THE PIT 5 AREA. RP 10/12/87

Surface Water Monitoring

Chapter IV, subsection 3.i. requires that surface water from affected lands be monitored for water quality and quantity during the course of coal mining and reclamation operations to determine the extent of disturbance to the hydrologic balance. Water quality monitoring results for discharges other than those authorized by the Wyoming Department of Environmental Quality, Water Quality Division shall be reported quarterly.

The applicant presents an acceptable surface water monitoring program on page MP-120U through MP-120Z of the Mine Plan and pages RP-54 through RP-64 of the Reclamation Plan.

(2) Environmental Consequences

General Surface Water Hydrology

The premining surface water system within areas to be disturbed, at the Big Horn Mine is unique in that channelized flows in defined channels are absent, except for the P-5

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Draw in the Pit 5 area. The surface hydrology of adjacent areas has, in some places, been drastically altered by past underground mining activities. Any impacts to the surface water system have the potential to impact the Tongue River and Big Goose Creek. Previous mining activities have disturbed the hydrologic system of both Big Goose Creek and the Tongue River to unknown degrees, including the disruption and replacement of sections of both stream channels. The present operation has established adequate stream buffer zones to minimize future disturbances to the Tongue River and Big Goose Creek.

Postmining Topography

The postmining topography is depicted on Exhibits RP-2 and RP-3. Exhibits RP-4 and RP-5 show alternate backfilling plans in the event the permanent impoundments fail to demonstrate acceptable water quality and quantity. Through drainage has been achieved in all areas except in the immediate drainage of the permanent impoundments. Through drainage in all areas will be achieved in the event that the alternate plans are implemented.

Proposed slope conditions appear adequate to achieve revegetation and subsequent hydrologic stabilization. Slope comparisons of the postmining and premining topographies are discussed on page RP-9. Tables RP-3 and RP-4 compare slope classes between pre and postmining conditions.

The reclaimed P-5 Draw basin should be about as hydrologically stable as premining conditions after revegetation becomes established. The present P-5 Draw (channel) is apparently being held in a state of equilibrium by bedrock controls. Although these controls are going to be removed by mining, the following considerations govern the stability of the reclaimed P-5 Draw.

1. The drainage area is being reduced by 9.3% which will reduce flows.

2. The width depth ratio has been increased to reduce velocities.

3. Good channel revegetation is expected.

4. Channel slope has been reduced.

5. It appears that adequate bedrock control exists both above and below the area to be reclaimed thereby minimizing potential head-cutting problems.

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REFER TO ADDENDUM 1 FOR A REVISED DISCUSSION OF THE RECLAIMED P-5 DRAW AND THE PIT 5 AREA.

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It should also be noted that any downstream impacts to the P-5 Draw will be attenuated quickly since the channel downstream of the area to be reclaimed has been drastically disturbed by past underground workings. Most, if not all, runoff passing through areas of the channel that have subsided, enters the underground workings. Therefore, it is doubtful that any adverse surface water impacts generated within the Pit 5 reclamation plan will affect the Tongue River.

Surface water from the P-5 Draw, which enters the groundwater system via the underground workings, should have a negligible effect to the groundwater system since the majority of the suspended sediment will not be transported through the groundwater system.

The establishment of the proposed Trout and Bass reservoirs as part of the final topography is further discussed in Section IV.e. of this document (Permanent Impoundments).

Surface Water Quantity

The quantity of surface water evolving from the reclaimed area may slightly increase initially after reclamation due to lower infiltration rates. Infiltration rates should eventually return to premining conditions as vegetation becomes more established, organic matter builds up, and soil structure returns to premining conditions. This change in the runoff regime will be minimal and beyond detection limits in relation to the discharge of the Tongue River. Pit pumpage during the active mining operation, and subsequent discharge via sediment ponds, will add minimal additional flow to the Tongue River. The discharge of pit pumpage water to the Tongue River is expected to be greatest in winter months when the demand for dust abatement water is at a minimum.

Surface Water Quality

A complete year of surface water quality data is found in Appendix D-5. Although this data does not constitute "premining baseline data", since the mine has been operating for many years, it is useful in understanding the system, observing trends, and in predicting impacts from the mining operation.

The Big Horn Coal Company has committed to burying unsuitable (toxic) materials at least four (4) feet below the regraded surface.

The quality of surface waters originating on reclaimed areas

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should not be much different that premining. There may be a slight increase in suspended solids until vegetation is adequately reestablished and the volume of runoff returns to premining levels. Adequate postmining slope conditions and a history of relatively good revegetation should limit unwarranted sediment production. The presence of stream buffer zones will help attenuate sediment transport to the Tongue River and Big Goose Creek.

During the actual mining operation mine drainage will be controlled through the use of diversions, interceptor ditches, and sedimentation ponds. Diversion ditches direct undisturbed area runoff around the operation, while interceptor ditches direct runoff from disturbed areas to sedimentation ponds for sediment control. The implementation of sedimentation ponds during the actual mining operation will help in ensuring that receiving waters will not be degraded. All water discharged to the Tongue River will be monitored to ensure that receiving waters are not degraded and effluent criteria, as set forth in the NPDES discharge permit WY #0022519 (Appendix MP1), are not exceeded. Sediment ponds will be used to treat runoff until the applicant can demonstrate that runoff from affected lands will not degrade receiving waters.

c. Hydrologic Balance - Groundwater

(1) Evaluation of Compliance

Preservation of Nonaffected Groundwaters

W.S. 35-11-415(b)(viii) requires the operator to prevent, through the mining and reclamation operations and for a period of five years, the pollution of groundwaters.

No material damage to off-site groundwaters is expected as a result of mining the Amendment 1 area and/or the remaining permit area. The proposed monitoring plan should be adequate to determine the impact of the mining operation.

Postmining Groundwater Quality

Chapter IV, subsection 3.a.(2) and 3.c.(3) and d.; subsection 3.f., WQD Regulations Chapter VIII, subsection 3.c. and subsection 4; Chapter IV, subsection 3.i., among other things, require that the mining and reclamation operation minimize adverse effects to groundwaters and protect those uses for which it is suitable. It is recognized that acid-forming or toxic material may have to be isolated from groundwaters to assure nonpollution.

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The above subject is adequately addressed in Section No. 2.C. of the original State Decision Document (Big Horn Coal Co., Permit 213-T1). The inclusion of the Amendment 1 area does not alter these findings.

Postmining Groundwater Recharge and Availability

Chapter IV, subsection 3.f. requires that the groundwater recharge capacity of the reclaimed lands be restored to a condition which supports the postmining land use, minimizes disturbances to the prevailing hydrologic balance, and provides a rate of recharge that approximates that which was present before mining.

The above subject is adequately addressed in Section No. 2.c. of the original State Decision Document (Big Horn Coal Co., Permit 213-T1). The inclusion of the Amendment 1 area does not alter these findings.

Abandonment of Wells and Exploration Holes

Chapter XV requires the proper plugging; sealing and capping of all wells, exploration holes, and drill holes.

The applicant has committed to capping, sealing and plugging drill holes in accordance with W.S. 35-11-404.

Groundwater Monitoring

Chapter IV, subsection 3.i. requires that groundwater quality and quantity be monitored during the course of surface coal mining and reclamation operations to determine the extent of the disturbance to the hydrologic balance. The monitoring program should be adequate to determine infiltration rates, subsurface flows, and storage characteristics of reclaimed lands and adjacent areas. Additionally, monitoring should determine the effects of reclamation on the recharge capacity of the reclaimed lands.

The applicant's proposed groundwater monitoring which is discussed on page MP120 of the Mine Plan and page RP-41 of the Reclamation Plan is acceptable.

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(2) Environmental Consequences

Geology and Aquifers

The Tongue River Member of the Fort Union Formation which comprises the stratigraphic units to be disturbed at the Big Horn Mine area dip to the east-southeast at approximately

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1.5-3.0 degrees. The units which function as aquifers include the coal seams and alluvial deposits of the Tongue River and Big Goose Creek.

The Dietz 2B coal seam is virtually dry in the areas to be mined since the seam outcrops above the North Tongue River, which is the major recharge mechanism to the coal seams in the area. The Monarch and Dietz 3 coal seams, which are presently being mined downdip of the Tongue River, are viable aquifers, and contain an extensive amount of water. The Carney Coal seam which also comprises a viable aquifer, is below mineable limits and should not be affected by the mining operations since it appears to be sufficiently separated by sequences of tight interbedded shales and sandstones.

The alluvial aquifers of the Tongue River and Big Goose Creek, which have been mined through and disturbed in prior operations, will not be directly impacted by the forthcoming mining operations except in the Pit 3 area where approximately 200,000 cubic yards of alluvial gravels have been stockpiled from the Pit 3 area. Before mining, these gravels comprised part of an alluvial aquifer, which resulted from a historic meander loop of the Tongue River. The premining function of the gravel was to act as a storage medium during peak flow events with subsequent release of water during low flow periods.

Recharge and Potentiometric Levels

Recharge to the aquifers of concern should not be overly disturbed after reclamation is completed, since those units downdip from the Tongue River and alluvium should receive more than adequate amounts of water to fully recharge the groundwater system. Considering the relatively high transmissivity of the coal aquifers, potentiometric surfaces that have been drawn down in adjacent areas should quickly recover to near premining conditions after mining ceases. Monitoring wells completed in reclaimed spoils at the Big Horn Mine have shown that the spoils do have the ability to transmit water and recharge the system.

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Recharge to disturbed areas which are stratigraphically above the Tongue River is primarily by surface infiltration through adjacent unsaturated burn areas, as well as direct vertical percolation. These adjacent recharge areas will not be disturbed, thereby preserving the major recharge mechanism.

Van Voast, Hedges and McDermott (1978) found that the most permeable portion of mine spoils is along the old mine

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floors, which leads to characteristics of a confined aquifer. This phenomenon appears to be occurring at the Big Horn Mine. Since the aquifer is being reestablished at approximately the same elevation, the projected potentiometric surface is expected to have the same general gradient and elevation that was present in the Monarch coal seam before mining. The postmining potentiometric surface for the affected aquifers are shown on Exhibits RP-14, RP-15 and RP-16 of the Reclamation Plan.

Groundwater Quality

The quality of groundwater at the Big Horn Mine area varies within and between aquifers. Water quality data is found in Appendix D-6. The best quality waters are found within the coal seams where TDS values are approximately 1000 mg/l. The alluvial aquifers produce waters which vary greatly both temporarily and spatially in direct response to the Tongue River and Big Goose Creek. Alluvial water is usually of poorer quality, with TDS values ranging from several hundred to several thousand mg/l.

The Big Horn Coal Company has a plan to identify unsuitable (toxic) materials, such as those containing high SAR values, high EC values, low pH values, etc. (Appendix D5 (Geology)). The applicant has committed to burying unsuitable materials at least four feet below the regraded surface and will be required to place unsuitable materials above the postreclamation potentiometric surface, to minimize adverse impacts to groundwater quality.

The quality of groundwater within reclaimed spoils also varies both temporarily and spatially (Van Voast, et al., 1978). Work done by Van Voast at the Decker Coal Mine in southeast Montana, approximately 18 miles from the Big Horn Mine, showed that the quality of groundwater in reclaimed spoils approached the quality of that found in the overburden aquifers. This amounted to about a three fold increase in TDS over that found before mining within the coal aquifers.

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Two wells completed in reclaimed spoils at the Big Horn Mine (Pit 1) have been sampled for water quality and it appears that trends are similar to those discussed above. It should also be noted that a substantial increase in sulfate concentrations was evident. Available literature also suggests that increases in calcium and sodium may also result.

The impact that spoil waters will have on down-gradient waters must be estimated from only a limited knowledge of

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the system. It is assumed that as the spoil waters move down-gradient, spread out and encompass larger areas, and mix with unperturbated groundwater, elevated concentrations of dissolved solids, etc. will become diluted and decrease. As time elapses and more pore volumes of water pass through the reclaimed spoil aquifer, the leaching of the soluble materials should decline and reach an equilibrium state.

In summary, it is reasonable to assume that groundwaters within reclaimed spoils will contain approximately two to three times the TDS concentration as undisturbed coal aquifers. Variable increases in other constituents, such as sulfate and sodium may also occur. With time, these elevated levels should decline as leaching reaches an equilibrium. The impact of changes to water quality and use are discussed in the section IV.d.(2) - Water Rights.

d. Hydrologic Balance - Water Rights

(1) Evaluation of Compliance

Replacement of Affected Water Rights

W.S. 35-11-415(b)(xii) requires that the applicant replace, in accordance with State law, the water supply of any owner of interest in real property who obtains all or part of his supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where the supply has been adversely affected by surface coal mining operations.

The applicant has committed to replacing any affected water rights on page MP-124 of the permit application.

(2) Environmental Consequences

The uses of groundwater at the Big Horn Mine area include livestock watering, domestic uses, and industrial water supply used mostly by the Big Horn mining operation. Mine and private wells are completed in alluvial aquifers along perennial streams and coal aquifers which are regionally significant.

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A listing of all valid groundwater appropriations within the Big Horn Coal Company's permit area and a 3 mile radius around it is found in Addendum D6-3 of the permit application and depicted on Exhibit D6-9 of the permit application. Besides hydrologic monitoring wells belonging to either Big Horn Coal or Peter Keiwit Sons' Company, there are approximately 33 water wells permitted for Sheridan Enterprises,

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Inc. for hydrologic monitoring, and approximately 62 other wells permitted for livestock and domestic supplies. Of the above 62 wells, most are livestock wells completed in alluvial aquifers.

Information regarding completion zones is not available so it is difficult to assess which groundwater wells within the area may be potentially impacted. Wells completed in units stratigraphically above or below the coal seams being mined face a remote chance of being affected.

Wells located to the east and south of the permit area have the greatest potential for being affected since the hydraulic gradient is primarily in a southeast direction for the Dietz 3 coal seam (Exhibit D6-5 of the permit application) and in an east and northeast direction for the Monarch Coal seam (Exhibit D6-6 of the permit application). Wells to the north and west of the permit have the least potential for being impacted since they are located up-gradient of the disturbed area, or beyond the coal outcrops. The worst case, life of mine, groundwater drawdown predictions are shown on Exhibit MP-34 of the permit application. It is improbable that any groundwater users in the area will be adversely affected by drawdowns.

Wells completed in alluvial aquifers have little potential for being adversely affected since no alluvial aquifers are proposed for mining and the quantity and quality of water supplying these aquifers should not be disrupted.

Changes to groundwater quality as a result of mining are discussed in the previous section. The predominant consumptive use of the groundwater is livestock watering. Changes to water quality are not expected to lower this use category (see DEQ, WQD Rules and Regulations Chapter VIII - Quality Standards for Wyoming Groundwaters). As discussed earlier, TDS values can reasonably be assumed to increase two to three fold within spoil aquifers. Even at three fold increase, TDS values should still be well within the livestock watering use category of 5000 mg/l. Although sulfate concentrations may increase, they should remain below the 3000 mg/l standards for livestock watering.

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To assure that the mining and reclamation operations do not have an adverse impact on water users, Big Horn Coal Company is monitoring a large network of wells for water quality and static water levels. Well locations are found on Exhibit MP-31 of the permit application. Monitoring of these wells will continue beyond reclamation, including the implementation and monitoring of wells completed in reclaimed spoils.

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Anticipated spoil well locations are found on Exhibit DF-11 of the permit application with details on completions found on page DF-36 of the permit application.

The Big Horn Coal Company is required to replace any water right which is adversely affected by the mining operation in accordance with W.S. 35-11-415(b)(xii). Alternate water supplies are available from the Tongue River, Tongue River alluvium and the Carney Coal seam.

e. Hydrologic Balance - Permanent Impoundments

(1) Evaluation of Compliance

Permanent Impoundments

The major feature of the postmining topography will be two permanent water impoundments. Bass Reservoir, which will be located in the Pit 1 area has been previously approved and is discussed in the original State Decision Document (Big Horn Coal Co., Permit 213-T1).

The Trout Reservoir will be constructed in the Pit 3 area. It is designed to be used for recreational purposes (fishing, picnicing, camping). The impoundment will cover approximately 91 acres at the projected high water elevation of 3570 feet.

Design and Construction

The applicant is required to submit contour maps and cross sections which show slope conditions around the impoundment and the anticipated high and low postmining water level.

No large embankments or spillways are proposed. The impoundments will be completely incised. No stability or safety problems are expected. The applicant will be in compliance with all applicable requirements.

The applicant has included contour maps and cross sections of the impoundments. Slopes around the impoundment will be very gentle. Water level fluctuations should be minimal due to the connection of the impoundment with the Tongue River alluvial aquifer.

Surface Owner Consent

Chapter IV, subsection 3.h.(1)(c) requires that consent be obtained for all permanent impoundments from the surface owner, if the landowner is not the operator or mineral

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owner.

The applicant owns the land to be occupied by the proposed Trout Reservoir. Surface owner consent is contained in Addendum RP-1 of the application.

Intended Use

W.S. 35-11-407 and Chapter IV, subsection 3.h.(1) requires that the size, contouring, revegetation and water quality and quantity of all permanent impoundments be suitable for the intended use(s). Final grading must provide adequate safety and access for proposed water users. Additionally, the intended land use must be equal to or greater than the premining land use.

The intended land use is for recreational purposes which includes fishing, picnicing, and camping. It is expected that the size, contouring, revegetation and water quality and quantity of the impoundment will be adequate for the intended use.

Hydrologic Balance

Chapter IV, subsection 3.h.(1)(b) and W.S. 35-11-415(b)(xii) requires that the construction of any permanent impoundment not adversely affect the hydrologic balance or water rights.

The construction of Trout Reservoir should not adversely affect the hydrologic balance or water rights. Hydrologic impacts are further discussed in Section IV.e.(2) of this document.

Alternative Plan

Chapter II, subsection 2.b.(3)(e)(v) requires that an alternative plan be included in any mine and reclamation plan where a permanent impoundment is proposed in case the quality and/or quantity of water in the permanent impoundment is insufficient to achieve the intended use.

On page RP-5 of the Reclamation Plan the applicant has committed to backfilling both Trout and Bass reservoirs in the event that the impoundment fails and other available alternatives have been exhausted. Exhibits RP-4 and RP-5 of the Reclamation Plan show the alternative postmining contours.

(2) Environmental Consequences

A major feature of the postmining topography is the estab-

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lishment of two permanent impoundments. Bass Reservoir which will be located in the NE1/4 Section 22, T57N, R84W, and SE1/4, Section 15, T57N, R84W where pit one was located during mining. The impoundment was approved within the original State Decision Document (Big Horn Coal Co., Permit 213-T1). Trout Reservoir is proposed as final reclamation in the Amendment 1 area and results from continued mining of the Pit 3 area. Both impoundments will be used for recreational purposes which include fishing as well as for livestock drinking water. Both Reservoirs will be linked with the Tongue River via the alluvium which will minimize water level fluctuations.

Physical characteristics of both reservoirs are contained in Table IV.e.(2)1. The greatest impact of both impoundments will be the replacement of land surface with water surface. The loss of approximately 127 acres of land is not considered significant, especially when the lack of surface water in the area is considered.

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Table IV.e.(2)1.

Physical Characteristics of the Bass and Trout Reservoirs

Characteristic	Bass Reservoir	Trout Reservoir
Surface area	36 ac.	91.0 ac.
Volume of water	2,337 ac. ft.	11,581 ac. ft.
Depth	52 feet	270 feet
Length	1,300 feet	2,580 feet
Width	1,200 feet	2,000 feet
Perimeter road length	.87 mi.	1.4 mi.
Shoreline length	.95 mi.	1.7 mi.

The impoundments will cause an increased loss of Tongue River water to evaporation. The annual loss to evaporation is estimated at approximately 318 AF which is considered insignificant when compared to the average annual discharge of the Tongue River (292,000 AF near Acme, Wyoming, 372,000 AF near state line at Decker, MT).

Neither impoundment will be inundated by the 100 year flood event. This will protect the impoundments against flooding which could connect the surface of the reservoirs with the Tongue River.

It is evident that the positive impacts of the impoundments (mainly recreational use by the public) outweigh any probable adverse impacts.

f. Cumulative Hydrologic Impacts

(1) Evaluation of Compliance

Chapter XXIII, subsection 2.a.(1), among other things, requires a determination of the short-term and long-term cumulative impacts to the hydrologic regime, including the expected total qualitative and quantitative, direct and indirect effects of all anticipated mining in the general area.

The addition of the Amendment 1 mine area does not significantly alter the findings contained in the "Probable Cumula-

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tive Hydrologic Impact" portion (Section 3) of the original State Decision Document, permit 213-T1.

Material Damage to Areas Outside the Permit Area

The addition of the Amendment 1 mine area does not significantly alter the findings contained in the "Material Damage to the Hydrologic Balance" portion (Section 3) of the original State Decision Document.

(2) Environmental Consequences

The addition of the Amendment 1 mine area does not significantly alter the probable cumulative hydrologic impacts discussed in Section 3 of the original State Decision Document.

g. Blasting

(1) Evaluation of Compliance

The applicant's blasting plan has been changed from the original blasting plan submitted in Permit Number 213-T1. The changes stem from the addition of a new mining area. Big Horn Coal Company plans to extend Pit Three to the southeast. The new area, entitled Amendment One, will allow mining to take place 3,000 feet farther to the east than the previously approved mine plan had allowed.

As a result of the additional mining area, Big Horn Coal Company will be blasting within the one-half mile limit set by the WDEQ/LQD Rules and Regulations Chapter VI, Section 5a(7). Blasting will occur approximately 1,950 feet from a dwelling. Administrator approval will be required before blasting can be conducted. The mine sequence map shows that mining within the half mile limit will take place in 1987 and 1988. Big Horn Coal Company will have to obtain the administrator's approval before they start the 1987 cut.

All aspects of the proposed blasting plan remain the same and are in compliance with the WDEQ/LQD Rules and Regulations with exception of administrator approval for conducting blasting within one half mile of a dwelling. Actual administrator approval will not be required until 1987. Big Horn Coal Company has committed to acquiring the administrator's approval prior to conducting blasting operations within one half mile of the Norman Schreibeis residence. The blasting plan can be approved.

(2) Environmental Consequences

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The impact from blasting approximately 1,950 feet from the dwelling should be minimal. Big Horn Coal Company has committed to following the weight formula W=(D/60) squared, where D is the distance to the nearest dwelling and W is the maximum allowable weight of explosive period. This will keep the peak particle velocity below one inch per second at the dwelling. The resident may notice an increase in the noise level, but it will remain within the airblast limits set by the Rules and Regulations.

Big Horn Coal Company currently has administrator approval to conduct blasting operations within one half mile of two dwellings. One dwelling is a home and the other is a commercial site. Blasting has been conducted near the dwelling since 1981 with no reported damage. Seismograph readings show peak particle velocities well below 1.0 inch per second at the dwellings. The experience Big Horn Coal Company has acquired over the last couple of years should help them safely conduct blasting within one half mile of the dwelling.

h. Fish and Wildlife Protection

(1) Evaluation of Compliance

From a wildlife standpoint, the most substantial Mine Plan changes include disturbance of an additional 433.23 acres of habitat in the Amendment I area, and creation of a 91 acre trout reservoir for recreational purposes.

The additional habitat disturbance includes 246.8 acres within the pit 3 expansion area, 27.06 acres associated with a scoria pit, and 159.37 acres in the overburden dump area (Table D8-1; Permit Application). Among the more important habitats to be eliminated are 8.58 acres of Deciduous Forest and 14.41 acres of Ponderosa Pine/Rocky Mountain Juniper stands. Approximately 2532 trees are involved. An estimated 19,105 trees will be, or have been removed from the remainder of the permit area (pp. D8-53 and D8-173; Permit Application).

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Topography on the Amendment I area is relatively flat, except for embankments and breaks adjoining the Tongue River flood plain (Exhibit D9-2; Permit Application). Portions of steeper topography will be disturbed in East 1/2 Sec. 14, T57N, R84W. This varied surface promotes additional habitat diversity.

The entire permit area is characterized by quite dense shrub growth. Shrub data summarized for 7 vegetation communities

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yield a weighted average density of 6.07 shrubs per square meter and 19.31 percent absolute cover on surfaces within disturbance limits of the Amendment I area. Data from surfaces sampled on the remainder of the permit area indicates a weighted average of 10.4 percent shrub cover and 5.7 shrubs per square meter within disturbance limits.

The applicant has proposed to restore native rangeland with 2 basic seed mixes designed for upland and lowland situations (Table RP-7; Permit Application). Each mix contains several grass species of documented forage value to grazing wildlife species. To provide cover and browse, several shrub and forb species will be broadcast seeded in conjunction with the upland and lowland mixes. Species include rubber rabbitbrush, fourwing saltbush, common winterfat, skunkbush, sumac, purple prairie clover, and big sagebrush in the upland mix, and silver sage, wild rose, western snowberry, perennial sweetpea, and northern sweetvetch in the lowland mix. On the Amendment I area, 87 one-eighth acre shrub plots will also receive supplemental shrub seedings at rates listed in Table RP-7 of the permit application. Surfaces within the original permit area will be interspersed with 143 such plots. Locations are illustrated on Exhibits RP-2 and 3 of the permit application. The applicant has stated that efforts will be made to achieve a goal of 1 shrub per square meter over 10 percent of the permit area. Methodologies for shrub plantings will be discussed in annual reports (RP-22; Permit Application).

The applicant has proposed to replace 3,642 trees in mitigation for trees removed from the Amendment I area. These will be distributed throughout the permit area, as illustrated on Exhibits RP-2 and RP-3 of the permit application.

The applicant has delineated only 11 rock pile locations on the permit area and none within the Amendment I area (Exhibits RP-2 and RP-3; Permit Application). It is stated in the text, however that a density goal of 1 rock pile per 25 acres will be established, contingent upon availability of materials. It is further stated on page RP-7 that slopes will be graded with dips and undulations of sufficient magnitude to provide cover, escape corridors, visual barriers, and to promote vegetation diversity. These measures should be sufficient to mitigate the loss of premine land form diversity.

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The applicant has proposed to leave a 91 acre permanent impoundment as a trout reservoir for recreational purposes. Such a reservoir can certainly be justified based upon regional fishing demands. The fishery formerly contained in

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the Brown-Williams pit received considerable pressure from local residents before the pit was dewatered. Fishing in the Tongue River, on the other hand, is rather limited near Sheridan.

An estimated 562 days will be required to fill the impoundment by alluvial groundwater inflow plus 10 cfs of diverted Tongue River flow (p. RP-83; Permit Application). The impoundment will be protected from Tongue River flooding and possible introduction of trash fish by construction of a berm designed to withstand the 500 year flood flow event. Estimated annual water level fluctuations within the impoundment will mimic those recorded in the Tongue River alluvium, and should not exceed 3 feet. This is an acceptable range.

The Wyoming Game and Fish Department has indicated willingness to stock and maintain fisheries in mine reclamation ponds open to public fishing (letter dated December 18, 1980, p. RP-108; Permit Application). Temperature and dissolved oxygen profiles examined in several nearby mine pit impoundments by L.C. Rockett (1976) provide good evidence that these factors will not be limiting in the proposed trout and bass impoundments (p. RP-171; Permit Application). Inorganic water quality parameters of the trout impoundment are predicted in Table RP-43 of the permit application. Water quality criteria for stock watering and fresh water aquatics are listed in Table RP-44. All predictions fall within acceptable ranges for these uses.

The Wyoming Game and Fish Department has recommended increasing shoreline sinuosity (letter dated December 18, 1980, p. RP-208; Permit Application) and varying littoral zone widths to provide steep drop-offs and productive shallows (p. RP-92; Permit Application). The basin profile (Exhibit RP-3; Permit Application) does not reflect these recommendations. Big Horn Coal has stated, however, that they will work with the Wyoming Game and Fish Department during the construction of both the bass and trout impoundments to ensure proper design. Each impoundment will have shorelines high in sinuosity to provide a productive fishery habitat (pRP-5; Permit Application). As yet, the applicant has not provided an acceptable mechanism to assure permanent public access to either the bass or trout impoundments.

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The reclamation proposals summarized above have been found sufficient to restore wildlife habitat, in accordance with Chapter IV, Subsection 2.a.(2) and Chapter IV, Subsection 3.p.(1).

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(2) Environmental Consequences

Impacts attributed to this single operation will be of little regional significance. On site effects will be limited to the removal of habitat during years of active mining, causing a temporary reduction in local carrying capacity and displacement of mobile species. Some direct mortality may occur during stripping operations and as a result of mine traffic.

Cumulative impacts are of greater concern, although currently available information is not sufficient to quantify their severity. By year 1993 a total of 1950.5 acres (3.05 square miles) of land will have been affected. Parcels of this land have been or will be unavailable from the time at which topsoil is stripped until reclamation is complete. This impact is minor and of short duration when evaluated for individual mine sites. The cumulative effect of disturbance at Big Horn and surrounding mines, however, will somewhat reduce the regional carrying capacity for all wildlife. This impact is unavoidable and can be ameliorated only through contemporaneous reclamation and enhancement of habitat in areas not scheduled for disturbance.

Secondary impacts are those related to human population growth. As new employees enter the region poaching, hunting, fishing, and wildlife harassment will increase. At present, this impact is not a major concern because large tracts of public land are readily accessible in nearby areas.

Big Game

The Big Horn permit site lies within the Clearmont antelope unit and straddles the Powder River and East Big Horn mule deer herd units. Most of the permit area lies outside occupied antelope range, though the east edge extends somewhat into yearlong range. The majority of the permit area is winter/yearlong mule deer range, though a small portion of unoccupied habitat occurs in the northeast. The amount of habitat to be lost or degraded by the Big Horn operation is small in comparison to the total available in herd units. Hence, habitat reduction due to this single operation will not be of regional significance. Assuming reclamation is successful, the on-site impact will involve eliminating parcels of habitat from the time mining commences to the completion of reclamation. After mining, big game winter use of the permit area may decline during heavy snowfall due to a substantial reduction in shrub and tree growth on reclaimed surfaces. This impact will persist for several

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decades, until sufficient shrub and tree cover recolonizes the surface. The site is not considered an important wintering area, however, and its availability to big game during winter months is not essential.

Raptors

Six red-tailed hawks, 4 American kestrel, and 1 great horned owl nests occur within the permit area (Exhibit D9-6; Permit Application). Six unidentified nests are also plotted within the permit area. Mining is scheduled to remove 1 red-tailed hawk nest, 1 great horned owl nest, and an American kestrel nest (p. D9-65; Permit Application). The applicant has stated that special purpose permits will be obtained from the U.S. Fish and Wildlife Service prior to the "take" of each of these nests. Appropriate mitigation plans will be developed as a condition for issuance of the USFW special purpose permits.

Five golden eagle nests were reported within the study area but outside permit limits. A sixth nest has recently been reported in SE 1/4 Sec 9, T57, R84W. Buffer zones have been delineated by the USFWS around the 3 nests nearest the permit area: Chiggy's eagle, Wilson's eagle, and the Sec 9 eagle. All eagle nests are sufficiently isolated from mine disturbance that productivity should not be affected.

Raptor use of the permit site for hunting will decline as the prey base is eliminated, but should increase on reclaimed surfaces as small mammals respond to the restoration of forage and den sites. That portion of the raptor prey base dependent upon shrubs may be eliminated or reduced for several decades, until sufficient shrub growth recolonizes the surface. This impact, however, is not considered regionally significant.

Upland Gamebirds

No sage grouse have been recorded on the permit area. Ring-necked pheasants are regularly stocked along the Tongue River by the WGFD. Observations of this species within the permit area, however, have been rather limited. One sharp-tailed grouse lek, the Hidden Water Lek, occurs in the northwest corner of the pit 5 area. The pit 5 mine plan includes an overburden stockpile which will cover the Hidden Water Lek. Birds using the lek will either be displaced elsewhere or eliminated from the local population.

Passerines

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Passerines are highly mobile and will be displaced as mining progresses. Some changes in community composition may be expected as reclaimed habitat is repopulated. Shrub cover and patchiness are related to nesting passerine abundance. Since shrub cover will be substantially reduced at the time of bond release, a reduction in breeding passerine abundance is expected. As shrubs spread over time, passerine abundance should increase to premine levels.

Small Mammals

A number of small mammal species will be displaced or eliminated as mining progresses. The most limiting habitat components on reclaimed surfaces will be cover and den sites. Rock piles will provide isolated cover situations, permitting occupancy of that amount of surface falling within the cruising radius of each species able to utilize this form of cover. Those species dependent upon shrubs for cover and/or browse are expected to decline after mining, but should steadily increase over time as shrub cover spreads.

Waterfowl

Use of the permit site by waterfowl is restricted to Goose Creek and the Tongue River. Except for one relocated segment of the Tongue, a buffer zone will be maintained along these streams. The creation of a 36 acre bass reservoir and 91 acre trout reservoir will provide additional habitat after mining. The impact to waterfowl has, therefore, been sufficiently mitigated.

Mammalian Predators

Most predators are wide ranging, mobile species and will be displaced as mining progresses. There may be some population reductions as individuals compete in territories to which they are displaced. The presence of other mines in nearby areas will further reduce available habitat. As reclamation is completed and the prey base becomes reestablished, predator populations will respond. Overall, the impact to predators is expected to be of short duration and minor.

Threatened and Endangered Species

No black-footed ferrets or their sign were encountered during baseline studies. Prairie dogs are a key prey item of the black-footed ferret. No prairie dog colonies occur on the permit area. No impacts are anticipated.

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Three peregrine falcons have been observed during spring and fall migration periods. No cliffs or escarpments suitable for nesting, however, occur on the permit area. No impacts are anticipated.

Bald eagles winter throughout the surrounding region. No roosts occur on or adjacent to the site. A bald eagle nest is located approximately four miles northeast of the mine site, in northcentral section 29, T58, R83W. The nest is sufficiently isolated that mining should not disrupt breeding activities. Due to the wide ranging, opportunistic feeding habits of this species, the mine should not adversely affect foraging activities.

Aquatic Areas

Aquatic habitat along the Tongue River within the permit area consists of a series of short, fast riffle areas, long runs of moderate depth and velocity, and scattered deep pools. The most widely spread fish species included carp, northern redhorse, white suckers, stonecat, and rock bass. The sauger is the most important game fish. Other game species included mountain whitefish, brown trout, rainbow trout, northern pike, black bullhead, stonecat, smallmouth bass, green sunfish, rock bass, white crappie, and yellow perch. Angler use of the Tongue River fishery appears to be quite limited near the permit area. Favored areas are the headwaters of the Tongue in the Big Horn National Forest and Tongue River Reservoir downstream in Montana. Neither of these areas will be impacted by mining.

In 1977, Big Horn Coal Company permanently relocated an approximate 1200 foot stretch of the Tongue River to dewater the Brown Williams pit. Fish contained in the pit were netted and transferred to the main river channel prior to dewatering. Aquatic fauna rapidly colonized the relocated stream channel. Maximum macroinvertebrate densities were achieved in 40 days, with maximum diversity lagging somewhat behind (p. D9-338; Permit Application). Nongame fish began to take up residence within 1 to 2 days and game fish about 14 days after opening of the channel. Reconstructed habitat in the channel consisted of snag areas, boulders, and rip-rap. Pools have formed naturally by scour and deposition during spring flood periods.

Sedimentation ponds and interceptor channels will prevent excessive silt depositions to the Tongue River. Compliance with NPDES permits will preclude adverse impacts due to mine discharges. The Big Horn operation is not expected to degrade the aquatic biota of the Tongue River.

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From a fisheries standpoint the creation of 2 final impoundments will have a positive impact, mitigating recreational opportunity lost with dewatering of the Brown-Williams pit. A bass reservoir will be created in the SE1/4, Section 22, T57N, R84W. Primary use will be a recreational sport fishery. The impoundment will encompass 36 surface acres, with a maximum depth of 52 feet.

A trout reservoir will be created in Sections 13 and 14, T57N, R84W and will interconnect with the Tongue River alluvium. The reservoir size will be 91 surface acres and 270 feet maximum depth. Both reservoirs may be accessed from Interstate 90 and Highway 338. The applicant has not yet included a satisfactory mechanism to assure permanent public access, however.

Secondary Impacts

Secondary impacts have resulted from population growth in the Sheridan region. Energy development has been a primary stimulus for human influxes. Illegal use of wildlife has risen, and road kills are more frequent due to the greater traffic volumes.

At present, the Big Horn Mine employs approximately 300 personnel (Sam Scott, personal communication). This number is expected to remain relatively constant over the life of mine. Associated with this work force are families and individuals employed by construction and service industries. The large population segment directly and indirectly supported by the Big Horn operation has contributed somewhat to secondary impacts.

Thus far, the impact has not been considered regionally significant because large tracts of public land are readily accessible in nearby areas such as the Big Horn National Forest. Potential mitigation might consist of increasing the opportunity for outdoor recreation in the region, and increasing the wildlife law enforcement staff to handle increased enforcement problems. The applicant's proposal to create 2 permanent fishing impoundments is a step toward mitigating secondary impacts by providing additional fishing opportunity to the local population.

i. Backfilling and Grading

(1) Evaluation of Compliance

The applicant proposes to make a major change in the mine plan for the No. 3 pit. The changes include expanding the

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mining limits to the east to recover additional deeper coal. The other active pits, No's 1, 4, and 5, remain the same in size and operation. The mining schedule for Pit No. 1 is changed, however. The applicant requests a delay in contemporaneous reclamation of part of this pit. Pits No. 4 and No. 5 will be reclaimed during the permit term. Approval of these changes is recommended.

The applicant has provided baseline information on overburden quality and an operational monitoring program so that unsuitable material can be delineated and handled specially. Additionally, a regraded spoil sampling program is provided that will ensure 4' of suitable surface material for the test zone.

Due to the high SAR of the premining water, overburden with high SAR will not be special handled. Any potentially low pH water that reaches the permanent impoundment will be diluted by the large volume of water in the pond and is not a concern.

The proposed changes from the present permit relating to backfilling and grading in the original permit are noted as follows:

a. The first change, the expansion of Pit No. 3 to the east, is included in the renewal by an amendment to the permit boundaries. This pit is to be mined by truck/shovel using haulback mining methods. This pit will be in operation during the entire term. The applicant proposes leaving a permanent impoundment near the final highwall. The shoreline of the impoundment will be reclaimed to provide access at all points. It is also proposed to plant game fish in the impoundment. The out-of-pit spoils from Pit No. 3 will cover an area which has caved severely due to the old underground workings below.

   An analysis of typical mine spoils showed a factor of safety for the highest and steepest spoil piles to be in excess of 2.9.

   The area to be covered with spoil is located over an abandoned underground coal mine. The applicant expects the weight of the spoil and and the movement of nearby equipment to accelerate the rate of subsidence. Vertical displacement of the spoil fill is not expected.

   Calculations show that there will be approximately 13.4 million cubic yards of excess spoil at this mine,

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approximately 9.8 million yards will be placed in a permanent spoil pile, the rest will be backfilled within pit limits to help achieve approximate original contours.

The proposed excess spoil disposal area meets all the requirements of Chapter IV.3.c.(1). Approximate original contours will be achieved for the new areas.

b. The second change involves the mining sequence of Pit No. 1. Except for the mining of a small amount of coal, no overburden will be removed during the five year renewal term. Reclamation of the northwest end will take place. The present approved plan had called for the pit to be completed by the second renewal year. Since future mining beyond this renewal will be to the south of Pit No. 1 the delay in completing Pit No. 1 is environmentally acceptable.

* C. SEE ADDENDUM 1 FOR THE CHANGE IN BACKFILLING FOR PIT 5. RP 10/12/87

(2) Environmental Consequences

The impact to the Eocene and later geology of the area will be insignificant. The relative area is small and there are no unique features. The interbedded sandstones, shales, siltstone and coal will be excavated, mixed to varying extents and redeposited. This will alter the particle size distribution and geochemistry. Mixing upon mining and special handling of the large volumes of unsuitable material will prevent damage to rooted plants on the surface and shallow groundwater. This change is essentially permanent.

The replaced topography will be significantly altered, however, it will support the approved postmining land use. A topography created in response to erosion on roughly horizontal strata of consolidated interbedded sandstones, siltstones, and shales will be replaced by a topography created in response to erosion on a homogeneous unconsolidated mix with little surface variability. Aspects and slopes will change with a subsequent change in microclimate that will affect plant communities. This will not affect reclamation success by presently required standards.

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j. Contemporaneous Reclamation

(1) Evaluation of Compliance

Surface mining at this site began in 1956 (1982 Annual Report) and is scheduled to end in 1997. The total life of the mine is 41 years. The applicant's Reclamation schedule is shown on Exhibits RP-10 and RP-11 in map form on a pit by

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pit basis and is summarized on Table RP-10 of the permit application.

A total of 1950.5 acres are scheduled to be affected during the life of the mine including acreage to be added by this amendment. As of August 1982, 1,157.5 acres (1982 Annual Report) have been affected by mining and related activities, while 311.6 acres have been reclaimed. This amendment will add a total of 366.4 acres to the permit area, while 424 additional acres will be affected by mining and related activities as a result of this amendment.

The applicant is required to show compliance with Land Quality Division Rules and Regulations, Chapter IV.2.1.(1) and IV.3.a.(1). Reclamation must begin as soon as possible after mining commences and must continue concurrently until such time that the mining operation is terminated and all affected land is reclaimed. Rough backfilling and grading must commence within 180 days of coal removal.

The applicant has applied for a delay in contemporaneous reclamation, citing contract obligations and economics. The information provided in Addendum RP-3 of the permit application is sufficient to justify the delay.

Upon restoration of the postmining contours, the disturbed areas should be topsoiled and seeded in a time frame that will provide maximum protection to the environment and its resources. The procedures for restoring wildlife habitat are presented in Addendum D of the Reclamation Plan. Seeding will be performed in the spring or fall.

Table RP-11 in the Reclamation Plan summarizes areas and dates for final bond release.

(2) Environmental Consequences

The proposed changes will result in a delay of reclamation of parts of Pit 1. The disturbed areas will be isolated and all runoff routed through sedimentation ponds. Adverse effects outside the Pit 1 area are not expected. The long term impacts of this delay will be insignificant because the area will be mined and reclaimed after 1991.

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k. Revegetation

(1) Evaluation of Compliance

The revegetation plan submitted by the applicant meets all

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applicable requirements of Wyoming's Land Quality Division Rules and Regulations. The reestablished vegetation must be capable of supporting the postmining land uses (Chapter IV, Section 2.d.(1) and Section 3.d.(1)). Seeding must be done on the contour during the first planting period after final preparation of the land (Chapter IV, Section 2.d.(4)). This same regulation requires the presentation of vegetation species and rates to be used in the revegetation efforts. The baseline vegetation inventory must be sufficient to fulfill the test for determining the success or revegetation (Section 2.d.(6) and Guideline No. 2, Jan. (1981). All reclaimed areas must be protected from livestock for at least two years (Section 2.d.(8)). Mulch or other equivalent procedures must be used to control erosion and enhance soil moisture (Section 3.d.(3)) and control areas must be properly managed (Section 3.d.(4)).

Big Horn Coal Amendment I vegetation study area consists of three different surveys. The first, known as the Pit 3 expansion, was conducted in 1980. The second known as the scoria pit, was conducted in 1981. The third, known as the overburden dump, was conducted in 1982 (Exhibit D8-3 of the permit document). The data for each survey is presented in Appendix D-8 of the permit document.

Vegetation inventories were conducted on the Amendment One area from July to October 1980, 1981, and 1982. Specific sampling dates are given on each transect summary sheet which are contained in Appendix D-8.

The vegetation information collected by the applicant included quantitative data for the major community types. Data included ground surface area cover, frequency distribution, shrub density, and annual forage production based on standing crop clipping. Shrub heights were also recorded.

Inventory methods were approved in Permit 213-T1 with letters dated March 27, May 16 and June 12, 1979. These letters are included in the permit application in Section I of Appendix D-8. The same methods were followed for this amendment; the only exception was for the scoria pit area and the OB dump where the 1981 Guideline No. 2 was followed for shrub density plots and annual production clipping of shrubs was dropped.

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Sample adequacy was determined by using the formulas given in Wyoming Land Quality Division Guideline No. 2 (revised, March, 1979, and January, 1981). Adequacy of both cover and productivity sampling was checked after the first ten randomly chosen transects in each type sampled. When addi-

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tional samples were required, they were taken sequentially from the original random designations.

Control area sampling for the three (1980, 1981, 1982) surveys followed methodologies used for the disturbed area surveys.

Six different native vegetation types were mapped and sampled within the amendment area: big sagebrush-western wheatgrass type, big sagebrush-bluebunch wheatgrass type, western wheatgrass-needle and thread -green needlegrass type, big sage-brush-skunkbush sumac type, weedy type (a result of previous mining activity), deciduous forest type, and ponderosa pine-Rocky Mountain juniper type. A description of each vegetation type is presented in Appendix D-8 of the renewal document. Table D8-2 presents the production, cover, and density values plus sample adequacy calculations for each vegetation type. Exhibits D8-1 through D8-4 contained in Volume 20, Appendix D-8 of the application show the range site and condition, community types, and sampling points for the permit area and the amendment area.

The concerns in reclamation are: vegetative cover (for supporting the land uses), total cover (protection of the soil resource), production (quality and quantity to support the approved postmining land uses), density (of woody plants for forage and shelter), species diversity (for supporting the land uses).

For testing the adequacy of revegetation, the calculations and formulas used will be those given in WDEQ/LQD Guideline No. 2 dated Jan. 1981. These calculations will be performed for vegetative cover, total cover, vegetative production and density. The cover and production parameters will be compared to premining affected area parameters after adjustment has been made for any changes that have occurred in the control areas.

Species composition will be qualitatively evaluated with respect to the proposed postmining land uses of livestock grazing and wildlife habitat. Both species richness (number) and equitability (the relative apportionment of the individuals among species) will be evaluated.

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Big Horn Coal Company would like to propose that the Motyka index of similarity be used to determine species diversity. The following similarity indexes would be calculated:

1. % cover by life form (native perennial grass, introduced perennial grass, annual grass, perennial forbs,

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annual forbs, subshrubs, and shrubs) to be 80% similar. The annual grass and forb component in the similarity index may be dropped if the index does not meet the 80% guideline and recalculated using the other life forms.

2. On the areas reclaimed through 1982 a comparison to a grassland control area would be made.

3. Species richness or number of species would be listed; this will include the number of species established from approved seed mixture plus natural invasion.

4. On post-1982 reclamation an index of similarity for the wildlife habitat special planting areas will be compared to shrubland control areas. The remaining reclamation will be compared to grassland control areas.

The following procedures will be used to prepare a proper seed bed: (1) scarify topsoil; (2) disc; and (3) harrow. These procedures, along with drill seeding, will be performed with the contour of the slope to minimize erosion and conserve moisture. Prior to harrowing, areas will be fertilized at the rate determined from the soil analyses. Drill seeding of prepared areas will be conducted after October 15th and prior to April 15th.

Four seed mixtures will be employed to create a diverse vegetation community and to reestablish the affected land to the premining potential. The upland seed mixture (Table RP-7 in the applicant's Reclamation Plan) will be planted on the majority of the area, while the lowland seed mixture (Table RP-7) will be confined to drainageways. The improved pastureland seed mixture (Table RP-8) will be used to restore dryland pastures in Sections 14 and 15, T57N, R84W. The hayland in Section 15, T57N, R84W will be reclaimed with a mixutre of alfalfa and smooth bromegrass (Exhibits RP-2 and RP-3 in the applicant's reclamation plan).

To provide for secondary uses, such as wildlife habitat, shrub seed will be planted with grass seed (Table RP-7; Reclamation Plan). In addition to this general planting, selected sites such as drainageways and the crests of slopes will receive spot plantings of rubber rabbitbrush, common winterfat, skunkbush sumac and western snowberry. These augmented seedings will be at the same rate noted in Table RP-7. Proposed locations for these augmented seedings are denoted on the reclamation plan maps (Exhibits RP-2 and RP-3) with each symbol representing approximately one-eighth of one acre.

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A variety of trees (Table RP-9) will also be planted at sites that are suited to their growth characteristics. Those proposed sites are denoted on the reclamation plan maps (Exhibits RP-2 and RP-3) with each symbol representing one-eighth of one acre. A density of 40 trees/acre for the upland sites will be reestablished to compliment the primary land use of livestock production.

Annual reports filed by existing mines in the Powder River Basin, including the present applicant and elsewhere in Wyoming, contain results of revegetation efforts. These reports indicate that reclamation is possible. The Big Horn Mine is located north of Sheridan and is included in BLM's Final Environmental Impact Statement for the Powder River Basin.

In evaluating the compliance, the following items should be considered: 1) the baseline vegetation inventory must be sufficient to fulfill the test for determining the success of revegetation; 2) a plan is presented to establish a diverse, permanent vegetative cover on all affected lands of the same seasonal variety native to the area or of a species that will support the approved postmining land uses; 3) and that a plan is provided for the management of reclaimed areas and their respective control areas.

The characteristics and values of the various reclamation species discussed under postmining land use below, provide evidence to support the applicant's claim that the postmining land uses will be equal to the premining uses. The pre and postmining land uses are grazing land and wildlife habitat.

Vegetative productivity, cover and composition will be monitored yearly on reclaimed areas and measured according to the Land Quality Division's Guideline No. 2, or other approved methods.

During the course of the baseline study, control areas were established, one for each major vegetative type. These sites, located throughout the permit area, will be used to compare pre and postmining vegetation.

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(2) Environmental Consequences

Native vegetation types identified and mapped within the permit and amendment area include: Big sagebrush-Western wheatgrass, big sagebrush-bluebunch wheatgrass, western wheatgrass-needle & thread green needlegrass, big

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sagebrush-skunkbush sumac, deciducus forest, and ponderosa pine-Rocky Mountain juniper. Exhibit D8-2 illustrates the distribution of vegetation types within the permit area and Exhibit D8-4 illustrates the distribution of vegetation types within the Amendment one area. Both of these exhibits are located in Volume 20 of the permit document. The vegetation types are discussed in Appendix D-8 and the data collected on all sites is presented.

The amendment one area consists of three separate areas: Pit 3 expansion, Scoria Pit, and overburden dump. The data was collected on the three areas in 1980, 1981, and 1982 respectively.

Table D8-3 in Appendix D-8 of the application presents the plant cover (%), productivity (g/m2), and shrub density (number/m2) values collected on the three sites for comparison purposes.

The direct vegetation impacts caused by the destruction of 1,950.5 acres of existing vegetation (1,157.5 acres of this has already been disturbed under previous permits according to the applicant's annual report received by LQD August 25, 1983) would not be remedied until reclamation of the area is completed. The applicant plans to reestablish plant communities composed of species with equal palatability to livestock and wildlife as those existing before mining occurred in the area.

Short term impacts associated with vegetation removal during construction and operational phases consist of potentially increased erosion and habitat loss for wildlife and livestock. Long term impacts potentially consist of a degradation of livestock and wildlife forage potential because of continued erosion, invasion of undesirable plant species, and reduction of species diversity. These impacts are insignificant since the vegetation types to be disturbed are common in Wyoming, no critical habitat will be disturbed and no threatened or endangered plant species occur on the proposed mine site.

An indirect impact would result from the dust from haul roads, blasting and mining activities that would be deposited on adjacent vegetation which would make it less palatable to livestock and wildlife. Also, this accumulation of dust on the vegetatation would decrease the growth rates of the vegetation due to decreased photosynthetic activity. The applicant commits to controlling fugitive dust by spraying water on the dirt roads.

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The greatest secondary impact would be the loss in diversity of shrubs and forbs for wildlife use. However, artificial seeding as well as natural colonization of shrub and forb species from adjacent undisturbed areas and from seeds present in the reapplied topsoil should increase the diversity over time (as should be expected in any case of secondary succession). It has been shown for example, that big sagebrush will move into an area from seeds present in the reapplied topsoil as fast as if it had been included in a revegetation seed mix (Clarke and DePuit, 1980).

No threatened or endangered species have been observed within the permit area. These observations are supported by the Department of Interior's Final Environmental Statement for the Eastern Powder River coal region (BLM 1979).

l. Roads and Other Transportation Facilities

(1) Evaluation of Compliance

No new roads are planned for development during the renewal term. The haulroads to Pits 4 and 5 will be reclaimed during the renewal term.

(2) Environmental Consequences

Any existing environmental impacts should be decreased with the elimination and reclamation of the haulroads going to Pit No's 4 and 5.

m. Buildings and Facilities

(1) Evaluation of Compliance

The applicant proposes to build a new office, change house, truck washing facility and explosive storage magazine to replace existing structures. The new construction was proposed in the existing approved permit so the renewal has no changes.

(2) Environmental Consequences

Any change in environmental impacts resulting from the construction of these new facilities will be insignificant. The sanitary treatment facilities for the new buildings has been previously approved in the existing permit. All buildings and facilities will be removed and the land reclaimed when mining is finished.

n. Prime Farmland

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(1) Evaluation of Compliance

A prime farmland letter for the amendment one area is included. There is no prime farmland on the amendment area.

o. Postmining Land Use

(1) Evaluation of Compliance

The applicant's reclamation plan is required to establish postmining land uses which will be equal to or greater than the highest previous uses, and this plan must be achievable (Chapter IV, Section 2.a.1.) and if an alternative land use is proposed the applicant must present appropriate plans, commitments and approvals (Chapter II, Section 3.b.(12)(b).

The revegetation plan proposed by the applicant is described above. This plan will have the potential of returning the premining land uses of livestock grazing and wildlife habitat.

The Big Horn Coal Company's reclamation plan is designed to reestablish the premining land uses of livestock grazing and wildlife habitat. It is the applicant's goal to restore the area to a level of production, diversity, cover and erosion stability equal to or better than that which existed prior to mining.

Two permanent water impoundments are also planned as part of final reclamation. Bass Reservoir is located in Sections 15 and 22. Trout Reservoir is located in Sections 13 and 14. Exhibit RP-1 shows the postmining land uses for the mine area and is located in the applicant's reclamation plan.

Since the present land use at the Big Horn Coal Company is industrial, it is necessary to change the land use classification in the area of the two final water impoundments. The change in land use for Bass Reservoir was approved by the Sheridan Area Planning Agency on May 15, 1981. The impoundment was approved by the DEQ on August 27, 1981 with the approval of Permit No. 213-T1. The State Engineer's office approved the impoundment on July 12, 1978 and issued Permit No. 7901R. The Wyoming Game and Fish Department gave a favorable response on December 18, 1980. The surface is owned by the Big Horn Coal Company, therefore, surface owner consent for the land use change was not required.

Trout Reservoir is planned as part of the final reclamation plan in the Amendment One area. The primary land use classification for this impoundment is recreation which includes

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fishing, picnicing and camping.

The change in land use was approved by the Sheridan Area Planning Agency and endorsed by the Wyoming Recreation Commission in December, 1982. The design drawings have been submitted to the State Engineer's office and are pending approval. The Wyoming Game and Fish Department has commented on the plans.

The surface containing Trout Reservoir is owned by Peter Kiewit Sons' Company which in turn owns and operates the Big Horn Coal Mine. Surface owner consent for the land use change is contained in Addendum RP-1.

In the event the impoundments fail, even after exhausting all available and reasonable technology, the alternative will be to backfill the failing impoundments. Bass Reservoir would be backfilled using material from Pit 1. Approximately 2,370,000 cubic yards of material will be required to backfill Bass Reservoir. Trout Reservoir would be backfilled using material from the Pit 3 and Amendment One areas. Approximately 19,340,000 cubic yards of material will be required to backfill Trout Reservoir. Exhibits RP-4 and RP-5 show the alternate reclamation plan as if both impoundments were backfilled.

Wildlife habitat will be reestablished on disturbed areas with the shrub and seed mixtures listed in Tables RP-7 and RP-8 in the Reclamation Plan which include species of documented forage value to wildlife (Blauer et al. 1977, McArthur et al. 1979). The general planting of these seed mixtures will also be complimented by spot plantings of additional shrubs, forbs and trees as discussed in the Species to be Seeded narrative of the applicant's reclamation plan. Approximately 2% of the affected area will be selected to receive spot planting of shrubs and a density of one shrub per square meter will be established.

Revegetated areas are protected by the applicant from uncontrolled grazing until final bond release is received. As mining progresses and a revegetated area can be grazed without disruption to the operations, grazing by livestock may be employed as a management tool. Measures such as mowing, weed spraying, fertilizing, and burning will be conducted for a period of at least five years to control weeds and pests. These activities will be coordinated with the Sheridan Weed and Pest Control Agency, the Soil Conservation Service and the Wyoming Department of Environmental Quality.

Normal and reasonable husbandry practice will also be fol-

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lowed to ensure that revegetation will be completed and the postmining land uses are achieved.

(2) Environmental Consequences

As of August 1983, 1,157.5 acres have been disturbed by the applicant at the present location. An additional 793 acres are scheduled to be disturbed under the current application. Reclaimed land will not be used for grazing purposes for at least 2 years after reseeding in order to give the vegetation time to become established.

The major adverse environmental consequences of the proposed action on land use would be the reduction of livestock grazing and loss of wildlife habitat on the mine plan area during the period of mining and reclamation. This would result in short-term adverse impacts on livestock production and wildlife habitat. Planned reclamation is expected to return the cover and productivity of the disturbed lands to similar or higher levels and quality relative to that supporting premining land uses within ten years of reseeding.

The greatest secondary impact would be the loss in diversity of shrubs and forbs for wildlife use. However, seeding as well as natural invasion of shrub and forb species from adjacent areas should increase the diversity over time (as should be expected in any case of secondary succession).

p. Cultural Resources

(1) Evaluation of Compliance

Cultural resource work at Big Horn began in 1974 when Michael Metcalf was retained to salvage a site near Acme (48SH231). Metcalf partially excavated this site and determined that its probable function was a hunter's overlook along Goose Creek (Addendum D3-A). Based upon cultural material, Metcalf put the site within the Early and Late Middle Prehistoric Periods (5000 BC - 0 AD) and the Late Prehistoric Period (200 AD - 1000 AD).

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In 1976, Michael L. Gregg, Mineral Research Center, surveyed 750 acres that were planned to be mined. Two archeological sites (48SH336 and 48SH337) and six isolated finds were recorded. Neither site was felt to be eligible for the National Register (Addendum D3-B).

Marvin Hoyt in 1977 conducted a survey of about 285 acres scattered around Big Horn Mine (Addendum D3-C). These areas were short-term lease parcels and were later resurveyed by

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Michael Metcalf in 1980. Hoyt located only one site and recommended that if any disturbance was planned, the site be more thoroughly studied. Metcalf's work satisfied this recommendation. Also in 1977, Bob Murray conducted a historical overview of the mine area (Appendix D2).

Michael Gregg resumed his work in 1978 with a 160-acre survey and the trenching of one site to determine the presence of subsurface deposits (Addendum D3-D). During the survey, two sites 48SH250 and 48SH251, were located. Although 48SH251, the Hidden Water Shelter, was tested with a backhoe with negative results, Gregg felt that the potential for material still exists so before any disturbance is planned, the site should be more systematically examined. Presently, the site is outside of planned disturbance areas and no further work is necessary. To ensure that unauthorized disturbance does not take place, general protective measures have been established for the mine. These are discussed below.

In 1979, Mineral Research Center was contracted to survey the Jensik Hill-Southeast Extension areas (Addendum D3-E). This work was carried out by Bonnie Hogan and Paul Anderson under the supervision of Mike Gregg. This survey covered 5,220 acres of both historical and archeological remains. Results include the location of ten prehistoric sites and ten historic sites. Clearance for this report was obtained on 6/03/80 from the Wyoming State Historic Preservation Office. A copy of this letter can be found at the end of Addendum D3-E.

Work continued at Big Horn during 1980 when Metcalf-Zier Archaeologists, Inc. surveyed 1,000 acres and tested two sites along the relocation route of State Highway 338. During the survey, 23 sites were recorded, 17 of which were felt to require additional work before a National Register evaluation could be made. The two sites tested were part of the 23 located.

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Three reports concerning this work were issued. This is because two projects were involved: the relocation of State Highway 338 and the permitting of the expansion of Big Horn mine into Pit 5. Addendum D3-F contains the overall report for MZAI's 1980 work. Addendum D3-G contains two reports focusing upon the highway relocation work by MZAI. These two reports are Bradley 1981 and Harrell and McKern 1980. Clearance for the relocation of Highway 338 was granted in 1981 by the Wyoming State Highway Department and the State Historic Preservation Office. While obtaining clearance, Kiewit Mining & Engineering Co. agreed to resurvey the actual highway route. This was done during early summer

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1981 by Hassler. One additional site (48SH230) was recorded, as well as the relocation of the previously identified sites by Hogan. None of these sites require additional work. Since the report by Hassler covering the relocation of the highway does not directly pertain to this submittal, it is not reproduced in this document. Instead, copies of the report can be obtained through the Wyoming State Historic Preservation Office.

With the expansion of Big Horn Mine into Pit 5, one site (48SH447)discovered by Metcalf was tested and evaluated by Carmen Sheldon, University of North Dakota (Addendum D3-H). This site proved to lack any potential for the National Register. This work was also carried out during the summer of 1981 and a clearance letter from the Wyoming State Historical Office can be found at the end of Addendum D3-H.

During August 1982, several archeological sites located by MZAI in the Pit 3 area were revisited. Metcalf originally recommended that seven sites be tested for subsurface deposits. Following the examination by Hassler, it was decided that these sites did not meet the criteria for the National Register and were not tested. The report detailing this evaluation is contained in Addendum D3-I.

On May 3, 1983, a field check of the Amendment One area was carried out by the Wyoming State Historic Preservation Office, the Wyoming Department of Environmental Quality and the Office of Surface Mining, United States Department of the Interior. At this time, it was decided that no further work needs to be done at 48SH438, 48SH439, 48SH441, 48SH442, 48SH444 and 48SH445. In addition, cultural sites 48SH251, 48SH350, 48SH354, 48SH436, 48SH446, 48SH453 and 48SH455 are outside of Big Horn disturbance area and will be preserved and protected according to the general measures outlined below.

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At this meeting, it was agreed that the only work remaining in the Amendment One area involves the Schreibeis homestead (48SH437). Big Horn Coal Company will record the physical manifestations of the homestead prior to disturbance. This will involve photographs and scaled drawings at the site. This data will be placed in a report and sent to the Wyoming SHPO and DEQ as fulfillment of this commitment within 90 days of field work completion.

In 1981, Jason Lillegraven conducted a paleontological survey for the Big Horn Mine. He concluded that there were no significant paleontological deposits at Big Horn. His report is reproduced as Addendum D3-J.

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Recently Danny Walker, University of Wyoming-Laramie, received Pleistocene fauna remains recovered from Pit 3 at Big Horn a few years back. These remains came from Pleistocene gravel deposits in Section 14, T57N, R84W. The geology and soils data for the Amendment One area are discussed in Appendix D5. These data are available to paleontologists who are interested in the potential for additional Pleistocene vertebrate fossils. Nevertheless, Big Horn Coal Company, in order to protect significant deposits will notify the Wyoming DEQ of any paleontological remains discovered during mining activities so that qualified personnel can evaluate and salvage such material. In addition, all fossil material uncovered during mining operations will be collected and sent to the University of Wyoming for their analysis.

Cultural resource work at the Big Horn Mine began in 1974, and 10 reports have been submitted by the applicant since that time. Only those written after 1979 meet current performance standards. Prior to 1980, survey methodology was conducted more intuitively. Systematic sampling designs were virtually unknown, or at least not utilized. Survey coverage was biased toward "likely" site locations, resulting in a skewed representation of prehistoric settlement patterns. Rigorously defined inventory methods are required today to insure that a representative sample of all site types are found. Prior to 1980 site definitions varied considerably. Today, a site is considered when two or more artifacts are found at a specific locus; isolated finds are single objects. The use of "prominant" and "indistinct" to describe cultural material by Hogan (1979:34), with a real artifact density criteria for each, is not considered acceptable methodology today.

Forty-nine cultural resource sites have been located at Big Horn (Table D3-1). Nine of these sites require additional work before field evaluations can be made, however, since these sites are outside of proposed disturbance areas, no further work is planned. Table D3-1 depicts the 49 cultural resource sites at Big Horn.

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Fortunately, all of the area inventoried prior to 1980 that will be disturbed by mining has been disturbed. All new areas of disturbance have been surveyed by current performance standards. Should new surface disturbance be planned within any of the areas surveyed prior to 1980, only the fieldwork and analysis need be required; the previous studies are a useful framework for further work. Some areas within the permit boundaries have never been surveyed, e.g. Section 16, T57N, R84W. These areas, however, have either

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been disturbed under the previous permit, or will never be disturbed.

The paleontology report meets current performance standards. In a letter to WDEQ/LQD dated February 15, 1983 the Wyoming Geological Survey described the report as an "adequate" effort. The letter further requested information regarding the extent of Pleistocene gravels within the permit area after receiving information from an amateur collector that caribou fossils had been recovered from Pit 3. The area in question has been thoroughly mined and no further disturbance of Pleistocene geologic strata is planned. The applicant has promised on pages MP-148 and 149, however, that any paleontological remains uncovered by mining will be reported to WDEQ/LQD. The same commitment has also been made for cultural resources, D3-6 (Vol. 4), along with other general protective measures including restriction of employee access to significant sites and the monitoring of all significant sites over the life of the mine. Specific commitments to preserve archeological sites 48SH251, 350, 354, 436, 446, 453, and 455 are made by the applicant on pp. MP-148 and 149.

(2) Environmental Consequences

Although a number of archeological sites will be destroyed by the proposed mining operation the information contained in these sites has been recorded for posterity. Archeological sites are irretrievable resources in the sense that once the artifacts are removed from their context (the sites) valuable environmental and locational data cannot be recovered by future, more refined scientific techniques. This loss is mitigated to a degree by the use of state-of-the-art techniques present as much as possible. The maximum practical amount of information that the resource contains has been recovered for future laboratory study.

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One final environmental consequence of surface mining must be mentioned. The oldest, most deeply buried, and most important archeological sites usually show no traces during a surface inventory. They exist at the interface of Pleistocene and Holocene stratigraphic levels. It is highly probable that surface mining for coal in Wyoming will uncover some of these sites. Company personnel should be made aware that there is the possibility that the oldest archeological sites in this country may be discovered by surface mining operations.

q. Alluvial Valley Floors

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(1) Evaluation of Compliance

Determination

The State Decision Document for Big Horn Coal, Permit No. 213-T1, dated August 21, 1981 identifies the Tongue River as an Alluvial Valley Floor. The Tongue River flows through the amendment one area and is also an AVF on the amendment area. This is based on a dependable supply of adequate quality water for irrigation; topographically suitable areas of practically manageable size with soils amendable to irrigation; historical water development and potential subirrigation. The extent is shown on Map D11-6 of the permit application as the terrace limits. These are not to be mined but will be disturbed and affected and agriculture will be interrupted. No other drainages are of significant size or lack the stream laid deposits necessary to be an Alluvial Valley Floor within the renewal and/or amendment areas.

Significance to Farming

There are 4 farm/ranch units that have developed agriculture on some portion of the Alluvial Valley Floor. There are the Terry, Shreibeis, Sanford and DeLapp operations. The most directly affected will be the Sanford unit which will be used for spoil and topsoil storage, and which will lie between the permanent impoundment and the river.

Addendum D-11-A of the permit application contains the information necessary to make significance to farming determinations, and it was possible to determine the proper values from the information provided.

Terry Unit

A total of 243 acres of land under varying management schemes could support a total of 30.03 animal units. Using the formula P=3+(.0014 (animal units over 100)) from Chapter III of the LQD Rules and Regulations, the farm can tolerate up to a 3% loss. Disturbance within the permit boundary of 11.6 acres would not be a significant loss. However, no disturbance or mining or interruption of farming activities is expected.

Schreibeis Unit

The 600 acres of the Schreibeis unit could support 35.48 animal units. Using the formula for significance, the farm unit could tolerate up to a 3% loss. Total potential loss

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to the farm is much less than 1%. As with the Terry unit, no disturbance is expected.

Sanford Unit

The Sanford unit is the critical area on the AVF since it contains a large irrigated terrace that will be disturbed and falls almost entirely within the amendment area. Pages D-11m and D-11n of the permit application show that the applicant has proposed disturbance on 3.3 acres of the AVF. This is an insignificant disturbance as far as total farm production is concerned and is allowed by law. The remaining 18 acres of disturbance is on an area of the farm that is not AVF.

DeLapp Unit

A total of 138.28 animal units were raised on 850.0 acres of land. An allowable loss of 3.05% was obtained from the significance formula. Potential disturbance will affect much less than 1%. However, no disturbance is expected.

The proposed disturbance to the AVF is not significant to any of the farming operations. All disturbed AVF will either have its functions restored or replaced immediately adjacent to the area. The application is in compliance with all applicable rules and regulations on Alluvial Valley Floors.

(2) Environmental Consequences

The proposed mining operation should have little or no effect on the adjacent AVF. Mining of alluvium is planned and the terrace of the Sanford farm will be used for topsoil storage and a dike for the permanent impoundment. The volume of water in the stream and alluvium should mask any short term drawdown effects of mining in the adjacent upland. All disturbed AVF will either be reconstructed on site or replaced on an adjacent area immediately to the west. The productivity of the land and use will be reestablished.

r. Air Quality

(1) Evaluation of Compliance

The Big Horn Coal Company obtained permit no. CT-209A from the Wyoming Department of Environmental Quality, Air Quality Division, in November, 1981. This permit allows the mining of up to 4.61 million tons of coal per year at the Big Horn

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mine and identifies the areas in which mining is to occur. The permit addresses air quality aspects of coal mining, haulage from mine pits to processing-loading facilities and of the facilities themselves. The applicant applied for an amendment to existing permit no. CT-209A to include the additional areas addressed in this State Program Permit renewal application on December 20, 1983. Approval of this permit amendment is expected in mid-fall, 1984. Big Horn Coal Company is authorized under existing permit CT-209A to continue operation until approval of the amended permit.

The applicant has demonstrated compliance with applicable Air Quality Division requirements.

(2) Environmental Consequences

Preliminary review of dispersion modeling performed in conjunction with the amendment application to Permit CT-209A indicates that all applicable air quality requirements shall be met and that total suspended particulate concentration limitations shall not be exceeded.

s. Bonding

(1) Evaluation of Compliance

Reclamation costs for the term of permit and a detailed estimate for reclamation cost after the first year of permitting are shown in the permit application, page RP-185. The applicant is estimating the total disturbed acreage at the end of the first year of the permit term to be 1348.4 acres. This includes 36 acres to be reclaimed if the proposed permanent impoundment should fail. The bond estimated by the applicant to reclaim this disturbance is $20,415,063.00 or $15,140.21 per acre. The calculations for the first year of the permit term include detailed, itemized cost estimates for facilities demolition and removal, overburden redistribution, topsoil redistribution, revegetation and miscellaneous costs. These estimates are based on unit costs of $3.55 per cubic yard for overburden haulage and $0.86 per cubic yard for topsoil haulage. Revegetation costs include seedbed preparation, seeding and mulching for a total of $837 per acre. The reclamation estimate includes the extra cost of the alternate reclamation plan in the event the proposed permanent impoundment would require backfilling and revegetation. Facilities demolition and removal costs were based on a detailed estimate prepared by the applicant's district office. The demolition costs in the 1982 annual report was increased by 7.16% to adjust for the last year's inflation rate.

10/12/87 REFER TO ADDENDUM 1 FOR THE PIT 5 REVISION PROCEDURES FOR BINDING.

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The applicant is required to comply with W.S. 35-11-406(b)(vi) and Land Quality Division Regulations, Chapter XIII, 2.a.(1) and (2), and Chapter XIII,2.b. The applicant is required to provide two types of bond calculations; an "Area Bond" and an "Incremental Bond." The area bond consists of an estimate of the cost to complete rough backfilling as defined in Chapter I.2.(74). The incremental bond is an estimate of the cost of performing the remaining required reclamation work after rough backfilling is completed.

The applicant has provided a bond in the required amount of $20,415,063. This bond is divided into an incremental and area bond portion.

IV. Findings:

On the basis of the information set forth in the renewal application or from information otherwise available, which has been made available to the applicant, I, Lyle D. Randen, Administrator, Land Quality Division, find that the applicant has satisfied the requirements of W.S. 35-11-405(e) in that:

No. 1. The renewal application is accurate and complete. The applicant has provided Land Quality Division with a sworn statement stating that all information contained in the application is true and correct to the best of his knowledge. In addition, to the extent necessary and appropriate, independent agency verification supports the accuracy of the application. All information required by the Act and regulations for a renewal is contained in the application, including:

Identification of interests	Mining operation plan
Compliance information	Reclamation plan
Resource information	License information
Land use information	Insurance information
Maps and plans	Proof of publication
Permit fee	Required verification

Other agency approvals

No. 2. Supplemented and updated information has been submitted for the term of the renewal permit as required by LQD regulations, Chapter II, Section 3.b.(1)(b), Section 3.b.(2), Section 3.b.(3), Section 3.b.(8), and Section 3.b.(17) and Chapter XIII, Section 1.(b)1.

No. 3. Supplemental and updated information has been submitted for previous terms of the renewal permit.

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No. 4. Operations to be conducted in areas covered during previous terms of the renewal permit plus those to be conducted in this term are in compliance with applicable laws and regulations, and the renewal will not jeopardize the operator's responsibility on existing affected land.

No. 5. With respect to areas proposed to be affected during the term of the renewal permit the findings of previous decision document(s) remain fully in effect except to the extent that they are modified or superseded by this finding.

No. 6. Public notice has been given and comments or objections received were handled in the following manner.

Public notice had been given and a letter of objection was received in a timely fashion from the Powder River Basin Resource Council (PRBRC). PRBRC raised the following issues in their objection: Blasting, Alluvial Valley Floors, Groundwater, and Toxic Disposal. An informal conference was held on May 9, 1984, before the Administrator of the Land Quality Division to discuss these issues. The Administrator reviewed all information and determined by letter to all parties concerned on July 3, 1984, that the issues expressed by PRBRC had been adequately addressed by the applicant and that the permit renewal application would be approved without further modification.

No other comments were received by the Land Quality Division pursuant to this permit renewal application.

No. 7. Permit conditions for purposes of the renewal include:

1. The applicant shall commit to following these additional blasting procedures immediately:

   Access to charged holes shall be controlled and clearly marked by the use of signs and highway cones.

   Prior to detonation, the blasting area shall be cleared of all personnel and equipment.

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2. The applicant shall place warning signs near the exposed pit 1 highwall located in the northeast corner of the pit. The signs shall give warning of the exposed highwall and shall state:

   Warning
   Danger
   Exposed Highwall
   Keep Out

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The signs shall be posted within thirty (30) days of permit approval and shall remain in place until mining activities resume.

3. The operator shall submit an approved instrument granting public access for the proposed Bass and Trout Reservoirs within six months after this permit renewal approval. The proposed reservoir sites shall be backfilled and reclaimed according to the operator's reclamation plan in the event that acceptable public access is not provided.

4. Mining or mining related disturbances shall not take place outside of the approved term of permit area.

5. The permit shall be renewed prior to the expiration of the 5 year term of permit. Application for renewal must be made not less than 120 days prior to expiration.

6. The operator shall conduct all operations in accordance with his approved mining and reclamation plan and any conditions of the permit or license.

7. The operator shall provide the rights of entry as described by the Act and any regulations promulgated pursuant thereto.

8. The operator shall conduct his operation in a manner which prevents violation of any other applicable State or Federal law; and

9. The operator shall take all possible steps to minimize any adverse impact to the environment or public health and safety resulting from noncompliance with his approved mining and reclamation plan and other terms and conditions of any permit or license, including monitoring to define the nature of the noncompliance and warning of any potentially dangerous condition.

10. The operator must first obtain approval from the Secretary, U.S. Department of the Interior, prior to mining any coal owned by the United States of America.

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No. 8 REFER TO THE ADDENDUM FOR THE DATES OF PUBLIC NOTICE, OBJECTIONS, INFORMAL CONFERENCE, AND RESOLUTIONS.

Signed this 1 day of August, 1984.

Lyle Randen, Administrator

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ADDENDUM D11-3

Borehole and Monitor Well Logs

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Test Hole Log

WESTERN WATER CONSULTANTS

Hole/Well No.: 578418-AL-1	Drilling Company: A-3 Services Driller: Shawn Ankney	Well Seals: Depth: 5′ to 1.0 Type: 3/8" chips
ımpany: RAMACO	Drilling Method: Mud Rotary Sample Method: Grab @ 5' intervals	Depth: 1.0 to +0.5 Type: Cement Depth: to Type:
Project: Brook Mine Monitor Network	Drilling Fluids: Gel	Formation Packer: None Location: N/A
County: Sheridan	Hole Depth: 27′ Diameter: 9⅞" Well Depth: 25′ Diameter: 5"	Protective Casing: Dia: 8" Type: Locking Steel Depth: 2'
Township: 57N Range: 84W	Casing Type: Certa-lok PVC Diameter: 5" ID Length: Gage: SDR-17	Samples: Material Samples Y(N) E-Log Y(N) Water Samples Y(N)
Location: Section: 18	Perforation Interval: 25′ To 5′ Type: 5" PVC Slot Size: 0.02"	Water Level: Date:
Date Started: 9-30-13 Date Finished: 9-30-13	Filter Pack 27′ To 5′ Type: 10/20 Silica Quantity (ft^2):	Ground Elevation: (msl) Measuring Point Elevation: (msl)
Recorded By: Swayne Redinger	Centralizer(s): (Y) N Type: Locations: None	MP Height (ft)

Remarks:

From	To	DRILLING LOG: (Geology, drilling and water conditions, and sampling)	Time
0	1	Topsoil, loose, weathered, brown with scoria chips	
1	14	Scoria chips in loose silty claystone, light brown, colluvial	
14	21	Alluvium, scoria in silty clay matrix, sub round. Rig chatter, less matrix in lower portion (more scoria)	
21	22	Claystone, soft, light brown	
22	25	Scoria, sub round in brown matrix, (claystone)	
25	27	Claystone, grey, firm, Bedrock	
		Total depth = 27′	

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RAMACO

Brook Mine

Test Hole Log

WESTERN WATER CONSULTANTS

Hole/Well No.:578512-AL-1	Drilling Company: A-3 Services Driller: Shawn Ankney	Well Seals: Depth: 5′ to 1.0 Type: 3/8" chips
ɔmpany: RAMACO	Drilling Method: Mud Rotary Sample Method: Grab @ 5' intervals	Depth: 1.0 to +0.5 Type: Cement Depth: to Type:
Project: Brook Mine Monitor Network	Drilling Fluids: Gel	Formation Packer: None Location: N/A
County: Sheridan	Hole Depth: 22' Diameter: 9⅞" Well Depth: 20' Diameter: 5"	Protective Casing: Dia: 8" Type: Locking Steel Depth: 2′
Township: 57N Range: 85W	Casing Type: 5" PVC Diameter: 5" ID Length: Gage: SDR-17	Samples: Material Samples Y(N) E-Log Y(N) Water Samples Y(N)
Location: Section: 13	Perforation Interval: 20' To 5' Type: 5" PVC Slot Size: 0.02"	Water Level: Date:
Date Started: 9-25-13 Date Finished: 9-25-13	Filter Pack Location: To Type:10/20 Silica Quantity (ft^2):	Ground Elevation: (msl) Measuring Point Elevation: (msl)
Recorded By: Swayne Redinger	Centralizer(s): Y(N) Type: Plastic Locations:	MP Height (ft)

Remarks:

From	To	DRILLING LOG: (Geology, drilling and water conditions, and sampling)	Time
0	1	Topsoil	
1	17	Coal and scoria chips in a brown silt to sandy clay matrix, more scoria at bottom sub-round	
17	19.5	Scoria chips, sub-round, larger, rig chatter	
19.5	22	Claystone, brown, soft	
		Total depth 22'	

TFN 6 2/025
RECD NOV 14, 2014

DEQ Ex. 4-1109

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RAMACO

Brook Mine

Test Hole Log

WESTERN WATER CONSULTANTS

Hole/Well No.: 578513-AL-1	Drilling Company: A-3 Services Driller: Shawn Ankney	Well Seals: Depth: 5′ to 1.0 Type: 3/8" chips
›mpany: RAMACO	Drilling Method: Mud Rotary Sample Method: Grab @ 5' intervals	Depth: 1.0 to +0.5 Type: Cement Depth: to Type:
Project: Brook Mine Monitor Network	Drilling Fluids: Gel	Formation Packer: None Location: N/A
County: Sheridan	Hole Depth: 22' Diameter: 9⅞" Well Depth: 20' Diameter: 5"	Protective Casing: Dia: 8" Type: Locking Steel Depth: 2'
Township: 57N Range: 85W	Casing Type: Certa-lok PVC Diameter: 5" ID Length: Gage: SDR-17	Samples: Material Samples Y(N) E-Log Y(N) Water Samples Y(N)
Location: Section: 13	Perforation Interval: 20' To 5' Type: 5" PVC Slot Size: 0.02"	Water Level: Date:
Date Started: 9-30-13 Date Finished: 9-30-13	Filter Pack 20′ To 5′ Type: 10/20 Silica Quantity (ft^2):	Ground Elevation: (msl) Measuring Point Elevation: (msl)
Recorded By: Swayne Redinger	Centralizer(s): (Y) N Type: Locations: None	MP Height (ft)

Remarks: Driller notes Masters feels wet.

From	To	DRILLING LOG: (Geology, drilling and water conditions, and sampling)	Time
0	1	Weathered, soil, brown	
1	12	Colluvial fill, scoria chips and weathered claystone	
12	20	Scoria chips in clay matrix, rounded, alluvial. Rig chatter, pea gravel sized pieces	
20	22	Claystone, brown to grey, soft, Bedrock	
		Total depth 22'	

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LOG OF BOREHOLE	BOREHOLE # 12-BH-1	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 9:35 am
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 10:15 am
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 27′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	3	Weathered topsoil brown to grey		1.5″ POLYACETATE TUBES
3	6	Colluvial pebbles of scoria in a silty clay matrix, angular, dry, brown		1.5″ POLYACETATE TUBES
6	12	Clay with silt, dark brown, soft, wet		1.5″ POLYACETATE TUBES
12	16	Angular scoria in clay/silt matrix, brown & wet		1.5″ POLYACETATE TUBES
16	18	Sub-round scoria in silty matrix, wet, brown. Very soft at 18′. Alluvium		1.5″ POLYACETATE TUBES
8	22	Silt & clay, dark brown, colluvial		1.5″ POLYACETATE TUBES
22	26	Scoria gravels in silt/clay matrix, brown, wet, sub-round, alluvium		1.5″ POLYACETATE TUBES
26	27	Coal, bedrock at 27′, soft zone 26-27′		1.5″ POLYACETATE TUBES
		TD at 27′		

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LOG OF BOREHOLE	BOREHOLE # 12-BH-2	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 10:45 am
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 11:15 am
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 28′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	2	Weathered topsoil, brown-grey		1.5″ POLYACETATE TUBES
2	17	Clay fill, brown-grey with some scoria chips. Damp at 7′ Tan/brown at 7′ & less scoria, all colluvium		1.5″ POLYACETATE TUBES
17	25	Scoria chips/pieces angular (colluvium) in clay matrix, brown with reds, fatty clays, wet		1.5″ POLYACETATE TUBES
25	28	Claystone, grey, firm, damp		1.5″ POLYACETATE TUBES
		Bedrock at 28′		

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LOG OF BOREHOLE	BOREHOLE # 13-BH-1	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 11:45 am
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 12:05 pm
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 23′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	2	Topsoil, weathered, brown/grey		1.5″ POLYACETATE TUBES
2	5	Clay, colluvium, dry		1.5″ POLYACETATE TUBES
5	17	Clay, damp, brown, isolated scoria chips, colluvium		1.5″ POLYACETATE TUBES
17	21	Clays with sandstone & scoria derivatives, reds & browns, damp, some organics		1.5″ POLYACETATE TUBES
21	23	Reddish brown silt with sandstone & scoria chips		1.5″ POLYACETATE TUBES
		Refusal at 23′. Hard, fine grained sandstone in bit, dry. Assume sandstone bedrock		

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LOG OF BOREHOLE	BOREHOLE # 13-BH-2	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 12:15 pm
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 12:40 pm
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 17′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	2	Weathered topsoil		1.5″ POLYACETATE TUBES
2	4	Silty clays, dark brown/dry		1.5″ POLYACETATE TUBES
4	9	Silty clays with scoria chips, dark brown, damp		1.5″ POLYACETATE TUBES
9	12.5	Clays, reds & greys with substantial scoria (angular) chips, very hard to push		1.5″ POLYACETATE TUBES
12.5	13.5	Clay, dry, very dark brown/grey		1.5″ POLYACETATE TUBES
.5	16	Silty sand with clay, dry, tan/brown		1.5″ POLYACETATE TUBES
16	17	Claystone, silty grey with tans, firm		1.5″ POLYACETATE TUBES
		Bedrock at 17′		

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LOG OF BOREHOLE	BOREHOLE # 18-BH-1	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 12:50 pm
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 1:15 pm
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 26′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	3	Weathered soil, brown		1.5″ POLYACETATE TUBES
3	9	Firm, organic clays with silts and few scoria chips, dark brown		1.5″ POLYACETATE TUBES
9	10.5	Coaly, shale (organic), black, dry		1.5″ POLYACETATE TUBES
10.5	11	Scoria pieces, angular, red, dry		1.5″ POLYACETATE TUBES
11	18.5	Scoria pieces, in clay matrix, damp, brown, sub-round (alluvial)		1.5″ POLYACETATE TUBES
.5	20	Scoria gravel in clay, reddish brown, sub-angular, damp		1.5″ POLYACETATE TUBES
20	25.5	Sandy fill with scoria, reds & browns, damp, some clays, dry 20-20.5′, sub-angular		1.5″ POLYACETATE TUBES
25.5	26	Coal, black, hard		1.5″ POLYACETATE TUBES
		Bedrock at 26′ (refusal)		

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LOG OF BOREHOLE	BOREHOLE # 18-BH-2	Page 1 of 1
PROJECT: RAMACO AVF TRANSECTS	**DRILLER:** Yon Malkuch	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Direct Push Power Pro	**START:** 1:20 pm
FACILITY:	**BIT(S):** Direct Push Drive Point	**FINISH:** 1:45 pm
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 21′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 2⅛″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
0	1	Weathered soil, brown		1.5″ POLYACETATE TUBES
1	5	Scoria chips on clay & silt matrix, dry & brown		1.5″ POLYACETATE TUBES
5	7	Dark brown, clayey silt, dry		1.5″ POLYACETATE TUBES
7	10	Clay, moist, soft		1.5″ POLYACETATE TUBES
10	10.5	Carbonaceous clay, damp, grey		1.5″ POLYACETATE TUBES
.5	21	Scoria-sub-angular, sand to pebbles in clayey matrix, red to brown, damp (alluvial/colluvial)		1.5″ POLYACETATE TUBES
21		Coal, black, hard		1.5″ POLYACETATE TUBES
		Bedrock at 21′		

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LOG OF BOREHOLE	BOREHOLE # HW-BH-1, 2 and 3	Page 1 of 1
PROJECT: RAMACO HIDDEN WATER AVF	**DRILLER:** Swayne Redinger	**DATE:** 5/5/14
CLIENT/LOCATION: Brook Mine	**RIG:** Hand Auger	**START:** 3:15 pm
FACILITY:	**BIT(S):** Hand Auger	**FINISH:** 3:45 pm
GROUND ELEVATION:		
COORDINATES:	**FLUID:** None	**TOTAL DEPTH:** 3 - 5′
N: **E:**		
SURVEYED: Handheld	**LOG BY:** Swayne Redinger	**HOLE DIAMETER:** 3″

DEPTH From	DEPTH To	DESCRIPTION OF MATERIALS (ASTM D2488)	ASTM D2487 SYMBOL	TEST, SAMPLES, OR NOTES
		HW-BH-1		
0	1	Topsoil, dark brown with scoria chips		
1	3	Scoria chips in silty clay matrix, brown, wet, angular to sub-angular, refusal on large rock at 3.0 ft, colluvial		GRAB
		Refusal at 3.0′		
		HW-BH-2 Start 3:55 pm Finish 4:20 pm		
0	1	Topsoil, dark brown with scoria		
1	3	Scoria in silty matrix, gravel to silt in size, sandstone pieces as well, dry, angular, colluvial		GRAB
		Refusal at 3′		
		HW-BH-3 Start 4:30 pm Finish 4:50 pm		
0	1.5	Topsoil, organics, soft, dark brown		
1.5	2.0	Scoria chips in silty matrix, dark brown		
2.0	4.0	Soft again, fine grained sand, brown, damp, carbonaceous clayey material at 3.5′		
4.0	5.0	Scoria at 4.0 ft, carbonaceous material, silts and sands 4.5-5′, damp, refusal at 5.0′ on large rock. All colluvial.		GRAB
		Refusal at 5.0′		

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ADDENDUM D11-4

SEO Water Rights

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ADDLEMAN SPRINKLER 30385D

TFN 6 2/025
RECD NOV 14,2014

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RAMACO
Form S.W. 1
Rev. 12/22/2008

Brook Mine

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING
STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the _____ day of _____, 20_____, at _____ o'clock _____ M.

Recorded in Book _____ of Ditch Permits, on Page _____

Fee Paid $ _____ Map Filed _____

WATER DIVISION NO. _____ DISTRICT NO. _____ TEMPORARY FILING NO. _____

PERMIT NO. **P30385.0D**

NAME OF FACILITY Addleman Sprinkler

1. Name(s), mailing address and phone no. of applicant(s) is/are , PO Box 68, Ranchester, Wyoming, 82839

E-mail address:
(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices , PO Box 6498, Sheridan, Wyoming, 82801

E-mail address:

3. (a) The use to which the water is to be applied is Irrigation-- Surface water

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is Tongue River, tributary of Yellowstone River, tributary of Missouri River

5. The point of diversion of the proposed works is located _____ feet distant from the _____ corner of Section 19 T. N ., R. W ., and is in the SW1/4NW1/4 of Section 19 T. 057N ., R. 084W .
Lot _____ Block _____ Subdivision Name _____
Latitude (Decimal Degrees) _____ Longitude (Decimal Degrees) _____

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is 1.1 cubic feet per second (c.f.s.)

8. The accompanying map is prepared in accordance with the State Engineer's Rules and Regulations for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is Two Years, and to complete the application of water to the beneficial uses stated in this application is Two Years.

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10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

Town-	Range	Sec.	NE¼				NW¼				SW¼				SE¼				
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
			Original Supply Irrigation for the following lands. Land Owner: , Status: ADJUDICATED.																
057N	084W	19							A 7 13.00										13.00
			Original Supply Irrigation for the following lands. Land Owner: , Status: ADJUDICATED.																
057N	085W	24				4.00													4.00

Number of acres to receive original supply 17.00
Number of acres to receive supplemental supply 0.00
Total number of acres to be irrigated 17.00

REMARKS

I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

W.J. Pilch
Printed Name and Signature of Applicant or Agent

Date

TFN 6 2/025
RECD NOV 14, 2014

DEQ Ex. 4-1121

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THE STATE OF WYOMING } ss
STATE ENGINEER'S OFFICE }

TEMPORARY FILING NO. _____

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The time for completing the construction work shall terminate on May 2, 1990

The time for completing the application of water to beneficial use shall terminate on December 31, 1991, and final proof of appropriation shall be made within 5 years thereafter.

Witness my hand this 10th day of March, A.D. 1990

TFN 6 2/025
RECD NOV 14, 2014

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PERMIT NO. P30385.0D

PERMIT STAT S

Priority Date August 2 , 1989

Approval Date March 10, 1990

TFN 6 2/025
RECD NOV 14, 2014

NOTICE

This permit does not constitute a complete water right. It is your authority to begin construction work.

All appropriations for irrigation are limited to 1 cubic foot per second of time for each 0 acres of land irrigated, except as provided in Section 1 320, Wyoming Statutes, 19 . Appropriations for other uses are limited to the amount of water beneficially used in accordance with the terms of the permit.

Notice of completion of work and of application of the water to the beneficial uses described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are re uired, re uests for same must be in writing, stating why the additional time is re uired, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

To perfect your water right, your Water Division Superintendent, or his authori ed representative, will contact you after you have submitted notice to the State Engineer stating that you have applied the water to the beneficial uses described in your permit. After execution of the proof, it will be considered by the State oard of Control, and, if found to be satisfactory, the oard will issue to you a Certificate of Appropriation which will constitute a completed water right.

The granting of a permit does not constitute the granting of right of way. If any right of way is necessary in connection with the application it should be understood that this responsibility is the applicant's.

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TWN	RGE	SEC	NE1/4				NW1/4				SW1/4				SE1/4				TOTAL
			NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	
			Original Supply Irrigation for the following lands. Land Owner: , Status: ADJUDICATED.																
057N	084W	19							A 7 13.00										13.00
			Original Supply Irrigation for the following lands. Land Owner: , Status: ADJUDICATED.																
057N	085W	24				4.00													4.00

TFN 6 2/025
RECD NOV 14, 2014

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B134035 WATERHAUL 34862D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

SW1-1235
Form S.W. 1
Rev. 12/22/2008

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

J. Fuller

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING
STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 4th day of January
20 13, at 2:37 o'clock P M.

State Engineer

Recorded in Book 160 of Ditch Permits, on Page 41

Fee Paid $ 50.00 Map Filed SA-33, 34862D

WATER DIVISION NO. +2 DISTRICT NO. +4 TEMPORARY FILING NO. 35 4/289 JMF

PERMIT NO. 34862

NAME OF FACILITY B134035 & B134036 CB WATER HAUL

1. Name(s), mailing address and phone no. of applicant(s) is/are WYDOT, 5300 BISHOP BLVD, CHEYENNE, Wyoming, 82009, PH: 307-777-4748

E-mail address:
(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices MATT SIMPSON, 5300 BISHOP BLVD, CHEYENNE, Wyoming, 82009, PH: 307-777-4748

E-mail address: matt.simpson@wyo.gov

3.(a) The use to which the water is to be applied is Temporary (Road Construction) INDUSTRIAL JMF

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is Big Goose Creek, tributary of Tongue River, tributary of Yellowstone River, tributary of Missouri River

5. The point of diversion of the proposed works is located _____ feet distant from the _____ corner of Section _____ T. _____ ., R. _____ ., and is in the NW1/4SW1/4 of Section 27 T. 057N ., R. 084W . 6. S.
Lot _____ Block _____ Subdivision Name _____
Latitude (Decimal Degrees) 44.88278 Longitude (Decimal Degrees) -106.98750 JMF

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is 1 cubic feet per second (c.f.s.)

8. The accompanying map is prepared in accordance with the State Engineer's Rules and Regulations for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is Two Years, and to complete the application of water to the beneficial uses stated in this application is Two Years

TFN 6 2/025
RECD NOV 14, 2014

Permit No 34862

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10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

Town-	Range	Sec	NE¼				NW¼				SW¼				SE¼				
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
UNKNOWN SURVEY			Temporary (Road Construction) at a rate not to exceed - c.f.s. Land Owner: State, Office of State Lands & Investments -																
057N	084W	27	---------- A ALL ----------																
57	84	28								ALL									SMF

Number of acres to receive original supply	0.00
Number of acres to receive supplemental supply	0.00
Total number of acres to be irrigated	0.00

REMARKS

NONE

THE AMOUNT OF APPROPRIATION SHALL BE LIMITED TO THE AMOUNT OF WATER USED FOR TEMPORARY INDUSTRIAL HIGHWAY CONSTRUCTION PURPOSES ONLY, NOT TO EXCEED THE DIVERSION RATE FROM THE BIG GOOSE CREEK OF 450 GPM OR 1.0 CFS OR 300,000 GALLONS PER DAY OR A TOTAL OF 1,000,000 GALLONS IN TWO YEARS. THE WATER WILL BE PIPED AND/OR TRUCK HAULED TO THE POINTS OF USE FOR HIGHWAY CONSTRUCTION PURPOSES. PROJECT B134035 & B134036 CB. JMF

I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

MATT SIMPSON
Printed Name and Signature of Applicant or Agent

January 4, 2013
Date

TFN 6 2/025
RECD NOV 14, 2014

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THE STATE OF WYOMING }
STATE ENGINEER'S OFFICE } ss.

TEMPORARY FILING NO. 356/267

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation shall be limited to the amount used for temporary industrial (Road construction) purposes only, not to exceed 1.0 cubic feet of water per second of time, 30,000 gallons per day, or a total of 3,000,000 gallons over a two year period.

The appropriation granted under this permit shall extend for only the period of time required to complete the road construction proposed under Inf. ~~Big Piney Airport~~ This Water Haul and in no case will extend beyond January 10, 2015, or upon completion of the B134035 & B134036 Water Haul, whichever comes first.

The notices of completion and beneficial use are waived and will not be required because of the temporary nature of this appropriation.

This permit is granted with the condition that the permittee must notify the District Water Commissioner prior to diverting water.

This permit is conditioned on the holder of this permit securing and/or providing free and unencumbered access to this facility site to allow State Engineer personnel to perform their duties as prescribed by Law. These duties include, but are not limited to, construction inspections and water administration.

NO WATER SHALL BE DIVERTED UNDER THIS PERMIT UNLESS THERE IS SURPLUS WATER IN THIS DRAINAGE SYSTEM. WATER MAY NOT BE AVAILABLE UNDER THIS PERMIT DURING THE SUMMER MONTHS AND IN SOME DRAINAGE SYSTEMS WATER MAY NOT BE AVAILABLE DURING THE FALL, WINTER AND EARLY SPRING DUE TO FILLING OF RESERVOIRS. DURING THESE TIME PERIODS IT MAY BE NECESSARY FOR YOU TO OBTAIN WATER FROM EXISTING APPROPRIATIONS BY WATER AGREEMENT FILED WITH AND APPROVED BY THE STATE ENGINEER.

This permit will be automatically cancelled on January 10, 2015.

No final proof of appropriation to be accepted under this permit.

~~The time for completing the construction work shall terminate on December 31, 20____.~~

~~The time for completing the application of water to beneficial use shall terminate on December 31, 20____, and final proof of appropriation shall be made within 5 years thereafter.~~

Witness my hand this 14th day of January, A.D. 2013

PATRICK T. TYRRELL, State Engineer

Permit No. 34862

Page No. 41 (Leave Blank)

TFN 6 2/025
RECD NOV 14, 2014

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PERMIT NO. 34863

PERMIT STATUS

Priority Date January 4, 2013 Approval Date January 14, 2013

NOTICE

This permit, does not constitute a complete water right. It is your authority to begin construction work, which must be commenced within the time allowed in the permit.

Notice of completion of the work described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are required, requests for same must be in writing, stating why the additional time is required, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

Once the Notice of Completion has been filed, Proof of Appropriation will be prepared and sent to your Water Division Superintendent. The Superintendent will arrange with you for an inspection of the facility. Should you desire adjudication, the Proof will be considered by the Board of Control, and, if found to be satisfactory, the Board will issue to you a Certificate of Construction which will constitute a completed water right.

The granting of a permit does not constitute the granting of right-of-way. If any right-of-way is necessary in connection with the application it should be understood that this responsibility is the applicant's.

TFN 6 2/025
RECD NOV 14, 2014

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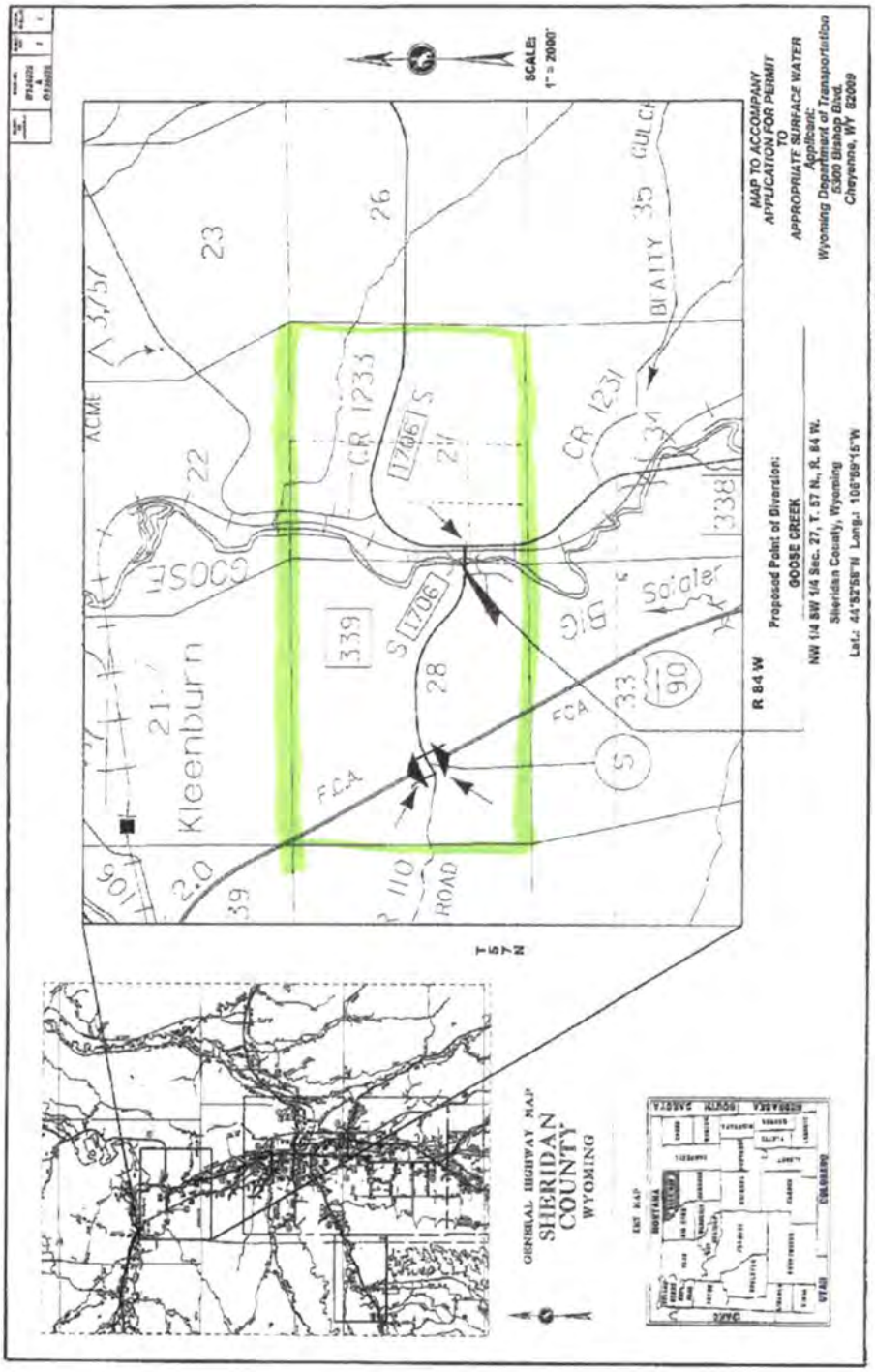

Area of use

THE AMOUNT OF APPROPRIATION SHALL BE LIMITED TO THE AMOUNT OF WATER USED FOR TEMPORARY INDUSTRIAL HIGHWAY CONSTRUCTION PURPOSES ONLY, NOT TO EXCEED THE DIVERSION RATE FROM THE BIG GOOSE CREEK OF 450 GPM OR 1 CFS OR 300,000 GALLONS PER DAY OR A TOTAL OF 3,000,000 GALLONS IN TWO YEARS. THE WATER WILL BE PIPED AND/OR TRUCK HAULED TO THE POINTS OF USE FOR CONSTRUCTION PURPOSES.

APPROVED: January 14, 2013

STATE ENGINEER
Patrick T. Tyrrell

MAP TO ACCOMPANY APPLICATION FOR
B134035 & B134036 CB WATER HAUL

APPLICANT: WYOMING DEPARTMENT OF TRANSPORTATION
5300 BISHOP BLVD.
CHEYENNE, WY 82009

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

BAXTER DITCH 12537D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO

Brook Mine

Application for a Permit to Divert and

Cert. Record 38 P. 74 Ac. 20

Proof submitted. NOV 15 1916

Water Division No. 2 District No.

I, Arnold Ischinger, of Sheridan, County of Sheridan, State of Wyoming, being duly sworn according to law, upon my oath say:

1. The name of the applicant Jane Barter
2. The postoffice address of the applicant Ranchester, Wyo
3. The use to which the water is to be applied is irrigation
4. The name of the ditch or canal is Barter Ditch
5. The source of the proposed appropriation is gulch, tributary to Six mile Creek, flowing into Tongue River
6. The headgate of the proposed ditch or canal is located N. 22° W. 805 ft. & N. 1030' W. 285 ft. from the South ¼ corner of Section 8, Township 57 N. Range 85 W.
7. The said ditch or canal is to be 0.35 miles long and to pass through the following lands (give route by courses and distances, or by naming legal subdivisions crossed): SE¼ SW¼ Sec 8, T. 57 N. R. 85 W.

8. The dimensions of said works are: (a) [At headgate] Width on top (at water-line) 3 feet; width on bottom 2 feet; depth of water 0.5 feet; grade 10.5 feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate:

[At] Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.
[At] Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.
[At] Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

9. Describe the character of proposed works, stating: 1st. The nature of the material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

1. Earth 2 none. 3 none. 4 Headworks to consist of a dam across gulch 101 ft long with maximum depth of 9.8 ft - forming a reservoir of 18/100 acres area with average depth of 3.5 ft of water

10. The estimated cost of said ditch & headworks is 350 Dollars.
11. The land to be irrigated has a total area of twenty acres, described as follows:

(Give estimated acreage in fractions of subdivisions)

SE¼ SW¼ Sec 8, T 57 N. R 85 W. 20 acres

TFN 6 2/025
RECD NOV 14, 2014

12. Construction will begin on proposed works on or before Dec 31, 1914
13. The time required for the completion of ditches and other distributing works is one year from Dec 31, 1914
14. The time required to complete the application of water to the beneficial use stated in this application is one year from Dec 31, 1914
15. A map of the proposed ditch or canal, prepared in accordance with Chapter 14, R. S. 1899, accompanies this application.

Signed: Arnold Ischinger

Scanned, 02/28/2020

THE STATE OF WYOMING, } ss.
COUNTY OF Sheridan }

I hereby certify that the foregoing application was signed in my presence and sworn to before me by
Arnold Jochugo this 9th day of July, 1914.
H A Floyd county clerk
By W S Doane, Deputy

Seal

Notice of application mailed OCT 2 1915

Notice of completion received NOV 4 1915

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE, }

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Witness my hand this ..... day of ....., A. D. 191....

State Engineer.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE, }

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

Tongue R 4 Feb

Construction of proposed works shall begin within one year from date of approval.

The time for completing the work shall terminate on December 31, 1915.

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1917

The amount of the appropriation shall be limited to one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 1917, ~~and the additional volume used for ..... purposes on or before said date.~~

Witness my hand this 30th day of July, A. D. 1914.

a. j. Parshall
State Engineer.

TFN 6 2/025
RECD NOV 14, 2014

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE, }

This instrument was received and filed for record on the 11th day of July, A. D. 1914, at 9 o'clock a. M., and duly recorded in Book 41 of Appropriations, Page 30

a. j. Parshall
State Engineer.

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BIRCHBY DITCH 1585D

TFN 6 2/025
RECD NOV 14, 2014

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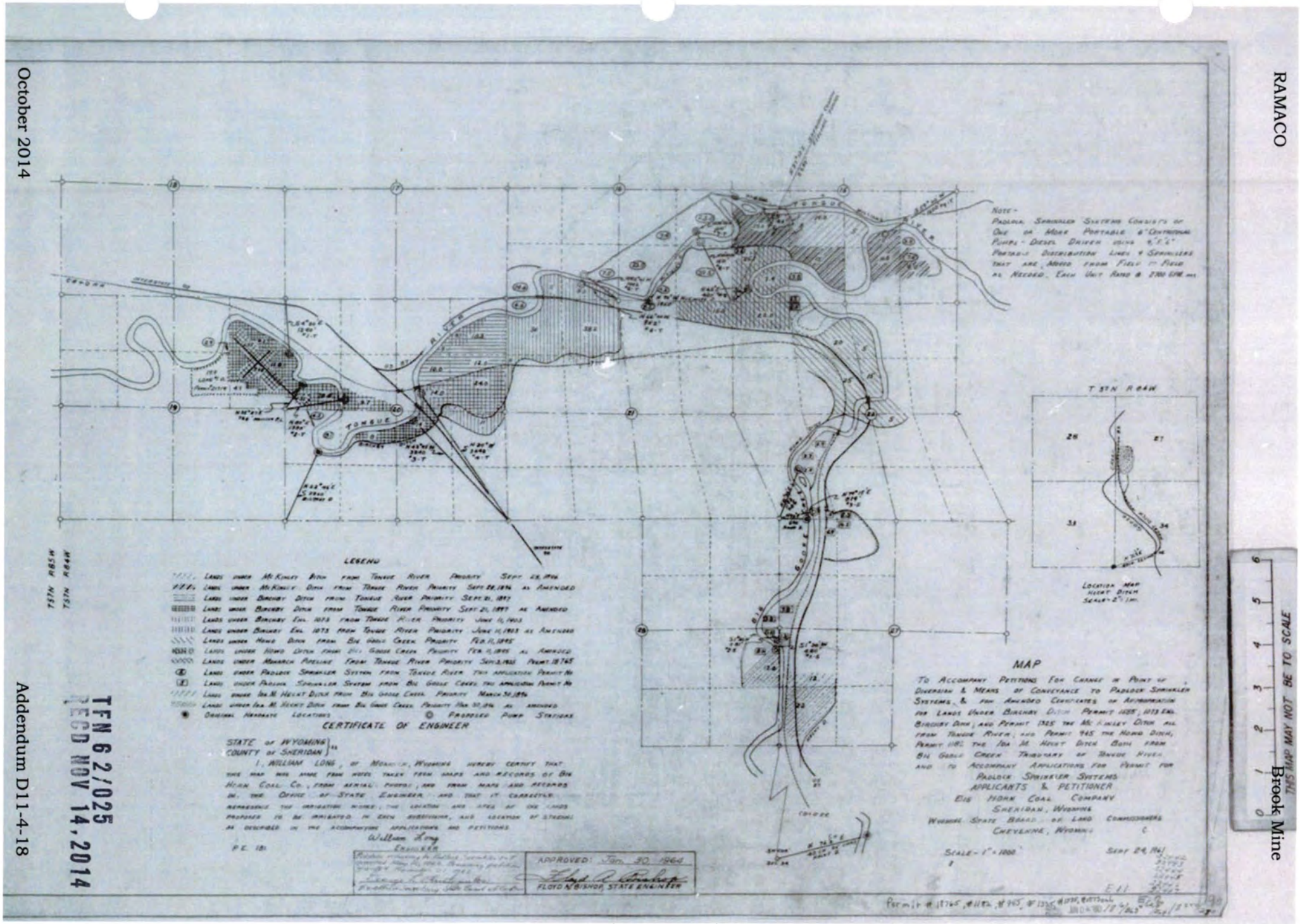
RAMACO

October 2014



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RECD NOV 14, 2014

Addendum D11-4-18

Brook Mine

DEQ Ex. 4-1135

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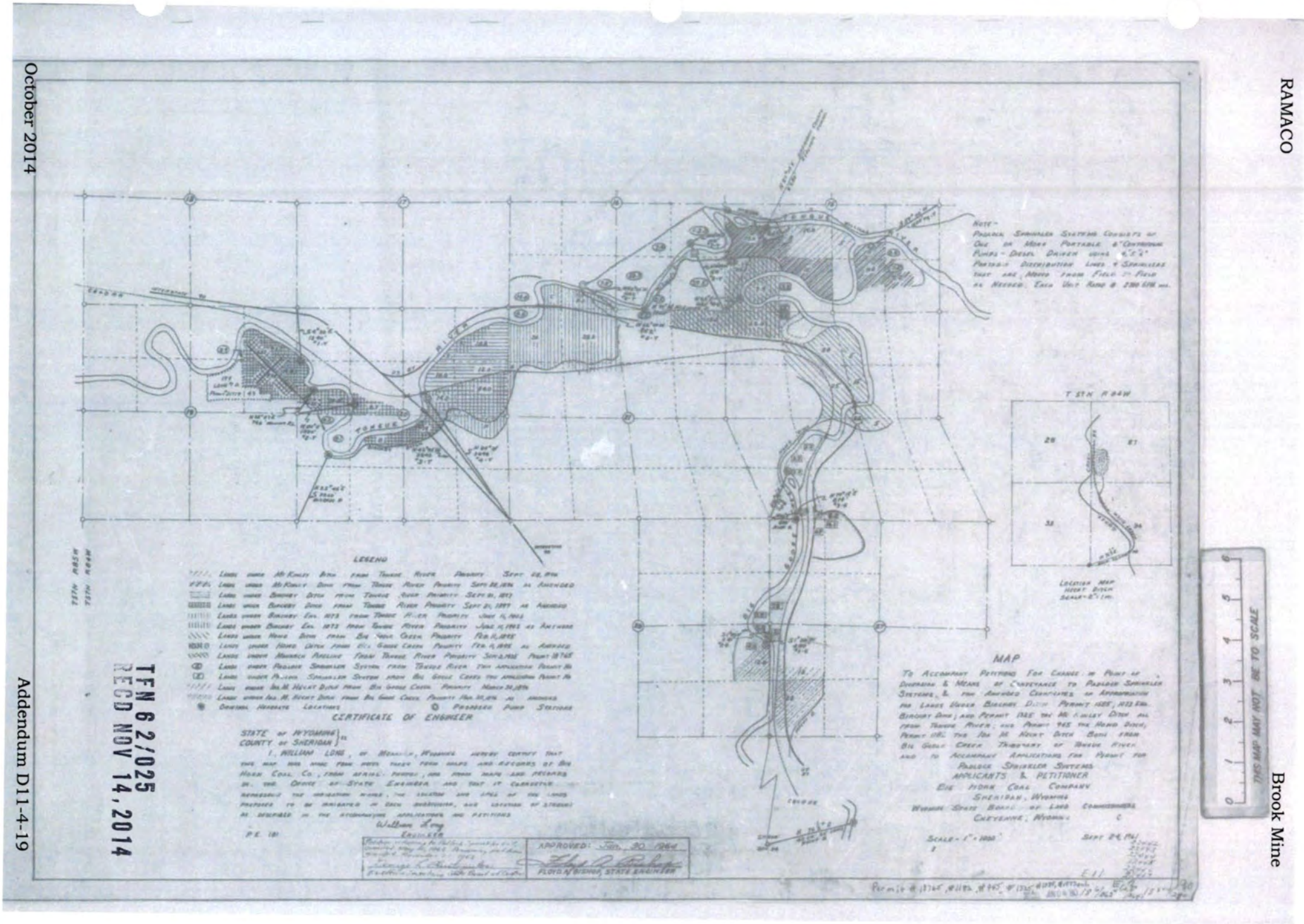

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DEQ Ex. 4-1136

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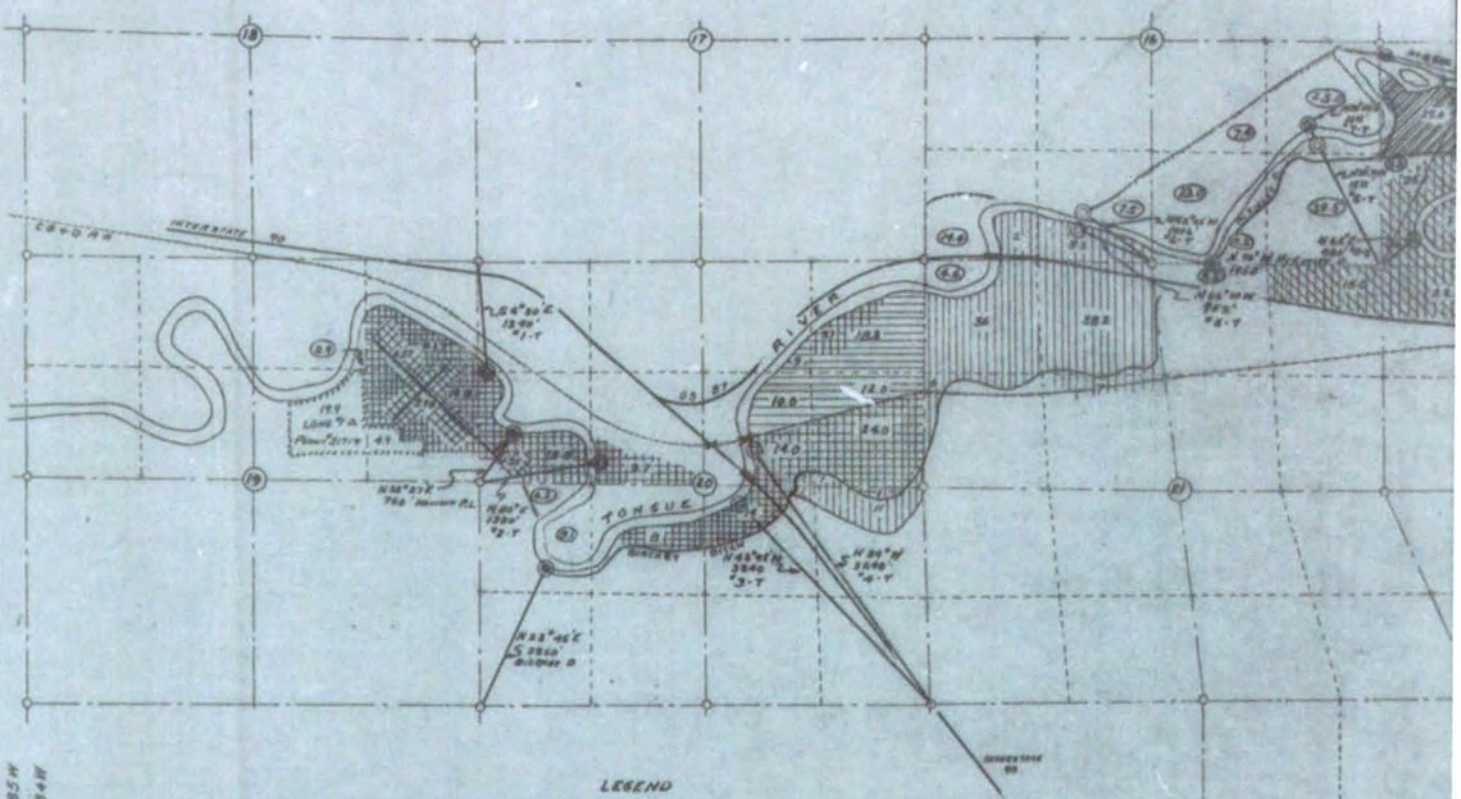

LEGEND

- Lands under McKinley Ditch from Tongue River Priority Sept 28, 1896
- Lands under McKinley Ditch from Tongue River Priority Sept 28, 1896 as Amended
- Lands under Burchby Ditch from Tongue River Priority Sept 21, 1897
- Lands under Burchby Ditch from Tongue River Priority Sept 21, 1897 as Amended
- Lands under Burchby Enl. 1875 from Tongue River Priority June 11, 1903
- Lands under Burchby Enl. 1875 from Tongue River Priority June 11, 1903 as Amended
- Lands under Howd Ditch from Big Goose Creek Priority Feb. 11, 1895
- Lands under Howd Ditch from Big Goose Creek Priority Feb. 11, 1895 as Amended
- Lands under Monarch Pipeline from Tongue River Priority Sept 3, 1935 Permit 18765
- Lands under Prologck Sprinkler System from Tongue River This Application Permit No
- Lands under Prologck Sprinkler System from Big Goose Creek This Application Permit No
- Lands under Jos. M. Hecht Ditch from Big Goose Creek Priority March 30, 1896
- Lands under Jos. M. Hecht Ditch from Big Goose Creek Priority Mar 30, 1896 as Amended
- Original Headgate Locations
- Proposed Pump Stations

CERTIFICATE OF ENGINEER

STATE of WYOMING } ss
COUNTY of SHERIDAN }

I, WILLIAM LONG, of Monarch, Wyoming hereby certify that this map was made from notes taken from maps and records of Big Horn Coal Co., from aerial photos, and from maps and records in the Office of State Engineer and that it correctly represents the irrigation works, the location and area of the lands proposed to be irrigated in each subdivision, and location of streams as described in the accompanying applications and petitions

William Long
Engineer

P.E. 181

Petition referring to Pulled Springs Ditch No. 1 Granted May 16, 1962 Recently petition for Right November 21, 1966
By George L. Christopulos
Ex-Officio Secretary, State Board of Control

APPROVED: Jan. 30, 1964
Floyd A. Bishop
FLOYD A. BISHOP, STATE ENGINEER

TFN 6 2/025
RECD NOV 14, 2014

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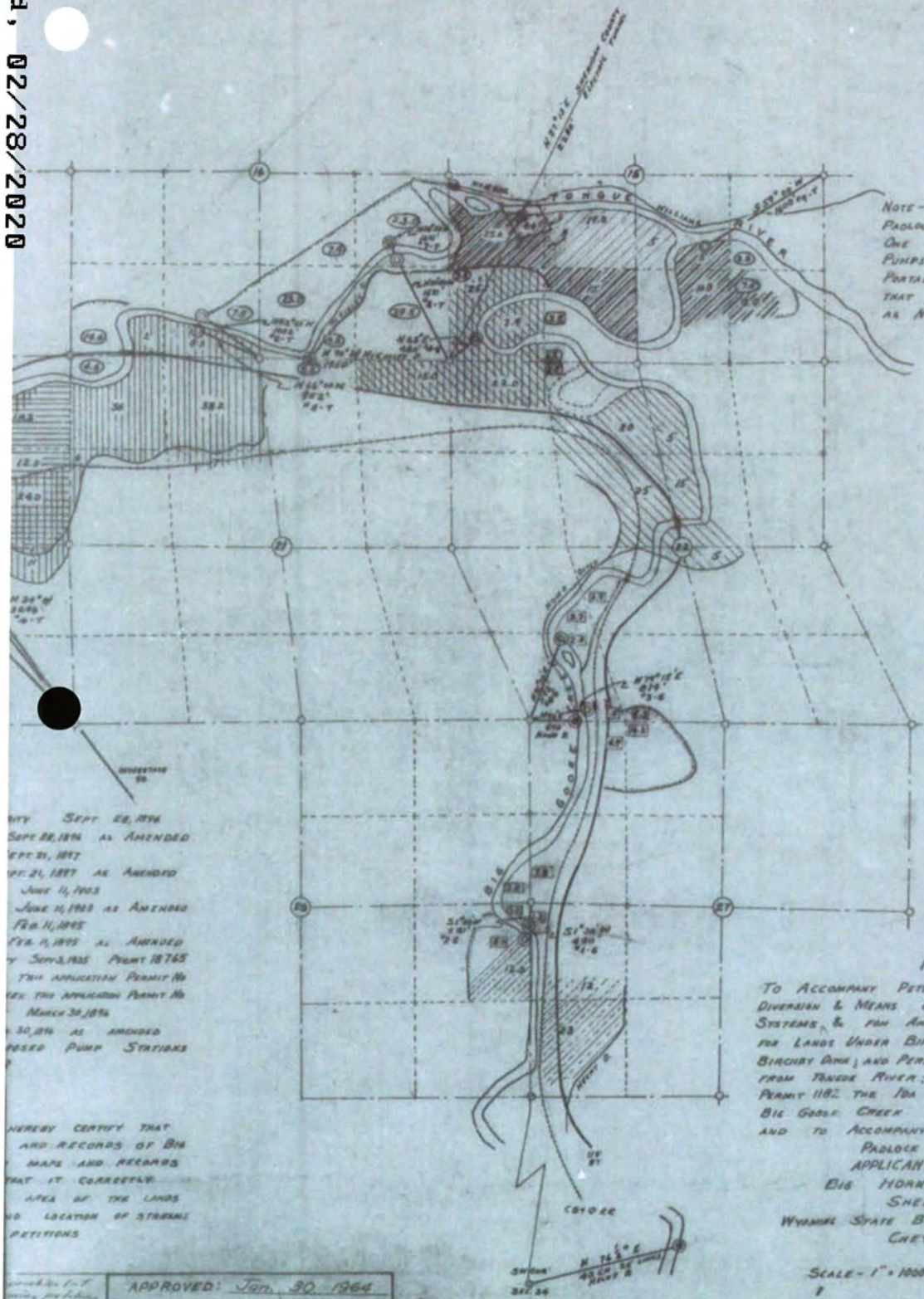

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BIRCHBY ENL 1073E

TEN 62/025
RECD NOV 14, 2014

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Wherefore I recommend that said appropriation be ~~—~~ allowed and that a certificate of appropriation be issued in accordance with said proof and the tabulation thereof filed herewith.

Dated Cheyenne Wyo 1st May, 1902

Frank N. Stratton

Superintendent of Water Division No. 2

PERMIT NO. 10736 E

Proof of Appropriation of Water.

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Laramie Area Division No. 2 District No. 5

1 Q. State your name.
A. Fred E. Jones Buckley

2 Q. Postoffice address.
A. Hecla Wyo.

3 Q. Are you the original applicant for Permit No. 10736 ?
A. Yes

4 Q. If not, state the date of your securing an interest therein and the nature of your interest in the works constructed under such permit.
A.

5 Q. When did the construction of the Buckley Extension ditch (or other distributing works described in said permit) begin?
A. Spring 1902

6 Q. When was it completed?
A. Spring 1902

7 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?
A. Top 4 Bottom 3½ Depth 2 Grade 4 ft

8 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision.

A. NW NE	Sec 20	T 15 N	R 74 W	1 Acre
NW SE	"	"	"	1 "
SE NE	"	"	"	1 "
NE SE	"	"	"	11 "
SW NW	Sec 21	"	"	6 "
SE NW	"	"	"	7 "
NW SW	"	"	"	36 "
NE SW	"	"	"	31.2 "
SW SW	Sec 16	"	"	2 "
SE SW	"	"	"	1.5 "

9 Q. Give the date when, under the terms of this permit, water was first beneficially used.
A. Spring 1903

PROOF OF APPROPRIATION
UNDER
PERMIT NO. 10736 E

Division No. 2 District No. 5

Date of Appropriation June 11 1902

PRIORITIES. STREAM.
GENERAL.

NAME OF STREAM.
Laramie River

TRIBUTARY OF

NAME OF CLAIMANT
Fred E. Jones Buckley

Filed with me this 7 day of May, 1902
Superintendent

Filed in this office this day of , 190
Secretary Board of Control.

The S. A. Briggs Co., Printers and Book Binders, Cheyenne

Dec. 1073 E and

TFN 6 2/025
RECD NOV 14, 2014

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Cert 4863

3-399

THE STATE OF WYOMING.

CERTIFICATE OF APPROPRIATION OF WATER.

WHEREAS, John & James Birchley has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Tongue River through the Birchley Ex Ditch under Permit No. 1093 Ex for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming, and for Irrigation

3 165

NOW KNOW YE, That the Board of Control, under the provisions of Division I, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 18th day of January, A. D. 1904, in Order Record No. 3, Page 164, determined and established the priority and amount of such appropriation as follows:

Name of Appropriator, John & James Birchley; Post-office Address, Dietz Wyoming.

General Priority Number on main stream and tributaries 1; Priority Number on Tongue River No 445

Amount of Appropriation, 1.60 cu. ft. per. sec.; Date of Appropriation June 1. 1903; Description of land to be irrigated, and for which this appropriation is determined and established 111 1/2

Being One (1) acre S1/4 N E1/4. One (1) acre N W1/4 S E1/4. One (1) acre S E1/4 N E1/4. Eleven (11) acres N E1/4 S E1/4. Section 20. & Six (6) acres S1/4 N W1/4. Seven (7) acres S E1/4 N S1/4. Thirty-Six (36) acres N W1/4 N W1/4. Thirty-Eight & 1/5 (38.2) acres N E1/4 N W1/4. Section 21. & Two (2) acres S1/4 S W1/4. Eight & 3/10 (8.3) acres S E1/4 S W1/4 Section 16 T. 57 N. R 84 W

Change in point of diversion and means of conveyance for part, O.R. 15, P. 424

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, Clarence T. Johnston, President of the State Board of Control, have hereunto set my hand this 15th day of June, A. D. 1904, and caused the seal of said Board to be hereunto affixed.

ATTEST: Henry L. Babcock Secretary. President.

RAMACO
Brook Mine
October 2014
Addendum D11-4-24
TFN 6 2/025
RECD NOV 14, 2014

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October 2014

RAMACO

10 Q. If for irrigation, give the location and acreage irrigated the first year and the location and acreage irrigated each subsequent year to the present.

A. Same lands described as Section 8 has been very short each subsequent year.

11 Q. What crops were grown on this land in 1902? Give estimated acreage of each crop.

A. Alfalfa 8 A. Grain 15 A. Gardens 10 A. Hay 5 A.

12 Q. During what months is water beneficially used?

A. April to October

13 Q. Give amount of your investment in the construction of ditch and laterals.

A. $350.00

14 Q. Give estimated cost per acre of preparing land for irrigation.

A. $5.00

15 Q. Does the map which accompanies this proof show correctly the location of diverting works and area of land where water is used?

A. Yes

THE STATE OF WYOMING, }
COUNTY OF Sheridan } ss.

I, John W. & James Buckley, being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 7 day of Sept A. D. 1903

John Buckley. James Buckley

Sheridan, Wyo., Sept 7, 1903

I HEREBY CERTIFY that the foregoing affidavit was read to the affiant in my presence before he signed his name thereto; that said affiant is to me personally known (or has been satisfactorily identified before me by), and that I verily believe him to be a credible person and the person he represents himself to be; and that this affidavit was subscribed and sworn to before me at Sheridan Wyo on this 7 day of Sept, 1903

Frank H. Stalle

Superintendent, Water Division No. 2

NOTE.—This proof is intended to be used only by parties making appropriations under permits issued in accordance with Section 916, Chapter 69, Title 41, Division One, Revised Statutes of Wyoming.

The map referred to in Paragraph 15 must show the entire work, in the case of individual ditches. In the case of larger works only one copy of the entire canal need be filed. Individual proof must, however, show ditch from point of diversion from main canal, and all laterals on land reclaimed. Where the duplicate map filed in the office of the State Engineer and returned to the applicant gives the necessary details and shows accurately the location of completed work, it may be filed.

The map which accompanies this proof must be on tracing linen, be accurately drawn on a scale of not less than two inches to the mile, and verified by the party making the measurements.

REPORT OF OFFICIAL EXAMINATION BY SUPERINTENDENT.

I HEREBY CERTIFY AND REPORT that pursuant to the notice of completion of appropriation, filed with the State Engineer, and in accordance with the rules and practice of the Board of Control, I appeared at Sheridan Wyo on the 7 day of Sept, 1903, and took and received the foregoing sworn proof of appropriation of water through the Buckley & Stevenson Ditch from Goose Creek under Permit No. 1935 by John W. & James Buckley, the owner thereof; that I made a personal examination of said ditch, and of the land irrigated thereunder and described in said permit; that I found said ditch had an average width of 4 feet, a depth of 2 and a grade of about 4 feet per mile. I found a sufficient number of laterals of a capacity to fully irrigate the land described herein, and found that of the land described in said permit the following acreage has been irrigated and reclaimed in each 40-acre tract, to-wit:

Same as described in Section 8

On this land the following crops were grown in 1903

Same as described in Section 7

I also certify that after due publication of notice of the time and place, said proof was opened for public inspection on the 17 day of October, 1903, at Sheridan Wyo in accordance with the provisions of said notice and the regulations of the Board of Control; that at said time

No persons

appeared filed contest or objection to said proof.

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-25

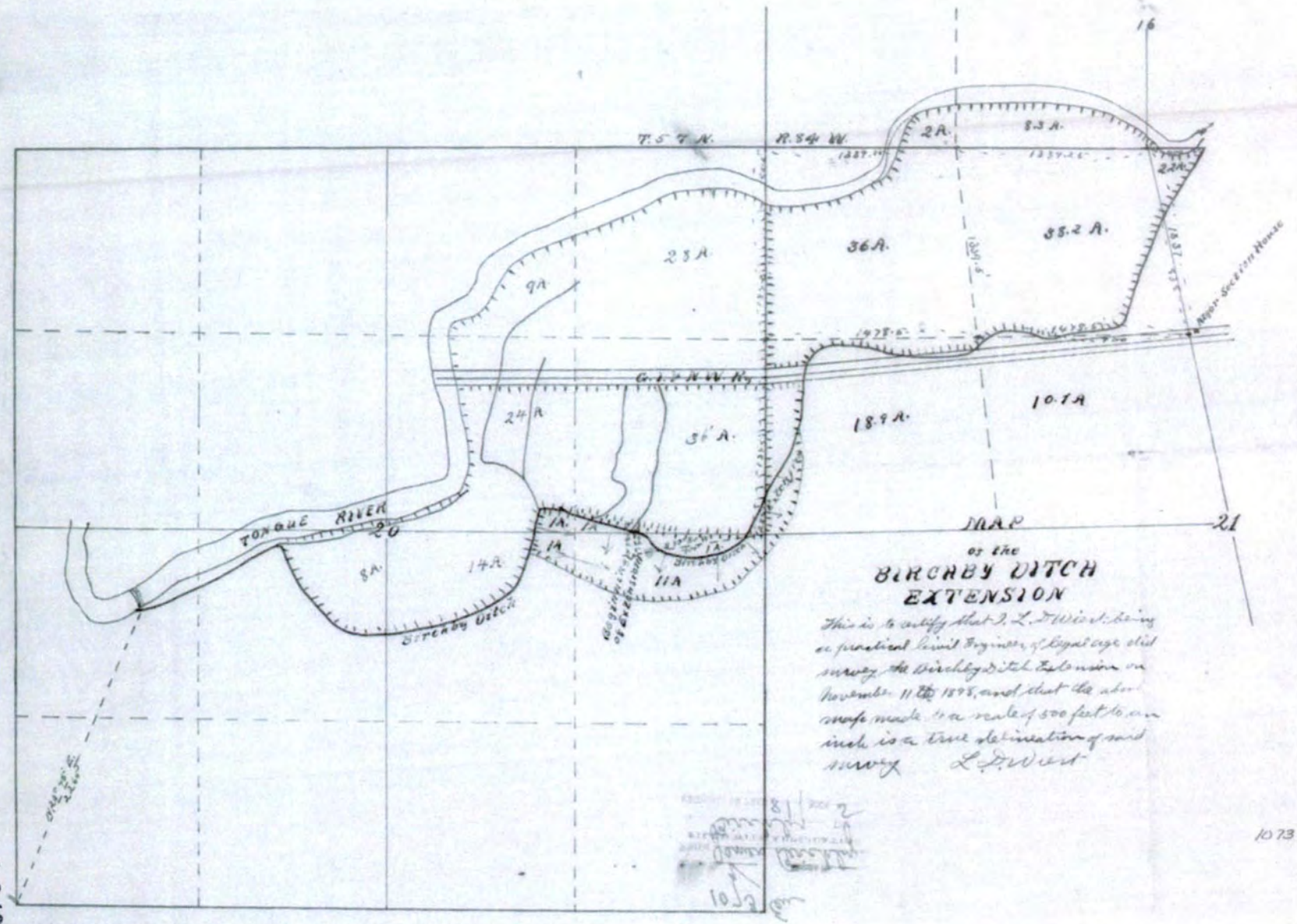
Brook Mine

DEQ Ex. 4-1142

02/28/2020

RAMACO

October 2014



Addendum D11-4-26

TFN 6 2/025
RECD NOV 14, 2014

THIS PRINT MAY NOT BE TRUE TO SCALE

Brook Mine

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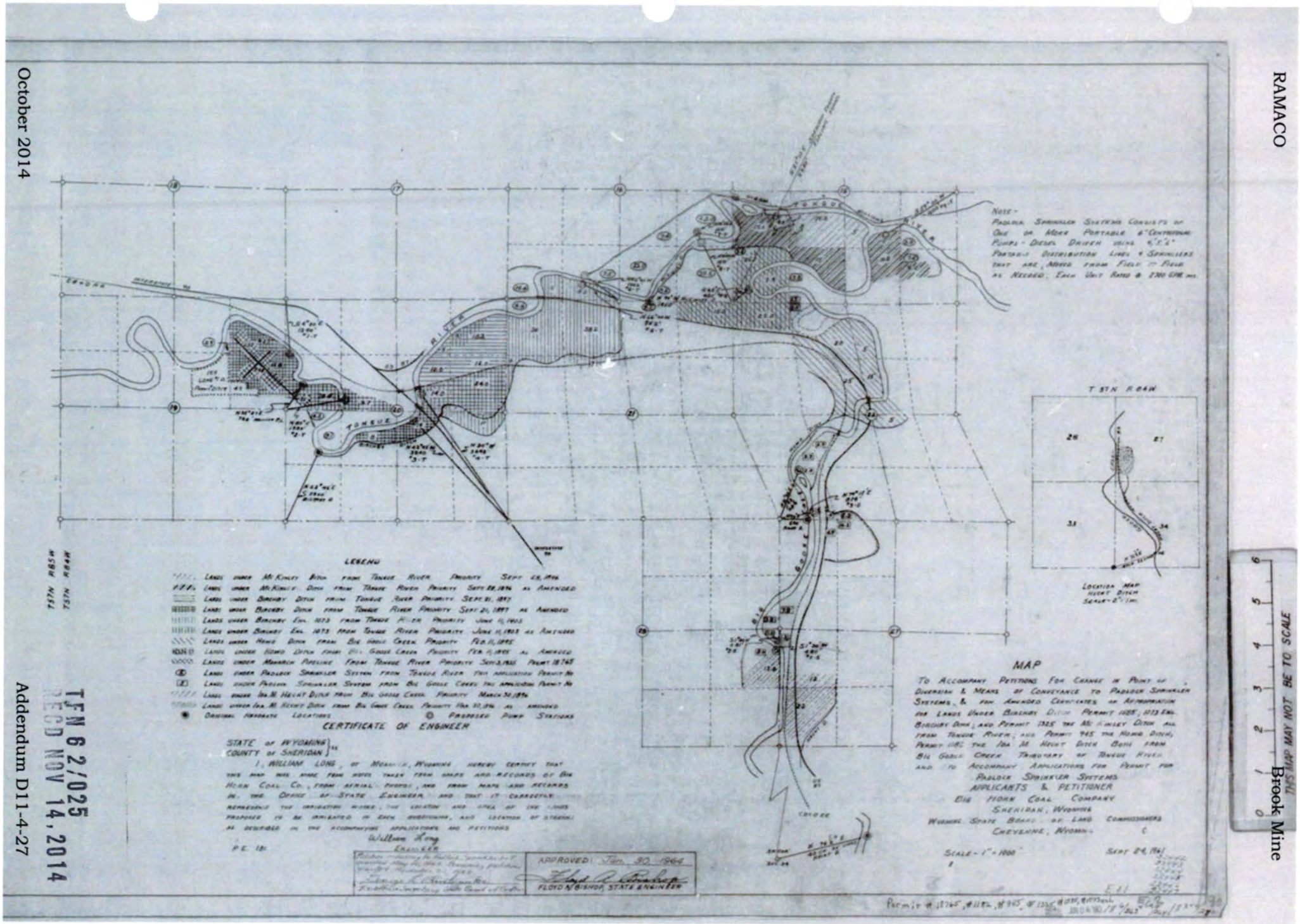
RAMACO

October 2014

Addendum D11-4-27

TFN 6 2/025
RECD NOV 14, 2014



Brook Mine

DEQ Ex. 4-1144

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BLEVINS PUMP 33816D

TFN 6 2/025
RECD NOV 14, 2014

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Form S.W. 1
Rev. Oct 2006

RAMCO $25.00
SE 35722
25.00
8/17/07
K Cameron

Note: Do not fold this form. Use typewriter or print neatly with black ink.

Brook Mine

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

03-17-2007 0932
SCANNED NOV 1 2007

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING, STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 17th day of August, A.D. 2007, at 9:32 o'clock A M.

Philip A. Vele
FOR John R. Barnes, Jr. State Engineer

Recorded in Book 153 of Ditch Permits, on Page 45

Fee Paid $ 25 . Map Filed SA

WATER DIVISION NO. 2 DISTRICT NO. 5 Temp. Filing No. 34 6/95

PERMIT NO. 33816
SA-30

NAME OF FACILITY: **Blevins Domestic Pump**

1. Name(s), mailing address and phone no. of applicant(s) is/are **Stephanie Blevins & Clinton Krumm**
1692 State Hwy. 345
Ranchester, WY 82839 **307-655-2541**
E-mail address:
(If more than one applicant, designate one to act as Agent for others)

2. Name & address of agent to receive correspondence and notices: **Same as above**
E-mail address:

3. (a) The use to which the water is to be applied is **Domestic (Lawn & Garden)**

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is **Tongue River, trib. Yellowstone River**

Latitude: **N 44°54'21.05"** Longitude: **W 107°4'21.74"**

5. The point of diversion of the proposed work is located ' feet distant from the corner of Section T. N., R. W., and is in the **NE1/4 NE1/4** of Section **23** T. **57** N., R. **85** W.

Lot Block Subdivision Name

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

No – all privately owned lands

TFN 6 2/025
RECD NOV 14, 2014

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is **0.056** cubic feet per second.

8. The accompanying map is prepared in accordance with the State Engineer's Manual of Regulations and Instructions for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is **existing**, and to complete the application of water to the beneficial uses stated in this application is **existing**

Scanned, 02/28/2020

10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Indicate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

			NE¼				NW¼				SW¼				SE¼				
Township	Range	Sec.	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	TOTALS
57	85	23	X																
			FOR DOMESTIC USE ONLY AT THE POINT OF USE DESCRIBED ABOVE NOT TO EXCEED 0.056 CFS															

Number of acres to receive original supply _____

Number of acres to receive supplemental supply _____

Total number of acres to be irrigated _____

REMARKS

Application is for domestic (lawn & garden) water use, via a small portable pump from the Tongue River.

Pump will be used during normal growing seasons.

The amount of the appropriation shall be limited to the amount of water used for domestic (lawn & garden) purposes only not to exceed the diversion rate of 0.056 cfs from the Tongue River.

Type of Pump: Electric

Horsepower: 1/2

Delivery Method: Water is pumped from Tongue River through garden hose to sprinklers.

TFN 6 2/025
RECD NOV 14, 2014

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete

Signature of Applicant or Agent

7-20-07
Date

Scanned, 02/28/2020

THE STATE OF WYOMING }
STATE ENGINEER'S OFFICE } ss.

TEMPORARY FILING NO. 34/6/95

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation for domestic supply shall be limited to the amount beneficially used for domestic purposes, diverted from Tongue River at a rate not to exceed 0.056 cubic-feet per second of water.

If in priority and in the event of a request for regulation, the applicant may be required to install a choke on the pump or a water flow reducing device in the pipeline which will provide for regulating the amount of water diverted to 0.056 cubic feet of water per second of time.

This permit is issued to make an existing facility a matter of record. The notice of completion of construction is hereby waived.

This permit is conditioned on the holder of this permit securing and/or providing free and unencumbered access to this facility site to allow State Engineer personnel to perform their duties as prescribed by Law. These duties include, but are not limited to, construction inspections and water administration.

This permit is granted subject to the terms of the Yellowstone River Compact.

TFN 6 2/025
RECD NOV 14, 2014

~~The time for completing the construction work shall terminate on December 31, 20____.~~

~~The time for completing the application of water to beneficial use shall terminate on December 31, 20____, and final proof of appropriation shall be made within 5 years thereafter.~~

Witness my hand this 25TH day of OCTOBER, A.D. 2007.

FOR PATRICK T. TYRRELL, State Engineer

Permit No. 33816

Page No. 45
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DEQ Ex. 4-1148

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PERMIT NO. 33816

SA-30

PERMIT STATUS

Priority Date August 17, 2007 Approval Date October 25, 2007

PROOF PREPARED
ADJUDICATION IN PROCESS
CERT. REC. 86, P. 187 PROOF NO. 39709
NRR. ___ STK. ___ DOM. X MISC. ___
AC. _____ C.F.S. 0.056

SCANNED DEC 2 2008

TFN 6 2/025
RECD NOV 14, 2014

NOTICE

This permit, does not constitute a complete water right. It is your authority to begin construction work.

All appropriations for irrigation are limited to 1 cubic foot per second of time for each 70 acres of land irrigated, except as provided in Section 41-4-320, Wyoming Statutes, 1977. Appropriations for other uses are limited to the amount of water beneficially used in accordance with the terms of the permit.

Notice of completion of work and of application of the water to the beneficial uses described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are required, requests for same must be in writing, stating why the additional time is required, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

To perfect your water right, your Water Division Superintendent, or his authorized representative, will contact you after you have submitted notice to the State Engineer stating that you have applied the water to the beneficial uses described in your permit. After execution of the proof, it will be considered by the State Board of Control, and, if found to be satisfactory, the Board will issue to you a Certificate of Appropriation which will constitute a completed water right.

The granting of a permit does not constitute the granting of right-of-way. If any right-of-way is necessary in connection with the applicatior ld be understood that this responsibility is not a

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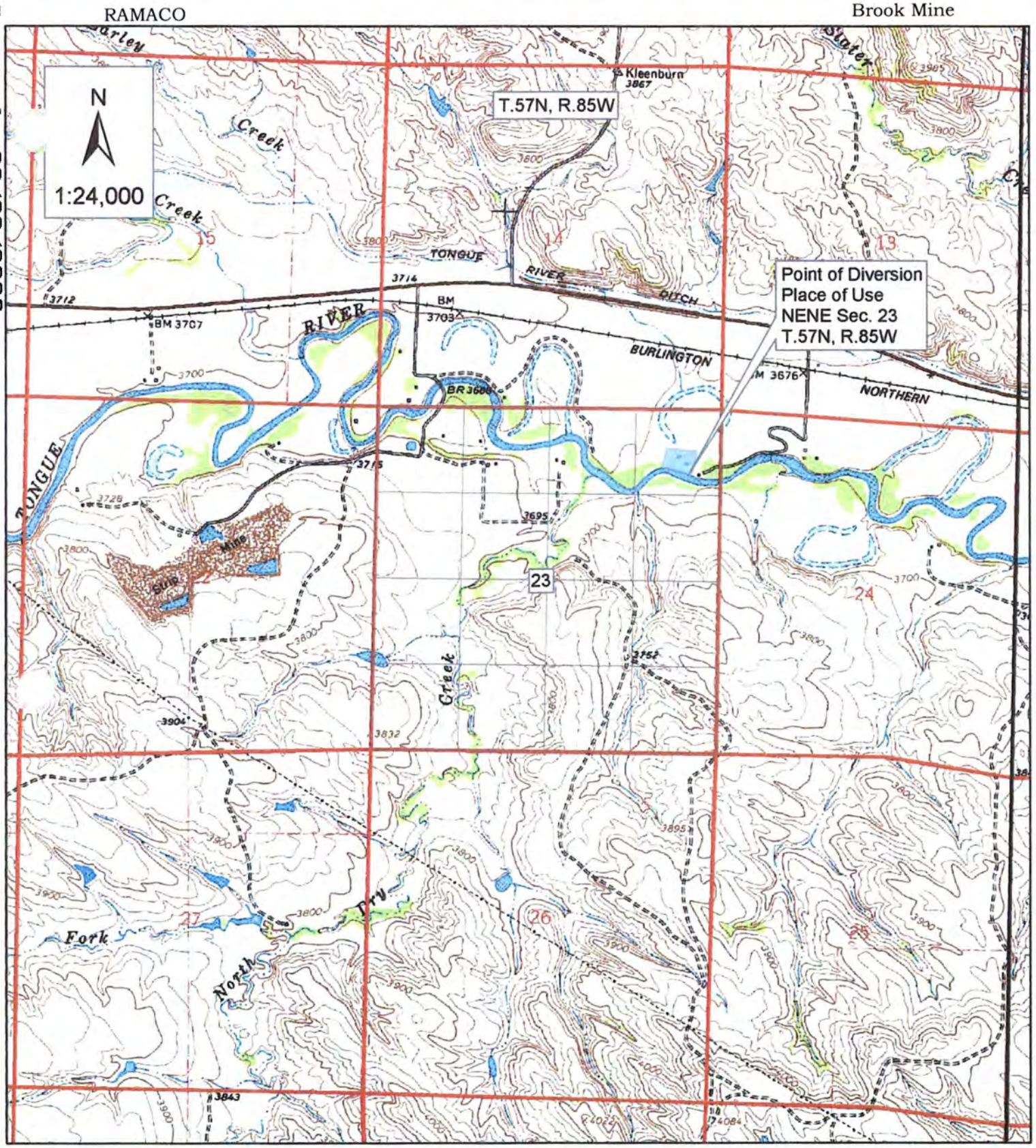

Legend

Stephanie Blevins & Clinton Krumm's Property

APPROVED: October 29, 2007

John E. Reeves FOR

Patrick T. Tyrrell — STATE ENGINEER

October 29, 2014

SCANNED NOV 1 2007

MAP TO ACCOMPANY APPLICATION FOR:

Blevins Domestic Pump

APPLICANTS:
Stephanie Blevins
Clinton Krumm
1692 State Hwy. 345
Ranchester, WY 82839

TFN 6 2/025
RECD NOV 14, 2014

DEQ Ex. 4-1150

338164 File SA-30

Addendum DH 4-33

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DR41299 WATERHAUL 34741D

TFN 6 2/025
RECD NOV 14, 2014

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RAMACO SEO 9727

SW1-1133

Form S.W.1
Rev. 12/22/2008

Brook Mine

07/18/12 02:16 PM

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

SCANNED AUG 08 2012

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING
STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 18th day of July, 20 12, at 02:16 o'clock P M.

John R. Barnes for State Engineer

Recorded in Book 159 of Ditch Permits, on Page 70

Fee Paid $ 50.00 Map Filed SA-33, 34741D

WATER DIVISION NO. 2 DISTRICT NO. 5 TEMPORARY FILING NO. 35 2/254D

PERMIT NO. 34741

NAME OF FACILITY DR41299 WATER HAUL

1. Name(s), mailing address and phone no. of applicant(s) is/are WYDOT, 5300 BISHOP BLVD, CHEYENNE, Wyoming, 82009, PH: 307-777-4748

E-mail address:

(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices MATT SIMPSON, 5300 BISHOP BLVD, CHEYENNE, Wyoming, 82009, PH: 307-777-4748

E-mail address: matt.simpson@wyo.gov

3. (a) The use to which the water is to be applied is Temporary (Road Construction)

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second

4. The source of the proposed appropriation is Tongue River, tributary of Yellowstone River, tributary of Missouri River

5. The point of diversion of the proposed works is located _____ feet distant from the _____ corner of Section _____ T. _____ ., R. _____ ., and is in the NW1/4SE1/4 of Section 20 T. 057N ., R. 084W Ori'sur.

Lot _____ Block _____ Subdivision Name _____

Latitude (Decimal Degrees) 44.90028 Longitude (Decimal Degrees) -107.02089

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned. State Hwy Right of Way

TFN 6 2/025
RECD NOV 14, 2014

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is 1 cubic feet per second (c.f.s.)

8. The accompanying map is prepared in accordance with the State Engineer's Rules and Regulations for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is Two Years, and to complete the application of water to the beneficial uses stated in this application is Two Years.

Permit No. 34741

Page No. 70 (Leave Blank)

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10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

Town-	Range	Sec	NE¼				NW¼				SW¼				SE¼				
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
UNKNOWN SURVEY			Temporary (Road Construction) at a rate not to exceed - c.f.s. Land Owner: State, Office of State Lands & Investments -																
057N	085W	17	A ALL																

Number of acres to receive original supply	0.00
Number of acres to receive supplemental supply	0.00
Total number of acres to be irrigated	0.00

REMARKS

NONE

THE AMOUNT OF APPROPRIATION SHALL BE LIMITED TO THE AMOUNT OF WATER USED FOR TEMPORARY INDUSTRIAL HIGHWAY CONSTRUCTION PURPOSES ONLY, NOT TO EXCEED THE DIVERSION RATE FROM THE TONGUE RIVER OF 450 GPM OR 1.0 CFS OR 300,000 GALLONS PER DAY OR A TOTAL OF 3,000,000 GALLONS IN TWO YEARS. THE WATER WILL BE PIPED AND/OR TRUCK HAULED TO THE POINTS OF USE FOR HIGHWAY CONSTRUCTION PURPOSES. PROJECT DR41299.

I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

MATT SIMPSON
Printed Name and Signature of Applicant or Agent

July 18, 2012
Date

TFN 6 2/025
RECD NOV 14, 2014

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THE STATE OF WYOMING }
STATE ENGINEER'S OFFICE } ss.

TEMPORARY FILING NO. 352/254

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation shall be limited to the amount used for temporary industrial (road construction) purposes only, not to exceed 1.0 cubic feet of water per second of time, 300,000 gallons per day, or a total of 3,000,000 gallons.

The appropriation granted under this permit shall extend for only the period of time required to complete the road construction proposed under DR41299 Water Haul and in no case will extend beyond 1 Sep 2014, the two year limit for temporary use permits, or upon completion of the DR41299 Water Haul, whichever comes first.

The notices of completion and beneficial use are waived and will not be required because of the temporary nature of this appropriation.

This permit is granted with the condition that the permittee must notify the District Water Commissioner prior to diverting water.

This permit is conditioned on the holder of this permit securing and/or providing free and unencumbered access to this facility site to allow State Engineer personnel to perform their duties as prescribed by Law. These duties include, but are not limited to, construction inspections and water administration.

NO WATER SHALL BE DIVERTED UNDER THIS PERMIT UNLESS THERE IS SURPLUS WATER IN THIS DRAINAGE SYSTEM. WATER MAY NOT BE AVAILABLE UNDER THIS PERMIT DURING THE SUMMER MONTHS AND IN SOME DRAINAGE SYSTEMS WATER MAY NOT BE AVAILABLE DURING THE FALL, WINTER AND EARLY SPRING DUE TO FILLING OF RESERVOIRS. DURING THESE TIME PERIODS IT MAY BE NECESSARY FOR YOU TO OBTAIN WATER FROM EXISTING APPROPRIATIONS BY WATER AGREEMENT FILED WITH AND APPROVED BY THE STATE ENGINEER.

This permit will be automatically cancelled on 1 Sep 2014.

No final proof of appropriation to be accepted under this permit.

~~The time for completing the construction work shall terminate on December 31, 20~~

~~The time for completing the application of water to beneficial use shall terminate on December 31, 20 and final proof of appropriation shall be made within 5 years thereafter.~~

Witness my hand this 3RD day of AUGUST A.D. 2012

PATRICK T. TYRRELL, State Engineer

Permit No. 34741

Page No. 70 (Leave Blank)

TFN 6 27025
RECD NOV 14, 2014

DEQ Ex. 4-1154

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PERMIT NO. 34741

PERMIT STATUS

Priority Date July 18, 2012 Approval Date August 3, 2012

TFN 6 2/025
RECD NOV 14, 2014

NOTICE

This permit, does not constitute a complete water right. It is your authority to begin construction work, which must be commenced within the time allowed in the permit.

Notice of completion of the work described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are required, requests for same must be in writing, stating why the additional time is required, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

Once the Notice of Completion has been filed, Proof of Appropriation will be prepared and sent to your Water Division Superintendent. The Superintendent will arrange with you for an inspection of the facility. Should you desire adjudication, the Proof will be considered by the Board of Control, and, if found to be satisfactory, the Board will issue to you a Certificate of Construction which will constitute a completed water right.

The granting of a permit does not constitute the granting of right-of-way. If any right-of-way is necessary in connection with the application it should be understood that this responsibility is the applicant's

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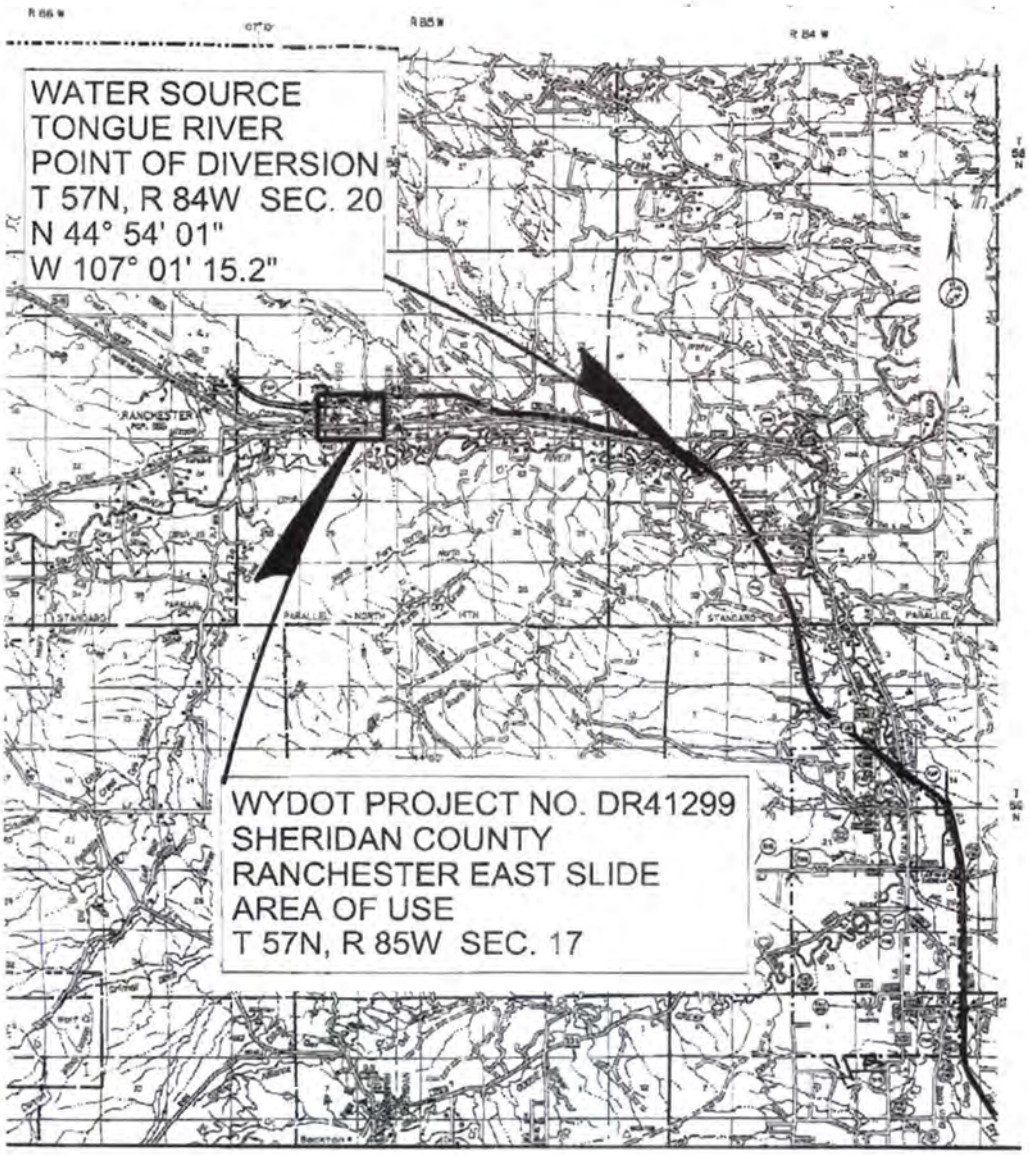

THE AMOUNT OF APPROPRIATION SHALL BE LIMITED TO THE AMOUNT OF WATER USED FOR TEMPORARY INDUSTRIAL HIGHWAY CONSTRUCTION PURPOSES ONLY, NOT TO EXCEED THE DIVERSION RATE FROM THE TONGUE RIVER OF 450 GPM OR 1 CFS OR 300,000 GALLONS PER DAY OR A TOTAL OF 3,000,000 GALLONS IN TWO YEARS. THE WATER WILL BE PIPED AND/OR TRUCK HAULED TO THE POINTS OF USE FOR CONSTRUCTION PURPOSES.

APPROVED: August 3, 2017

STATE ENGINEER

Patricia T. Tyrrell

MAP TO ACCOMPANY APPLICATION FOR
DR41299 WATER HAUL

APPLICANT: WYOMING DEPARTMENT OF TRANSPORTATION
5300 BISHOP BLVD.
CHEYENNE, WY 82009

TFN 6 2/025
RECD NOV 14, 2017

TF 35 21254

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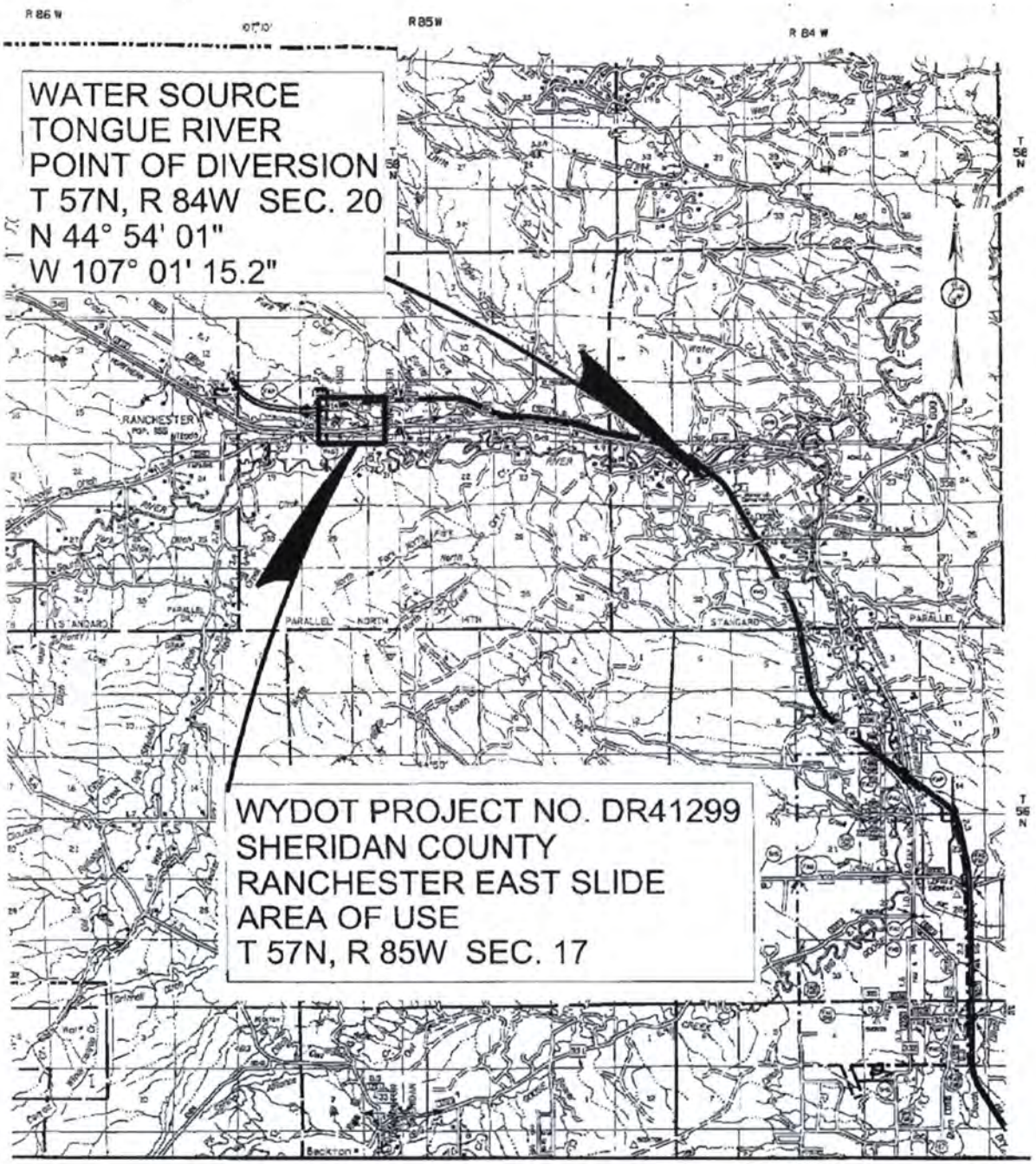

THE AMOUNT OF APPROPRIATION SHALL BE LIMITED TO THE AMOUNT OF WATER USED FOR TEMPORARY INDUSTRIAL HIGHWAY CONSTRUCTION PURPOSES ONLY, NOT TO EXCEED THE DIVERSION RATE FROM THE TONGUE RIVER OF 450 GPM OR 1 CFS OR 300,000 GALLONS PER DAY OR A TOTAL OF 3,000,000 GALLONS IN TWO YEARS. THE WATER WILL BE PIPED AND/OR TRUCK HAULED TO THE POINTS OF USE FOR CONSTRUCTION PURPOSES.

APPROVED: _____

STATE ENGINEER

MAP TO ACCOMPANY APPLICATION FOR
DR41299 WATER HAUL

APPLICANT: WYOMING DEPARTMENT OF TRANSPORTATION
5300 BISHOP BLVD.
CHEYENNE, WY 82009

TFN 6 2/025
RECD NOV 14, 2014

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EARLEY CREEK 1 3456D

TFN 6 2/025
RECD NOV 14, 2014

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DIVISION No. 2 PERMIT No. 3456 DISTRICT No.

PROOF OF APPROPRIATION OF WATER

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Eagle Creek Tributary Tongue River

1 Q. State your name. A. Luella Morrow

2 Q. Postoffice address. A. Sheridan Wyo

3 Q. Are you the original applicant for Permit No. 3456 ? A. Yes

4 Q. If not, state the date of your securing an interest therein, and the nature of your interest in the works constructed under such permit.

A.

5 Q. For what purpose is water used? A. Irrigation

6 Q. When did the construction of the Eagle Ditch No 1

ditch (or other distributing works described in said permit) begin? A. 1901

7 Q. When was it completed? A. 1902

8 Q. Give date when water was first beneficially used. A. 1902

9 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?

A. Width on top 5' Width on bottom 4' Depth 1' Grade 8"

10 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision, prior to the time of the expiration of your permit.

A.

NW SW	Sec 10	T 57 R 85	22 Acres
E½ SW	"	"	12 "
NW NW	Sec 15	"	5 "
N½ NW	"	"	20 "
NW NE	"	"	30 "
			89

11 Q. Has the water been used beneficially and land irrigated each year since the expiration of your permit?

A. Yes

12 Q. What crops were grown on this land in 1905 ? Give estimated acreage of each crop.

A. Grass & Hay

13 Q. During what months is water beneficially used?

A. March to November

14 Q. Give amount of your investment in the construction of ditch and laterals. A. $250.00

15 Q. Give estimated cost per acre of preparing land for irrigation. A. $5.00

16 Q. Does the map filed with this permit show correctly the location of diverting works and area of land where water is used? A. Yes

THE STATE OF WYOMING, }
COUNTY OF Sheridan } ss.

I, Luella Morrow by J. Morrow, being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 12 day of February, A. D. 1906

Luella Morrow by J. Morrow

Subscribed and sworn to before me this 12 day of January, 1906

Frank A. Stutts

Superintendent, Water Division No. 2

TFN 6 2/025
RECD NOV 14, 2014

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REPORT OF SUPERINTENDENT

I hereby certify and report that I have made an investigation of the works constructed under Permit No. [illegible], described in foregoing proof. I found same to be as stated in proof, except

I also certify that this proof has been opened for public inspection in accordance with regulations, and

I recommend that said proof be accepted and that certificate of appropriation be issued in accordance with said proof and the tabulation filed.

Frank A. Emerson
Supt. Water Division No. 2

Cheyenne, Wyoming, March 1 1920

DITCH

PROOF OF APPROPRIATION

UNDER PERMIT No. 3[illegible]

Division No. 2 District No.

DATE OF PRIORITY [illegible]

NAME OF STREAM Crooked Creek

TRIBUTARY OF Sweetwater River

DITCH No. 1 Crooked Creek

NAME OF CLAIMANT Rawlins Mercantile Co.

Filed with me this 12 day of March, 1920

Superintendent.

Filed in this office this ____ day of ____, 1920

Secretary Board of Control.

Fees paid, $ 1.00

The S. A. Bristol Co., Printers and Binders, Cheyenne

6501

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

October 2014

RAMACO

6501

THE STATE OF WYOMING.

CERTIFICATE OF APPROPRIATION OF WATER. CERTIFICATE RECORD No. 17 PAGE 87

WHEREAS, Luella Morrow has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Earley Creek tributary of Tongue River through the Earley Creek No 1 Ditch under Permit No. 3456 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming, and for irrigation

NOW KNOW YE, That the Board of Control, under the provisions of Division 1, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 4th day of April, A. D. 1906 in Order Record No. 3, Page 387, determined and established the priority and amount of such appropriation as follows:

Name of Appropriator Luella Morrow; Postoffice Address Sheridan, Wyoming; General Priority Number on main stream ; Priority Number on Amount of Appropriation 1.27 cu. ft. per sec.; Date of Appropriation October 7-1901; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Eighty-nine (89) acres.

22	acres	S½ SW¼	of Section	10,	T. 57 N., R. 85 W.
12	"	SE¼ SW¼	"	"	" " " "
5	"	N½ NW¼	"	15	" " " "
20	"	NE¼ NW¼	"	"	" " " "
30	"	NW¼ NE¼	"	"	" " " "
89	"	Total acreage			

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, CLARENCE T. JOHNSTON, President of the State Board of Control, have hereunto set my hand this 8th day of June, A. D. 1906, and caused the seal of said Board to be hereunto affixed.

ATTEST: Robert P. Quest, Secretary. Clarence T. Johnston President.

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-44

Brook Mine

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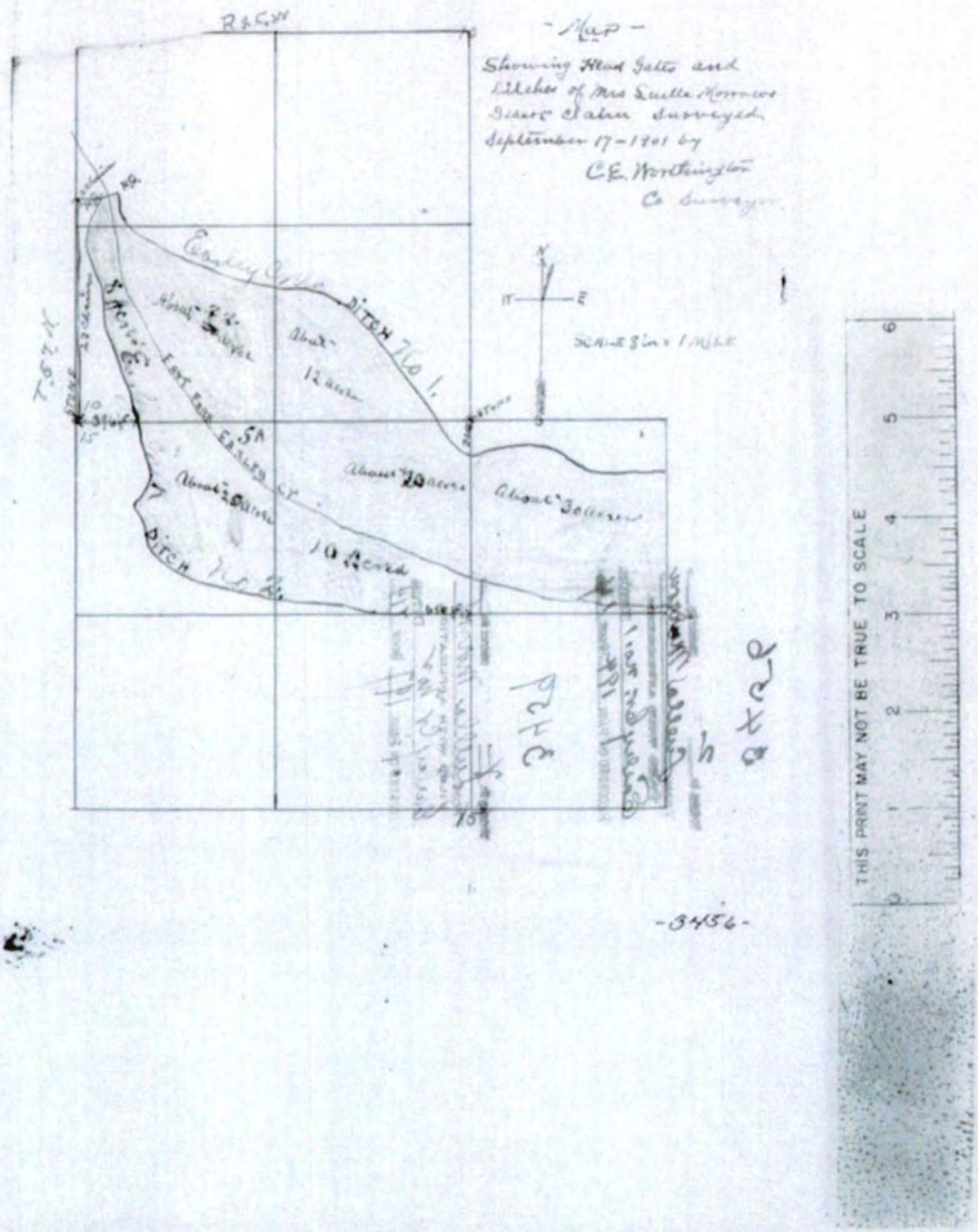

TFN 6 2/025
RECD NOV 14, 2014

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EARLEY CREEK 2 3459D

TFN 6 2/025
RECD NOV 14, 2014

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DIVISION No. 2 PERMIT No. 3459 DISTRICT No.

PROOF OF APPROPRIATION OF WATER

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Early Ditch Tributary Tongue River

1 Q. State your name. A. Lulla Morrow

2 Q. Postoffice address. A. Sheridan Wyo

3 Q. Are you the original applicant for Permit No. 3459 ? A. Yes

4 Q. If not, state the date of your securing an interest therein, and the nature of your interest in the works constructed under such permit.

A.

5 Q. For what purpose is water used? A. Irrigation

6 Q. When did the construction of the Early Ditch No 2

ditch (or other distributing works described in said permit) begin? A. 1901

7 Q. When was it completed? A. 1902

8 Q. Give date when water was first beneficially used. A. 1902

9 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?

A. Width on top 5' Width on bottom 4' Depth 1' Grade 8'

10 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision, prior to the time of the expiration of your permit.

A.

NW NW	Sec 10	Tp 57	R 85	8 Acres
NW NE	Sec 15	"	"	20 "
NE NW	"	"	"	10 "
				38 "

11 Q. Has the water been used beneficially and land irrigated each year since the expiration of your permit?

A. Yes

12 Q. What crops were grown on this land in 1925 ? Give estimated acreage of each crop.

A. Grass & Hay

13 Q. During what months is water beneficially used?

A. March to November

14 Q. Give amount of your investment in the construction of ditch and laterals. A. $150

15 Q. Give estimated cost per acre of preparing land for irrigation. A. $5.12

16 Q. Does the map filed with this permit show correctly the location of diverting works and area of land where water is used? A. Yes

THE STATE OF WYOMING, }
COUNTY OF Sheridan } ss.

I, Lulla Morrow by E J Morrow, being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 12 day of February, A. D. 1926

Lulla Morrow by E J Morrow

Subscribed and sworn to before me this 12 day of February, 1926

Frank V Watts

Superintendent, Water Division No. 2

TFN 6 2/025
RECD NOV 14, 2014

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REPORT OF SUPERINTENDENT

I hereby certify and report that I have made an investigation of the works constructed under Permit No. [illegible], described in foregoing proof. I found same to be as stated in proof, except

I also certify that this proof has been opened for public inspection in accordance with regulations, and

I recommend that said proof be accepted and that certificate of appropriation be issued in accordance with said proof and the tabulation filed.

Frank K Smith

Supt. Water Division No. 2

Cheyenne Wyoming, Mch. 14 19 16

DITCH

PROOF OF APPROPRIATION

UNDER

PERMIT No. 3457

Division No. 2 District No.

DATE OF PRIORITY Sept 27 1909

NAME OF STREAM Crow Creek

TRIBUTARY OF Crow Creek

DITCH Crow Creek No 2

NAME OF CLAIMANT Frederick Mercer

Filed with me this 12 day of Mch, 19 16

Frank K Smith *Superintendent.*

Filed in this office this day of , 19

Secretary Board of Control.

Fees paid, $ 1.50

The S. A. Bristol Co., Printers and Binders, Cheyenne

6502

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

6502-

THE STATE OF WYOMING.

CERTIFICATE OF APPROPRIATION OF WATER. CERTIFICATE RECORD NO. 17 PAGE 85

WHEREAS, Luella Morrow has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Barley Creek tributary of Tongue River through the Barley Creek No. 2 Ditch under Permit No. 3459 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming, and for irrigation

NOW KNOW YE, That the Board of Control, under the provisions of Division 1, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 4th day of April, A. D. 1902, in Order Record No. 3, Page 387, determined and established the priority and amount of such appropriation as follows:

Name of Appropriator Luella Morrow; Postoffice Address Sheridan, Wyoming; General Priority Number on main stream ; Priority Number on

Amount of Appropriation .5 cu. ft. per sec.; Date of Appropriation September 27-1901; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Thirty-eight (38) acres

8 acres S½ S½ of Section 10, Tp. 57 N. R. 85 W.
20 " N½ N½ " " 15 " " " " "
10 " NE¼ NW¼ " " " " " " "
38 " Total acreage

TFN 6 2/025
RECD NOV 14, 2014

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, CLARENCE T. JOHNSTON, President of the State Board of Control, have hereunto set my hand this 4th day of June, A. D. 1902, and caused the seal of said Board to be hereunto affixed.

ATTEST: Robert P. Quest. Secretary. Clarence T. Johnston President.

October 2014
Addendum D11-4-49
RAMACO
Brook Mine

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EAST SIDE DITCH2 4077D

TFN 6 2/025
RECD NOV 14, 2014

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DIVISION No. 2 PERMIT No. 4077 DISTRICT No.

PROOF OF APPROPRIATION OF WATER

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From State Creek Tributary Tongue River

1 Q. State your name. A. A & E Williams

2 Q. Postoffice address. A. Monarch Wyo

3 Q. Are you the original applicant for Permit No. 4077? A. Yes

4 Q. If not, state the date of your securing an interest therein, and the nature of your interest in the works constructed under such permit.

A. Purchased entire Interest A & E Williams

5 Q. For what purpose is water used? A. Irrigation

6 Q. When did the construction of the East Side Ditch ditch (or other distributing works described in said permit) begin? A. 1902

7 Q. When was it completed? A. 1902

8 Q. Give date when water was first beneficially used. A. 1902

9 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?

A. Width on top 3' Width on bottom 2' Depth 1' Grade 10'

10 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision, prior to the time of the expiration of your permit.

A. NW NE Sec 3 Tp 5 S R 85 W 40 acres

11 Q. Has the water been used beneficially and land irrigated each year since the expiration of your permit?

A. Yes

12 Q. What crops were grown on this land in 1906? Give estimated acreage of each crop.

A. Some wild Hay

13 Q. During what months is water beneficially used?

A. March to Nov

14 Q. Give amount of your investment in the construction of ditch and laterals. A. $ 10.

15 Q. Give estimated cost per acre of preparing land for irrigation. A. $5

16 Q. Does the map filed with this permit show correctly the location of diverting works and area of land where water is used? A. Yes

THE STATE OF WYOMING, }
COUNTY OF Sheridan } ss.

I, A & E Williams & E J Meredith, being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

In Witness Whereof, I have hereunto set my hand this 6 day of Feb, A. D. 1907

A & E Williams

E J Meredith

Subscribed and sworn to before me this 6 day of Feb, 1907

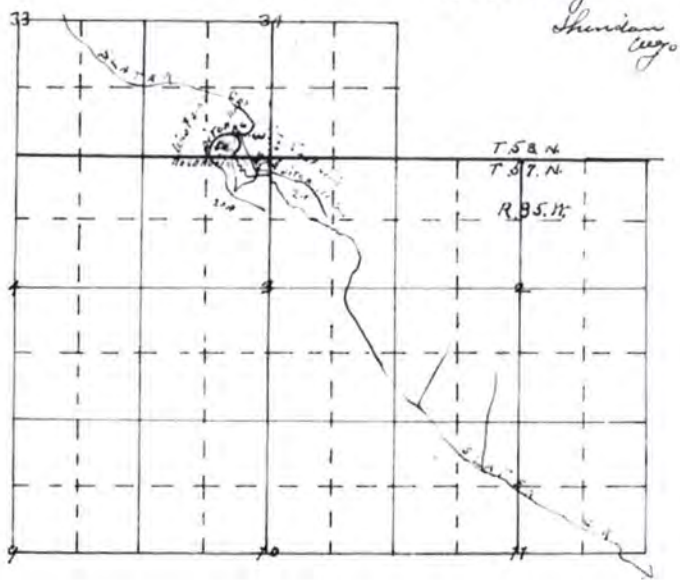
Superintendent, Water Division No. 2

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

Map Showing
Desert filing any & the
of Elias A. Hare Sheridan Co Wyo
July 26 - 1902

I hereby Certify that I am a Practical
Surveyor that on July 26th 1902 I Surveyed
the lieths any located the Headgates
any that this Map Correctly represents
the same
C. E. Northington
Sheridan
Wyo.



Scale 1" = 2000'

THIS PRNT MAY NOT BE TRUE TO SCALE
0 1 2 3 4 5 6

4077
4078

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RECD NOV 14, 2014

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7-26.

THE STATE OF WYOMING

CERTIFICATE OF APPROPRIATION OF WATER CERTIFICATE RECORD No. 25 PAGE 130

WHEREAS, J. D. Williams has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek tributary of Tongue River through the East Side No. 2 Ditch under Permit No. 4017 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming, and for irrigation

NOW KNOW YE, That the Board of Control, under the provisions of Division 1, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 12th day of June, A. D. 1907, in Order Record No. 4 Page 13, determined and established the priority and amount of such appppropriation as follows:

Name of Appropriator J. D. Williams; Postoffice Address Monarch, Wyoming;
General Priority Number on main stream ; Priority Number on
Amount of Appropriation 1 cu. ft. per sec.; Date of Appropriation July 21- 1902; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Seven (7) acres.

7 acres NW¼ NE¼ Section 3, To. 57 N. R. 85 W.

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, CLARENCE T. JOHNSTON, President of the State Board of Control, have hereunto set my hand this 6th day of August, A. D. 1907, and caused the seal of said Board to be hereunto affixed.

ATTEST: Martha Kalis, Secretary. C. T. Johnston, President.

October 2014
RAMACO
Brook Mine
Addendum D11-4-53
TFN 6 2/025
RECD NOV 14, 2014
DEQ Ex. 4-1170

Scanned, 02/28/2020

HART BROS DITCHES 1317D

TFN 6 2/025
RECD NOV 14, 2014

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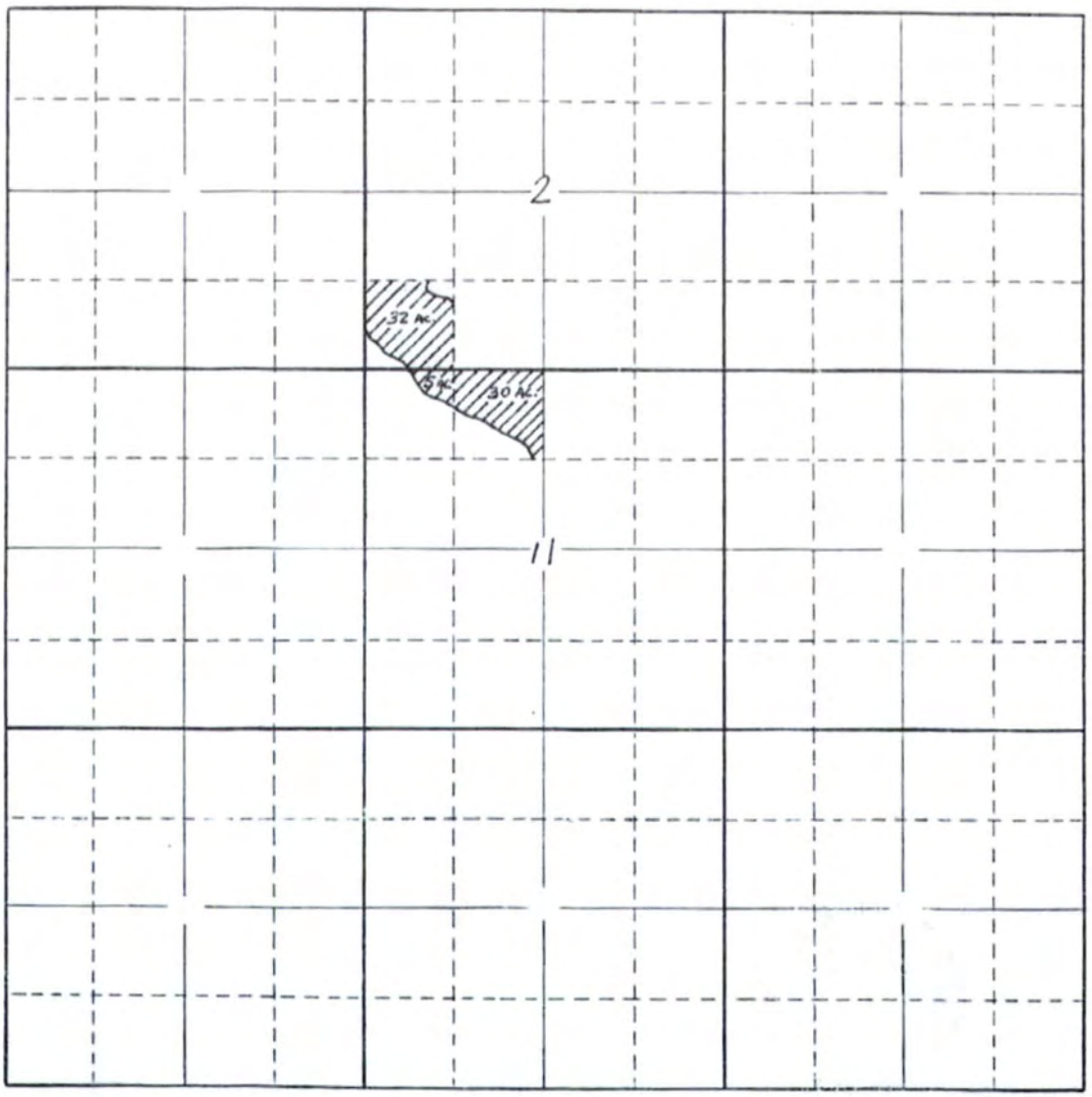
MICRO FILMED OCT 10 '91

T. 57 N., R. 85 W.

Scale 1" = 2000'



TFN 6 2/025
RECD NOV 14, 2014

MISCELLANEOUS NOTICES
PERMIT NO. 1317 MICRO FILMED OCT 10 '91

State Engineer
Cheyenne, Wyoming

Dear Sir:

The requirements of a portion of Permit No. 1317,
name of facility, Hart Brothers Ditches,
recorded in the name of Hart Brothers,
and as issued by your office, have not been complied with on lands described below. Final proof for the beneficial use of water will not be submitted. You are, therefore, authorized and requested to eliminate the following described subdivisions from Permit No. 1317 upon the records of your office:

Township 57 North, Range 85 West	
Section 2: SW1/4 SW1/4	32 acres
Section 11: NE1/4 NW1/4	30 acres
NW1/4 NW1/4	5 acres
Total:	67 acres

This form must be signed by the owner(s) of the above lands and must be accompanied by a Certificate of Ownership.

Date October 20 1989 Signed Dan S. Scott
DAN S. SCOTT, VICE PRESIDENT
Dulphenia Loner
SECRETARY, PADLOCK RANCH CO.

CORPORATE SEAL

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

HOWD 945D

TFN 6 2/025
RECD NOV 14, 2014

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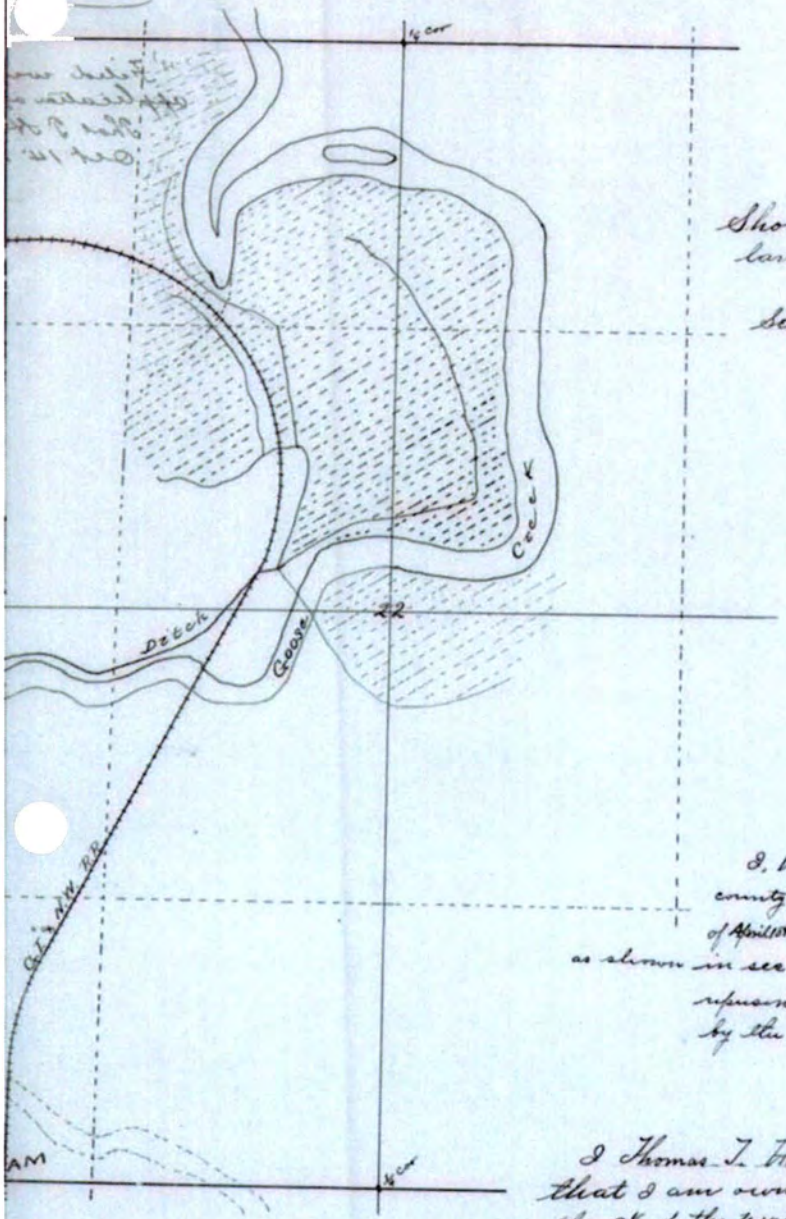

Plat
Showing location of Dam, ditch lines and land watered by Thomas T. Howd.
in
Section 22, T 57 N, R 84 W. 6th PM
Sheridan County
Wyoming.

Scale - 1 inch = 400 feet.

Red lines are for ditches.
Red dotted sections indicates land watered
Land watered = 75 acres.
Length of main ditch = 5 miles
Grade " " " = 2 feet per mile
Width on bottom 3 feet.
Capacity of ditch - 2 cubic feet per second
Height of Dam = 4½ feet.

I, W. A. Swan, a practical surveyor in and for said county and state, do hereby certify that on the 6th day of April 1916 surveyed and located the dams and ditch lines as shown in sec 22 - T 57 N - R 84 W. and that this plat correctly represents the location of dam - ditches, and land watered by the Howd Ditch as shown on plat.

W. A. Swan.
Surveyor.

I Thomas T. Howd, hereby certify that I am owner and proprietor of the E½ of the N.W.¼, the S.W.¼ of the N.E.¼ and the N.W.¼ of the S.E.¼ all of sec 22 T 57 N. R 84 W. and that the dam and ditches have been constructed for the purpose of watering the land designated on plat.

Thomas T. Howd.

945

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TFN 6 2/025
RECD NOV 14, 2014

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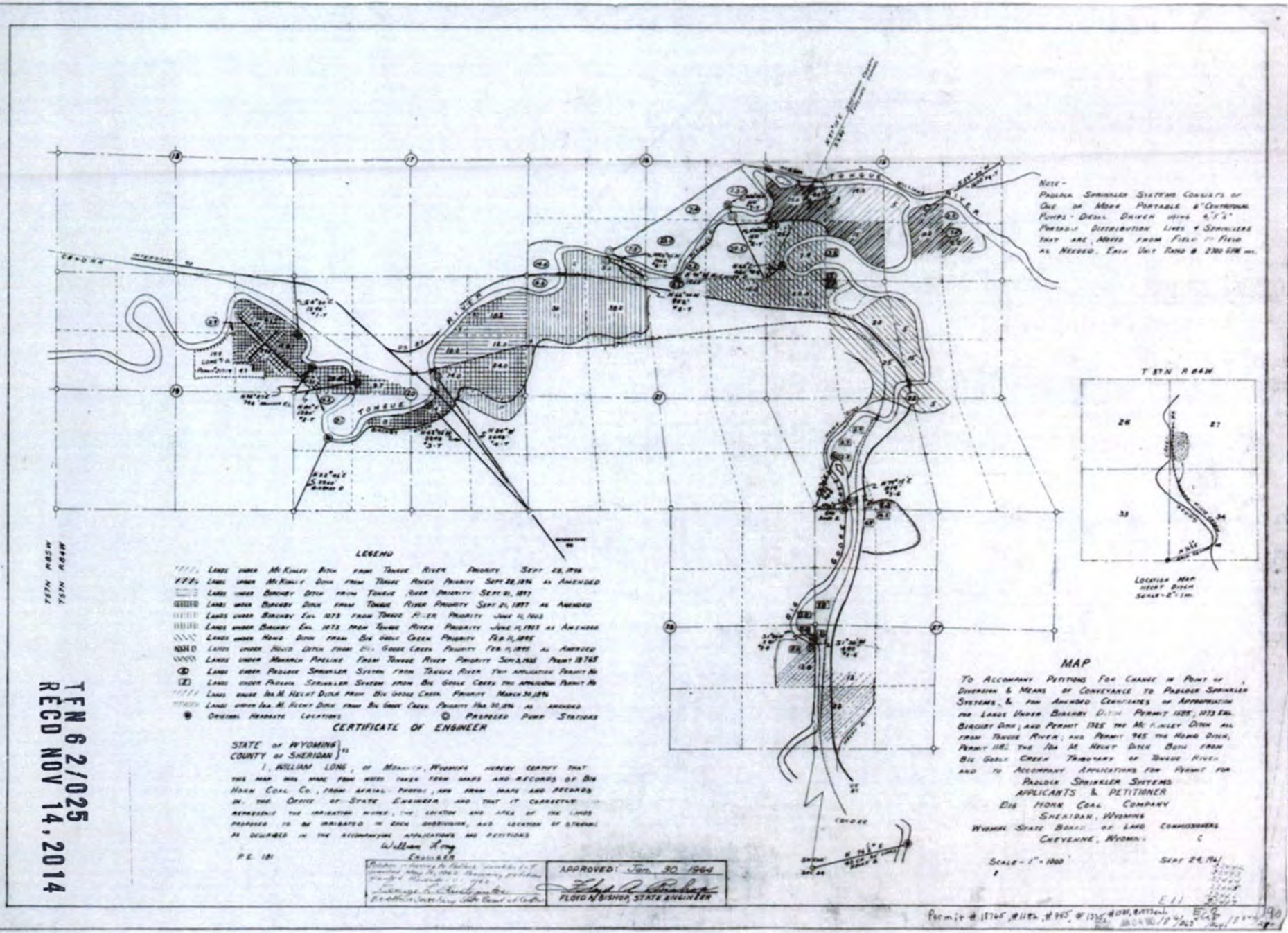

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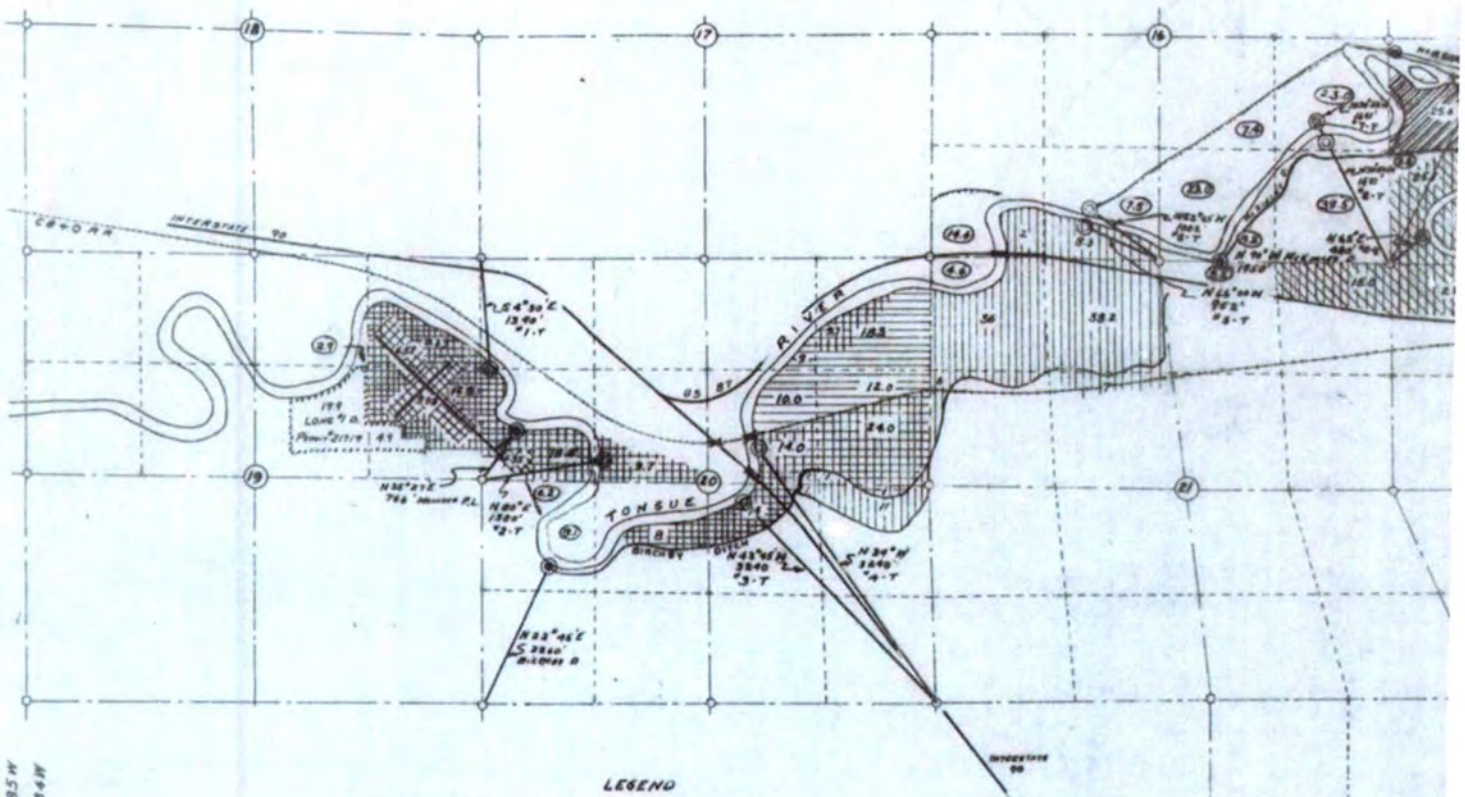

LEGEND

- ////, LANDS UNDER MC KINLEY DITCH FROM TONGUE RIVER PRIORITY SEPT 28, 1896
- V V V, LANDS UNDER MC KINLEY DITCH FROM TONGUE RIVER PRIORITY SEPT 28, 1896 AS AMENDED
- LANDS UNDER BIRCHBY DITCH FROM TONGUE RIVER PRIORITY SEPT 21, 1897
- LANDS UNDER BIRCHBY DITCH FROM TONGUE RIVER PRIORITY SEPT 21, 1897 AS AMENDED
- LANDS UNDER BIRCHBY ENL. 1973 FROM TONGUE RIVER PRIORITY JUNE 11, 1903
- LANDS UNDER BIRCHBY ENL. 1973 FROM TONGUE RIVER PRIORITY JUNE 11, 1903 AS AMENDED
- LANDS UNDER HOWD DITCH FROM BIG GOOSE CREEK PRIORITY FEB. 11, 1895
- LANDS UNDER HOWD DITCH FROM BIG GOOSE CREEK PRIORITY FEB. 11, 1895 AS AMENDED
- LANDS UNDER MONARCH PIPELINE FROM TONGUE RIVER PRIORITY SEPT 3, 1935 PERMIT 18765
- LANDS UNDER PROLOCK SPRINKLER SYSTEM FROM TONGUE RIVER THIS APPLICATION PERMIT NO
- LANDS UNDER PROLOCK SPRINKLER SYSTEM FROM BIG GOOSE CREEK THIS APPLICATION PERMIT NO
- LANDS UNDER IDA M. HECHT DITCH FROM BIG GOOSE CREEK PRIORITY MARCH 30, 1896
- LANDS UNDER IDA M. HECHT DITCH FROM BIG GOOSE CREEK PRIORITY MAR. 30, 1896 AS AMENDED
- ORIGINAL HEADGATE LOCATIONS
- PROPOSED PUMP STATIONS

CERTIFICATE OF ENGINEER

STATE OF WYOMING } ss
COUNTY OF SHERIDAN }

I, WILLIAM LONG, OF MONARCH, WYOMING HEREBY CERTIFY THAT THIS MAP WAS MADE FROM NOTES TAKEN FROM MAPS AND RECORDS OF BIG HORN COAL CO., FROM AERIAL PHOTOS, AND FROM MAPS AND RECORDS IN THE OFFICE OF STATE ENGINEER AND THAT IT CORRECTLY REPRESENTS THE IRRIGATION WORKS, THE LOCATION AND AREA OF THE LANDS PROPOSED TO BE IRRIGATED IN EACH SUBDIVISION, AND LOCATION OF STREAMS AS DESCRIBED IN THE ACCOMPANYING APPLICATIONS AND PETITIONS.

William Long
ENGINEER

P.E. 181

Petition relating to Pollock Sprinkler I-T granted May 16, 1962. Remaining petition granted November 21, 1962.
George E. Christopulos
Ex-Officio Secretary State Board of Control

APPROVED: Jan. 30 1964
Floyd A. Bishop
FLOYD A. BISHOP, STATE ENGINEER

TFN 6 2/025
RECD NOV 14, 2014

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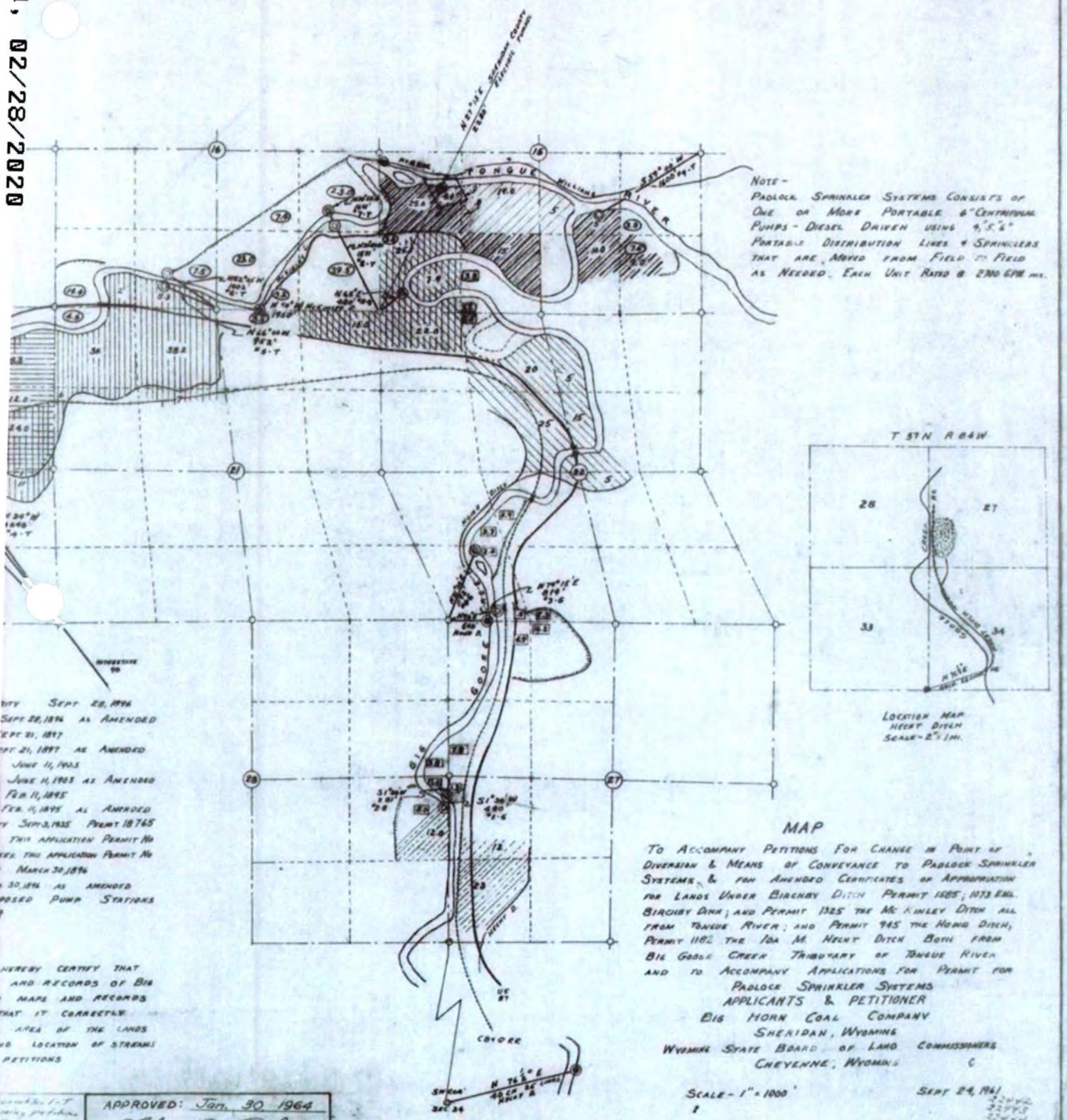

TFN 6 2/025
RECD NOV 14, 2014

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JANE BUYOK PUMP 34669D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO

Brook Mine

Note: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

SCANNED

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING, STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 31 day of January, A.D. 2011, at 9:44 o'clock A M.

John R. Barnes for State Engineer

Recorded in Book 158 of Ditch Permits, on Page 148

Fee Paid $ 25.00 Map Filed SA-33, 34669D

Temp. 35 3/124

WATER DIVISION NO. 2 DISTRICT NO. 5 Filing No.

PERMIT NO. 34669

NAME OF FACILITY: **Jane Buyok Domestic Pump**

1. Name(s), mailing address and phone no. of applicant(s) is/are **Jane Buyok**
102 Monarch Road
Ranchester, WY 82839 **307-673-2747**
E-mail address:
(If more than one applicant, designate one to act as Agent for others)

2. Name & address of agent to receive correspondence and notices: **Same as above**
E-mail address:

3. (a) The use to which the water is to be applied is **Domestic (Lawn & Garden)**

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is **Tongue River, trib. Yellowstone River**

Latitude: N 44.90202 Longitude W 107.04512 NAD83

5. The point of diversion of the proposed work is located -- feet distant from the -- corner of Section -- T -- N., R -- W., and is in the **SE1/4 NW1/4** of Section 19 T 57 N., R 84 W. ORIG SURVEY

Lot ____ Block ____ Subdivision Name ____

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

No – all privately owned lands

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is **0.056** cubic feet per second.

8. The accompanying map is prepared in accordance with the State Engineer's Manual of Regulations and Instructions for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is **existing**, and to complete the application of water to the beneficial uses stated in this application is **existing**

TFN 6 2/025
RECD NOV 14, 2014

Permit No 34669 Page No. 148 (Leave Blank)

Scanned, 02/28/2020

The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision.) Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

			NE¼				NW¼				SW¼				SE¼				
Township	Range	Sec	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	TOTALS
57	84	19								X									
			FOR DOMESTIC USE ONLY AT THE POINT OF USE DESCRIBED ABOVE NOT TO EXCEED 0.056 CFS															

Number of acres to receive original supply –

Number of acres to receive supplemental supply –

Total number of acres to be irrigated –

REMARKS

Application is for domestic (lawn & garden) water use, via a small portable pump from the Tongue River.

Pump will be used during normal growing seasons.

Type of Pump: Electric

Horsepower: 1 HP

Delivery Method: Water is pumped from Tongue River through HDPE pipe to sprinklers.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete

TFN 6 2/025
RECD NOV 14, 2014

Signature of Applicant or Agent

1/24/11
Date

Scanned, 02/28/2020

THE STATE OF WYOMING }
STATE ENGINEER'S OFFICE } ss.

TEMPORARY FILING NO. 353/124

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation shall be limited to the amount beneficially used for domestic purposes only, diverted from Tongue River at a rate not to exceed 25 G.P.M. or 0.056 cubic feet per second of water.

If in priority and in the event of a request for regulation, the applicant may be required to install a choke on the pump or a water flow reducing device in the pipeline which will provide for regulating the amount of water diverted to 0.056 cubic feet of water per second of time.

This permit is conditioned on the holder of this permit securing and/or providing free and unencumbered access to this reservoir site to allow State Engineer personnel to perform their duties as prescribed by Law. These duties include, but are not limited to, construction inspections and water administration.

This permit is issued to make an existing facility a matter of record. The notices of completion of construction and beneficial use are hereby waived.

~~The time for completing the construction work shall terminate on December 31, 20____~~

~~The time for completing the application of water to beneficial use shall terminate on December 31, 20____, and final proof of appropriation shall be made within 5 years thereafter.~~

Witness my hand this 30TH day of APRIL A.D. 2012

TFN 6 2/025
RECD NOV 14, 2014

FOR PATRICK T. TYRRELL, State Engineer

Permit No 34669

Page No. 148
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PERMIT NO. 34669

PERMIT STATUS

Priority Date January 31, 2011

Approval Date April 30, 2012

SCANNED APR 17 2012

PROOF PREPARED
ADJUDICATION IN PROCESS

NOTICE

This permit, does not constitute a complete water right. It is your authority to begin construction work.

All appropriations for irrigation are limited to 1 cubic foot per second of time for each 70 acres of land irrigated, except as provided in Section 41-4-320, Wyoming Statutes, 1977. Appropriations for other uses are limited to the amount of water beneficially used in accordance with the terms of the permit.

Notice of completion of work and of application of the water to the beneficial uses described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are required, requests for same must be in writing, stating why the additional time is required, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

To perfect your water right, your Water Division Superintendent, or his authorized representative, will contact you after you have submitted notice to the State Engineer stating that you have applied the water to the beneficial uses described in your permit. After execution of the proof, it will be considered by the State Board of Control, and, if found to be satisfactory, the Board will issue to you a Certificate of Appropriation which will constitute a completed water right.

The granting of a permit does not constitute the granting of right-of-way. If any right-of-way is necessary in connection with the application it should be understood that this responsibility is the applicant's.

TFN 6 2/025
RECD NOV 14, 2014

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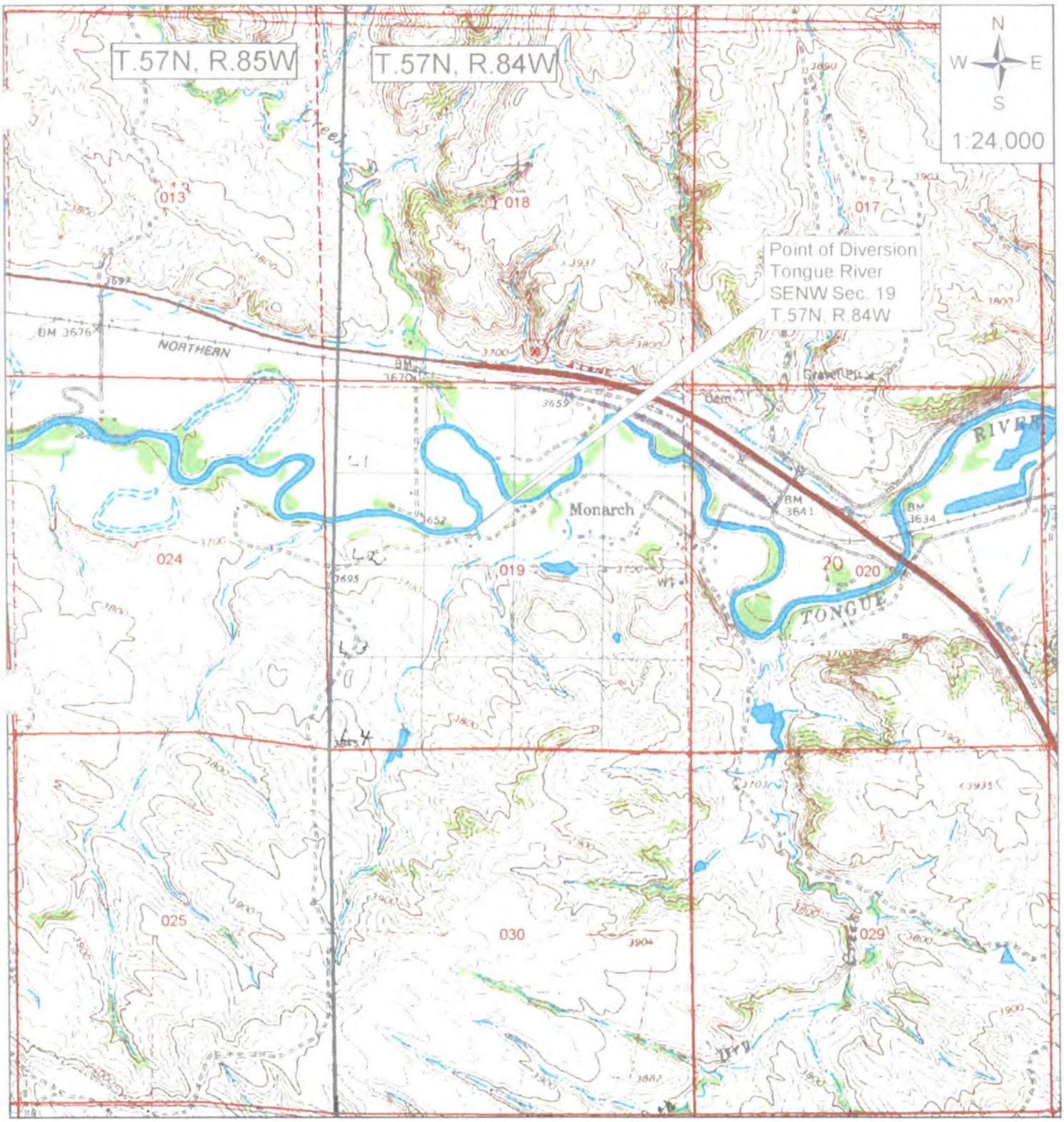
RAMACO

Brook Mine



APPROVED APRIL 30, 2012

Patrick T. Tyrrell STATE ENGINEER

MAP TO ACCOMPANY APPLICATION FOR:
Jane Buyok Domestic Pump

APPLICANT:
Jane Buyok
102 Monarch Road
Ranchester, WY 82839

TFN 6 2/025
RECD NOV 14, 2014

SCANNED APR 30 2012

3 48060 File: 5A-33

Scanned, 02/28/2020

JOHNSON PUMP 33569

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO Form SW-1 Rev. 10-1999

Brook Mine

S003242
25.00
8/11/06

NOTE: Do not fold form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

MICRO FILMED SCANNED DEC 01 2006

SEP 06 2006

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

Kathy Cameron

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING, STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 11th day of August, A.D. 2006, at 9:30 o'clock A M.

Phillip A. Velez
for JOHN R. BARNES for State Engineer

Recorded in Book 151 of Ditch Permits, on Page 98.

Fee Paid $ 25.00. Map Filed SA

WATER DIVISION NO. 2 DISTRICT NO. 5 Temp. Filing No. 33 2/325

PERMIT NO. 33569

SA-29

NAME OF FACILITY Johnson Domestic Pump

1. Name(s), mailing address and phone no. of applicant(s) is/are John & Gaylene Johnson
P.O. Box 424
Ranchester, WY 82839
(307) 655-2410

(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices Same as Above

3. (a) The use to which the water is to be applied is Domestic

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is Tongue River, tributary Yellowstone River
Lat. 44.903333
Long. 107.068333

5. The point of diversion of the proposed works is located ——— feet distant from the ——— corner of Section ——— T. ——— N., R. ——— W., and is in the NE¼NE¼ of Section ~~27 NE NE~~ 23 T. 57 N., R. 85 W. KC

Lot ——— Block ——— Subdivision Name ———

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.
No

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is 0.056 cubic feet per second. or 25 gpm. KC

8. The accompanying map is prepared in accordance with the State Engineer's Manual of Regulations and Instructions for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is 1 year, and to complete the application of water to the beneficial uses stated in this application is 1 year

TFN 6 2/025
RECD NOV 14, 2014

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10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

Township	Range	Sec.	NE¼				NW¼				SW¼				SE¼				TOTALS
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
~~57~~	~~85~~	~~27~~																	
57	85	23	X	(garden & lawn)															
				For domestic use only at the point of use															
				described above not to exceed 0.056 CFS or 25 GPM															

Number of acres to receive original supply 1

Number of acres to receive supplemental supply

Total number of acres to be irrigated

REMARKS

Application is for domestic (garden & lawn) water use, via a small portable pump from Tongue River. Pump will be used during normal growing seasons.

The amount of appropriation shall be limited to the amount of water used for domestic (garden & lawn) purposes only not to exceed the diversion rate from Tongue River ~~of~~ of 25 GPM or 0.056 CFS.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

TFN 6 2/025
RECD NOV 14, 2014

John L. Johnson
Signature of Applicant or Agent

8/10/06
Date

Scanned, 02/28/2020

THE STATE OF WYOMING }
STATE ENGINEER'S OFFICE } ss.

TEMPORARY FILING NO. 33 2/325

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation for domestic supply shall be limited to the amount beneficially used for domestic purposes, diverted from Tongue River at a rate not to exceed 0.056 cubic-feet per second of water.

If in priority and in the event of a request for regulation, the applicant may be required to install a choke on the pump or a water flow reducing device in the pipeline which will provide for regulating the amount of water diverted to 0.056 cubic feet of water per second of time.

This permit is granted subject to the terms of the Yellowstone River Compact.

The time for completing the construction work shall terminate on December 31, 20 08.

The time for completing the application of water to beneficial use shall terminate on December 31, 20 08, and final proof of appropriation shall be made within 5 years thereafter.

Witness my hand this 22ND day of August, A.D. 2006.

TFN 6 2/025
RECD NOV 14, 2014

FOR PATRICK T. TYRRELL, State Engineer

Permit No. 33569

Page No. 98
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PERMIT NO. 33569

SA-29

PERMIT STATUS

Priority Date August 11, 2006 Approval Date August 22, 2006

June 19, 2007 Notice of Completion of Construction on June 18, 2007, received from applicant.

June 19, 2007 Notice of Completion of Beneficial Use on June 18, 2007, received from applicant.

PROOF PREPARED
ADJUDICATION IN PROCESS

SCANNED JUL 16 2007

CERT. REC. 86, P. 185 PROOF NO. 39707
IRR. ___ STK. ___ DOM. X MISC. ___
AC. ___ C.F.S. 0.056

SCANNED DEC 2 2008

TFN 6 2/025
RECD NOV 14, 2014

NOTICE

This permit, does not constitute a complete water right. It is your authority to begin construction work.

All appropriations for irrigation are limited to 1 cubic foot per second of time for each 70 acres of land irrigated, except as provided in Section 41-4-320, Wyoming Statutes, 1977. Appropriations for other uses are limited to the amount of water beneficially used in accordance with the terms of the permit.

Notice of completion of work and of application of the water to the beneficial uses described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are required, requests for same must be in writing, stating why the additional time is required, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

To perfect your water right, your Water Division Superintendent, or his authorized representative, will contact you after you have submitted notice to the State Engineer stating that you have applied the water to the beneficial uses described in your permit. After execution of the proof, it will be considered by the State Board of Control, and, if found to be satisfactory, the Board will issue to you a Certificate of Appropriation which will constitute a completed water right.

The granting of a permit does not constitute the granting of right-of-way. If any right-of-way is necessary in connection with the applicatio uld be understood that this responsi[illegible]

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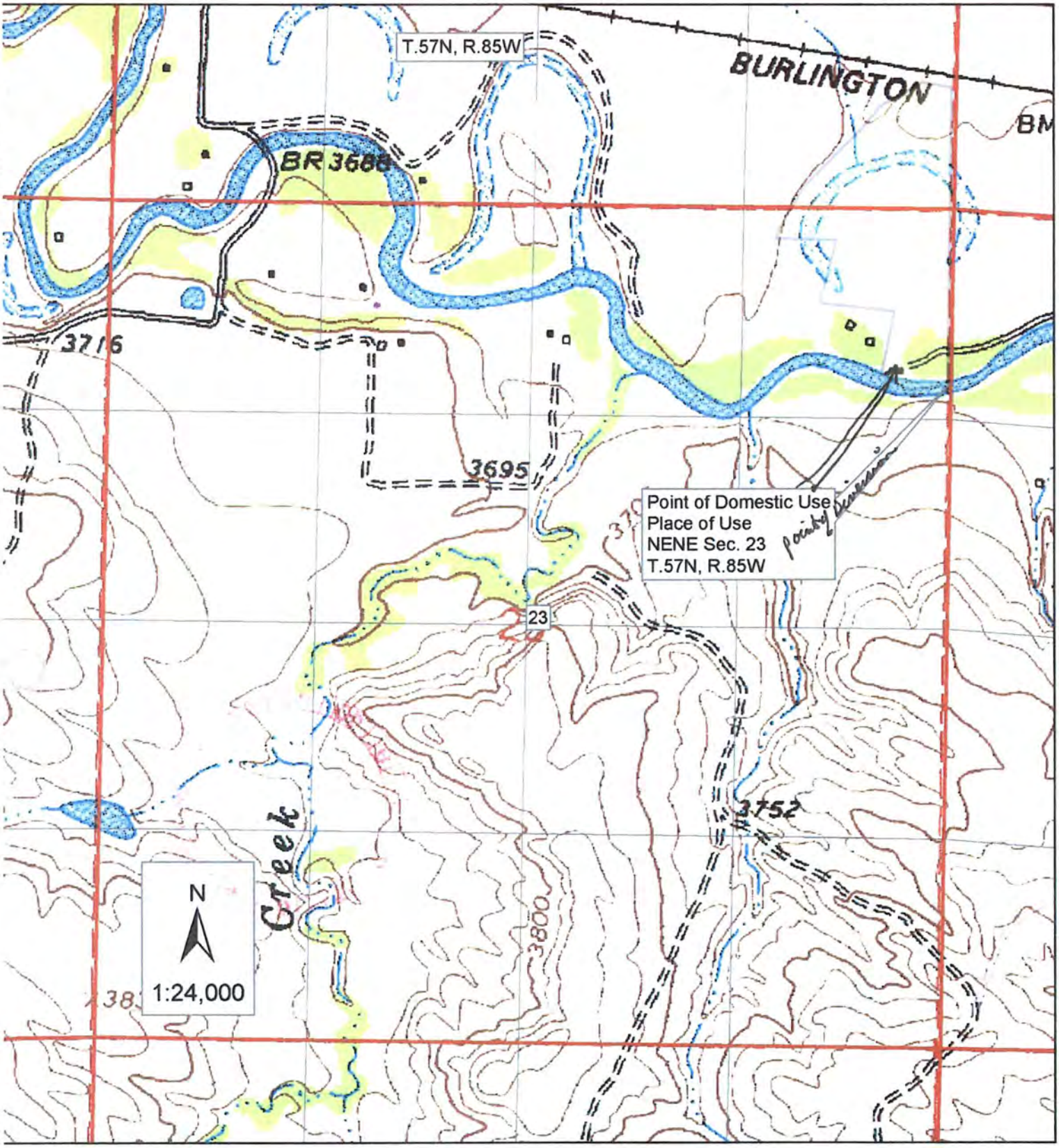

SCANNED SEP 06 2006

APPROVED: August 22, 2006

Patrick T. Tyrrell STATE ENGINEER

October 2014

MAP TO ACCOMPANY APPLICATION FOR:

Johnson Domestic Pump

TFN 6 2/025

APPLICANT: RECD NOV 14, 2014

John & Gaylene Johnson

P.O. Box 424

Ranchester, WY 82839

Addendum #1 4/73

21 - C 33569 Fee: $4.28

Scanned, 02/28/2020

KOOI COAL MINING 8298D

TFN 6 2/025
RECD NOV 14, 2014

RAMACO

Application for a Permit to Divert and

Brook Mine

Cont. R. card 32 p 250 for 2.00 cu. ft.

The R. A. Bristol Co., Printers and Binders, Cheyenne

Proof submitted.

NOV 1911

Water Division No. 2 District No.

I, Arnold Tschirgi of Sheridan, County of Sheridan, State of Wyoming being duly sworn according to law, upon my oath say:

1. The name of the applicant Acme Coal Mining Co.

2. The postoffice address of the applicant Acme, Wyoming

3. The use to which the water is to be applied is Mining and [illegible]

4. The name of the ditch or canal is Acme Coal Mining Co's water supply

5. The source of the proposed appropriation is Tongue River

6. The headgate of the proposed ditch or canal is located [illegible] from the [illegible] cor. of Section [illegible], Township [illegible] N., Range [illegible] W.

7. The said ~~ditch or canal is to be~~ miles long and to pass through the following lands (give route by courses and distances, or by naming legal subdivisions crossed):

The present works consist of a pumping plant [illegible] and [illegible] [illegible] [illegible] to pressure reservoir with proposed distribution & [illegible] on the following subdivisions [illegible] by the company's plant and town [illegible] [illegible]

8. The dimensions of said works are: (a) [At headgate] Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate.

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

9. Describe the character of proposed works, stating: 1st. The nature of material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

10. The estimated cost of said ditch is 5000.00 Dollars.

11. The land to be irrigated has a total area of acres, described as follows: (Give estimated acreage in fractions of subdivisions)

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12. Construction will begin on proposed works on or before , 190

13. The time required for the completion of ditches and other distributing works is two year from July 1st, 1908

14. The time required to complete the application of water to the beneficial use stated in this application is 2 year from July 1st, 1908

15. A map of the proposed ditch or canal, prepared in accordance with Chapter 14, R. S. 1899, accompanies this application.

Signed: Arnold Tschirgi

Note.— The statements in the fo[illegible]

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Scanned, 02/28/2020

Appropriate the Water of the State of Wyoming

THE STATE OF WYOMING,
County of Sheridan } ss.

I hereby certify that the foregoing application was signed in my presence and sworn to before me by
Arnold Lechner this 5 day of March, 1908

Notary Public
My commission expires January 8 1910

Notice of [illegible] received Dec 2-1910. (Mar 23-1911)

Notice of expiration mailed SEP 2 3 1910

THE STATE OF WYOMING,
State Engineer's Office } ss.

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Witness my hand this day of A. D. 190

State Engineer.

THE STATE OF WYOMING,
State Engineer's Office } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

TFN 6 2/025
RECD NOV 14, 2014

Construction of proposed works shall begin within one year from date of approval.

The time for completing the work shall terminate on December 31, 1910

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1910

The amount of the appropriation shall be limited to ~~one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 190~~ ; and the ~~additional~~ volume used for Mining & Municipal purposes on or before said date.

Witness my hand this 1st day of April, A. D. 1908

Clarence T. Johnston
State Engineer.

THE STATE OF WYOMING,
State Engineer's Office } ss.

This instrument was received and filed for record on the 16 day of March, A. D. 1908 at 9 o'clock A. M. and duly recorded in Book 26 of Applications on Page 2[illegible]

Clarence T. Johnston
State Engineer.

Scanned, 02/28/2020

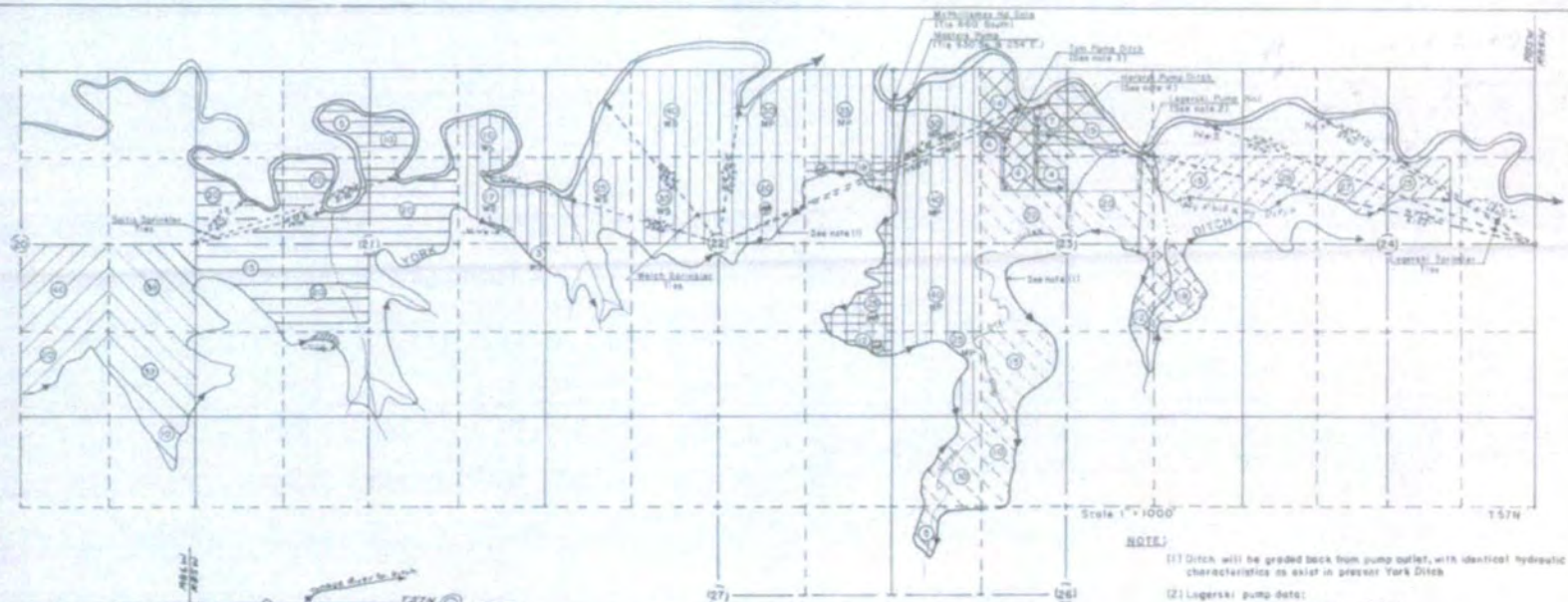
MCKINLEY 1335D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO

October 2014



NOTE:

(1) Ditch will be graded back from pump outlet, with identical hydraulic characteristics as exist in present York Ditch

(2) Legerski pump data:
pumping head = 110 feet
30 HP pump
1445 L.F. 12" discharge pipe

(3) Tom pump ditch data:
pumping head 47 feet
5 H.P. pump
330 L.F. 4" pipe

(4) Haratyk pump ditch data:
pumping head = 22 feet
3 H.P. pump
260 L.F. 3" pipe

(5) Legerski sprinkler data:
1500 L.F. main line pipe (4")
1000 L.F. distr. pipe (4")
max. pumping head = 30 feet

(6) Welch sprinkler data:
3000 L.F. main line pipe (4")
2000 L.F. distr. pipe (4")
max. pumping head = 105 feet

(7) Soltis sprinkler data:
1500 L.F. main line pipe (6")
1100 L.F. distr. pipe (4")
max. pumping head = 110 feet

Small scale map showing York Ditch above lands covered by these petitions

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Lands under McPhillamey Ditch, permit no. 5016, priority 8-2-1902, owned by G. Legerski, covered by listed petition (4)

Lands under McPhillamey Ditch, permit no. 1133 enl., priority 1-12-1903, owned by G. Legerski, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (2)

Lands under Masters Pump, permit no. 388, priority 1-6-1893, owned by W. Welch, petition for change of pt. of diversion granted 5-14-1946

Lands under York Ditch, permit no. 1128 enl., priority 11-9-1903, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 1129 enl., priority 11-12-1903, owned by G. Legalski, covered by listed petition (5)

MAP

To Accompany

(1) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO SOLTIS SPRINKLER

(2) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO WELCH SPRINKLER

(3) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND YORK DITCH PERMIT NO. 1128 enl. TO MASTERS PUMP

(4) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF McPHILLAMEY DITCH TO LEGERSKI SPRINKLER

(5) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND ALL OF PERMIT NO. 1129 enl. TO LEGERSKI PUMP

(6) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO TOM PUMP DITCH

(7) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO HARATYK PUMP DITCH

PETITIONERS

(1) Rudolph Soltis	Ranchester, Wyoming
(2 & 7) Milton Welch	Thornton, Wyoming
(4 & 5) George Legerski	
(6) Joe, Tom, & John Legerski	"
(7) M. & J. Haratyk	"

CERTIFICATE OF SURVEYOR

COUNTY OF SHERIDAN
STATE OF WYOMING

I, Walter J. Pilch, of Sheridan, Wyoming, certify that this map was made from records and maps on file in the State Engineer's Office and from notes taken during an actual survey made by me on January 11, 23, 24, 1962, and that it correctly represents the irrigation works, the location and area of lands to be irrigated in each subdivision and the location of streams in so far as these petitions are affected.

REGISTRATION NO. 537

Engineer & Surveyor

Petition 388 granted May 9, 1963
Petition 9 granted May 10, 1963
Petition [illegible] granted [illegible]

George E. Christensen
Director Secretary State Board of Control

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-78

Brook Mine

DEQ Ex. 4-1195

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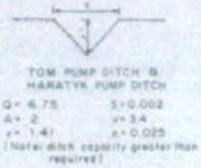
MCPHILL 5016D

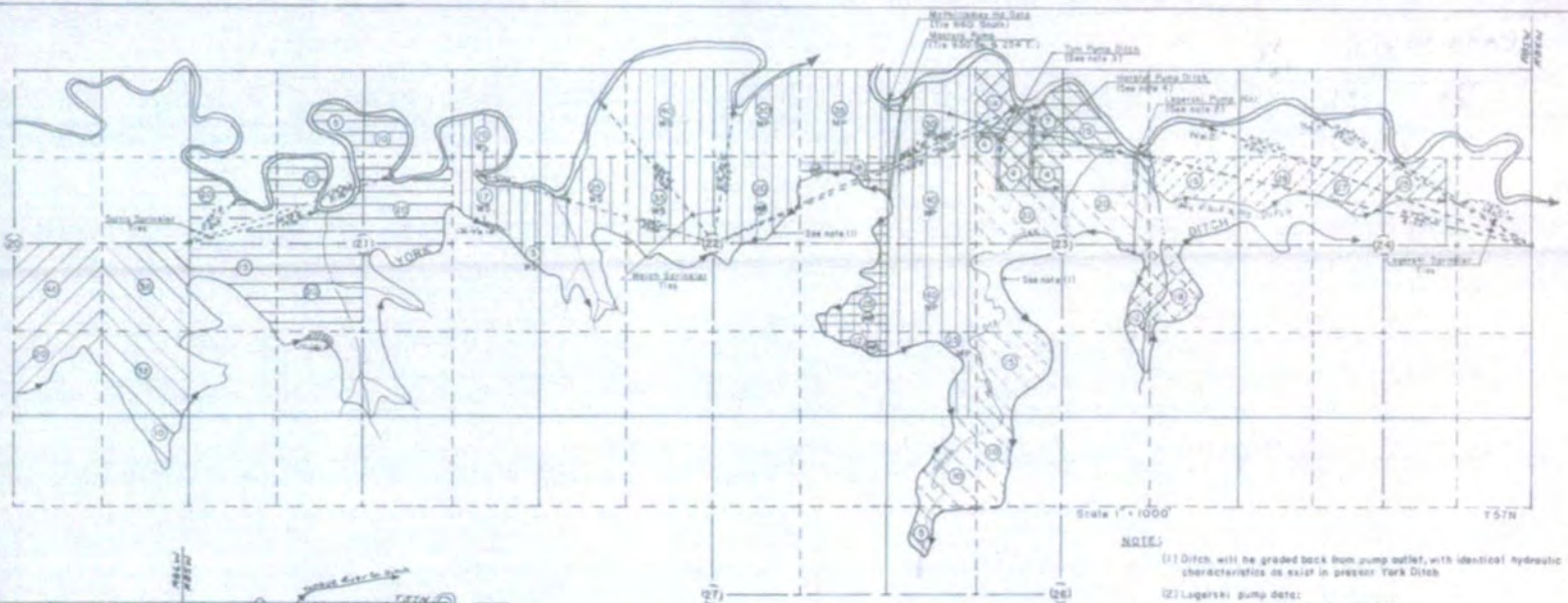
TFN 6 2/025
RECD NOV 14,2014

Scanned, 02/28/2020

RAMACO

October 2014





Small scale map showing York Ditch above lands covered by these petitions

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Lands under McPhillamey Ditch, permit no. 1135 enl., priority 11-12-1903, owned by G. Legerski, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (2)

Lands under Masters Pump, permit no. 388, priority 1-6-1893, owned by W. Welch, petition for change of pt. of diversion granted 3-14-1916

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Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (3)

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NOTE:

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(2) Legerski pump data:
pumping head = 110 feet
30 H.P. pump
1445 L.F. 12" diameter pipe

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pumping head 47 feet
5 H.P. pump
330 L.F. 4" pipe

(4) Haratyk pump ditch data:
pumping head = 22 feet
3 H.P. pump
260 L.F. 3" pipe

(5) Legerski sprinkler data:
1500 L.F. main line pipe (6")
1900 L.F. distr. pipe (4")
max. pumping head = 30 feet

(6) Welch sprinkler data:
3000 L.F. main line pipe (6")
2000 L.F. distr. pipe (4")
max. pumping head = 105 feet

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1500 L.F. main line pipe (6")
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max. pumping head = 110 feet

MAP

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(2 & 7) William Welch — Sheridan, Wyoming
(4 & 5) George Legerski
(6) Jos., Tom, & John Legerski
(7) M. & J. Haratyk

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COUNTY OF SHERIDAN
STATE OF WYOMING

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REGISTRATION NO. 537

Engineer & Surveyor

Petitions approved May 9, 1963
Petition to amend approved May 10, 1963

George L. Christopulos
Deputy Secretary and Board of Control

TFN 6 2/025
RECD NOV 14, 2014

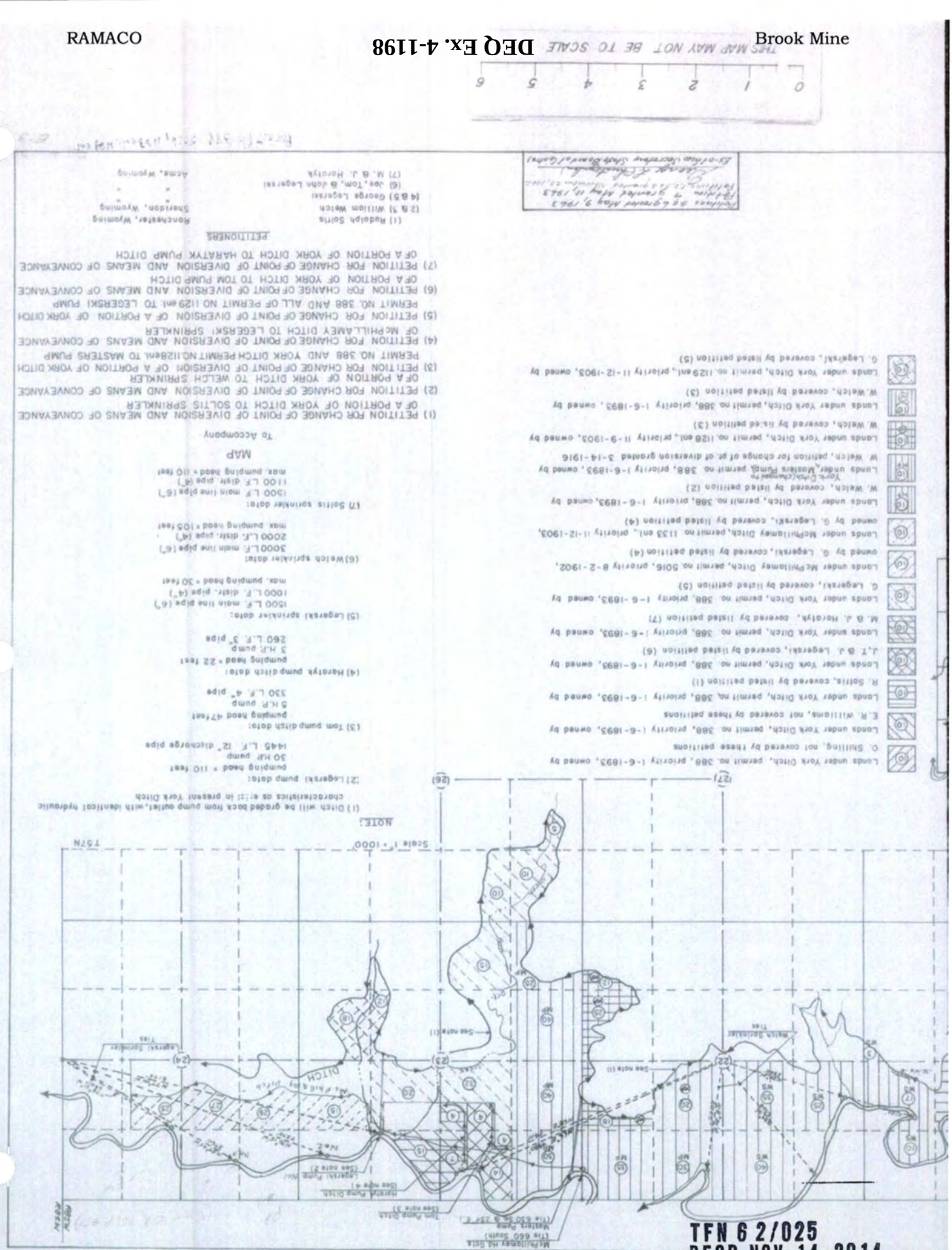
Addendum D11-4-80

Brook Mine

DEQ Ex. 4-1197

Scanned, 02/28/2020

DEQ Ex. 4-1198



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RECD NOV 14, 2014

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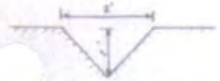
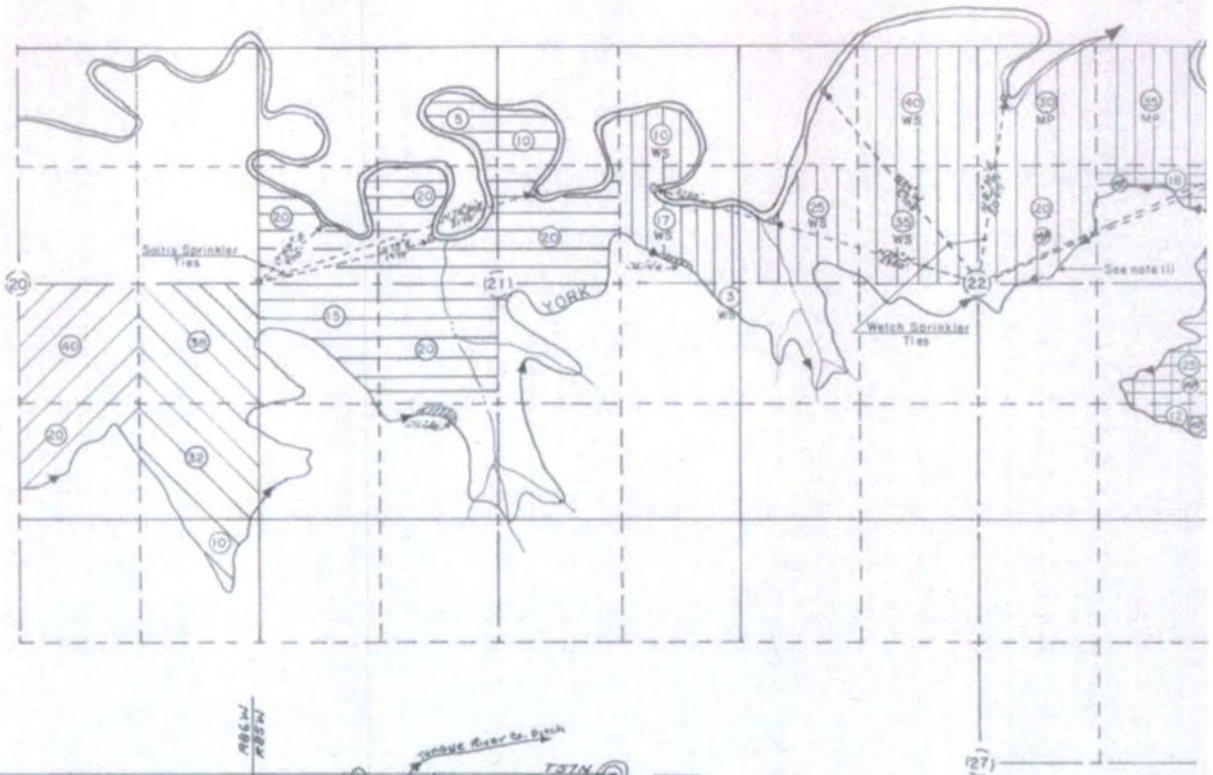


TOM PUMP DITCH &
HARATYK PUMP DITCH

Q = 6.75 S = 0.002
A = 2 V = 3.4
r = 1.41 n = 0.025
(Note: ditch capacity greater than required)



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M. & J. Haratyk, covered by listed petition (7)

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owned by G. Legerski, covered by listed petition (4)

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W. Welch, covered by listed petition (2)

Lands under York Ditch (changed to Masters Pump), permit no. 388, priority 1-6-1893
W. Welch, petition for change of pt. of diversion granted 3-14

Lands under York Ditch, permit no. 1128 enl., priority 11-9-190
W. Welch, covered by listed petition (3)

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REGISTRATION NO. 537

Walter J. Pilch
Engineer & Surveyor

TFN 6 2/025
RECD NOV 14, 2014

Petitions 6 & 1 granted May
Petition 4 granted May
Petitions 2, 3, 5 & 7 granted May
George L. Christ
Ex-officio Secretary State Bo

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MCPHILL ENL 1133E

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RECD NOV 14, 2014

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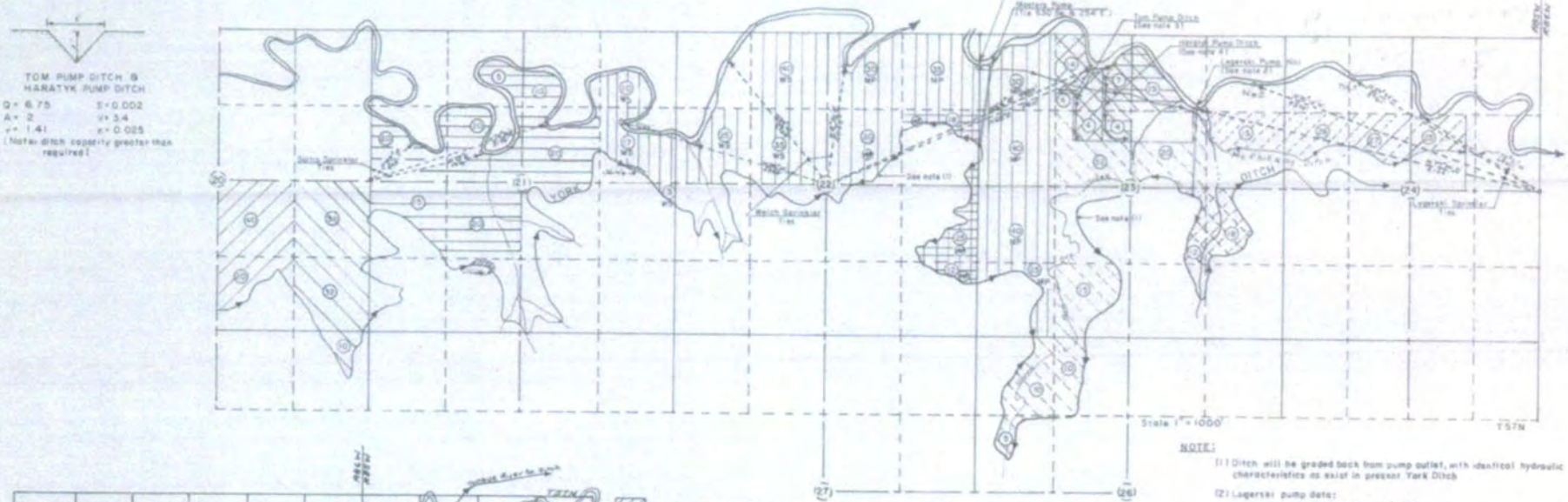
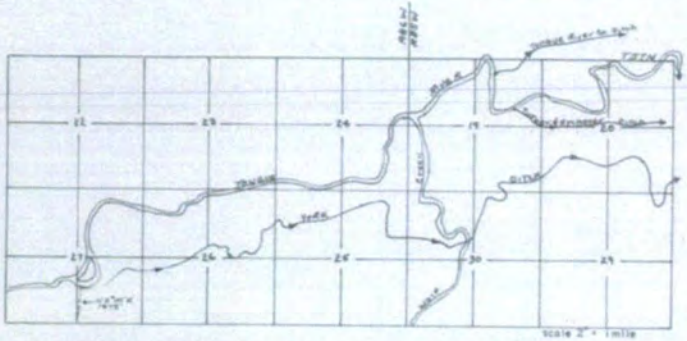
October 2014

RAMACO





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York Ditch changed to
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(2 & 3) William Welch — Sheridan, Wyoming
(4 & 5) George Legerski
(6) Jos., Tom, & John Legerski
(7) M. & J. Haratyk — Dietz, Wyoming

CERTIFICATE OF SURVEYOR

COUNTY OF SHERIDAN
STATE OF WYOMING ss

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REGISTRATION NO. 537

Engineer & Surveyor

Petition 3 & 4 granted May 9, 1963
Petition 1 granted May 11, 1963
Petition 2 granted [illegible]
George E. Christensen
Deputy State Engineer (State Board of Control)

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-84

Brook Mine

DEQ Ex. 4-1201

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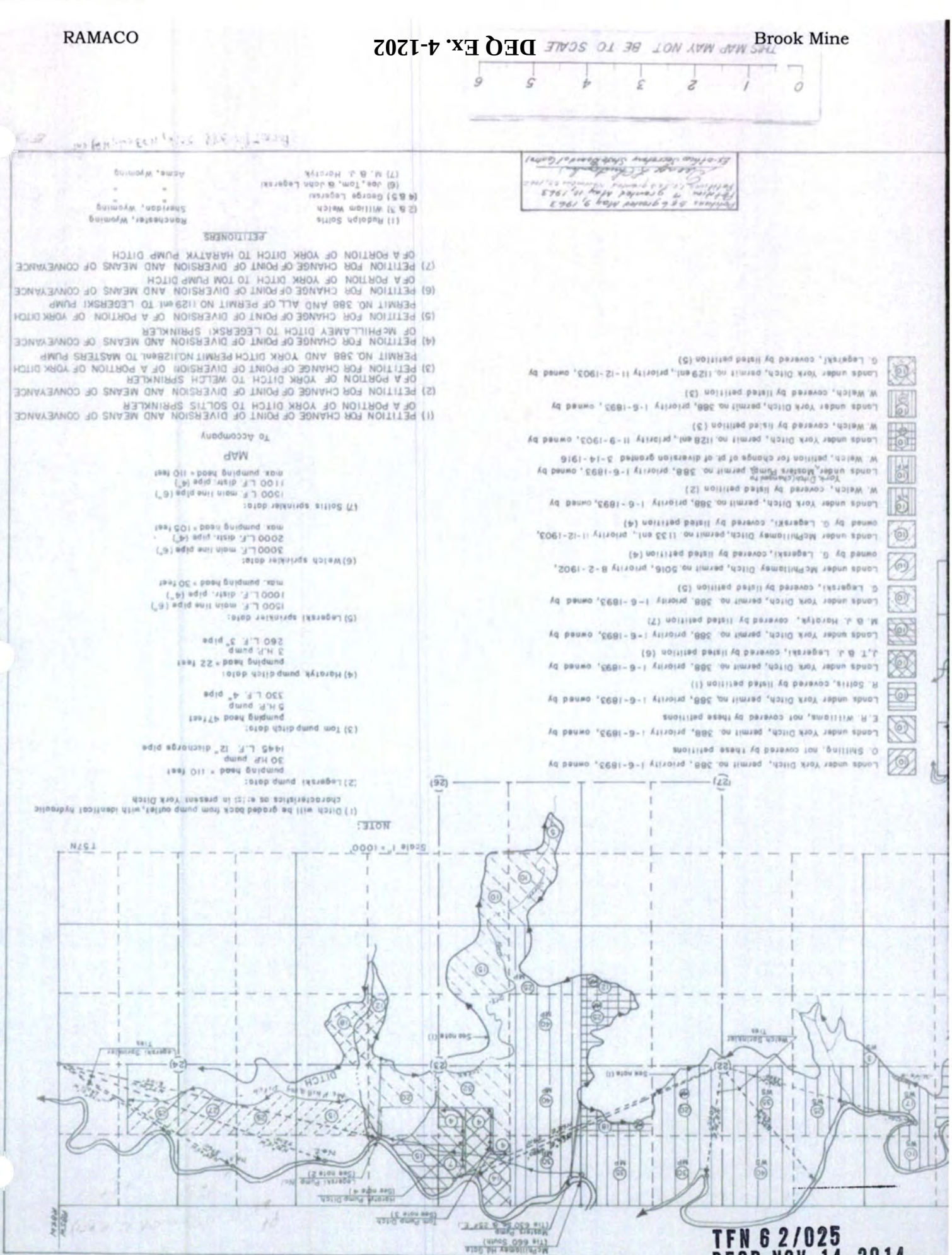
DEQ Ex. 4-1202



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RECD NOV 14, 2014

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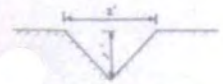

TOM PUMP DITCH &
HARATYK PUMP DITCH

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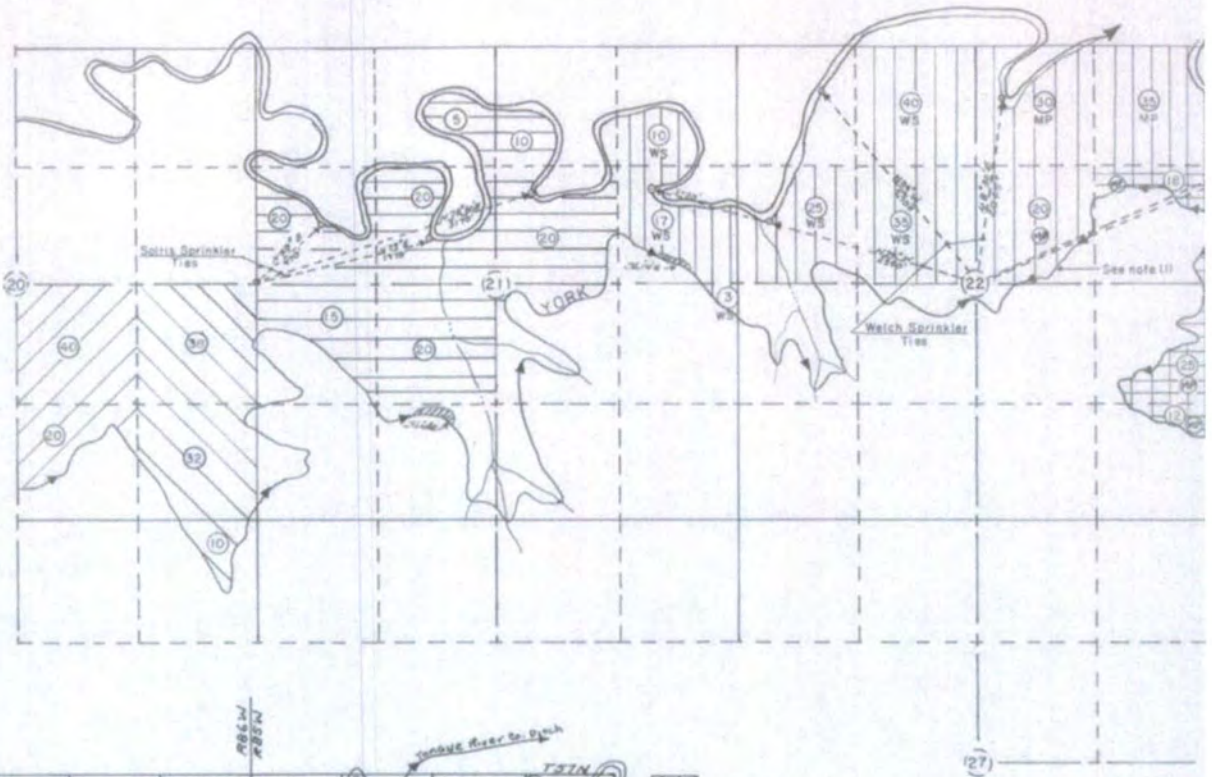


Small scale map showing York Ditch above lands covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893,
O. Shilling, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893,
E. R. Williams, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893,
R. Soltis, covered by listed petition (1)

Lands under York Ditch, permit no. 388, priority 1-6-1893,
J., T. & J. Legerski, covered by listed petition (6)

Lands under York Ditch, permit no. 388, priority 1-6-1893,
M. & J. Haratyk, covered by listed petition (7)

Lands under York Ditch, permit no. 388, priority 1-6-1893,
G. Legerski, covered by listed petition (5)

Lands under McPhillamey Ditch, permit no. 5016, priority 8-2
owned by G. Legerski, covered by listed petition (4)

Lands under McPhillamey Ditch, permit no. 1133 enl., priority
owned by G. Legerski, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893,
W. Welch, covered by listed petition (2)

Lands under York Ditch (changed to Masters Pump), permit no. 388, priority 1-6-1893
W. Welch, petition for change of pt. of diversion granted 3-14

Lands under York Ditch, permit no. 1128 enl., priority 11-9-190
W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 388, priority 1-6-1893,
W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 1129 enl., priority 11-12-19
G. Legerski, covered by listed petition (5)

CERTIFICATE OF SURVEYOR

COUNTY OF SHERIDAN
STATE OF WYOMING ss

I, Walter J. Pilch, of Sheridan, Wyoming, certify that this map was made from records and maps on file in the State Engineers Office and from notes taken during an actual survey made by me on January 11, 23, 24, 1962, and that it correctly represents the irrigation works, the location and area of lands to be irrigated in each subdivision and the location of streams in so far as these petitions are affected.

REGISTRATION NO. 537

Walter J. Pilch
Engineer & Surveyor

Petitions B & 6 granted May
Petition 4 granted May
Petitions [illegible] granted
George E. Hunt
Ex-officio Secretary State Bo

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

MONARCH PIPELINE 18765D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

C.R.56,p.5,A.17.30

RAMACO

PERMIT NO. 18765 B5

Brook Mine

NOTICE OF COMPLETION RECEIVED October 7, 1937 PROOF SUBMITTED

APPLICATION FOR A PERMIT TO DIVERT AND APPROPRIATE THE WATER OF THE STATE OF WYOMING

WATER DIVISION No. 2 DISTRICT No. 5

I, Paul F. Anderson of Sheridan

County of Sheridan, State of Wyoming, being duly sworn according to law, upon my oath say:

1. The name of the applicant Sheridan Wyoming Coal Co.

2. The postoffice address of the applicant Monarch, Wyoming.

3. The use to which the water is to be applied is Irrigation.

4. The name of the pipe line is Monarch Pipe Line.

5. The source of the proposed appropriation is Tongue River which is a tributary of Yellowstone River (Montana).

6. The headgate of the proposed pipe line is located N. 35° 27' E. 766.0 feet distant from the W ¼ corner of Section 20 T. 57 N., R. 84 W., and is in the SW¼ NW¼ of Section 20 T. 57 N., R. 84 W.

7. The said pipe line is to be 0.968 miles long.

8. The carrying capacity of the pipe line at the headgate is 0.89 cu. ft. per sec.

9. (a) The nature of the material to be moved is Earth.

(b) Number, length and size of tunnels None.

(c) Number, length and size of flumes None.

10. The estimated cost of said works is $ 870.00 Dollars.

11. Construction on proposed work will begin within one year from date of approval of this application.

12. The time required for the completion of the pipe line and other distributing works is one year from December 31st, 19 35.

13. The time required to complete the application of water to the beneficial uses stated in this application is one year from December 31st, 1935.

14. The accompanying map is prepared in accordance with the Manual of Regulations and Instructions for Filing Applications in the State Engineer's Office and is hereby declared a part of this application.

15. The land to be irrigated is described in the following tabulation:

(Give irrigable acreage in each 40 acre subdivision. Designate ownership of land, Government, State or Private. If Private, give names of owners)

TOWNSHIP	RANGE	SEC.	NE¼ NE¼	NE¼ NW¼	NE¼ SW¼	NE¼ SE¼	NW¼ NE¼	NW¼ NW¼	NW¼ SW¼	NW¼ SE¼	SW¼ NE¼	SW¼ NW¼	SW¼ SW¼	SW¼ SE¼	SE¼ NE¼	SE¼ NW¼	SE¼ SW¼	SE¼ SE¼	TOTALS
57N.	84W.	19	6.57			9.98													16.55
"	"	20						1.35											1.35

Above lands owned by applicant.

TOTAL NUMBER OF ACRES TO BE IRRIGATED 17.90

(Signed) Paul F. Anderson

THE STATE OF WYOMING,)
) SS.
COUNTY OF Sheridan)

I hereby certify that the foregoing application was signed in my presence and sworn to before me by Paul F. Anderson this 29th day of July, 1935.

J. C. Rhodes
Notary Public

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

THE STATE OF WYOMING, }
STATE ENGINEER'S OFFICE, } SS.

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use surplus water of the stream when all prior rights are satisfied.

Construction of proposed work shall begin within one year from the date of approval.

The time for completing the work shall terminate on December 31, 1938.

The time for completing the application of water to beneficial use shall terminate on December 31, 1938, and final proof of appropriation shall be made within five years thereafter.

The amount of appropriation shall be limited to one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 1938.

Witness my hand this 15th day of September, A. D. 1937.

John D. Quinn, State Engineer.

THE STATE OF WYOMING, }
State Engineer's Office, } SS.

This instrument was received and filed for record on the 3rd day of September, A. D. 1938, at 10:00 o'clock A. M.

Edwin A. Burritt
State Engineer.

Recorded in Book 61 of Applications, on Page 118.

Oct. 7, 1937 - Notice of commencement of construction of work received.
Oct. 7, 1937 - Notice of completion of the application of water to beneficial use received.
Certificate Record 56, page 5, acres 17.30.

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

THE STATE OF WYOMING, } SS.
STATE ENGINEER'S OFFICE, }

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use surplus water of the stream when all prior rights are satisfied.

Construction of proposed work shall begin within one year from the date of approval.

The time for completing the work shall terminate on December 31, 1938.

The time for completing the application of water to beneficial use shall terminate on December 31, 1938, and final proof of appropriation shall be made within five years thereafter.

The amount of appropriation shall be limited to one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 1938.

Witness my hand this 16th day of September, A. D. 1937.

John D. Quinn, State Engineer.

THE STATE OF WYOMING, } SS.
State Engineer's Office, }

This instrument was received and filed for record on the 3rd day of September, A. D. 1938, at 10:00 o'clock A. M.

Edwin W. Burritt
State Engineer.

Recorded in Book 61 of Applications, on Page 118.

Oct. 7, 1937 - Notice of commencement of construction of work received.
Oct. 7, 1937 - Notice of completion of the application of water to beneficial use received.
Certificate Record 50, page 5, acres 17.30.

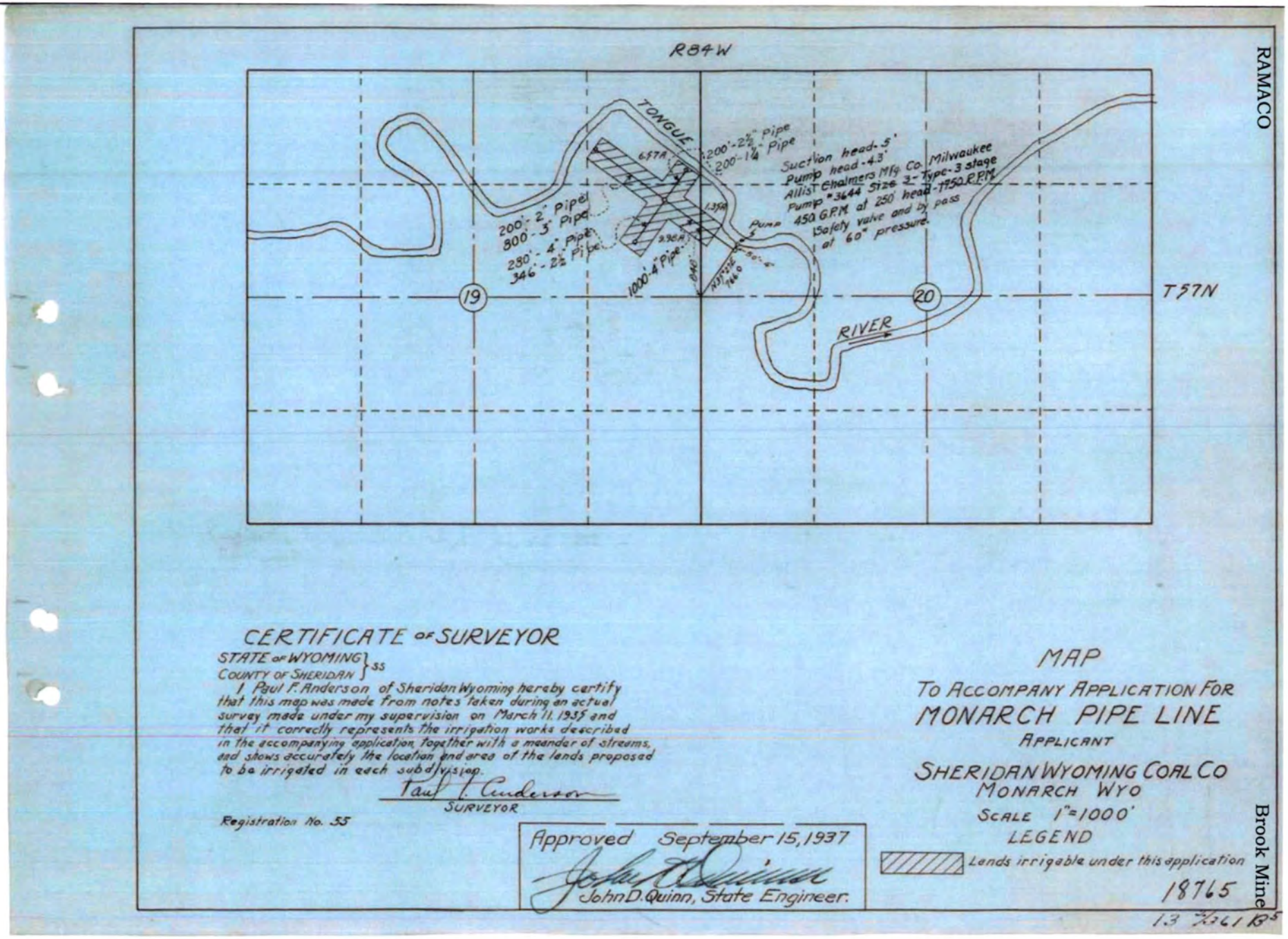
TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

October 2014

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-91



CERTIFICATE of SURVEYOR

STATE of WYOMING } ss
COUNTY of SHERIDAN }

I, Paul F. Anderson of Sheridan Wyoming hereby certify that this map was made from notes taken during an actual survey made under my supervision on March 11, 1935 and that it correctly represents the irrigation works described in the accompanying application together with a meander of streams, and shows accurately the location and area of the lands proposed to be irrigated in each subdivision.

Paul F. Anderson
SURVEYOR

Registration No. 55

Approved September 15, 1937
John D. Quinn
John D. Quinn, State Engineer.

MAP
TO ACCOMPANY APPLICATION FOR
MONARCH PIPE LINE
APPLICANT
SHERIDAN WYOMING COAL CO
MONARCH WYO
SCALE 1"=1000'
LEGEND
Lands irrigable under this application

18765

1.3 7361 R5

DEQ Ex. 4-1208

Scanned, 02/28/2020

MONROE WILLIAMS 1107D

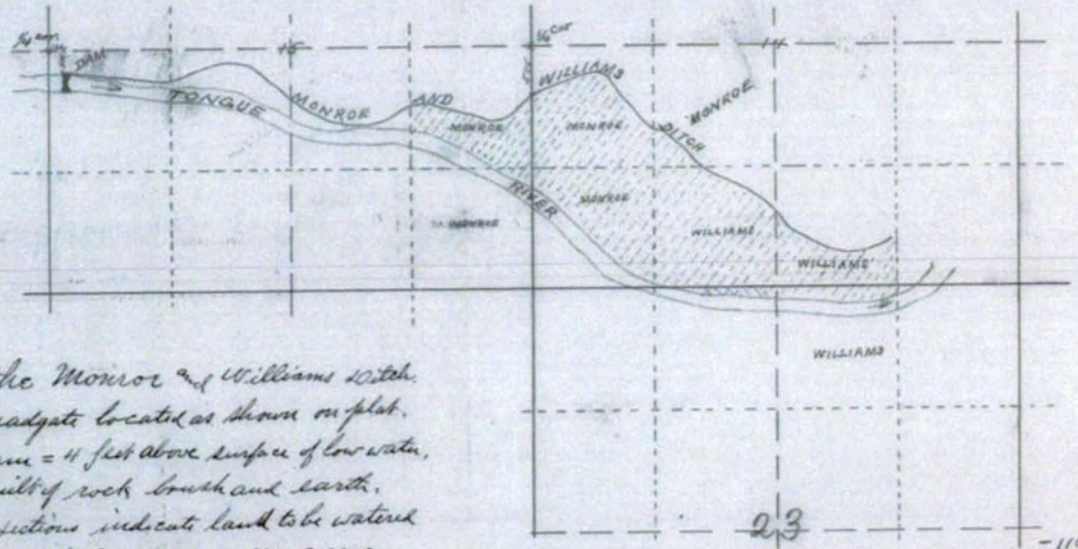
TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO

October 2014

T57N. R84W.



Plat of the Monroe and Williams ditch.
Dam & headgate located as shown on plat.
Height of dam = 4 feet above surface of low water.
Dam to be built of rock brush and earth.
Dotted red sections indicate land to be watered
Land watered by Monroe = 70 acres
" " Williams = 70 "
Grade of ditch = 4" fall per mile upper 1st mile only 5"
Width " on bottom = 3 feet
Scale of plat = 1" to 1000'

I. W. Brown - a practical surveyor hereby certify that I have surveyed the Monroe and Williams ditch and that this plat correctly represents the location of dam - ditches & land watered.

W. A. Brown. Surveyor.
Sheridan, Wyo.

TFN 6 2/025
RECD NOV 14, 2014

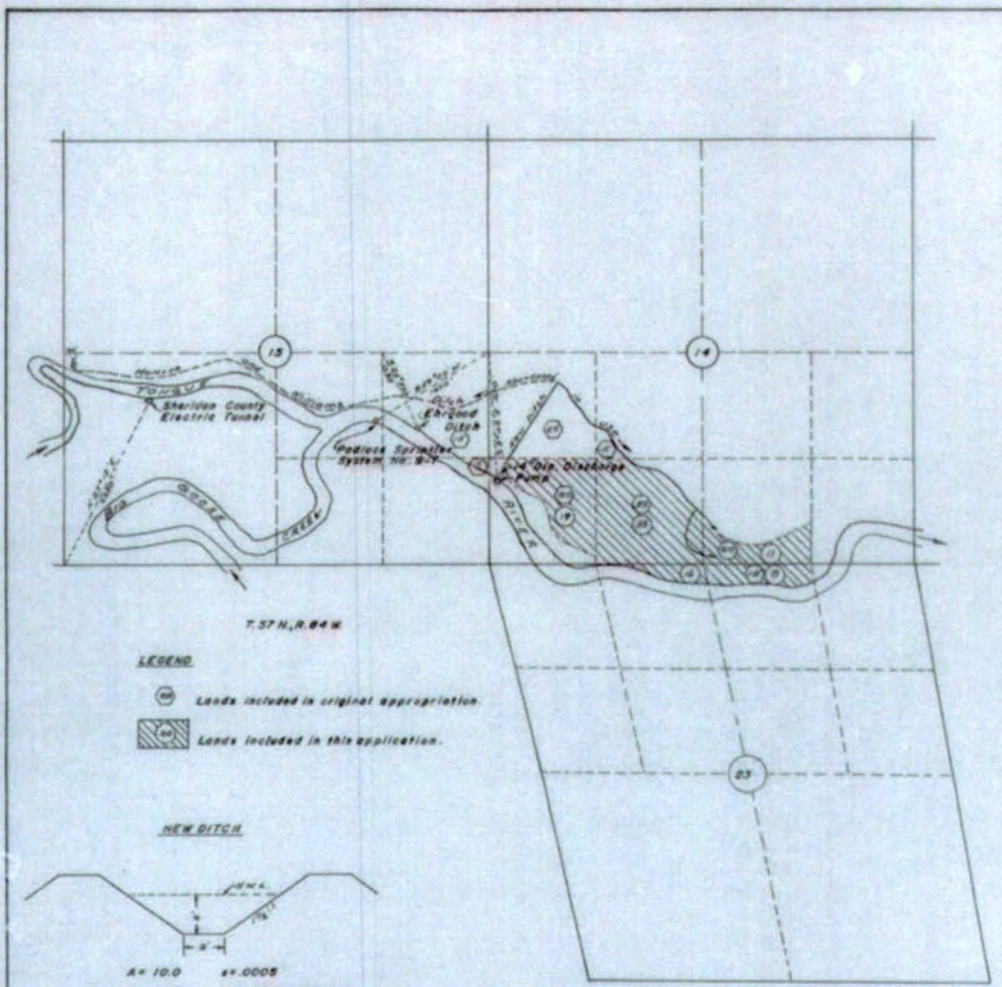
Addendum D11-4-93

Brook Mine

Scanned, 02/28/2020

0 1 2 3 4 5 6

THIS MAP MAY NOT BE TO SCALE



CERTIFICATE OF SURVEYOR

State of Wyoming)
County of Sheridan) ss

I, James R. Wright of Sheridan, Wyoming, hereby certify that this map was made from notes taken during an actual survey made by me on June 11, 1963, from the records of the State Engineer and from plans of the Wyoming Highway Department which show the corners of Section 23, and that it correctly shows the location of Tongue River, the pump and the lands to be irrigated.

R.L.S. 258

James R. Wright
Surveyor

TFN 6 2/025
RECD NOV 14, 2014

MAP
TO ACCOMPANY PETITIONS FOR
CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE
AND
CORRECTION OF LAND DESCRIPTION
FOR
MONROE AND WILLIAMS DITCH, PERMIT 11017
PETITIONERS:
R. ROY WILLIAMS AND OTHERS
SHERIDAN, WYOMING

Petition granted May 13, 1969
George K. Christensen
Ex-officio Secretary State Board of Control

Permit No. 11017 D-2 204

Scanned, 02/28/2020

CERTIFICATE RECORD,

Cert 4859

3-400

THE STATE OF WYOMING.

CERTIFICATE OF APPROPRIATION OF WATER.

WHEREAS, Robert T Williams has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Tongue River through the Monroe & Williams Ditch under Permit No. 1107 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming, and for Irrigation

NOW KNOW YE, That the Board of Control, under the provisions of Division I, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 18th day of January, A. D. 1904, in Order Record No. 3, Page 164, determined and established the priority and amount of such appropriation as follows:

3 165

Name of Appropriator, Robert T Williams; Post-office Address, Sheridan Wyoming.

General Priority Number on main stream and tributaries ; Priority Number on Tongue River No 26

Amount of Appropriation, 2. cu. ft. per. sec.; Date of Appropriation Dec 24 1895; Description of land to be irrigated, and for which this appropriation is determined and established 140 acres Fifteen (15) acres NE¼SE¼ Five (5) acres SE¼SE¼ Sec 15 & Twenty-five (25) acres N½N½SW¼ Twenty (20) acres S½S½SW¼ Five (5) acres NE¼SW¼ Thirty-five (35) acres SE¼SW¼ Twenty (20) acres SW¼SE¼ Section 14 & Fifteen (15) acres N½N½NE¼ Sec 23 T 57 N. R 84 W.

Amended description; change in point of diversion & means of conveyance for part O.R. 15, P. 538.

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, Clarence T Johnston, President of the State Board of Control, have hereunto set my hand this 15th day of June, A. D. 1904 and caused the seal of said Board to be hereunto affixed.

ATTEST: Henry L Babcock Secretary. President.

Cert 4860

October 2014
RAMACO
Addendum D11-4-95
TFN 6 2/025
RECD NOV 14, 2014
Brook Mine

Scanned, 02/28/2020

PERMIT NO. 1107

Proof of Appropriation of Water.

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Tongue River Division No. 2 District No. 5

1 Q. State your name.
A. Robert F. Williams

2 Q. Postoffice address.
A. Sheridan, Wyoming

3 Q. Are you the original applicant for Permit No. 1107 ?
A. Yes.

4 Q. If not, state the date of your securing an interest therein and the nature of your interest in the works constructed under such permit.
A. Own the James Monroe interest

5 Q. When did the construction of the Monroe & Williams ditch (or other distributing works described in said permit) begin?
A. March of 1895 & 1896

6 Q. When was it completed?
A. July 1900

7 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?
A. Width on top 5 ft. Width on bottom 3 ft. Depth 1 ft. Grade 4 ft.

8 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision.

A. NE¼ SE¼	Sec. 15	T. 57	R. 84 W.	15 acres.
SE¼ SE¼	" 15	"	"	5 "
NW¼ SW¼	" 14	"	"	25 "
SW¼ SW¼	" 14	"	"	20 "
NE¼ SW¼	" 14	"	"	5 "
SE¼ NW¼	" 14	"	"	35 "
SW¼ NE¼	" 14	"	"	20 "
NW¼ NE¼	" 23	"	"	15 "
				140 "

9 Q. Give the date when, under the terms of this permit, water was first beneficially used.
A. July 1900

Wherefore I recommend that said appropriation be — allowed and that a certificate of appropriation be issued in accordance with said proof and the tabulation thereof filed herewith.

Dated Sheridan Wyo Nov 7th, 1903

Frank A Hall
Superintendent of Water Division No. 2

PROOF OF APPROPRIATION
UNDER
PERMIT NO. 1107.

Division No. 2 Division No. 5

Date of Appropriation Nov 24 1895

GENERAL PRIORITIES STREAM

NAME OF STREAM
Tongue River
TRIBUTARY OF

NAME OF CLAIMANT:
Robert F. Williams

Filed with me this 2nd day of Nov 1903
Frank A Hall
State Engineer.

Filed in this office this day of , 190

Secretary Board of Control.

The S. A. Bristol Co., Printers and Book Binders, Cheyenne

Nov 24 1903

4859

Nov. 1107

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

10 Q. If for irrigation, give the location and acreage irrigated the first year and the location and acreage irrigated each subsequent year to the present.

A. Land mentioned by question 8 have been irrigated every subsequent year to present.

11 Q. What crops were grown on this land in 1903? Give estimated acreage of each crop.

A. Alfalfa 30 A. Wheat 2A Potatoes 9 A. Corn 5A Garden 4 A. Hay Native 105 A.

12 Q. During what months is water beneficially used?

A. April to October

13 Q. Give amount of your investment in the construction of ditch and laterals.

A. $2000.00

14 Q. Give estimated cost per acre of preparing land for irrigation.

A. $5.00

15 Q. Does the map which accompanies this proof show correctly the location of diverting works and area of land where water is used?

A. Yes

THE STATE OF WYOMING, }
COUNTY OF Sheridan } ss.

I, Robert T. Williams, being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

IN WITNESS WHEREOF, I have hereunto set my hand this 28 day of August A. D. 1903

Robert T. Williams

Sheridan, WYO., Aug 28, 1903

I HEREBY CERTIFY that the foregoing affidavit was read to the affiant in my presence before he signed his name thereto; that said affiant is to me personally known (or has been satisfactorily identified before me by), and that I verily believe him to be a credible person and the person he represents himself to be; and that this affidavit was subscribed and sworn to before me at Sheridan Wyo on this 28 day of August, 1903

Frank A. Hatt

Superintendent, Water Division No. 2

Note.—This proof is intended to be used only by parties making appropriations under permits issued in accordance with Section 126, Chapter 14, Title 9, Revised Statutes of Wyoming.

The map referred to in Paragraph 15 must show the entire work in the case of individual ditches. In the case of large works only one map of the entire canal need be filed. Individual proof must, however, show ditch from point of diversion from main canal, and all laterals so filed established. Where the duplicate map filed in the office of the State Engineer and returned to the applicant gives the necessary details and shows accurately the location of completed work, it may be filed.

The map which accompanies this proof must be on tracing linen, be accurately drawn on a scale of not less than two inches to the mile, and verified by the party making the measurements.

REPORT OF OFFICIAL EXAMINATION BY SUPERINTENDENT.

I HEREBY CERTIFY AND REPORT that pursuant to the notice of completion of appropriation, filed with the State Engineer, and in accordance with the rules and practice of the Board of Control, I appeared at Sheridan Wyoming on the 28 day of August, 1903, and took and received the foregoing sworn proof of appropriation of water through the Maxwell & Williams Ditch from Tong at Town under Permit No. 1107 by Robt. T. Williams, the owner thereof; that I made a personal examination of said ditch, and of the land irrigated thereunder and described in said permit; that I found said ditch had an average width of 4 feet, a depth of 1 and a grade of about 4 feet per mile. I found a sufficient number of laterals of a capacity to fully irrigate the land described herein, and found that of the land described in said permit the following acreage has been irrigated and reclaimed in each 40-acre tract, to-wit:

Same as answered by Question 8

On this land the following crops were grown in 1903

Same as answered by Question 11

I also certify that after due publication of notice of the time and place, said proof was opened for public inspection on the 17 day of October, 1903, at Sheridan Wyo in accordance with the provisions of said notice and the regulations of the Board of Control; that at said time

No persons

appeared filed contest or objection to said proof.

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

POWER DITCH 8321D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

7
8321.

Application for a Permit to Divert and

The S. A. Bristol Co., Printers and Binders, Cheyenne

Water Division No. 2 District No.

I, C. E. Worthington, of Sheridan, County of Sheridan, State of Wyoming, being duly sworn according to law, upon my oath say:

1. The name of the applicant W E Wagner

2. The postoffice address of the applicant Sheridan Wyo

3. The use to which the water is to be applied is power

4. The name of the ditch or canal is Power Ditch

5. The source of the proposed appropriation is Tongue River

6. The headgate of the proposed ditch or canal is located R. 3E West 1920 ft from S Sec Corner on South side of Section 11, Township 57 N Range 84 W

7. The said ditch or canal is to be 450 feet ~~miles long and to pass through the following lands (give route by courses and distances, or by naming legal subdivisions crossed):~~

For details of waterway Sill &c
See accompany plat

8. The dimensions of said works are: (a) [At headgate] Width on top (at water-line) 17 feet; width on bottom 10 feet; depth of water 7 feet; grade 2.5 feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate:

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

[At] width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

9. Describe the character of proposed works, stating: 1st. The nature of material to be moved. 2nd. Number and length of tunnels, if any. 3rd Amount of fluming, if any.

Earth and Rock
Tunnel 260 ft

10. The estimated cost of said ditch is $3,000.00 Dollars.

11. The land to be irrigated has a total area of acres, described as follows:

(Give estimated acreage in fractions of subdivisions)

TFN 6 2/025
RECD NOV 14, 2014

12. Construction will begin on proposed works on or before June 15- , 1908

13. The time required for the completion of ditches and other distributing works is 3 years from Dec 31 , 1908

14. The time required to complete the application of water to the beneficial use stated in this application is 3 years from Dec 31 , 1908

15. A map of the proposed ditch or canal, prepared in accordance with Chapter 14, R. S. 1899, accompanies this application.

Signed: C E Worthington

NOTE.—*The statements in the foregoing application must comply with the requirements of Chapter 14, R. S. 1899.*

Appropriate the Water of the State of Wyoming

THE STATE OF WYOMING,
County of Wyoming | ss.

I hereby certify that the foregoing application was signed in my presence and sworn to before me by
C. E. Worthington this 18 day of March, 1908
W. E. Willis, Notary Public.
My Commission Expires Dec 28-1908.
Seal.

Notice of expiration mailed SEP 21 1910

Time for completion extended to December 31, 1912
Clarence T. Johnston
State Engineer. Dec 28-1910

Time for completion extended to Dec 31, 1913. A. J. Parshall, State Eng. Dec 31/1912.
Time for completion extended to Dec 31, 1914. A. J. Parshall, State Eng. Dec 28, 1913

Time for completion extended to DEC 31 1915 A. J. PARSHALL, State Engineer. DEC 30 1914

Notice of expiration mailed SEP 21 1915

Time for completion extended to DEC 31 1917 Jno. C. True State Engineer DEC 31 1915

Notice of expiration mailed OCT 1 1917

Time for completion extended to DEC 31 1920 Jno. C. True State Engineer DEC 31 1917

Notice of expiration mailed SEP 30 1920

Time for completion extended to DEC 31 1923 Frank L. Emerson State Engineer DEC 31 1920

Notice of expiration mailed SEP 30 1923

NOTICE OF EXPIRATION OF TIME FOR COMPLETION TO BENEFICIAL USE MAILED SEP 30 1923

Time for completion extended to DEC 31 1924 B. D. Sharrow State Engineer DEC 26 1923

Notice of expiration mailed SEP 30 1924

NOTICE OF EXPIRATION OF TIME FOR COMPLETION TO BENEFICIAL USE MAILED SEP 30 1924

THE STATE OF WYOMING,
State Engineer's Office. | ss.

Time for completion extended to DEC 31 1925 Frank L. Emerson State Engineer DEC 31 1924

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Notice of expiration mailed. SEP 30 1925

NOTICE OF EXPIRATION OF TIME FOR COMPLETION TO BENEFICIAL USE MAILED. SEP 30 1925

Witness my hand this ____ day of ____, A. D. 190__

State Engineer.

THE STATE OF WYOMING,
State Engineer's Office. | ss.

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

Not to interfere with the use of water for irrigation.

SCANNED MAY 15 2009

Construction of proposed works shall begin within one year from date of approval.

The time for completing the work shall terminate on December 31, 1910

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1910

The amount of the appropriation shall be limited to ~~one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 190__, and~~ the ~~additional~~ volume used for Power purposes on or before ~~said date~~ December 31st, 1910.

Witness my hand this 14th day of April A. D. 1908

Clarence T. Johnston
State Engineer.

TFN 6 2/025
RECD NOV 14, 2014

THE STATE OF WYOMING,
State Engineer's Office. | ss.

This instrument was received and filed for record on the 20th day of March, A. D. 1908, at 9 o'clock A.M., and duly recorded in Book 27 of Applications on Page 7.

Clarence T. Johnston
State Engineer.

Scanned, 02/28/2020

Scanned, 02/28/2020

October 2014

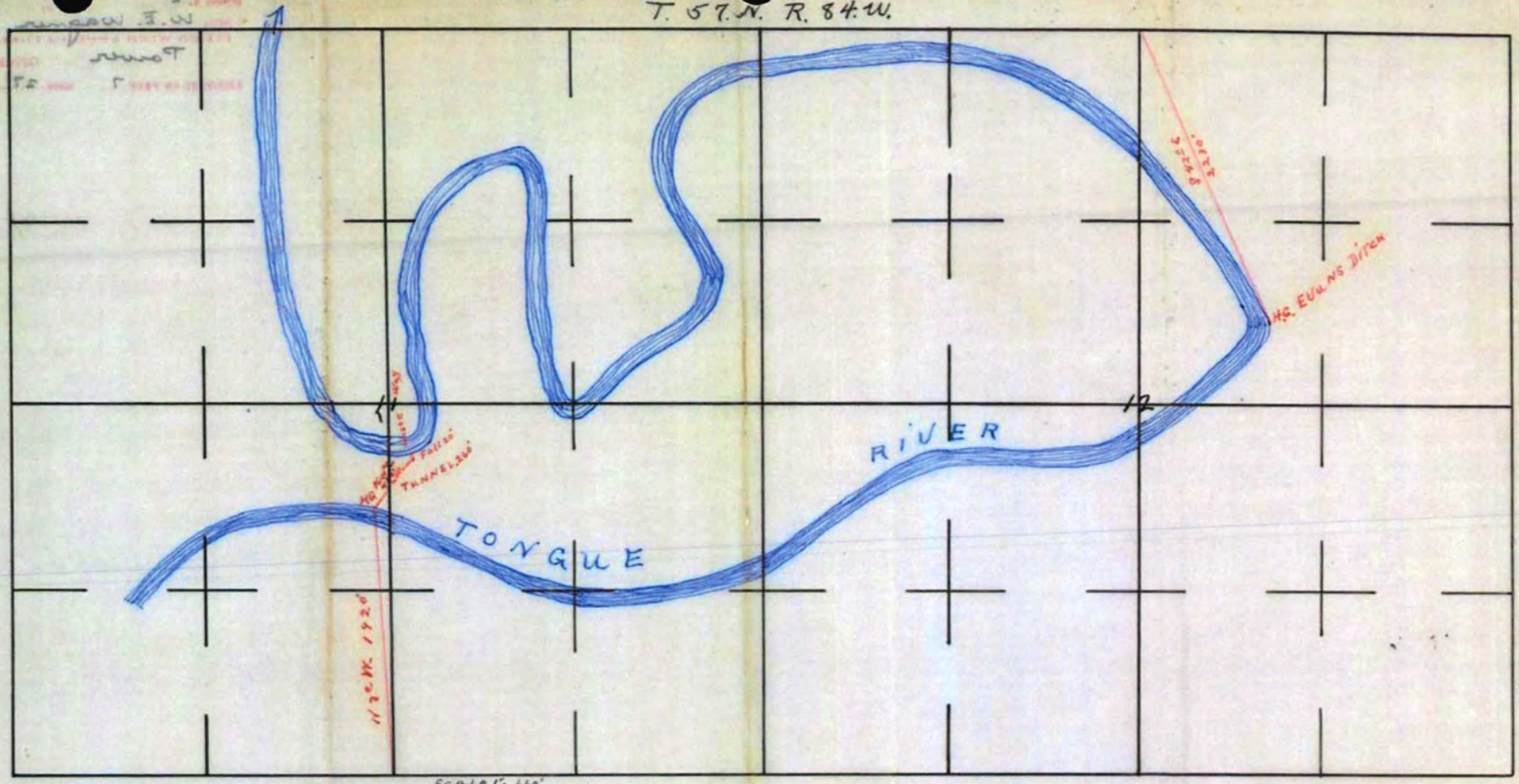
RAMACO

Addendum D11-4-101

Brook Mine

1568

T. 57 N. R. 84 W.



CERTIFICATE OF SURVEYOR.

STATE OF WYOMING, }
County of Sheridan } ss.

I, G.G. Worthington of Sheridan hereby certify that this map was made from notes taken during an actual survey made by me on March 1908, and that it correctly represents the irrigation works described in the accompanying application together with a meander of streams, and shows accurately the location and area of the lands proposed to be irrigated in each forty acre tract.

G.G. Worthington
Surveyor.

SCANNED MAY 15 2009

8321

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

ROSA DITCHES 5679D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

October 2014

RAMACO

10 Q. If for irrigation, give the location and acreage irrigated the first year and the location and acreage irrigated each subsequent year to the present.

A. The land described in Section 8 has been irrigated since 1904

11 Q. What crops were grown on this land in 1904? Give estimated acreage of each crop.

A. Hay 10 Acres

12 Q. During what months is water beneficially used?

A. April to October

13 Q. Give amount of your investment in the construction of ditch and laterals.

A. $300.00

14 Q. Give estimated cost per acre of preparing land for irrigation.

A. $5.00

15 Q. Does the map which accompanies this proof show correctly the location of diverting works and area of land where water is used?

A. Yes

THE STATE OF WYOMING,
COUNTY OF Sheridan } ss.

I, Rosa Master for Thos E Master Est., being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

In Witness Whereof, I have hereunto set my hand this 3 day of Sept A. D. 1904

Rosa Master
By Thomas E Master as Agent

Subscribed and sworn to before me at Sheridan, Wyo., Sept 3 1904

I Hereby Certify that the foregoing affidavit was read to the affiant in my presence before he signed his name thereto; that said affiant is to me personally known (or has been satisfactorily identified before me by _____), and that I verily believe him to be a credible person and the person he represents himself to be; and that this affidavit was subscribed and sworn to before me at Sheridan Wyo on this 3 day of Sept, 1904

Superintendent, Water Division No. 2

Form.—This proof is intended to be used only by parties making appropriations under permits issued in accordance with section 328, Chapter 52, Title 9, Revised Statutes of Wyoming.

The map referred to in Paragraph 15 must show the entire work in the case of individual ditches. In the case of larger works only one unit of the entire canal need be filed. Individual proof must, however, show ditch from point of diversion from main canal, and all laterals on land reclaimed. Where the duplicate was filed in the office of the State Engineer and returned to the applicant given the necessary details and shows accurately the location of unexpired work, it may be filed.

The map which accompanies this proof must be on tracing linen, must be accurately drawn on a scale of not less than two inches to the mile, and verified by the party making the measurements.

Report of Official Examination by Superintendent.

I Hereby Certify and Report that pursuant to the notice of completion of appropriation, filed with the State Engineer, and in accordance with the rules and practice of the Board of Control, I appeared at Sheridan Wyo on the 3 day of Sept, 1904, and took and received the foregoing sworn proof of appropriation of water through the Rosa Dr Ditch from Gulch - tributary Tongue River under Permit No. 5679 by Rosa Master the owner thereof; that I made a personal examination of said ditch, and of the land irrigated thereunder and described in said permit; that I found said ditch had an average width of 1 foot, a depth of 12" and a grade of about 20 feet per mile. I found a sufficient number of laterals of a capacity to fully irrigate the land described herein, and found that of the land described in said permit the following acreage has been irrigated and reclaimed in each forty-acre tract, to-wit:

Same as described in Section 8

On this land the following crops were grown in 1904

Same as described in Section 11

I also certify that after due publication of notice of the time and place said proof was opened for public inspection on the 7 day of Nov, 1904 at Sheridan Wyo in accordance with the provisions of said notice and the regulations of the Board of Control; that at said time

No party

appeared ~~—~~ filed any contest or objection to said proof.

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-103

Brook Mine

DEQ Ex. 4-1220

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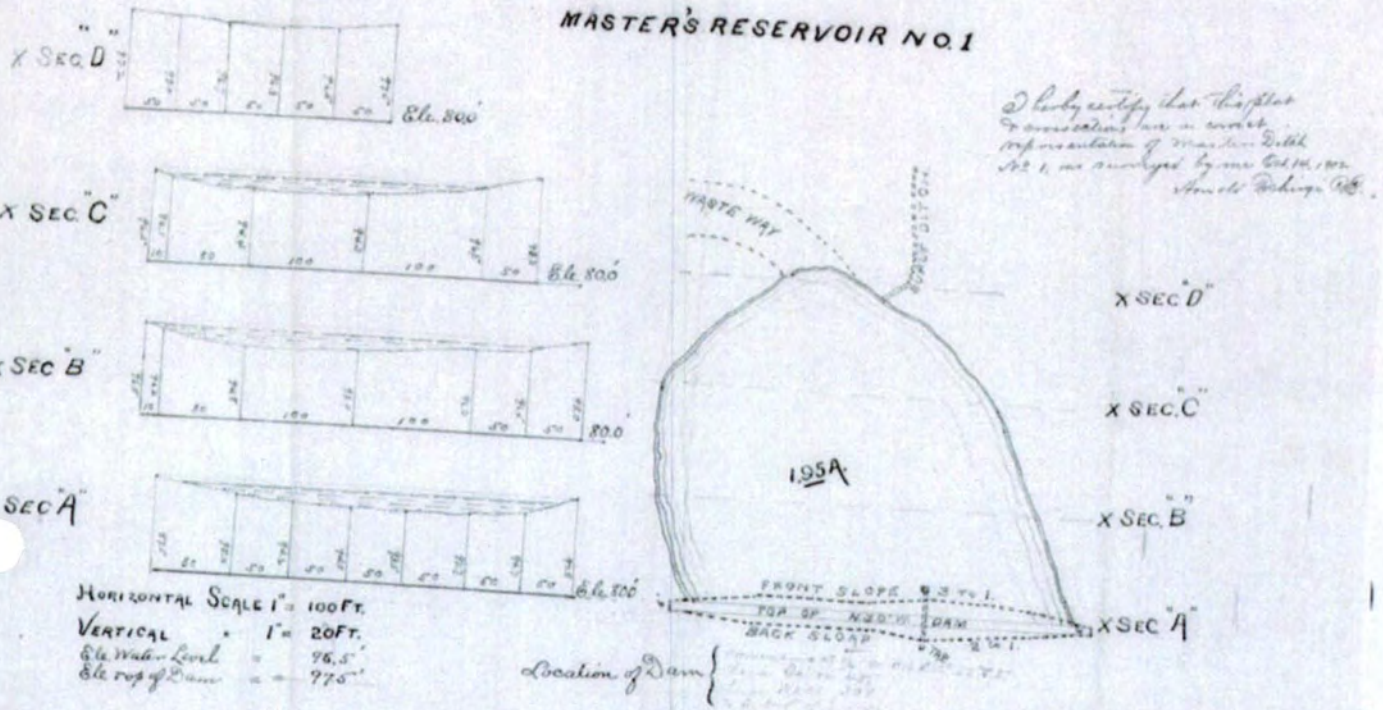

TFN 6 2/025
RECD NOV 14, 2014

I hereby certify that this is a correct Plat of MASTER'S RESERVOIR NO. 1 also of ROSA. M. AND YORK DITCHES used to irrigate the Rosa. master Ditch as surveyed by me Oct. 14-1902

Arnold Pschirgi C.E.

Land covered by Rosa. M. Ditch

Land under York Ditch

-5679-
447 Pgs.

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

PERMIT No. 5679

PROOF OF APPROPRIATION OF WATER.

(In accordance with the provisions of Section 928, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Little Fork Tongue River Division No. 2 District No.

1 Q. State your name.
A. Coal Mutual

2 Q. Postoffice address.
A. Dayton Wyo

3 Q. Are you the original applicant for Permit No. 5679 ?
A. Yes

4 Q. If not, state the date of your securing an interest therein, and the nature of your interest in the works constructed under such permit.
A.

5 Q. When did the construction of the Coal M. ditch (or other distributing works described in said permit) begin?
A. Spring 1909

6 Q. When was it completed?
A. Spring 1909

7 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?
A. Surveyed 2 Mile Width 4ft x ft bottom 1 ft depth 2 ft Grade 20 ft to mile
Reservoir completed according to terms of permit

8 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision.
A. NW SE Sec 22 T 57 R 85 W. 8 Acres
NE NE " 27 " " 6 "
14

9 Q. Give the date when, under the terms of this permit, water was first beneficially used.
A. 1909

Wherefore I recommend that said appropriation be ——— allowed and that a certificate of appropriation be issued in accordance with said proof and the tabulation thereof filed herewith.

Dated Nov 17 1914

Frank N. Case
Superintendent of Water Division No. 2

PROOF OF APPROPRIATION
ISSUED
PERMIT No. 5679

Division No. 2 District No.
Date of Appropriation Nov 9 1912
GENERAL PRIORITIES. STREAM.

NAME OF STREAM.
Little
TRIBUTARY OF
Tongue River
NAME OF CLAIMANT.
Coal Mutual

Filed with me this 3 day of Sept, 1914
State Engineer

Filed in this office this day of , 190

Secretary Board of Control.

5790

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

SHERIDAN COUNTY ELEC TUNNEL 11181D

TFN 6 2/025
RECD NOV 14, 2014

Application for a Permit to Divert and

94-211 S of

Water Division No. 2 District No.

NOV 1912

I, Judson Ribb, by general manager and agent at Sheridan, Wyoming, of the Sheridan County Electric Company, a corporation, County of Sheridan, State of Wyoming, being duly sworn according to law, upon my oath say:

1. The name of the applicant ~~Sheridan County Electric Company, a corporation duly organized and existing under and by virtue of the laws of the State of New Jersey~~

2. The postoffice address of the applicant ~~is Sheridan, Wyoming~~ See Endorsement

3. The use to which the water is to be applied is manufacturing, or more specifically to condense the steam from the turbines of the power plant of said applicant, situate on Tongue River

4. The name of the ditch or canal is the Intake canal and is a tunnel and its name or Sheridan County Electric Company tunnel

5. The source of the proposed appropriation is Tongue River Sheridan County, Wyoming

6. The headgate of the proposed ditch or canal is located North 24 East 2370 ft. from the South West corner of

of Section 15 Township 57 N Range 84 W

7. The said ~~ditch or canal is to be~~ tunnel is ~~to be constructed~~ 100 rod in length and is ~~also state by course and distances of its general local subdivisions passed through~~ situate wholly within the NW¼ of SW¼ of said Section 15

The said tunnel is made of concrete all the way through, and its dimensions are seven feet by ten feet the entire length. The tunnel is of practically same grade as stream at that point, and permits water to flow through very slowly.

8. The dimensions of said works are (a) At headgate: Width on top (at water-line) feet, width on bottom feet, depth of water feet, grade feet per mile.

(b) Give dimensions at each point where enlarged in size, stating miles from headgate:

(At) Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(At) Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(At) Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

9. Describe the character of proposed works, stating: 1st. The nature of the material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

The tunnel was completed in December 1911 and has been in operation ever since. 1st. The material moved was dirt and rock. 2nd. The size of tunnel is one hundred feet long and seven feet by ten feet. 3rd. ~~The~~ Flumming

10. The estimated cost of said ~~ditch or canal~~ is twelve hundred Dollars.

11. The land to be irrigated has a total area of acres, described as follows:

(Give estimated acreage in fractions of subdivisions)

The amount of water required for the purpose of condensing the stream from said turbines is five (5) cubic feet per second of time, and this application is for that amount. The plant where said water is used is situate in the NW¼ of SW¼ of Sec. 15, T. 57 N. R. 84 W.

The water passes through the tunnel and the stream from the turbines is exhausted into it, creating a vacuum in the condensers. The water then passes into Tongue River again, undiminished in quantity and not in any way rendered impure.

12. Construction will begin on proposed works on or before 191

13. The time required for the completion of ditches and other distributing works is year from , 191

14. The time required to complete the application of water to the beneficial use stated in this application is year from , 191

15. A map of the proposed ditch or canal, prepared in accordance with Chapter 14, R. S. 1899, accompanies this application.

Signed: Judson Ribb

NOTE.—*The statements in the foregoing application must comply with the requirements of Chapter 14, R. S. 1899.*

TFN 6 2/025
RECD NOV 14, 2014

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Scanned, 02/28/2020

Appropriate the Water of the State of Wyoming

THE STATE OF WYOMING, }ss.
COUNTY OF Sheridan }

I hereby certify that the foregoing application was signed in my presence and sworn to before me by
Judson Bliss this 9th day of March 1912

James - Burgess
Notary Public

Seal

Notice of completion received

March 19, 2001 Fort Acme Inc. owners of the Sheridan County Electric Company hereby transfers and assigns all their rights, title and interest of whatsoever nature in this permit to Lee A. Bartel, HC 36 Box 2168, Hardin, MT, his heirs, successors or assigns forever. Assignment filed in Miscellaneous Notices under this permit.

MICROFILMED MAY 04 2001

Water diverted not to exceed 5 cubic feet per second and to be returned to the stream undiminished in volume

SCANNED APR 2 2010

THE STATE OF WYOMING, }ss.
STATE ENGINEER'S OFFICE, }

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons

Witness my hand this day of A. D. 191

State Engineer

THE STATE OF WYOMING, }ss.
STATE ENGINEER'S OFFICE, }

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions: # see above

Jonquin P. Wade

Construction of proposed works shall begin within one year from date of approval.

The time for completing the work shall terminate on December 31, 1913

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1913

The amount of the appropriation shall be limited to ~~one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 191 and~~ the ~~additional~~ volume used for manufacturing purposes on or before said date.

Witness my hand this 22 day of May A. D. 1912

a. J. Parshall

State Engineer.

THE STATE OF WYOMING, }ss.
STATE ENGINEER'S OFFICE, }

This instrument was received and filed for record on the 23rd day of March A. D. 1912 at 9 o'clock A. M., and duly recorded in Book 36 of Applications, on Page 108

a. J. Parshall.

State Engineer.

TFN 6 2/025
RECD NOV 14, 2014

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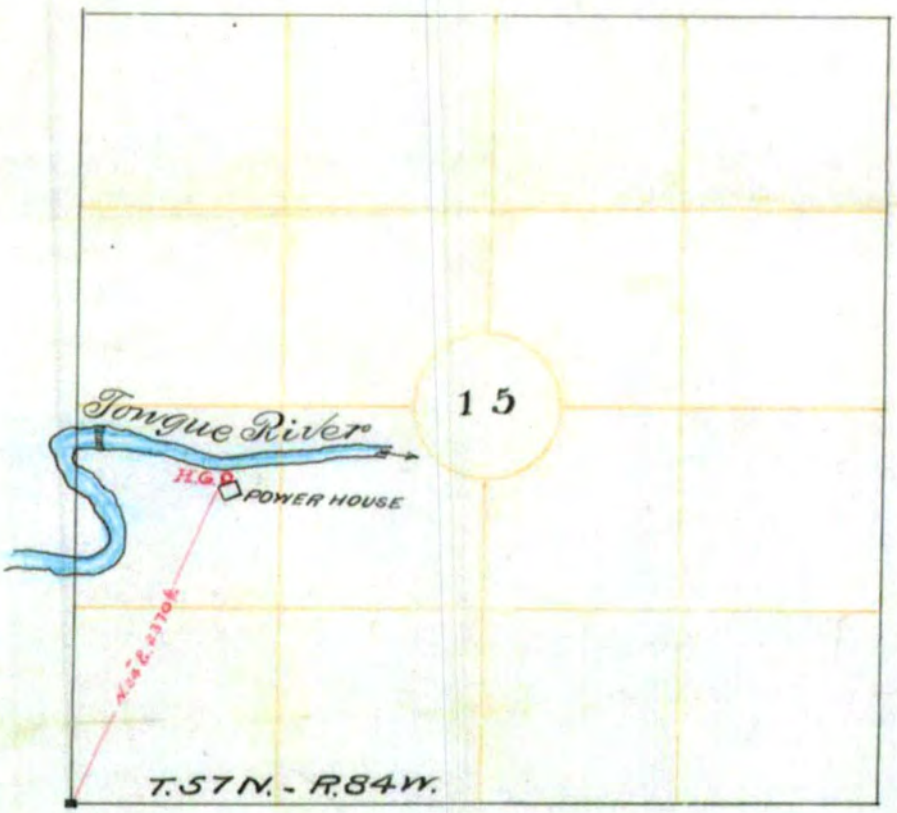
I, Arnold Tschirgi of Sheridan, hereby certify that this map was made from notes taken during an actual survey made by me on March 9 - 1912, and that it correctly shows the location of the headgate to the tunnel entering the Power House of the Sheridan Electrict Light & Power Co, taken from Tongue River for manufacturing purposes

Arnold Tschirgi
Surveyor

License No 91.



TFN 6 2/025
RECD NOV 14, 2014

82.00 fa
to accompany

Scanned, 02/28/2020

SMITH DOMESTIC PUMP 33570D

TFN 6 2/025
RECD NOV 14, 2014

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RAMACO

State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoleg@seo.wyo.gov

MICRO FILMED DEC 01 2006 Brook Mine

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

September 6, 2006

EARL & ROBIN SMITH
PO BOX 697
RANCHESTER, WY 82839

RE: Smith Domestic Pump, Permit No. 33570

Dear Applicants:

Enclosed please find a copy of the above referenced permit and the accompanying map. The time limits for Completion of Construction, and Completion of Application of Water to Beneficial Use are indicated in the enclosed permit. Furnished herewith are partially filled out Notice Forms which must be completed and sent to this office within the time limits specified on your permit, in order for you to keep your filings in good standing on our records.

Should the enclosed copies of the permit or print be lost or destroyed, additional copies may be obtained for a nominal charge.

If the work proposed under this permit cannot be accomplished within the time allowed, the State Engineer may grant an extension of time to complete the work. Your request for such extension must be received in writing before the specified time expires and give reason for the State Engineer to grant the extended time.

If you have any questions regarding this permit, feel free to contact this office at (307) 777-6168.

With best regards,

Leah Bratton for
PATRICK T. TYRRELL
State Engineer

PTT/cme
Enclosures

ec: Mike Whitaker, Superintendent
Bill Knapp, and Pat Boyd, Hydrographer Commissioners
Water Division II
PO Box 6103
Sheridan, WY 82801

TFN 6 2/025
RECD NOV 14, 2014

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MICRO FILMED DEC 0 1 2006

NOTICE OF COMPLETION OF CONSTRUCTION

This form is to be filled in with the date that all of the construction work required under the permit referenced below has been finished.

If all of the construction work cannot be finished by the expiration date for completion of construction given on the permit, write the State Engineer and request an extension of time to finish the work, giving the reasons why more time is required. Such request must be received prior to the expiration date for completion of construction shown on the permit above the State Engineer's signature. IF THIS NOTICE IS NOT RETURNED OR AN EXTENSION OF TIME IS NOT REQUESTED BEFORE THE EXPIRATION DATE, YOUR PERMIT WILL BE SUBJECT TO CANCELLATION.

(Fill out and return Form below)

NOTICE OF COMPLETION OF CONSTRUCTION

SEP 20 [redacted]
...NEER
...NE, WYO.

Sheridan County, Wyoming

Sept 15, 2006

PERMIT NO(s). 33570

WYOMING STATE ENGINEER
HERSCHLER BUILDING 4-EAST
CHEYENNE WY 82002

I hereby notify you that on the 15th day of September, 2006, construction work was entirely completed under the terms of Permit No. **33570** on the **Smith Domestic Pump** which is proposed to appropriate water from **Tongue River.**

Earl D. Smith
Signature of Applicant or Authorized Agent

Earl D. Smith
Printed Name of Applicant/Authorized Agent

TFN 6 2/025
RECD NOV 14, 2014

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MICRO FILMED DEC 0 1 2006

NOTICE OF COMPLETION OF THE APPLICATION OF WATER TO BENEFICIAL USE

This form is to be completed with the date water was used for the purpose or purposes specified in the permit referenced below.

This form should not be completed until 1) *all* set-out lands have been irrigated or 2) beneficial use made at *all* proposed points of use, or 3) the maximum water use allowed under the permit is developed. If a) the irrigation of *all* of the lands, or b) beneficial use made at *all* the proposed points of use, or c) the maximum diversion contemplated under the permit cannot be completed by the expiration date for *Completion of Beneficial Use* specified in the permit, write the State Engineer and request an extension of time, giving the reasons why more time is required to complete *all* the permitted uses or develop the resource to its maximum permitted capacity. Such request must be received *prior to the expiration date* for completion of beneficial use shown in the permit above the State Engineer's signature.

IF THIS NOTICE IS NOT RETURNED OR AN EXTENSION OF TIME IS NOT REQUESTED BEFORE THE EXPIRATION DATE, YOUP PERMIT WILL BE SUBJECT TO CANCELLATION.

(Fill out and return Form below)

NOTICE OF BENEFICIAL USE OF WATER

SEP 20 2006

Sheridan County, Wyoming

Sept. 18, 2006
(DATE)

PERMIT NO. 33570

WYOMING STATE ENGINEER
HERSCHLER BUILDING 4-EAST
CHEYENNE WY 82002

I hereby notify you that I have completed the application of water to beneficial use for all set-out lands or uses proposed under the **Smith Domestic Pump**, Permit No. **33570**, proposing to divert water from Tongue River on the 18th day of September, 2006.

Earl D. Smith
Signature of Applicant or Authorized Agent

Earl D. Smith
Printed Name of Applicant/Authorized Agent

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

TONGUE RIVER DITCH ENL 1552E

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO

Application for a Permit to Divert and

Brook Mine

Cert. Record 26 P 213 Ac. 56.

Water Division No. V District No. 5.

ENLARGEMENT OF THE Tongue River Ditch (Co. Ditch)

I, Leonard Tschiggi, of Sheridan, County of Sheridan State of Wyoming, being duly sworn according to law, upon my oath say:

1. The location and description of the ditch to be enlarged is as follows—

2. The headgate is situated S. 44° 15' E. - 1320 ft. from North ¼ Cor of Section 19, Township 57, Range 83

3. Said ditch is 6 miles long and passes through the following lands (give legal subdivisions) the same being correctly shown on the map accompanying this application:

N½ NE¼ Sec. 19, T. 57 N. R. 83 W. SW¼ Sec. 5 T. 57 R. 83 — SW¼ Sec. 3 T. 57 R. 83
SE¼ SE¼ " 18 " " " SE¼ NW¼ " 15 " SE¼ SE¼ " 13 " "
S½ S½ " 17 " " " S½ NE¼ " 15 " E½ SW¼ " 18 T. 57 R. 84
SW¼ " 16 " " " NE¼ SE¼ " 15 "
SE¼ " 16 " " " N½ S½ " 18 "

4. The dimensions of said ditch are: Width on top (at water-line) 11.5 feet; width on bottom 8.5 feet; depth of water 1.7 feet; grade 2.5 feet per mile.

5. Said ditch now serves to irrigate the following described land:

S½ SW¼ Sec. 17, T. 57 R. 83 — W½ SE¼ Sec. 15, T. 57 R. 83 W
NW¼ " 20 " " — SW¼ NE¼ " 15 " "
NW¼ " 21 " " — NE¼ SE¼ " 15 " "
N½ NE¼ " 21 " " — SW¼ " 14 " "
N½ NW¼ " 22 " " — NW¼ SE¼ " 14 " "
NW¼ SE¼ " 22 " " — S½ S½ " 13 " "
S½ SW¼ " 15 " " — N½ N½ " 24 " "
NE¼ SW¼ " 15 " " — SW¼ SW¼ " 18 T. 57 N. R. 84 W.
— NW¼ NW¼ " 19 " "

6. The total area now irrigated from said ditch being 4135 acres.

7. Application is hereby made for permission to enlarge or extend the use of water through the above named and described ditch and to divert and appropriate the water of the State as follows:

1. The name of the applicant Fred McPhillamey
2. The postoffice address of the applicant Monarch, Wyo.
3. The use to which the water is to be applied is Irrigation
4. The name of the ditch or canal is Tongue River Ditch.
5. The source of the proposed appropriation is Tongue River and the head of the proposed extension is located of Section , Township , Range
6. The said ditch or canal as enlarged is to be 6 miles long and to pass through the following lands (give sections, townships and ranges):

Sections 3-14-15-16-17-18-19, T. 57 N. R. 83 W.
" 18 T. 57 N. R. 84 W.

7. The dimensions of said ditch are to be: (a) [At headgate] Width on top (at water-line) 12 feet; width on bottom 9 feet; depth of water 1.7 feet; grade 2.5 feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate: [At 3179 feet] width on top (at water-line) 11 ft.; width on bottom 8 ft.; depth of water 1.5 ft.; grade 2.5 ft. per mile.

[At 4400 ft.] width on top (at water-line) 9.0 ft.; width on bottom 6.5 ft., depth of water 1.5 ft., grade 2.5 ft. per mile.

8. Describe the character of proposed works, stating: 1st. The nature of material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

Earth
175' flume.

9. The estimated cost of said enlargement is 500 Dollars.

10. The land to be irrigated has a total area of 56 Acres acres, described as follows: (Give estimated acreage in fractions of subdivisions)

NE¼ NW¼ Sec. 19 T. 57 R. 84 22.
NW¼ NE¼ " 19 " " 34.

TFN 6 2/025
RECD NOV 14, 2014

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7. The dimensions of said ditch are to be: (a) [At he ite] Width on top (at water-line) 12 feet; width ottom 9 feet; depth of water 1.7 feet; grade 2.5 feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate: [At 3179 feet] width on top (at water-lin " ft. width on bottom 8 ft.; depth of water 1.5 ft.; grade 2.5 ft. per mile. [At 4400 ft.

8. Describe at 2 mi. from H. G. T/p. 8 - Bottom 5 Feet - Grade 2.5' per M
of tunnels, if an at 3 3/4 mi " " " T/p. 5 " 3' " " 5' " "

9. The estimated cost of said enlargement is 500 Dollars.

10. The land to be irrigated has a total area of 56 Acres acres, described as follows:

(Give estimated acreage in fractions of subdivisions)

NE¼ NW¼ Sec. 19 T. 57. R. 84 22.
NW¼ NE¼ " 19 " " 34.

* If the proposed work is to be an extension of the original ditch, give the location of the head of the extension by courses and distances from the nearest Government corner.

October 2014
TFN 6 2/025
RECD NOV 14, 2014
Addendum D11-4-117
RAMACO
Brook Mine

Scanned, 02/28/2020

11. Construction of the proposed enlargement or extension will begin within one year from date of approval of this application

12. The time required for the completion of enlargement or extension is one year from July 1st, 1906

13. The time required to complete the application of water to the beneficial use stated in this application is one year from July 1, 1906

14. A map in duplicate, prepared in accordance with the provisions of Section 35 of the Water Laws, accompanies this application.

Signed: Arnold Tschirgi

NOTE.—The statements in the foregoing application must comply with the requirements of Chapter 14, R. S. 1899.

NOTE.—Before applications for the enlargement of ditches can be approved, the written consent of the owners of such ditches must be secured, and this must accompany the application.

THE STATE OF WYOMING, } ss.
COUNTY OF Sheridan }

I hereby certify that the foregoing application was signed in my presence and sworn to before me by Arnold Tschirgi this 5th day of May, 1906.

J. F. Hoop
Notary Public.

My commission January 31-1909. Seal.

Notice of Expiration Mailed
OCT 1 1 1906

Extract of minutes of the Tongue River Ditch Co.- Held March 11-1905 at the company's office - at Ranchester, Wyo.

Moved and seconded that Fred McPhillamey be allowed to become a member of the Tongue River Ditch Co.- provided that he enlarges the ditch flumes and laps - sufficient to carry the required state appropriation of water.

The above motion was adopted + passed March 11, 1905

O. F. Rhode
Secy.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE. }

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Witness my hand this day of , A. D. 190

State Engineer.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE. }

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

The records of the State Engineer's Office show the waters of Tongue R. + trib. to be largely appropriated. The appropriator under this permit is hereby notified of this fact and that the issuance of this permit grants only the right to divert and use the surplus or waste water of the stream and confers no rights which will interfere with or impair the use of water by prior appropriators.

Work will begin within one year from date of approval.

The time for completing construction shall terminate on December 31, 1907.

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1907.

The amount of the appropriation shall be limited to one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 1907, ~~and the additional volume applied to~~ purposes on or before said date.

TFN 6 2/025
RECD NOV 14, 2014

Witness my hand this 26th day of May, A. D. 1906.

Clarence T. Johnston
State Engineer.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE. }

This instrument was received and filed for record on the 28th day of May, A. D. 1906, at 9 o'clock A. M., and duly recorded in Book 6 of Enlargements on Page 263.

Scanned, 02/28/2020

October 2014

RAMACO

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-119

Brook Mine

Notes of Ditch Survey

Sta	Course	Dis	Remarks
0			is Head Sta being S 20° 30' E 1000 ft from N¼ Cor bet Sec 18 & 19 T 57 - R 85
0	N 21° E	2177	to ft in center of X Road Canal
1	S 85 30 E	1000	along center line of [illegible]
			Sta 1 + 70 ft to Junction Box. Dist 1 + 12 ft to Junction Box
2	N 48° E	1667	Sta 1 + 2000 ft to N & S Center
3	N 1920 E	1400	
4	N 14½ E	3300	Sta 4 + 150 ft Junction Box. Sta 4 + 160 ft Junction Box
5	N 7½ E	1045	
6	N 17½ E	2300	
7	S 49½ E	1900	Sta 7 + 100 ft N & S fence
8	S 74° E	1900	Sta 8 + 50 ft Junction Box
9	S 76° E	1930	
10	S 82° E	3300	Sta 10 + 30 ft Junction Box
11	S 70½ E	3300	
12	S 16° E	1600	to Head Gate - Sta 13

Sta 13 is at N 725 ft W of N¼ Cor bet Sec 18 & 19 T 57 - R 84

PLAT
OF
TONGUE RIVER DITCH
TO BE ENLARGED
To Irrigate the
NE¼ NW¼ & NW¼ NE¼ of SEC. 19 T. 57 - R 84

Scale 1" = 2000 ft

CERTIFICATE OF SURVEYOR

STATE OF WYOMING
County of Sheridan ss

I, Arnold Verhage of Sheridan, Wyo. [illegible] that I have carefully made some [illegible] during the month of April 16 [illegible] and that the accompanying [illegible] and the results [illegible]

Arnold Verhage

R.85W. R.84W. T.57N.

TONGUE RIVER DITCH

Tongue River

Tongue River Reservoir

Big Goose Cr.

Barley Cr.

Flume

Sturgis Cr.

Flume

180A. 260A. 200A. 200A. 80A. 100A. 15A. 22A. 34A.

SCANNED JAN 19 2010

Scanned, 02/28/2020

VANESSA DOMESTIC PUMP 34570D

TFN 6 2/025
RECD NOV 14, 2014

Scanned, 02/28/2020

RAMACO 3570583
Form S.W. 1
Rev. 12/22/2008

E7649
25.00

KYLE MUMM

03/14/11 09:31 AM Brook Mine

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date

THE STATE OF WYOMING
STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 14th day of March, 20 11, at 09:31 o'clock A M.

JOHN BARNES For State Engineer

Recorded in Book 158 of Ditch Permits, on Page 49

Fee Paid $ 25.00 Map Filed SA-32

WATER DIVISION NO. 2 DISTRICT NO. 5 TEMPORARY FILING NO. 35 6/132D

PERMIT NO. **P34570.0D**

NAME OF FACILITY VANESSA DOMESTIC PUMP

1. Name(s) & mailing address and phone no. of applicant(s) is/are JOHN AND VANESSA BUYOK, 86 MONARCH ROAD, RANCHESTER, Wyoming, 82839, PH: 307-673-0068

E-mail address:

(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices SAME AS ABOVE

E-mail address:

3. (a) The use to which the water is to be applied is Domestic Use-- Surface water

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is Tongue River, tributary of Yellowstone River, tributary of Missouri River

5. The point of diversion of the proposed works is located _____ feet distant from the _____ corner of Section _____ T. _____ ., R. _____ ., and is in the SW1/4NE1/4 of Section 19 T. 057N ., R. 084W .

Lot _____ Block _____ Subdivision Name _____

Latitude (Decimal Degrees) 44.90306 Longitude (Decimal Degrees) -107.04200

6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

No- all privately owned lands

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is 0.056 cubic feet per second (c.f.s.)

8. The accompanying map is prepared in accordance with the State Engineer's Rules and Regulations for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is _____, and to complete the application of water to the beneficial uses stated in this application is _____

TFN 6 2/025
RECD NOV 14, 2014

Permit No. **P34570.0D**

Page No. **158/49**
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10. The land to be irrigated under this permit is described in the following tabulation. Give irrigable acreage in each 10 acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately. If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 10 acre subdivision and owner.

Town	Range	Sec	NE¼				NW¼				SW¼				SE¼				
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
			Domestic Use for a single family dwelling at the following point of use not to exceed .056 c.f.s. Land Owner: Patented, Applicant - JOHN AND VANESSA BUYOK																
057N	084W	19			A X														

Number of acres to receive original supply 0.00
Number of acres to receive supplemental supply 0.00
Total number of acres to be irrigated 0.00

REMARKS

Application is for domestic (lawn and garden) water use, via a small portable pump from the Tongue River. Pump will be used during normal growing seasons. Type of Pump: Electric Horsepower: 1HP Delivery Method: Water is pumped from the Tongue River through HDPE pipe to springlers.

.056 cfs (25 gpm)

I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

JOHN AND VANESSA BUYOK
Printed Name and Signature of Applicant or Agent

March 14, 2011
Date

TFN 6 2/025
RECD NOV 14, 2014

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THE STATE OF WYOMING } ss
STATE ENGINEER'S OFFICE }

TEMPORARY FILING NO. 35 6/132D

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This permit grants only the right to use the water available in the stream after all prior rights are satisfied.

The amount of appropriation shall be limited to the amount beneficially used for Domestic purposes only, not to exceed 0.056 cubic feet per second of time.

This permit is issued to make an existing facility a matter of record. The notice of completion of construction is hereby waived.

The notice of beneficial use has been waived.

Witness my hand this 10th day of October, A.D. 2011

TFN 6 2/025
RECD NOV 14, 2014

JOHN BARNES For State Engineer

Permit No. P3□5□0.0D

Page No. 158/□9

DEQ Ex. 4-1240

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PERMIT NO. P3[5[0.0D

PERMIT STAT[S

Priority Date March 1[, 2011 Approval Date October 1[, 2011

TFN 6 2/025
RECD NOV 14, 2014

NOTICE

This permit does not constitute a complete water right. It is your authority to begin construction work.

All appropriations for irrigation are limited to 1 cubic foot per second of time for each [0 acres of land irrigated, except as provided in Section [1[[320, Wyoming Statutes, 19[[. Appropriations for other uses are limited to the amount of water beneficially used in accordance with the terms of the permit.

Notice of completion of work and of application of the water to the beneficial uses described in the permit, must be filed in the State Engineer's Office before the expiration of the time allowed in the permit.

If extensions of time beyond the time limits set forth in the permit are re[uired, re[uests for same must be in writing, stating why the additional time is re[uired, and must be received in the State Engineer's Office before the expiration of the time allowed in the permit.

To perfect your water right, your Water Division Superintendent, or his authori[ed representative, will contact you after you have submitted notice to the State Engineer stating that you have applied the water to the beneficial uses described in your permit. After execution of the proof, it will be considered by the State [oard of Control, and, if found to be satisfactory, the [oard will issue to you a Certificate of Appropriation which will constitute a completed water right.

The granting of a permit does not constitute the determination that any right of way is necessary in connection with the application. It should be understood that this responsibility is the applicant's.

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TWN	RGE	SEC	NE1/4				NW1/4				SW1/4				SE1/4				TOTAL
			NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	NE1/4	NW1/4	SW1/4	SE1/4	
			Domestic Use for a single family dwelling at the following point of use not to exceed .056 c.f.s. Land Owner: Patented, Applicant - JOHN AND VANESSA BUYOK.																
057N	084W	19			A X														

TFN 6 2/025
RECD NOV 14, 2014

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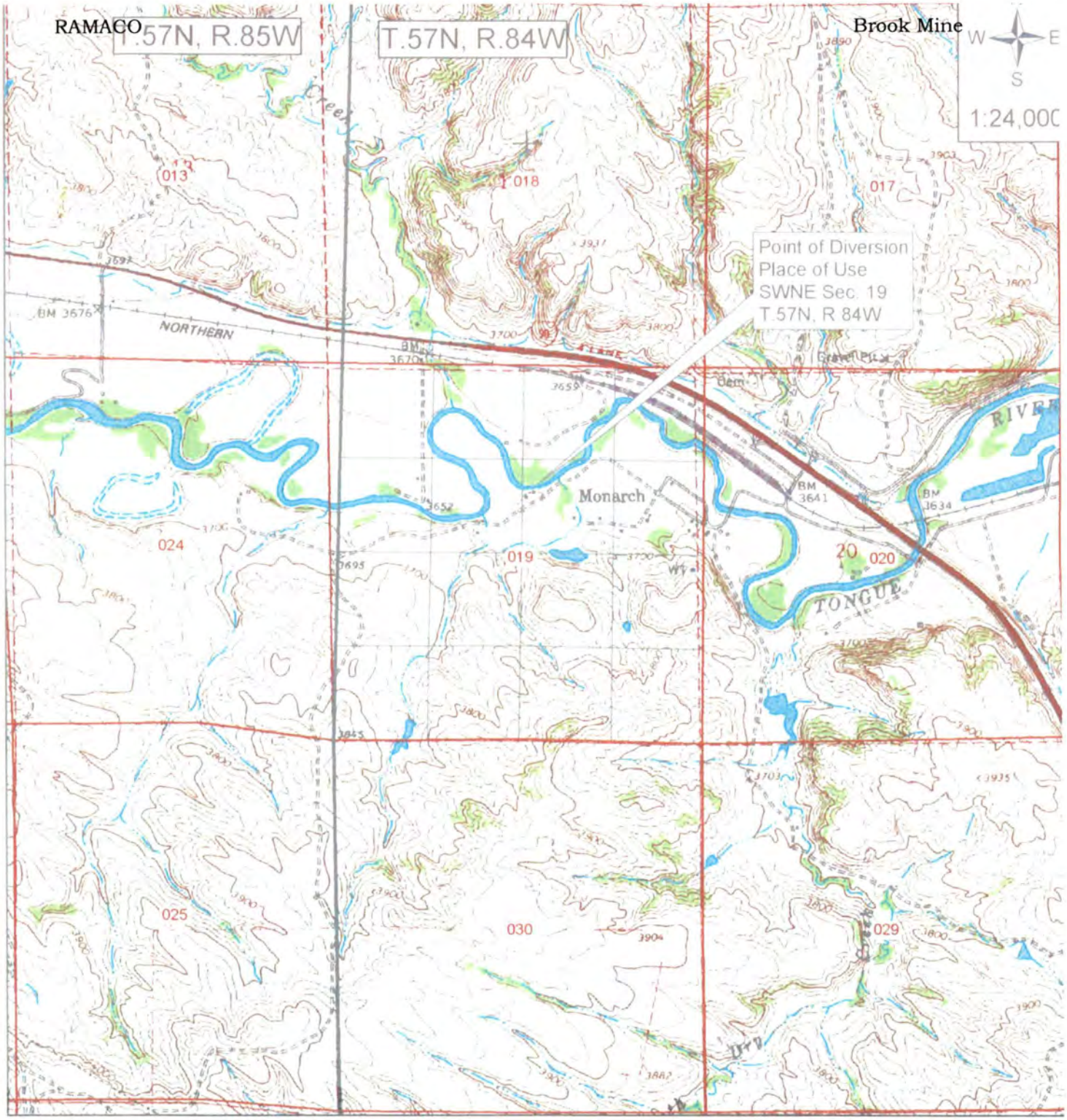

APPROVED

Patrick T. Tyrrell STATE ENGINEER

MAP TO ACCOMPANY APPLICATION FOR:
Vanessa Domestic Pump

APPLICANT:
John & Vanessa Buyok
86 Monarch Road
Ranchester, WY 82839

TFN 6 2/025
RECD NOV 14, 2014

October 2014

DEQ Ex. 4-1243

Addendum D11-4-126

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WYOMING COAL MINING 8297D

TFN 6 2/025
RECD NOV 14, 2014

Application for a Permit to Divert and

Cert. Rec. 31 p. 316 2.5 cu ft

The S. A. Bristol Co., Printers and Binders, Cheyenne

Completed

Water Division No. 2 District No.

I, [illegible] of [illegible], County of [illegible], State of [illegible] being duly sworn according to law, upon my oath say:

1. The name of the applicant [illegible]

2. The postoffice address of the applicant [illegible]

3. The use to which the water is to be applied is [illegible]

4. The name of the ditch or canal is [illegible]

5. The source of the proposed appropriation is [illegible]

6. The headgate of the proposed ditch or canal is located [illegible] 820 ft. from the East [illegible] of Section [illegible], Township [illegible], Range [illegible]

7. The said ditch or canal is to be miles long and to pass through the following lands (give route by courses and distances, or by naming legal subdivisions crossed):

The works consist of a pumping plant - section 6 - and main supply pipe to a pressure reservoir - with distribution of service pipe on the following subdivisions occupied by The Company's plant and Town Site - [illegible]

8. The dimensions of said works are: (a) (At headgate) Width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate:

(At) width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(At) width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

(At) width on top (at water-line) feet; width on bottom feet; depth of water feet; grade feet per mile.

9. Describe the character of proposed work, stating: 1st. The nature of material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

10. The estimated cost of said ~~ditch~~ works is [illegible] Dollars.

11. The land to be irrigated has a total area of acres, described as follows: (Give estimated acreage in fractions of subdivisions.)

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RECD NOV 14, 2014

12. Construction will begin on proposed works on or before , 190

13. The time required for the completion of ditches and other distributing works is July 1st 1905 ~~year from~~ , ~~190~~

14. The time required to complete the application of water to the beneficial use stated in this application is ~~year from~~ July 1st, 1905

15. A map of the proposed ditch or canal, prepared in accordance with Chapter 14, R. S. 1899, accompanies this application.

Signed Arnold [illegible]

Note.—The statements in the foregoing application must comply with the requirements of Chapter 14, R. S. 1899.

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Appropriate the Water of the State of Wyoming

THE STATE OF WYOMING, } ss.
County of Sheridan }

I hereby certify that the foregoing application was signed in my presence and sworn to before me by
Arnold Sorenson this 2 5th day of March, 1908.

Notary Public
My commission expires January 3 1st 1910

Date of completion received June 3, 1908

THE STATE OF WYOMING, } ss.
State Engineer's Office }

SCANNED APR 2 2010

This is to certify that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Witness my hand this day of A. D. 190

State Engineer.

THE STATE OF WYOMING, } ss.
State Engineer's Office }

This is to certify that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

Construction of proposed works shall begin within one year from date of approval.

The time for completing the work shall terminate on December 31, 1908.

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1908.

The amount of the appropriation shall be limited to ~~one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 190 , and~~ the ~~additional~~ volume used for Mining Power & Domestic purposes on or before said date.

Witness my hand this 1st day of April, A. D. 1908.

Clarence T. Johnston
State Engineer.

TFN 6 2/025
RECD NOV 14, 2014

THE STATE OF WYOMING, } ss.
State Engineer's Office }

This instrument was received and filed for record on the 16 day of March, A. D. 1908, at 9 o'clock A. M., and duly recorded in Book 26 of Applications on Page 214.

Clarence T. Johnston
State Engineer.

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TFN 6 2/025
RECD NOV 14, 2014

WYOMING COAL MINING CO's
WATER SUPPLY

scale 1" = 1 m.f.

I hereby certify that this plat shows the correct location of intake and pipe line of the Wyoming Coal Mining Co's water supply, taken from notes in an actual survey made by me Feb 22-08

Arnold Tschirgi
Surveyor.

License No 31.

SCANNED APR 2 2010

8297

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YORK DITCH 388D

TFN 6 2/025
RECD NOV 14, 2014

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October 2014

RAMACO

ORDER RECORD No. 2 -STATE BOARD OF CONTROL

166

Priority No.	Name of Ditch	Name of Appropriator	P.O.Address	Date of Appropriation	Use to Which Water is Applied	Amount Appropriated Cu.Ft.Per Sec.	Amount Previously Appropriated	No.Acres Irrigated	Description of Lands Irrigated
167			Void - see O. S. S. P. 301						
1973 17	Highline Ditch Co.	J. D. Thorn	Dayton,Wyo.	Nov. 10, 1891	Irrigation				Permit issued. Time for application not expired
			Void - no record of Permit or Adjudication						
18	Huntington 2 App.	C. D. Friebe	" "	Jan. 26, 1892	"				" " " " " "
1975 19	Ellison	Samuel Ellison	Sheridan"	1892	"	.69		46	Part of NW¼NW¼, Sec. 13; N½NE¼, SE¼NE¼, Sec. 14; SW¼SE¼, Sec. 11, T. 57 N., R. 84 W.
186			Void - see O. S. S. P. 302						
1974 20	York	Thomas E. Masters	" "	Jan. 6, 1893	"				Permit issued. Time for application not expired.
444			Cancelled - see Permit 444						
1976 21	Eisele	John C. Barr, et al	" "	March 29,1893	"				" " " " " "
39 Enl.			Void - see O. S. S. P. 375						
1976 22	Huntington	Elizabeth McNutt Simpson	" "	June 5, 1893	"				" " " " " "
1977 22	"	C. H. Ketcham	Dayton "	Season, 1893	"	2.30		160	Part of S½SW¼, Sec. 27; NW¼, Sec. 34, T. 57 N., R. 86 W.
1978 22	"	Mary A. Kueny	" "	" "	"	2.00		140	Part of S½NW¼, W½NE¼, Sec. 35, T. 57 N., R. 86 W.
1979 23	Evans	Simon J. Evans	Sheridan"	Sept. 20,1893	"	1.79		125	Part of SE¼SW¼, S½SE¼, NE¼SE¼, Sec. 2, NW¼SW¼, Sec. 1, T. 57 N., R. 84 W.
1980 24	McCarthy	Patrick McCarthy	" "	Season, 1893	"	1.50		105	Part of NE¼, Sec. 21; NW¼NW¼, Sec. 22, T. 56 N., R. 83 W.

168 169

Priority No.	Name of Ditch	Name of Appropriator	P.O.Address	Date of Appropriation	Use to Which Water is Applied	Amount Appropriated Cu.Ft.Per Sec.	Amount Previously Appropriated	No.Acres Irrigated	Description of Lands Irrigated
1981 24	Walker & Boyle	John W. Boyle	Sheridan, Wyo.	Season, 1893	Irrigation	1.00		70	Part of Lots 1 & 2, SE¼NE¼, Sec. 20; Lot 4, SW¼NW¼, Sec. 21, T. 56 N., R. 83 W.
1982 24	" " "	Mary J. Roland	" "	" "	"	.39		27	Part of SW¼NE¼, Sec. 20, T. 56 N., R. 83 W.
56 Enl.									Permit issued. Time not expired.
1983 25	Adams & Lord	Rollin L. Marohl	" "	Jan. 8, 1894	"				

See Book 3 - Page 165, No. 26

It is therefore ordered by the State Board of Control that the above-named appropriators do have the use of the water of Tongue river and tributaries in the amounts and for the purposes set forth in the above table, and that the order of priority and the rights of the various appropriators to the use of the water of said stream and tributaries be the same as the order of their statement and as limited by the statements in said table.

In Witness Whereof, the President of the said Board has hereunto set his hand this 13th day of March, A. D., 1896.

ELWOOD MEAD
President, State Board of Control

Attested by:

James A. Johnston, Secretary

3-34 In the Matter of the determination of the rights to water from Big Goose creek, in Water Division No. 2, Sheridan County, Wyoming.

Opinion

The proof submitted by the Division Superintendent to the Board of Control includes only that of parties who were unable to submit proof at the two prior hearings on this stream and had been granted an extension of time to complete the use of the water and to submit proof of such application to beneficial uses. A proper understanding of claimants proof and the right sought to be established by such proof makes it necessary to include their proof and petitions submitted at former hearings of the Board, and to consider in connection with the final proof the former action of the Board relative to these claims.

It appears that at the original taking of proof of appropriation from this stream a number of the owners of, and intending appropriators through, each of the following named ditches, viz: the Grinnell Live Stock Company ditch, the Peralto ditch, the Big Goose and Beaver ditch, the Cross and Cruse Creek ditch, and the Big Goose ditch of the Patrick Bros., submitted petitions each setting forth in substantially the same terms the following facts:

That each of the above-named ditches were of

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RECD NOV 14, 2014

Addendum D11-4-132

Brook Mine

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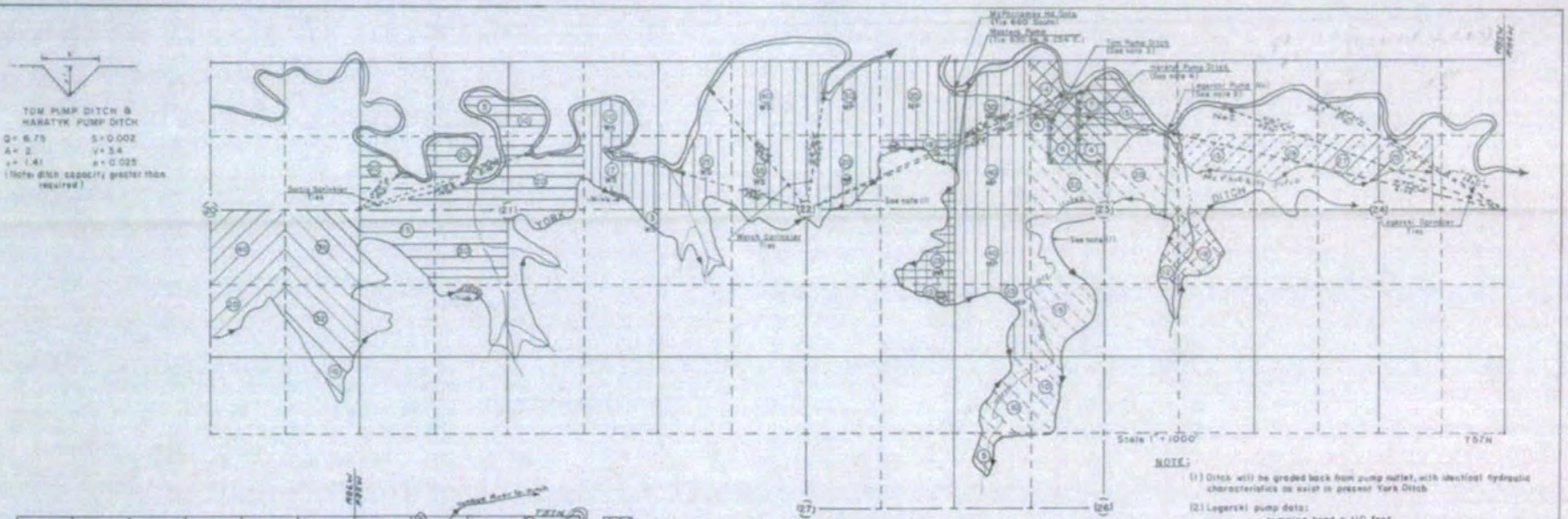
RAMACO

Brook Mine

October 2014

Addendum D11-4-133



Small scale map showing York Ditch above lands covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by O. Stilling, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by E.R. Williams, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by R. Soltis, covered by listed petition (1)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by J.T. & J. Legerski, covered by listed petition (6)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by M. & J. Haratyk, covered by listed petition (7)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by G. Legerski, covered by listed petition (5)

Lands under McPhillamey Ditch, permit no. 5016, priority 8-2-1902, owned by G. Legerski, covered by listed petition (4)

Lands under McPhillamey Ditch, permit no. 1133 enl., priority 11-12-1903, owned by G. Legerski, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (2)

Lands under Masters Pump, permit no. 388, priority 1-6-1893, owned by W. Welch, petition for change of pt. of diversion granted 3-14-1916

Lands under York Ditch, permit no. 1128 enl., priority 11-9-1903, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 1129 enl., priority 11-12-1903, owned by G. Legerski, covered by listed petition (5)

NOTE:

(1) Ditch will be graded back from pump outlet, with identical hydraulic characteristics as exist in present York Ditch

(2) Legerski pump data:
pumping head = 110 feet
30 H.P. pump
1445 L.F. 12" discharge pipe

(3) Tom pump ditch data:
pumping head =7 feet
5 H.P. pump
330 L.F. 4" pipe

(4) Haratyk pump ditch data:
pumping head = 22 feet
3 H.P. pump
260 L.F. 3" pipe

(5) Legerski sprinkler data:
1500 L.F. main line pipe (6")
1000 L.F. distr. pipe (4")
max. pumping head = 30 feet

(6) Welch sprinkler data:
3000 L.F. main line pipe (6")
2000 L.F. distr. pipe (4")
max. pumping head = 105 feet

(7) Soltis sprinkler data:
1500 L.F. main line pipe (6")
1100 L.F. distr. pipe (4")
max. pumping head = 110 feet

MAP

To Accompany

(1) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO SOLTIS SPRINKLER
(2) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO WELCH SPRINKLER
(3) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND YORK DITCH PERMIT NO. 1128enl. TO MASTERS PUMP
(4) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF McPHILLAMEY DITCH TO LEGERSKI SPRINKLER
(5) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND ALL OF PERMIT NO. 1129 enl. TO LEGERSKI PUMP
(6) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO TOM PUMP DITCH
(7) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO HARATYK PUMP DITCH

PETITIONERS

(1) Rudolph Soltis	Manchester, Wyoming
(2 & 7) William Welch	Sheridan, Wyoming
(4 & 5) George Legerski	" "
(6) Jos., Tom, & John Legerski	" "
(7) M. & J. Haratyk	Acme, Wyoming

SCALE 1 INCH = 1 MILE

CERTIFICATE OF SURVEYOR

COUNTY OF SHERIDAN
STATE OF WYOMING } ss

I, Walter J. Prich, of Sheridan, Wyoming, certify that this map was made from records and maps on file in the State Engineer's Office and from notes taken during an actual survey made by me on January 15, 23, 24, 1962, and that it correctly represents the irrigation works, the location and area of lands to be irrigated in each subdivision and the location of sprinkle in so far as these petitions are affected.

REGISTRATION NO. 537

Engineer & Surveyor

Petitions 6 & 7 granted May 9, 1963
Petition "5" granted May 10, 1963
Petitions 1, 2, 3 & 4 granted May 13, 1963
George F. Christensen
Secretary, State Board of Control

TFN 6 2/025
RECD NOV 14, 2014

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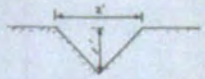
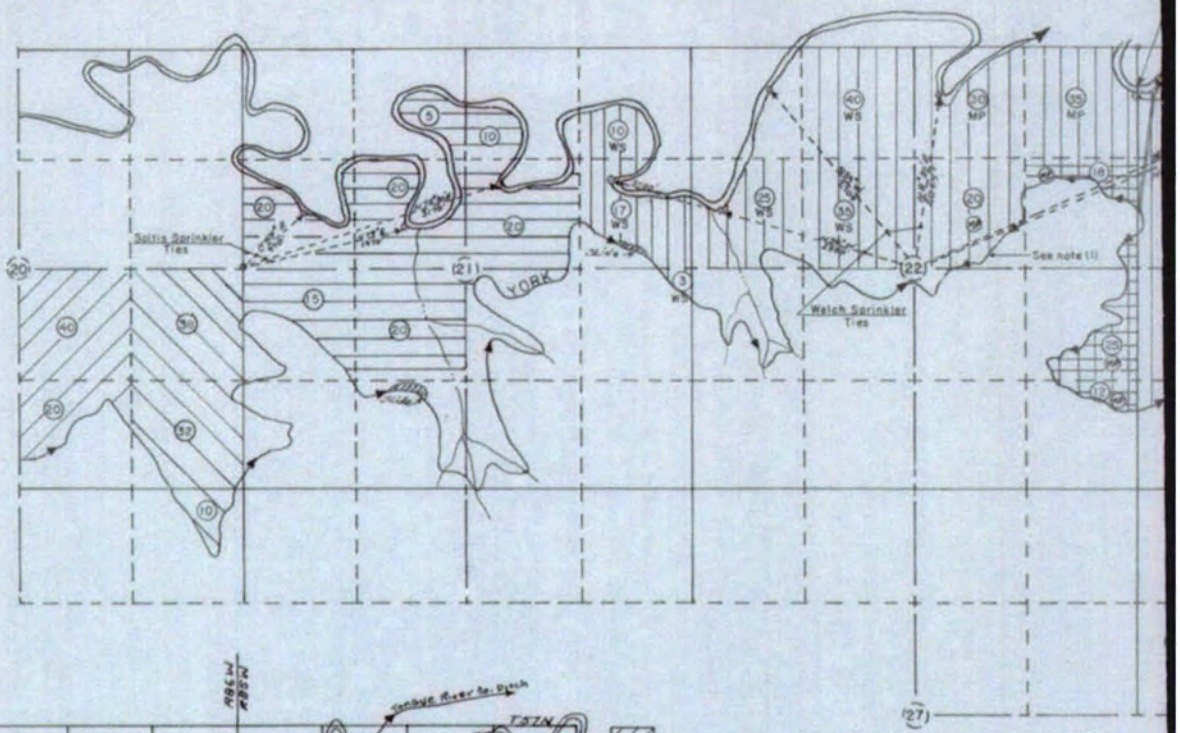
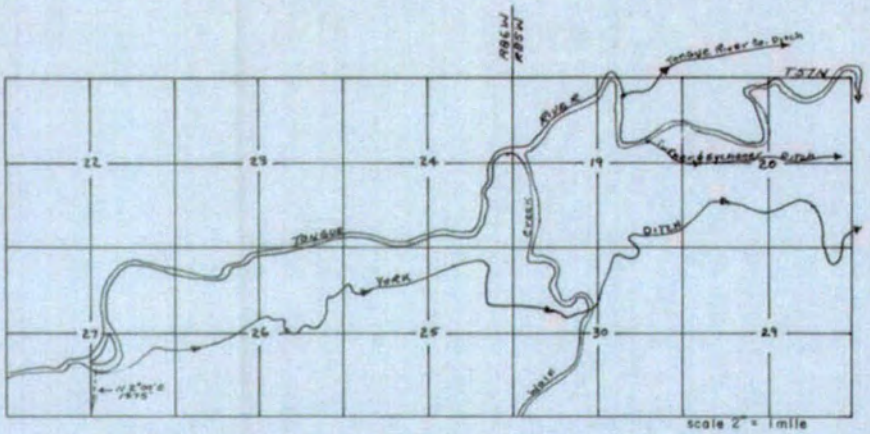


TOM PUMP DITCH &
HARATYK PUMP DITCH

Q= 6.75 S=0.002
A= 2 V= 3.4
r= 1.41 n= 0.025
(Note: ditch capacity greater than required)





Small scale map showing York Ditch above lands covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned O. Shilling, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned E. R. Williams, not covered by these petitions

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned R. Soltis, covered by listed petition (1)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned J.T. & J. Legerski, covered by listed petition (6)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned M. & J. Haratyk, covered by listed petition (7)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned G. Legerski, covered by listed petition (5)

Lands under McPhillamey Ditch, permit no. 5016, priority 8-2-190 owned by G. Legerski, covered by listed petition (4)

Lands under McPhillamey Ditch, permit no. 1133 enl., priority 11-12- owned by G. Legerski, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned W. Welch, covered by listed petition (2)

Lands under York Ditch (changed to Masters Pump), permit no. 388, priority 1-6-1893, ow W. Welch, petition for change of pt. of diversion granted 3-14-1916

Lands under York Ditch, permit no. 1128 enl., priority 11-9-1903, ow W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 1129 enl., priority 11-12-1903, ow G. Legerski, covered by listed petition (5)

CERTIFICATE OF SURVEYOR

COUNTY OF SHERIDAN
STATE OF WYOMING ss

I, Walter J. Pilch, of Sheridan, Wyoming, certify that this map was made from records and maps on file in the State Engineers Office and from notes taken during an actual survey made by me on January 11, 23, 24, 1962, and that it correctly represents the irrigation works, the location and area of lands to be irrigated in each subdivision and the location of streams in so far as these petitions are affected.

REGISTRATION NO. 537

Walter J. Pilch
Engineer & Surveyor

Petitions 5 & 6 granted May 9, 19
Petition 7 granted May 10, 1
Petitions 1-2-3-4 granted [illegible]

George L. Christensen
Ex-officio Secretary, State Board of

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RECD NOV 14, 2014

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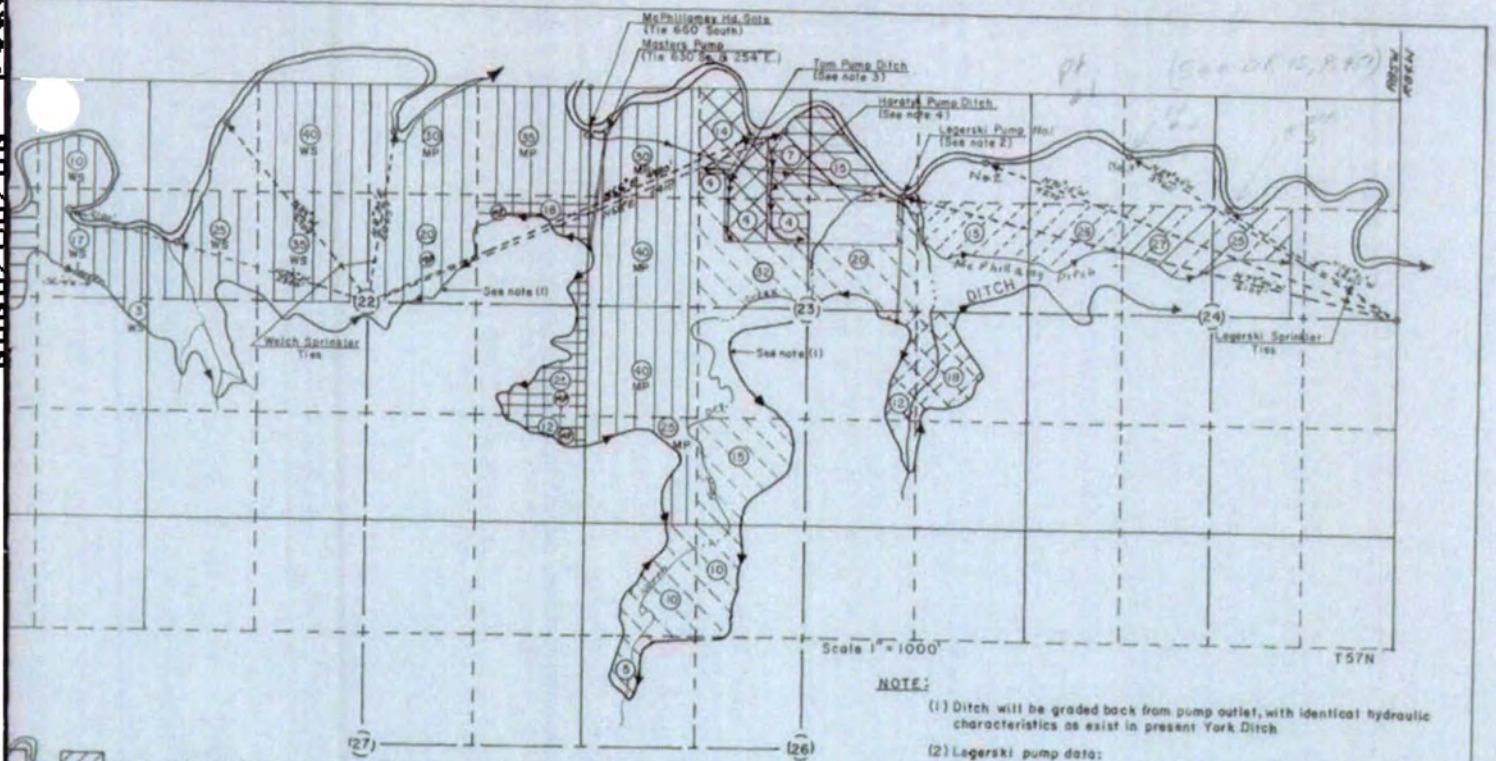

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Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by R. Soltis, covered by listed petition (1)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by J.,T. & J. Legerski, covered by listed petition (6)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by M. & J. Haratyk, covered by listed petition (7)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by G. Legerski, covered by listed petition (5)

Lands under McPhillamey Ditch, permit no. 5016, priority 8-2-1902, owned by G. Legerski, covered by listed petition (4)

Lands under McPhillamey Ditch, permit no. 1133 enl., priority 11-12-1903, owned by G. LegersKi, covered by listed petition (4)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (2)

York Ditch (changed to Masters Pump) permit no. 388, priority 1-6-1893, owned by W. Welch, petition for change of pt. of diversion granted 3-14-1916

Lands under York Ditch, permit no. 1128 enl., priority 11-9-1903, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 388, priority 1-6-1893, owned by W. Welch, covered by listed petition (3)

Lands under York Ditch, permit no. 1129 enl., priority 11-12-1903, owned by G. Legerski, covered by listed petition (5)

NOTE:

(1) Ditch will be graded back from pump outlet, with identical hydraulic characteristics as exist in present York Ditch

(2) Legerski pump data:
pumping head = 110 feet
30 HP pump
1445 L.F. 12" discharge pipe

(3) Tom pump ditch data:
pumping head 47 feet
5 H.P. pump
330 L.F. 4" pipe

(4) Haratyk pump ditch data:
pumping head = 22 feet
3 H.P. pump
260 L.F. 3" pipe

(5) Legerski sprinkler data:
1500 L.F. main line pipe (6")
1000 L.F. distr. pipe (4")
max. pumping head = 30 feet

(6) Welch sprinkler data:
3000 L.F. main line pipe (6")
2000 L.F. distr. pipe (4")
max. pumping head = 105 feet

(7) Soltis sprinkler data:
1500 L.F. main line pipe (6")
1100 L.F. distr. pipe (4")
max. pumping head = 110 feet

MAP

To Accompany

(1) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO SOLTIS SPRINKLER

(2) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO WELCH SPRINKLER

(3) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND YORK DITCH PERMIT NO. 1128 enl. TO MASTERS PUMP

(4) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF McPHILLAMEY DITCH TO LEGERSKI SPRINKLER

(5) PETITION FOR CHANGE OF POINT OF DIVERSION OF A PORTION OF YORK DITCH PERMIT NO. 388 AND ALL OF PERMIT NO. 1129 enl. TO LEGERSKI PUMP

(6) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO TOM PUMP DITCH

(7) PETITION FOR CHANGE OF POINT OF DIVERSION AND MEANS OF CONVEYANCE OF A PORTION OF YORK DITCH TO HARATYK PUMP DITCH

PETITIONERS

(1) Rudolph Soltis	Ranchester, Wyoming
(2 & 3) William Welch	Sheridan, Wyoming
(4 & 5) George Legerski	" "
(6) Joe, Tom, & John Legerski	" "
(7) M. & J. Haratyk	Acme, Wyoming

Petitions 6 & 6 granted May 9, 1963
Petition 7 granted May 10, 1963
Petitions 1, 2, 3, 4 & 5 granted November 27, 1962
George E. Christopulos
Director Secretary State Board of Control

0 1 2 3 4 5 6

THIS MAP MAY NOT BE TO SCALE

Permit to 388, 5016, 1133 enl. MP (in)

E-3 7

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YORK DITCH ENL 1128E

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RECD NOV 14, 2014

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10 Q. If for irrigation, give the location and acreage irrigated the first year and the location and acreage irrigated each subsequent year to the present.

A. The Lands described in Section 8 Ten Acres Irrigated in 1904

11 Q. What crops were grown on this land in 1904? Give estimated acreage of each crop.

A. Alfalfa 55 Acres

12 Q. During what months is water beneficially used?

A. April to October

13 Q. Give amount of your investment in the construction of ditch and laterals.

A. $250.00

14 Q. Give estimated cost per acre of preparing land for irrigation.

A. $5.00

15 Q. Does the map which accompanies this proof show correctly the location of diverting works and area of land where water is used?

A. Yes

THE STATE OF WYOMING,
County of Sheridan } ss.

I, Asael Masters by Thos. E Masters Agt., being first duly sworn, do depose and say that I have read the above and foregoing proof of appropriation of water; that I know the contents thereof; and that the facts therein stated are true.

In Witness Whereof, I have hereunto set my hand this 3 day of Sept A. D. 1904

Asael Masters
By Thomas E Masters or Agent

Subscribed and sworn to before me at Sheridan Wyo., Wyo., Sept 3 1904

I Hereby Certify that the foregoing affidavit was read to the affiant in my presence before he signed his name thereto; that said affiant is to me personally known (or has been satisfactorily identified before me by _____), and that I verily believe him to be a credible person and the person he represents himself to be; and that this affidavit was subscribed and sworn to before me at Sheridan Wyo on this 3 day of Sept, 1904

Frank W Stitt
Superintendent, Water Division No. 2

Note.—This proof is intended to be used only by parties making appropriations under permits issued in accordance with Section 126, Chapter 74, Title 9, Wyoming Code Annotated Revision of Wyoming, 1910.

The map referred to in Paragraph 15 must show the centre mark in the case of individual ditches. In the case of larger works only one map of the entire canal need be filed. Individual proof must, however, show ditch from point of diversion from main canal, and all laterals on land cultivated. Where the duplicate copy filed in the office of the State Engineer and returned to the applicant gives the necessary details and shows accurately the location of completed work, it may be filed.

The map which accompanies this proof must be accurately drawn on a scale of not less than two inches to the mile, and verified by the party making the measurements.

Report of Official Examination by Superintendent.

I Hereby Certify and Report that pursuant to the notice of completion of appropriation, filed with the State Engineer, and in accordance with the rules and practice of the Board of Control, I appeared at Sheridan Wyo on the 3 day of Sept, 1904, and took and received the foregoing sworn proof of appropriation of water through the Fort Geng Ditch from Tongue River under Permit No. 11286 by Asael Masters, the owner thereof; that I made a personal examination of said ditch, and of the land irrigated thereunder and described in said permit; that I found said ditch had an average width of 5 feet, a depth of 2 and a grade of about 5 feet per mile. I found a sufficient number of laterals of a capacity to fully irrigate the land described herein, and found that of the land described in said permit the following acreage has been irrigated and reclaimed in each forty-acre tract, to-wit:

Same as described in Section 8

On this land the following crops were grown in 1904

Same as described in Section 8

I also certify that after due publication of notice of the time and place, said proof was opened for public inspection on the 7 day of Nov, 1904, at Sheridan Wyo in accordance with the provisions of said notice and the regulations of the Board of Control; that at said time

No parties

appeared in filed their contest or objection to said proof.

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October 2014

RAMACO

Wherefore I recommend that said appropriation be ~~not~~ allowed and that a certificate of appropriation be issued in accordance with said proof and the tabulation thereof filed herewith.

Dated Nov 17, 1904

Superintendent of Water Division No. 2

PROOF OF APPROPRIATION
UNDER
PERMIT No. 1128 E

Division No. 2 Division No.

Date of Appropriation Dec 9, 1903

GENERAL PRIORITIES STREAM

NAME OF STREAM, Tongue River

TRIBUTARY OF

NAME OF CLAIMANT, Canal Master

Filed with me this 3 day of Nov, 1904

Superintendent

Filed in this office this day of , 190

Secretary, Board of Control

PERMIT No. 1128 E

PROOF OF APPROPRIATION OF WATER.

(In accordance with the provisions of Section 925, Chapter 14, Title 9, Division One, Revised Statutes of Wyoming, and the regulations of the Board of Control thereunder.)

From Tongue River Division No. 2 District No.

1 Q. State your name.
A. Canal Master

2 Q. Postoffice address.
A. Dayton Wyo

3 Q. Are you the original applicant for Permit No. 1128 ?
A. Yes

4 Q. If not, state the date of your securing an interest therein, and the nature of your interest in the works constructed under such permit.
A.

5 Q. When did the construction of the Yost Enlargement ditch (or other distributing works described in said permit) begin?
A. Spring 1904

6 Q. When was it completed?
A. Spring 1904

7 Q. What are the dimensions of the ditch (or other distributing works) built under said permit?
A. Length as Mb. Bottom 2 ft 5 ft Bottom 4 ft Depth 2½ ft Grade 5 ft to mile

8 Q. Give the legal subdivisions of land owned or controlled by you on which water has been used, and if an appropriation of water for irrigation is claimed, give the acreage which has been irrigated in each legal subdivision.

A.	SE ¼ NE ¼	Sec 22	T 57 N	R 85 W. 18 Acres
	NE ¼ SE ¼	" 22	"	" 25 "
	SE ¼ SE ¼	" 22	"	" 12 "
				55 "

9 Q. Give the date when, under the terms of this permit, water was first beneficially used.
A. 1904

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-138

Brook Mine

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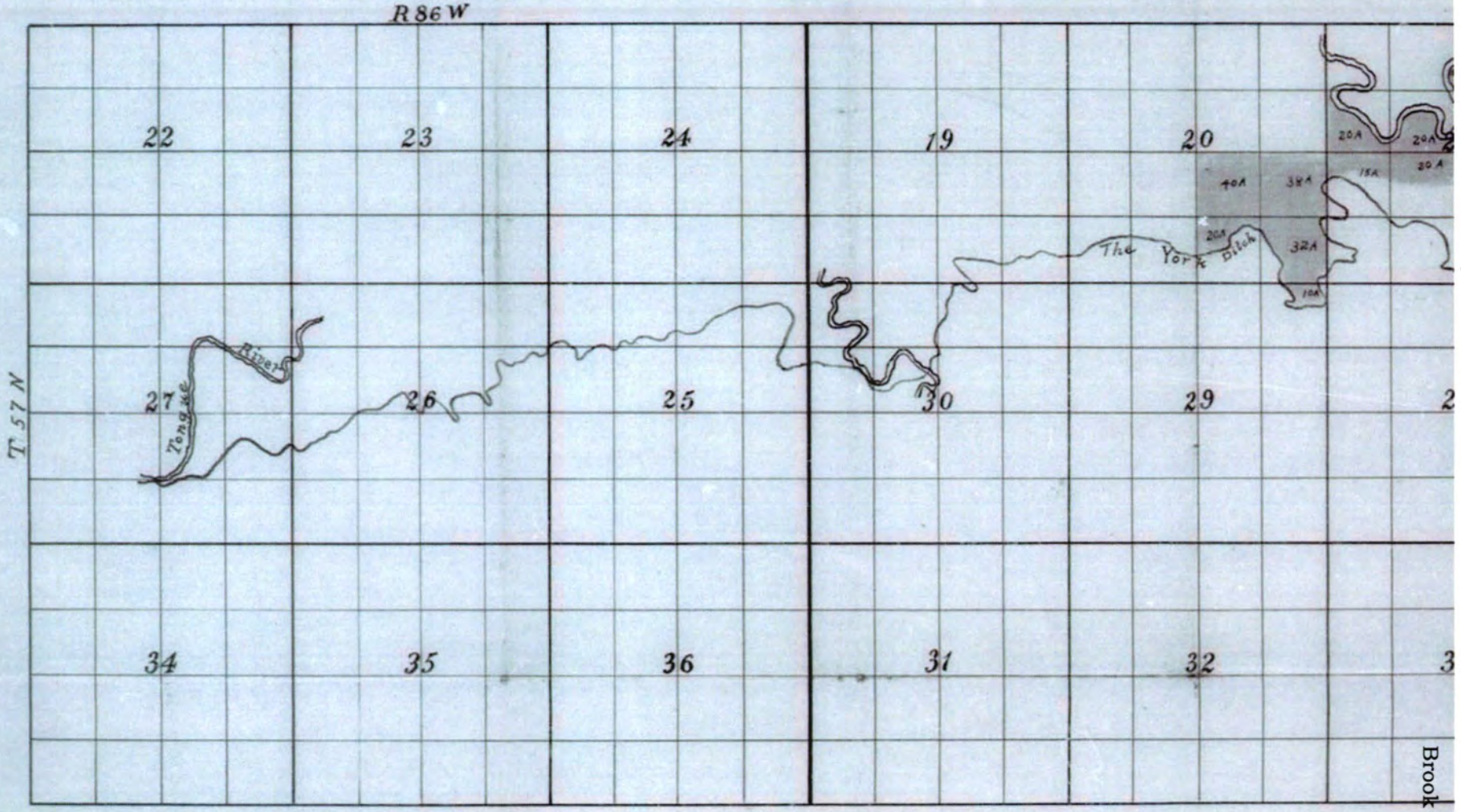
Enlargement of THE YORK DITCH

RAMACO



Brook Mine

October 2014

TFN 6 2/025
RECD NOV 14, 2014

Addendum D11-4-139

DEQ Ex. 4-1256

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HALL RESERVOIR 363R

AND

HALL DITCH P5195D

TFN 6 2/025
RECD JUL 30,2015

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Permit to Construct the Hall Reservoir and

Water Division No. District No.

of Sheridan County of Sheridan, State of Wyoming, being duly sworn according to law, upon my oath say:

1. The name of the applicant ~~[illegible]~~ John R. Bocek, HC 31 Box 221, Ranchester, WY 82839

2. The post office address of the applicant Ranchester, Wyo.

3. The name of stream from which reservoir is to be filled and appropriation made is [illegible]

4. The location of the proposed reservoir will be in Sec. 11, T. 57 N., R. 85 W., described as follows:

(a) State whether situated in channel of running stream, and give character of material at outlet.

[illegible]

(b) If not in channel of running stream state how it is to be filled. If through canal give name and dimensions.

[illegible]

(c) The construction of dam, the material of which it is to be built and the method of protecting from waves are as follows:

Material is earth. Protected by [illegible] with rock

5. The area of reservoir is [illegible] acres with maximum depth of 31 feet and approximate mean depth of water of [illegible] feet.

6. The dimensions of dam are: Length on top [illegible] feet. Length on bottom [illegible] feet. Width on top 10 feet. Width on bottom 150 feet. Depth 31 feet. Slope of front 3:1. Slope of back 2:1. Height of dam above water line when full 7 feet.

7. The outlet and wasteway, with dimensions of each, are as follows:

Outlet [illegible] pipe with gate valve. Wasteway [illegible]

8. The use to which the water is to be applied is Irrigation

9. The name of the ditch or canal is Hall

10. The headgate of the proposed ditch or canal is located [illegible] 650 ft south of center

of section 11, Township 57 North, Range 85 West.

11. The said ditch or canal is to be [illegible] miles long and to pass through the following lands (give route by courses and distances, or by naming legal subdivisions crossed).

[illegible]

12. The dimensions of said ditch are (a) [At headgate] Width on top (at water-line) 4 feet; width on bottom 3 feet; depth of water 1 feet; grade 8 feet per mile.

(b) Give dimensions at each point where reduced in size, stating miles from headgate:

[At] Width on top (at water line) ft.; width on bottom ft.; depth of water ft.; grade ft. per mile

[At] Width on top (at water line) ft.; width on bottom ft.; depth of water ft.; grade ft. per mile

13. Describe the character of proposed ditch, stating: 1st. The nature of material to be moved. 2nd. Number and length of tunnels, if any. 3rd. Amount of fluming, if any.

Earth. No tunnels or fluming

14. The estimated cost of said ditch is $ [illegible] and of the reservoir is $ [illegible]

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RECD JUL 30, 2015

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to Divert and Appropriate the Water of the State of Wyoming.

15. The land to be irrigated has a total area of 77 acres, described as follows:
(Give estimated acreage in fractions of subdivisions)

NW ¼ SW ¼ NE ¼
5 SE ¼ NE ¼
30 NE ¼ SE ¼ Sec. 11 Twp 57 R 85 W.
22 NW ¼ SE ¼ Sec. 12

16. Construction will begin on proposed works on or before April 15, 1903
17. The time required for the completion of ditches and other distributing works is 2 year from April 15, 1903
18. The time required to complete the application of water to the beneficial use stated in this application is 3 year from April 15, 1903

Signed: C. E. Worthington

Note.—The statements in the foregoing application, together with the maps and plans, must comply with the requirements of Chapter 15, R. S. 1899.

THE STATE OF WYOMING, } ss.
COUNTY OF Sheridan

I HEREBY CERTIFY that the foregoing application was signed in my presence and sworn to before me by C. E. Worthington this 17 day of November, 1902

C. B. Holmes
Notary Public
Seal
My Com Expires Nov 1, 1905

Time for completion extended to Dec. 31, 1906
Clarence T. Johnston
State Engineer Dec 10, 1904.

Time for completion extended to Dec 31, 1908
Clarence T. Johnston
State Engineer Dec 3-06

Time for completion extended to Dec 31, 1910
State Engineer

Time for completion extended to December 31, 1912
State Engineer Nov 14-1910

Time for completion extended to Dec 31, 1905
State Engineer Nov ...

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE.

THIS IS TO CERTIFY that I have examined the foregoing application and have returned the same without my approval for the following reasons:

Notice of Expiration Mailed ... 1905
Notice of Expiration Mailed November ..., 1906.
Notice of Expiration Mailed SEPT 27, 1910

Witness my hand this day of A. D. 190

State Engineer.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE.

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

Construction of proposed works shall begin within one year from date of approval.

The time for completing the works shall terminate on December 31, 1904

The time for completing the appropriation of water for beneficial use shall terminate on December 31, 1905

The amount of the appropriation shall be limited to one cubic foot per second of time for each seventy acres of land reclaimed on or before December 31, 1905 and the additional volume used for purposes on or before said date.

Witness my hand this 6 day of December A. D. 1902

Fred Bond
State Engineer.

THE STATE OF WYOMING, } ss.
STATE ENGINEER'S OFFICE.

This instrument was received and filed for record on the 28 day of November A. D. 1902 at 9 o'clock a. M., and duly recorded in Book 2 of Reservoirs and Water Appropriations on Page 10

Fred Bond
State Engineer.

TFN 6 2/025
RECD JUL 30, 2015

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PERMIT NO. 5195 - 363 Res. Page 10

The following is a chronological account of the activities that have taken place during the life of this permit, relative to its' status. The original endorsements are not effected and remain unchanged in context. This account is solely for the purpose of clarification.

November 23, 1904 Notice of expiration mailed.

December 10, 1904 Time for completion extended to December 31, 1906.
/s/ Clarence T. Johnston
State Engineer

November 28, 1906 Notice of expiration mailed.

December 31, 1906 Time for completion extended to December 31, 1908.
/s/ Clarence T. Johnston
State Engineer

October 13, 1908 Notice of expiration mailed.

November 2, 1908 Time for completion extended to December 31, 1909.
/s/ Clarence T. Johnston
State Engineer

October 16, 1909 Notice of expiration mailed.

November 17, 1909 Time for completion extended to December 31, 1910.
/s/ Clarence T. Johnston
State Engineer

September 24, 1910 Notice of expiration mailed.

November 14, 1910 Time for completion extended to December 31, 1912.
/s/ Clarence T. Johnston
State Engineer

September 6, 1912 Notice of expiration mailed.

December 6, 1912 Time for completion extended to December 31, 1914.
/s/ A. J. Parshall
State Engineer

January 28, 1913 (Penciled Note) Lands relinquished by the filing of 9 5/77. (Permit No. 11695)
20 acres SW¼NE¼
5 acres SE¼NE¼ Section 11, T.5/N., R.85W.

Typed and Proofread on May 2, 1972 by MC - JLG.

TFN 6 2/025
RECD JUL 30,2015

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COMBINATION PERMIT NO. 5195 DITCH AND 363 RESERVOIR
Combination Book 2 Page 10

PERMIT STATUS

August 17, 1955 Affidavit and warranty deed were filed by John R. Bocek claiming ownership of Permit No. 363R. The documents are filed in Miscellaneous Notices under this permit. The permit is being endorsed accordingly.

Affidavits for reservoir reinstatement by Tony J. Bocek and Patricia M. Brantz indicated that the reservoir was constructed prior to 1910 and has stored water since. These affidavits appear to be valid, as filed, but final acceptance will be dependent on a field inspection and written report by the Superintendent of Water Division No. 2 and final action by the Board of Control on any proof submitted for this reservoir.

Affidavits for beneficial use of water by Patricia M. Brantz and Tony J. Bocek for re-instatement of land irrigated in:

T 57 N, R 85 W		
Section 11	NE¼SE¼	30 acres
Section 12	NW¼SW¼	22 acres
	Total	52 acres

These affidavits appear to be valid, as filed, but final acceptance will be dependent on a field inspection and written report by the Superintendent of Water Division No. 2 and final action by the Board of Control on any proof submitted for these lands.

SCANNED DEC 19 2005

JAN 13 2006

CERT. REC. 85 P. 41 PROOF NO. 39191
ISS. ✓ STK. ___ DOM. ___ MISC. Sec Sply
AC. 52 CFS. ___

CERT. REC. R-17 P. 74 PROOF NO. 39217
ISS. ✓ STK. ___ DOM. ___ MISC. ___
AC. ___ ~~CFS~~ AF 42.0

June 18, 2007: Affidavits of beneficial use were received from Patricia M. Brantz, (who was 18 years of age in 1959 and has lived in the area for 64 years) and Tony J. Bocek (who was 18 years of age in 1936 and has lived in the area for 87 years) showing beneficial use from their earliest recollection and continuous use through July 2005. These affidavits appear to be valid with the best available evidence, as filed for Secondary Supply the following described lands under Permit No. 5195:

Township 57 North, Range 85 West:

Section 11:	NE¼SE¼	30 acres
Section 12:	NW¼SW¼	22 acres
Total:		52 acres

Affidavits of beneficial use were received from Patricia M. Brantz, (who was 18 years of age in 1959 and has lived in the area for 64 years) and Tony J. Bocek (who was 18 years of age in 1936 and has lived in the area for 87 years) showing beneficial use from their earliest recollection and continuous use through July 2005. These affidavits appear to be valid with the best available evidence, as filed for irrigation. The reservoir is located at the following described lands under Permit No. 363R.

Township 57 North, Range 85 West, NW¼SE¼, Section 11

See copies of the Proof Report of Superintendent and a copy of the warranty deed which is filed with the affidavits of best available evidence in Miscellaneous Notices under Permit No. 5195 and 363R.

SCANNED JUN 19 2007

JOHN R. BARNES, Administrator
Surface Water and Engineering

TFN 6 2/025
RECD JUL 30, 2015

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LANDEN DITCH P11695D

TFN 6 2/025
RECD JUL 30,2015

Scanned, 02/28/2020

12,506

THE STATE OF WYOMING

CERTIFICATE OF APPROPRIATION OF WATER CERTIFICATE RECORD NO. 30 PAGE 330

WHEREAS, James Landen has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek tributary of Tongue River through the Landen Ditch under Permit No. 11495 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming.

NOW KNOW YE, That the Board of Control, under the provisions of Chapter 61, Compiled Statutes of Wyoming, 1910, has, by an order duly made and entered on the 22nd day of November, A. D. 1913, in Order Record No. 4, Page 713, determined and established the priority and amount of such appropriation as follows:

Name of Appropriator James Landen; Postoffice Address Monarch, Wyoming; Amount of Appropriation 0.57 cu. ft. per sec.; Date of Appropriation January 29, 1913; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Forty (40) acres.

22 A. SW¼ NE¼ Sec. 11, T. 57 N. R. 85 W.
18 A. SE¼ NE¼ Sec. 11, T. 57 N. R. 85 W.
40 A. Total acreage.

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I A. J. Parshall, President of the State Board of Control, have hereunto set my hand this 24 day of February, A. D. 1914, and caused the seal of said Board to be hereunto affixed.

ATTEST: , *Secretary.* , *President.*

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RECD JUL 30, 2015

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WILLIAMS DITCH P1317D

TFN 6 2/025
RECD JUL 30,2015

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THE STATE OF WYOMING.

CERTIFICATE OF APPROPRIATION OF WATER. CERTIFICATE RECORD NO. 27 PAGE 267

WHEREAS, H. H. Williams has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek tributary of Tongue River through the Hurt Brothers Ditch under Permit No. 1317 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming.

NOW KNOW YE, That the Board of Control, under the provisions of Division 1, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 5th day of May, A. D. 190 8, in Order Record No. 4 Page 114, determined and established the priority and amount of such apppropriation as follows:

Name of Appropriator H. H. Williams; Postoffice Address Monarch, Wyoming; Amount of Appropriation .91 cu. ft. per. sec.; Date of Appropriation June 15, 1896; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Sixty-four (64) acres.

30 A. NE¼ SE¼ Sec. 3, Tp. 57 N., R. 85 W.
18 A. SE¼ NE¼ " " " " " " " "
16 A. SW¼ NE¼ " " " " " " " "
64 A. Totsl acreage.

For am. certificate + change of point of diversion + partial means of conveyance of a portion see O.R. 36, p. 385; C.R. 77, p. 296.

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, CLARENCE T. JOHNSTON, President of the State Board of Control, have hereunto set my hand this MAY 1 [illegible] day of , A. D. 190 , and caused the seal of said Board to be hereunto affixed.

ATTEST: , *Secretary.* , *President.*

July 2015
RAMACO
Brook Mine
Addendum D11-4-148
TFN 6 2/025
RECD JUL 30, 2015

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11,011

THE STATE OF WYOMING

CERTIFICATE OF APPROPRIATION OF WATER

CERTIFICATE RECORD NO. 33 PAGE 478

WHEREAS, Nunzio Gavita has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek tributary of Tongue River through the Williams Ditch under Permit No. 8710 for irrigation of the lands herein described, lying and being in Sheridan County, Wyoming;

NOW KNOW YE, That the Board of Control, under the provisions of Division 1, Title 9, Chapters 10 and 14 of the Revised Statutes of Wyoming, 1899, has, by an order duly made and entered on the 17th day of April, A. D. 1912, in Order Record No. 4 Page 469, determined and established the priority and amount of such appropriation as follows:

Name of Appropriator Nunzio Gavita; Postoffice Address Carneyville, Wyoming; Amount of Appropriation 0.38 cu. ft. per sec.; Date of Appropriation October 23, 1908; Description of land to be irrigated and for which this appropriation is determined and established; Total Acreage Twenty-seven (27) acres.

12 A. SE¼ NE¼ Sec. 3, Tp. 57 N. R. 85 W.
5 A. SE¼ SE¼ Sec. 3, Tp. 57 N. R. 85 W.
10 A. NW¼ SW¼ Sec. 2, Tp. 57 N. R. 85 W.
27 A. Total acreage.

For amended certificate + change of point of diversion see D.R. 36, p. 380; C.R. 77, p. 289.

The right to water hereby confirmed and established is limited to irrigation and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot per second for each seventy acres of land for which appropriation is herein determined and established.

IN TESTIMONY WHEREOF, I, A. J. Parshall, President of the State Board of Control, have hereunto set my hand this 24 day of May, A. D. 1912, and caused the seal of said Board to be hereunto affixed.

ATTEST: [illegible], *Secretary.* A. J. Parshall, *President.*

July 2015

Addendum D11-4-149

TFN 6 2/025
RECD JUL 30, 2015

RAMACO

Brook Mine

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COPY

AMENDED

THE STATE OF WYOMING
Certificate of Appropriation of Water

Proof No. 11811
Certificate Record No. 77, Page 289
Water Division No. 2, District No. 5

WHEREAS, Padlock Ranch Company (successor to Nunzio Gavita, original appropriator) has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek, tributary Tongue River, tributary Yellowstone River through the Williams Ditch under Permit No. 8710; --- reservoir supply and for irrigation of lands herein described, lying and being in Sheridan County, Wyoming.

NOW KNOW YE, That the State of Board of Control, under the provisions of the Statutes of Wyoming, has, by an order duly made on February 13, 1990 and entered on January 10, 1991, in Order Record 36 Page 380, determined and established the priority and amount of such appropriation as follows: Name and Address of Appropriator(s) Padlock Ranch Company, Ranchester, Wyoming 82839 : Priority October 23, 1908 : Amount of Appropriation -----0.38----- cu. ft. per sec.;

Total Acreage Twenty-seven (27.0) Acres : Head Gate SE¼SW¼ Section 34-58-85

DESCRIPTION OF LAND TO BE IRRIGATED AND FOR WHICH THIS APPROPRIATION IS DETERMINED AND ESTABLISHED

TWP.	RANGE	SEC.	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
57N	85W	2											5.0	2.0					7.0
57N	85W	11					18.0	2.0											20.0
																	TOTAL		27.0

Reservoir supply for the Hart Brothers Reservoir, Permit No. 60 Res., at a rate of 4.17 c.f.s., not to exceed 26.0 acre-feet in any one (1) year.

THIS AMENDED CERTIFICATE IS ISSUED IN LIEU OF THE ORIGINAL CERTIFICATE OF APPROPRIATION OF RECORD IN CERTIFICATE RECORD 33, PAGE 478, AND AMENDS THE ORDER OF ADJUDICATION OF RECORD IN ORDER RECORD 4, PAGE 569; PROOF NO. 11811.

The right to water hereby confirmed and established is limited to irrigation and reservoir supply ---------- and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot of water per second for each seventy acres of land for which the appropriation is herein determined and established; except when there is surplus water available under provisions of Sections 11-4-317 thru 11-4-325, W.S. 1977, and where there is excess water available under provisions of Sections 11-4-329 thru 11-4-331, W.S. 1985.

IN TESTIMONY WHEREOF, I, GORDON W. FASSETT, President of the State Board of Control, have hereunto set my hand this 10th day of January, A.D. 1991, and caused the seal of said Board to be hereunto affixed.

Attest: Francis Allen Ex-officio Secretary

Gordon W. Fassett President.

Revised 2-87

RAMACO

Brook Mine

July 2015

Addendum DTI-4-150

TFN 6 2/025
RECD JUL 30, 2015

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A M E N D E D

THE STATE OF WYOMING
Certificate of Appropriation of Water

Proof No. 8966
Certificate Record No. 77, Page 290
Water Division No. 2, District No. 5

WHEREAS, Padlock Ranch Company (successor to H. H. Williams, original appropriator) has presented to the Board of Control of the State of Wyoming proof of the appropriation of water from Slater Creek, tributary Tongue River, tributary Yellowstone River through the Hart Bros. Ditch (as changed in part to the Williams Ditch) under Permit No. 1317; ---------- for irrigation of lands herein described, lying and being in Sheridan County, Wyoming.

NOW KNOW YE, That the State of Board of Control, under the provisions of the Statutes of Wyoming, has, by an order duly made on February 13, 1990 and entered on January 10, 1991, in Order Record 36 Page 385, determined and established the priority and amount of such appropriation as follows: Name and Address of Appropriator(s) Padlock Ranch Company, Ranchester, Wyoming 82839 : Priority June 15, 1896 : Amount of Appropriation -----0.91----- cu. ft. per sec.:

Total Acreage Sixty-four (64.0) Acres : Head Gate Hart Bros.-NW¼NE¼ Sec. 3-57-85;Williams-SE¼SW¼ Sec. 34-58-85

DESCRIPTION OF LAND TO BE IRRIGATED AND FOR WHICH THIS APPROPRIATION IS DETERMINED AND ESTABLISHED

TWP.	RANGE	SEC.	NE¼				NW¼				SW¼				SE¼				TOTAL
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
			Lands irrigated through the Hart Brothers Ditch:																
57N	85W	3		L.2 7.0	4.0	9.0									3.0		Subtotal		23.0
			Lands changed to the Williams Ditch, Permit No. 8710:																
57N	85W	2										9.0	13.0						22.0
57N	85W	3				4.0									15.0				19.0
																	Subtotal		41.0
																	GRAND TOTAL		64.0

THIS AMENDED CERTIFICATE IS ISSUED IN LIEU OF THE ORIGINAL CERTIFICATE OF APPROPRIATION OF RECORD IN CERTIFICATE RECORD 27, PAGE 267, AND AMENDS THE ORDER OF ADJUDICATION OF RECORD IN ORDER RECORD 4, PAGE 114; PROOF NO. 8966.

The right to water hereby confirmed and established is limited to irrigation ---------- and the use is restricted to the place where acquired and to the purpose for which acquired; rights for irrigation not to exceed one cubic foot of water per second for each seventy acres of land for which the appropriation is herein determined and established; except when there is surplus water available under provisions of Sections 41-4-317 thru 41-4-325, W.S. 1977, and where there is excess water available under provisions of Sections 41-4-329 thru 41-4-331, W.S. 1985.

IN TESTIMONY WHEREOF, I, GORDON W. FASSETT, President of the State Board of Control, have hereunto set my hand this 10th day of January, A.D. 19 91, and caused the seal of said Board to be hereunto affixed.

Attest: Juanita Allen Ex-officio Secretary

Gordon W. Fassett President.

Revised 2-87

RAMACO

Brook Mine

July 2015

Addendum DTT-4-151

TFN 6 2/025

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PERMIT SUMMARY

Instrument: FIRST PERMIT ON A FACILITY FOR A DITCH, PIPELINE OR PUMP

Facility Name :	HART BROTHERS DITCHES (CHANGEDIN PART TO	Water Right Status :	FULLY ADJUDICATED
Application Number :		Date Accepted for Processing :	
Temporary File Number :		Priority Date :	06/15/1896
Permit Number :	P1317.0D	Division : 2	District : 5
Proof Number :		SC Original Expiration Date :	11/15/1899
Docket Number :		SC Extended Expiration Date :	
Order Number :		SC Actual Date :	
Certificate Record Number :		BU Original Expiration Date :	12/31/1897
Auto Cancellation Date :		BU Extended Expiration Date :	
Extended Auto Cancellation Date :		BU Actual Date :	
Last Modified By :		Last Modified Date :	01/01/1800
Created By :			

General Info

Type Of Diversion:	Stream
Supply Type:	Original Supply
Special Cases:	

Prefix	Water Right Number	Suffix

Appropriator(s)

Appropriator	Last Name	First Name	Company	City	State
Applicant	HART BROTHERS			Ranchester	Wyoming

Agent

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Beneficial Uses

TFN 6 2/025
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Beneficial Uses:	

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	Irrigation-- Surface water

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Water Right POD

Principal Meridian	Township	Range	Section	Quarter	Qtr-Qtr	SurveyType	Number	Primary POD
06	057N	085W	03	NE	NWNE	Aliquot Parts	2	Y
06	058N	085W	34	SW	SESW	Aliquot Parts	12	N

Stream Source

Source	Tributary Of	Tributaty Of	Tributary Of	WR Number Type	WR Number
Slater Creek	Tongue River	Yellowstone River	Missouri River	P	1317

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Water Right POU

Principal Meridian	Township	Range	Section	Quarter	Q-Q	WR Status	Acres	Use	Sub Use	Supply Type
06	057N	085W	02	SW	NWSW	OTHER	9.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	02	SW	SWSW	OTHER	13.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	02	SW	SWSW	ELIMINATED	32.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	NWNE	ADJUDICATED	7.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	SENE	OTHER	18.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	SENE	ADJUDICATED	9.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	SENE	OTHER	4.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	SWNE	ADJUDICATED	4.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	NE	SWNE	OTHER	16.000	Irrigation-- Surface water		ORIGINAL
06	057N	085W	03	SE	NESE	OTHER	30.000	Irrigation-- Surface water		ORIGINAL

1 2

Supply Type	Acres
Original	195.000

Total acres irrigated : 195.000

Comments

Created Date	Comment Details	Created by
1/1/1800 12:00:00 AM	THIS FACILITY IS MADE UP OF TWO DITCHES. THE WEST DITCH HAVING A POINT OF DIVERSION IN LOT 2 AND THE EAST DITCH HAVING A POINT OF DIVERSION IN THE SENE OF SECTION 3, T57N, R85W. T57N, AND 58N, R85W HAS BEEN DEPENDENTLY RESURVEYED. REQUEST FROM PADLOCK RANCH TO ELIMINATE 67 ACRES AS FOLLOWS: 32 ACRES IN THE SWSW OF SECTION 2 - 30 ACRES IN THE NENW AND 5 ACRES IN THE NWNW OF SECTION 11 ALL IN T57N, R85W, RECEIVED AND GRANTED. REQUEST OF ELIMINATION AND PROOF OF OWNERSHIP FILED IN MISCELLANEOUS NOTICES. ADJUDICATED WITH H.H. WILLIAMS AS APPROPRIATOR. PERMIT RECORD REFLECTS SOURCE AS SLATER CREEK AND WATER STORED IN THE HART BROTHERS RESERVOIR, P60R, XR7825A, HOWEVER CERTIFICATE RECORD REFLECTS .91 CFS FOR THE IRRIGATION OF 64 ACRES. BOC PETITION II 89-4-2 BY PADLOCK RANCH WAS GRANTED TO ISSUE AMENDED CERTIFICATE C77/290A TO REDESCRIBE LANDS WITHOUT CHANGING LAND TOTALS AND TO CHANGE POINT OF DIVERSION FROM THE RECORD POINT IN THE NWNE AND SENE OF SECTION 3, 57N, R85W AND PARTIAL MEANS OF CONVEYANCE FOR 41 ACRES (.59 CFS) TO THE WILLIAMS DITCH, P8710D, C77/289A DIVERTING WATER FROM SLATER CREEK IN THE SESW OF SECTION 34, T58N, R85W AS RECORDED IN ORDER RECORD BOOK 36, PAGES 385-390 AND RECEIVED ON CD3/578A. THIS LEAVES 23 ACRES STILL IRRIGATED UNDER THIS PERMIT. LANDS SHOWN BELOW AS	MIGRATED

TFN 6 2/025
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	"AME" AND "ELI" ARE THOSE ORIGINALLY DESCRIBED UNDER THIS DITCH.	
1/1/1800 12:00:00 AM	Remuna AprAmt,AprUnit,Use :0CFSIRR	MIGRATED

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Documents

Document Type	Document Name	Document Date	Document Created by	Document Uploaded by	Uploaded Date	View

Micro film (There are more than 5 documents with this document type, but only latest 5 documents are shown.)

Remarks

Appropriation Amount

Permitted Amount for Surface Water (Irrigation-- Surface water)	
Permitted Amount:	Total Flow (CFS) =1.870 Total Capacity (AF/Yr) = 0.000 Diversion capacity at the headgate (CFS) =-1.00

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Related Transactions

Instrument Type	Instrument Name	Instrument Code	WR Number Type	WR Number

TFN 6 2/025
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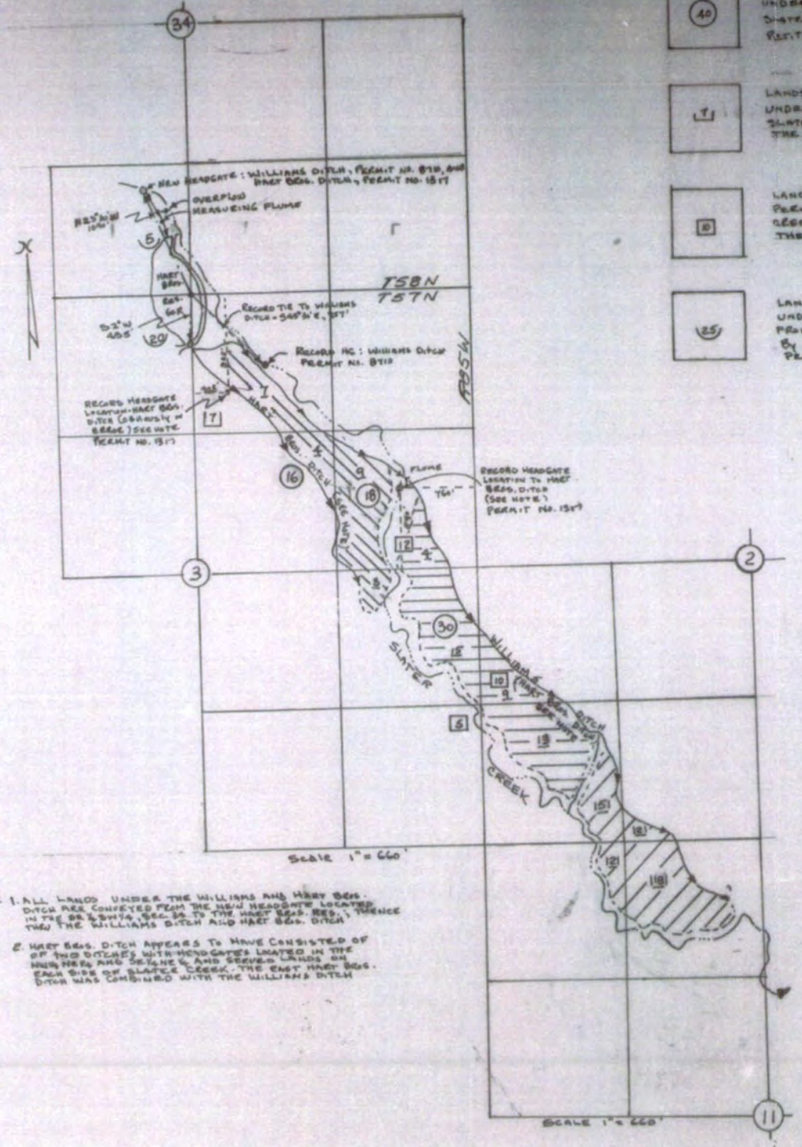


NOTE: 1. ALL LANDS UNDER THE WILLIAMS AND HART BROS. DITCH ARE CONVEYED FROM THE NEW HEADGATE LOCATED IN THE SW¼SW¼, SEC. 34 TO THE HART BROS. RES.; THENCE THRU THE WILLIAMS DITCH AND HART BROS. DITCH

2. HART BROS. DITCH APPEARS TO HAVE CONSISTED OF OF TWO DITCHES WITH HEADGATES LOCATED IN THE NW¼NE¼ AND SE¼NE¼ AND SERVED LANDS ON EACH SIDE OF SLATER CREEK. THE EAST HART BROS. DITCH WAS COMBINED WITH THE WILLIAMS DITCH

LEGEND - AS OF RECORD

(40) LANDS QUERED UNDER THE HART BROTHERS D.&R. UNDER PERMIT NO. 1317; PRIORITY 6-15-96; FROM SLATER CREEK; 64 ACRES; AFFECTED BY THESE PETITIONS; THE H.H. WILLIAMS APPROPRIATION, PROOF NO. 8966

(1) LANDS QUERED UNDER THE EAST SIDE NO. 2 DITCH; UNDER PERMIT NO. 4078; PRIORITY 7-31-1902; FROM SLATER CREEK; 7 ACRES; NOT AFFECTED BY THESE PETITIONS; THE H.H. WILLIAMS APPROPRIATION, PROOF NO. 7826

(10) LANDS QUERED UNDER THE WILLIAMS DITCH; UNDER PERMIT NO. 8710; PRIORITY 10-23-1908; FROM SLATER CREEK; 37 ACRES; AFFECTED BY THESE PETITIONS; THE NUNZIO GAUTA APPROPRIATION, PROOF NO. 11811

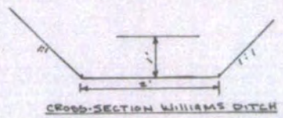
(25) LANDS QUERED UNDER THE WESTSIDE NO. 2 DITCH: UNDER PERMIT NO. 4078; PRIORITY 7-31-1902 FROM SLATER CREEK; 25 ACRES; NOT AFFECTED BY THESE PETITIONS; THE H.H. WILLIAMS APPROPRIATION, PROOF NO. 7827

LEGEND - AS AMENDED

(10) LANDS UNDER THE H.H. WILLIAMS APPROP., PROOF NO. 8966 DIVERTING FROM SLATER CREEK THROUGH THE HART BROS. DITCH, PERMIT NO. 1317; WITH PRIORITY OF JUNE 15, 1896, FOR 23 ACRES, AS AMENDED BY THESE PETITIONS

(10) LANDS UNDER THE NUNZIO GAUTA APPROP., PROOF NO. 11811 DIVERTING FROM SLATER CREEK THROUGH WILLIAMS DITCH, PERMIT NO. 8710, WITH PRIORITY OF OCT. 23, 1908; FOR 37 ACRES, AS AMENDED BY THESE PETITIONS

(10) LANDS UNDER THE H.H. WILLIAMS APPROP., PROOF NO. 8966 DIVERTING FROM SLATER CREEK THROUGH THE HART BROS. DITCH; PERMIT NO. 1317 WITH PRIORITY OF JUNE 15, 1896, FOR 41 ACRES, AS AMENDED AND CHANGED TO WILLIAMS DITCH BY THESE PETITIONS



CROSS-SECTION WILLIAMS DITCH

S = 0.0015 — V = 0.62
n = 0.032 — A = 3.0
V = 1.59 ft/sec. — Q = 4.77 C.F.S.

NOTE: HART BROS. DITCH SECTION SIMILAR. BOTH DITCH CAPACITIES ARE LARGER THAN THEIR APPROPRIATIONS

CERTIFICATE OF SURVEYOR

STATE OF WYOMING } ss
COUNTY OF SHERIDAN }

I, WALTER J. PILCH, OF SHERIDAN, WYOMING HEREBY CERTIFY THAT THIS MAP WAS MADE FROM RECORDS FROM THE STATE ENGINEER'S OFFICE, AERIAL PHOTOS AND JUNE 24, 1981 FIELD OBSERVATIONS AND THAT IT CORRECTLY DESCRIBES THE IRRIGATION WORKS AS FAR AS THIS PETITION IS CONCERNED

Walter J. Pilch
P.E. & L.S. NO 5317

PETITION FILED: FEBRUARY 13, 1990
Wyoma Q. Jones
SECRETARY
STATE BOARD OF CONTROL

MAP
TO ACCOMPANY
PETITIONS TO THE STATE BOARD OF CONTROL FOR FOR CHANGE OF POINT OF DIVERSION AND PERSONAL MEANS OF CONVEYANCE AND AN AMENDED CERTIFICATE OF APPROPRIATION FOR THE HART BROS. DITCH, FOR THE H.H. WILLIAMS APPROPRIATION, DIVERTING FROM SLATER CREEK; TR. B. OF TONGUE RIVER UNDER PERMIT NO. 1317, WITH PRIORITY OF JUNE 15, 1896; PARTIALLY CHANGED TO THE WILLIAMS DITCH

AND FOR CHANGE OF POINT OF DIVERSION AND AN AMENDED CERTIFICATE OF APPROPRIATION FOR THE WILLIAMS DITCH, FOR THE NUNZIA GAUTA APPROPRIATION, DIVERTING FROM SLATER CREEK; TR. B. OF TONGUE RIVER UNDER PERMIT NO. 8710, WITH PRIORITY OF OCTOBER 23, 1908

PETITIONER
FADDICK RANCH CO.
MANCHESTER, WYOMING

THIS PRINT MAY NOT BE TRUE TO SCALE

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E-7, page 50

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ADDENDUM D11-5

WDEQ Documentation for the AVF Declaration for Brook Mine

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le 2/025
Brook Mine

RAMACO

Department of Environmental Quality

To protect, conserve, and enhance the quality of Wyoming's environment for the benefit of current and future generations

Matthew H. Mead, Governor

Todd Parfitt, Director

February 24, 2016

Mr. Randall Atkins
c/o WWC Engineering
1849 Terra Ave.
Sheridan, WY 82801

RE: AVF Determination, Brook Mine Coal Mine Permit Application, TFN 6 2/025

Dear Mr. Atkins

The Land Quality Division has evaluated potential Alluvial Valley Floor (AVF) lands within the proposed permit boundary of the Brook Mine. An AVF determination was initiated on September 24, 2015 when a group of LQD personnel visited the proposed mine site for a field evaluation of one drainage, Slater Creek. The entire length of the stream within the permit boundary was walked for evaluation purposes. The geomorphology, vegetation, and hydrology of the drainage was observed. Photos were taken to assist in AVF characterization. Upon completing the field examination of Slater Creek and evaluation of aerial photography, Big Horn Coal Permit 213 AVF assessments, historic geologic maps, available literature, and personal communication within LQD, a determination of the AVF characteristics of the drainage within the Brook Mine proposed permit boundary has been made. The analysis of the potential Slater Creek AVF has determined that 13.11 acres within the Brook Mine Permit Boundary are considered to be AVF and have been declared as such. The declaration statement was crafted as a memorandum to file and placed within the active TFN for the Brook Mine permit application, TFN 6 2/025. The document is available for review at the Sheridan LQD office as well as the LQD office in Cheyenne.

Further determination of the status of AVF potential for Slater Creek one-half mile upstream from the proposed Brook Mine permit boundary is pending. The acreage in question is owned by Mr. Tony Bocek and permission to access his property to complete the AVF determination is required at this time. It is the responsibility of the mine permit applicant to obtain written permission to facilitate the final AVF determination. Upon receipt of written permission for LQD personnel to access Mr. Bocek's property, a field evaluation of the acreage in question will be scheduled. An invitation will be extended to your representative to accompany LQD personnel on the site analysis. LQD will provide the name of the staff member or members who will be present at the field evaluation.

An evaluation of the lands within one-half mile of the proposed Brook Mine permit boundary that may qualify as AVF has concluded. The Hidden Water Creek valley floor is located to the north of the proposed permit boundary as well as within the acreage in the northeastern quadrant of the projected

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permit. It has been determined that the Hidden Water Creek streambed materials do not qualify as AVF at this time.

The lands south of and adjacent to the Brook Mine submittal, within one-half mile, are located along the valley of the Tongue River. Previous AVF analyses were made for the Big Horn Coal Company (BHC) coal mining permit (No. 213) in 1981 and the Tongue River flood plain was determined to be AVF at that time. This determination covered affected lands downstream from BHC as well as all acreage upstream, terminating at the west section line of section 21, T57N, R84W. The Tongue River bottom lands need to have a field survey for AVF characteristics from that location in section 21 to a distance of approximately four miles upstream of the Interstate 90 Bridge which crosses the Tongue River. The acreage in question is all fee surface ownership and permission to access the properties is required prior to AVF evaluation. Unfortunately, there are 27 owners of record who would need to be approached for permission to trespass. This places AVF determination in a difficult position as it is strongly expected that some of the property owners will not grant LQD access to perform their studies. These positions have been indicated in personal communication to LQD staff by some of the landowners.

Because of this, final declaration of the Tongue River valley as an AVF cannot yet be completed. The acreage within one-half mile of the proposed Brook Mine permit boundary was defined as potential AVF by the Brook Mine permit application, Appendix D-11, Alluvial Valley Floors. This characterization is corroborated by LQD analysis. Because of this, the Tongue River acreage within one-half mile of the southern boundary of the proposed permit is assumed to be AVF at this time.

A tributary of the Tongue River, Goose Creek, is also located within one-half mile of the proposed Brook Mine permit boundary. This was determined to be AVF and was included in the previously mentioned Big Horn Coal mine permit 213. Since the acreage adjacent to Goose Creek has already been declared AVF, no further declaration needs to be made unless the Brook Mine permit boundary is modified in future amendments to include lands south of the present permit application.

This letter serves as notification that Appendix D11, and other relevant sections of the submitted coal mine permit application must be updated to reflect the findings of AVF by LQD. Please contact Bj Kristiansen or Mark Rogaczewski at the LQD District 3 office with questions or comments.

Sincerely,

Bjarne Kristiansen, PG
Natural Resources Program Principal
WDEQ-LQD District III

Cc: Cheyenne LQD files

DEQ Ex. 4-1275

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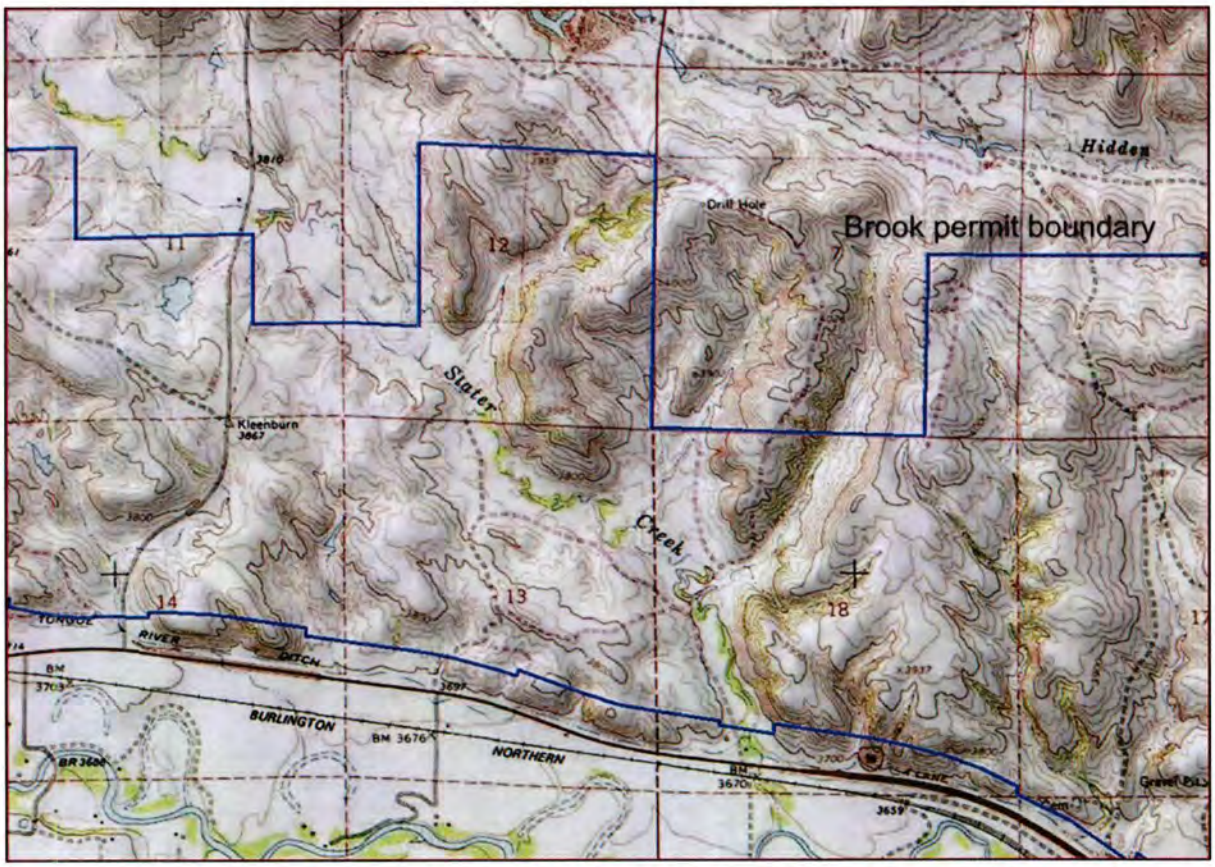
MEMORANDUM

TO: File, Ramaco Brook Mine TFN 6 2/025
FROM Bj Kristiansen, PG
RE: Brook Mine AVF Determination, Slater Creek
DATE: January 7, 2016

The following narrative is created for the determination of Alluvial Valley Floor (AVF) potential **within** the proposed permit boundary of the Brook Mine.

Ramaco Coal Company has submitted a permit application to LQD for a surface coal mine, to be operated in Sheridan County, Wyoming. The mine has been named the Brook Mine and is found on acreage located within T.57N., R.84W and R.85W. An AVF determination was initiated on September 24, 2015 when a group of LQD personnel visited the mine site for a field evaluation of one drainage, Slater Creek (Map, below). The entire length of the stream within the permit boundary was walked for evaluation purposes. The geomorphology, vegetation, and hydrology of the drainage was observed. Photos were taken to assist in AVF characterization.



Map 1 - Slater Creek topography within the proposed Brook Mine permit boundary.

DEQ Ex. 4-1276

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Upon completing the field examination of Slater Creek and evaluation of aerial photography, Big Horn Coal Permit 213 AVF assessments, historic geologic maps, available literature, and personal communication within LQD, a determination of the AVF characteristics of the drainage within the Brook Mine proposed permit boundary has been made. The analysis of the Slater Creek AVF has determined that:

1. That portion of Slater Creek occurring in the SW ¼ sec.12, N ½ sec.13, T.57N., R.85W, and the W ½ sec.18, T.57N., R.84W. is classified at this time as an intermittent stream that has segments of perennial flow during wet years. (Figure 1).

2. Acreage directly upstream of the proposed Brook Mine permit boundary has been farmed in the recent past (1 to 2 years) along the margins of Slater Creek, northwest of the abovementioned land, for a distance of approximately 4 ½ miles. The primary crop has been hay used as feedstock for cattle. The farmed lands have historically been watered by flood irrigation methods from a ditch system fed by the North Branch of Slater Creek, originating in the SE1/4 SE1/4, sec.29,T.58N., R.85W. (Figure 2).

3. A segment of the Slater Creek drainage, from the SW ¼ sec.12, T.57N., R85W. to the SW ¼ sec. 18, T.57N., R.84W., has been examined and mapped by LQD staff with a goal of classification of AVF characteristics. **It was determined that 13.11 acres within the Brook Mine Permit Boundary are considered to be AVF** (Figure 3), based on the following criteria:
   a. This acreage is located in the SW ¼ SW¼ sec. 12, T.57N., R.85W., within the northern zone of **perennial flow**. (Figures 1 and 3). Water was present and flowing during the field examination on September 24, 2015.
   b. The streambed is underlain by 16 feet of unconsolidated stream laid deposits, as exemplified by a Ramaco alluvial monitor well, number 578512-AL. (Figure 4). Additionally, there is evidence of abandoned meanders and minor terracing (left). The channel bottom in this location does not occur within bedrock material, as it does further downstream where the channel is deeply incised. There is sufficient alluvial fill in the AVF area to present a relatively flat, unincised geomorphology.

DEQ Ex. 4-1277

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c. Subirrigation or natural flood irrigation occurring on the stream laid deposits is of sufficient extent to provide for flood irrigation agricultural activities. Artificial flood irrigation has been or is presently practiced on the valley bottom immediately adjacent

to the northwest corner of the area under study where alfalfa hay has been grown in the past. There are significant quantities of subirrigated indicator plant species in the form of grasses, sedges and rushes, and wetland shrubs (above). Subirrigated vegetation is also evident when viewing color-infrared aerial photography (2001) and seasonal, conventional imagery.

d. Identification of a water table exhibiting diurnal fluctuations as a result of transpirational losses is not yet possible due to the short baseline presently submitted by Ramaco for the Brook Mine permit application. The water levels in 578512-AL (below) have been

recorded and presented in a hydrograph running from September, 2013 through May, 2014, where the hydrostatic surface has increased by 0.4 feet. This would indicate a gaining system, as would be expected during the fall and winter when vegetation is dormant and transpiration is not occurring. The static water level in the monitor well is approximately 4 feet below ground level. This depth would indicate that potential subirrigation is available for some perennial grass species used as forage by ranchers.

DEQ Ex. 4-1278

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e. Neither natural nor artificial flood irrigation occurs on Slater Creek within the Brook Mine permit boundary. The aforementioned adjacent hay meadows farmed by the neighboring rancher are artificially flood irrigated through a system of ditches and diversions. The hay meadows along Slater Creek upstream of the permit area have been irrigated for decades by the resident land owners. Since the stretch of Slater Creek under examination exhibited water flow in late September (below), it is assumed that the flow existed during the summer months. There have been no large rainfall

events during the summer of 2015 to contribute to flows so they are assumed to be perennial. Artificial flood irrigation within the studied acreage has potential to be performed at the same time that the upstream pastures are irrigated but water quantities are unknown at this time. Further research is needed to quantify available surface water. Miller Regression Analyses crafted for Slater Creek in the Brook Mine permit application indicates that the estimated 2-Year Annual Peak Flow for Slater Creek is 80 cubic feet per second (cfs).

f. Water analyses from the alluvial well indicates that the water is slightly saline in nature. The pH averages 8.0, Conductivity is 5,180 µmhos/cm, Total Dissolved Solids (TDS) is 5,210 mg/L, and Sodium Adsorption ratio (SAR) is 4.0. Use of this water in flood irrigation would be effective for forage crops as long as the salts were allowed to move downward through the alluvial materials and exit the system through sub-flow. Water quality samples were collected by Ramaco from a surface water monitoring station located on Slater Creek in the perennial flow section under study. The sample indicates a water type of magnesium-calcium sulfate. In this sample the pH was 8.58, Conductivity was 1,504 µmhos/cm, TDS equals 1,220 mg/L, and SAR was 1.9. Again, the sample indicates some salinity but would suffice for the production of forage crops, such as alfalfa.

g. Soils in the study area are fairly homogenous, with a very fine, sandy loam (NRCS map symbol 154) occurring along the bottom lands along Slater Creek. The closest soil

DEQ Ex. 4-1279

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determined to be a Prime Farmland Soil by the NRCS (Figure 5) is located approximately 1 mile upstream from the AVF acreage.

h. The AVF acreage is located on lands that are characterized as undeveloped rangeland, no improvements to the land's productivity or management have occurred. The AVF acreage is not significant to farming.

i. None of the land within the Brook Mine permit boundary determined to be AVF will be affected by mining, according to the mine plan presented in the permit application.

4. Based on the analysis performed on the upper part of Slater Creek mentioned above, the tentative classification of the AVF is a "Case X" alluvial valley floor, as defined in Guideline 9, page 14. This is defined as:
   a. A stream for which the alluvial saturated zone storage capacity is great enough to contribute to stream flow. The stream is dry at some periods of the year.
   b. It is further identified by subirrigated vegetation that appears intermittently down the channel length (below).

   c. Hydrograph analyses for the comparison of alluvial water levels and stream stage are available in the Brook Mine permit application to identify baseflow and interflow components. At this time the baseline period of data collection is insufficient for definitive, long-term evaluation. Further investigation of the flow components is recommended.

5. A backhoe pit in the alluvial material proximate to the channel is necessary to identify the alluvial saturated zone. This activity can be enabled when the permit to mine is issued and affected area bond has been submitted.

6. Alluvial Valley Floor determinations on acreages along Tongue River and Goose Creek have been made in the past for the Big Horn Coal Company mining permit 213 (Figure 6). The extent of the AVF definitions were included in the State Decision Document (SDD) crafted for

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the first Term of the Big Horn Coal permit in 1981. Finding No. 11 of the T-1 SDD for the Big Horn Mine permit issued AVF determinations for the Big Horn Mine based on two Exhibits in the permit, Exhibits D11-7 and D11-10. Exhibit D11-7, Drill Hole Location and Alluvial Isopach Map, is no longer valid since the acreages mapped at that time have subsequently been mined and reclaimed. Their essential hydrologic characteristics have been compromised and no longer function as originally defined. Exhibit D11-10, Potential Subirrigated Areas, was not affected by mining by Big Horn Coal and remains a valid AVF determination. That acreage is shown on Figure 5 as the yellow areas along Tongue River and Goose Creeks.

7. Since the Tongue River AVF is not planned to be disturbed by mining, additional in-depth classification for lands adjacent to the proposed Brook Mine permit boundary is unwarranted at this time. A separate determination will be made, supplemental to this document.

The AVF determination of the acreage along the upper reach of Slater Creek within the proposed Brook Mine permit boundary has reached an impasse. LQD has performed as much of the analysis as is possible at this time. Potential AVF lands on Slater Creek upstream and adjacent to the northern permit boundary must remain as future evaluations due to inaccessibility at this time. A proposed plan for AVF determination for these lands will be crafted by the end of February, 2016.

Bj Kristiansen, PG
Natural Resources Program Principal
LQD – District 3

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EXHIBITS

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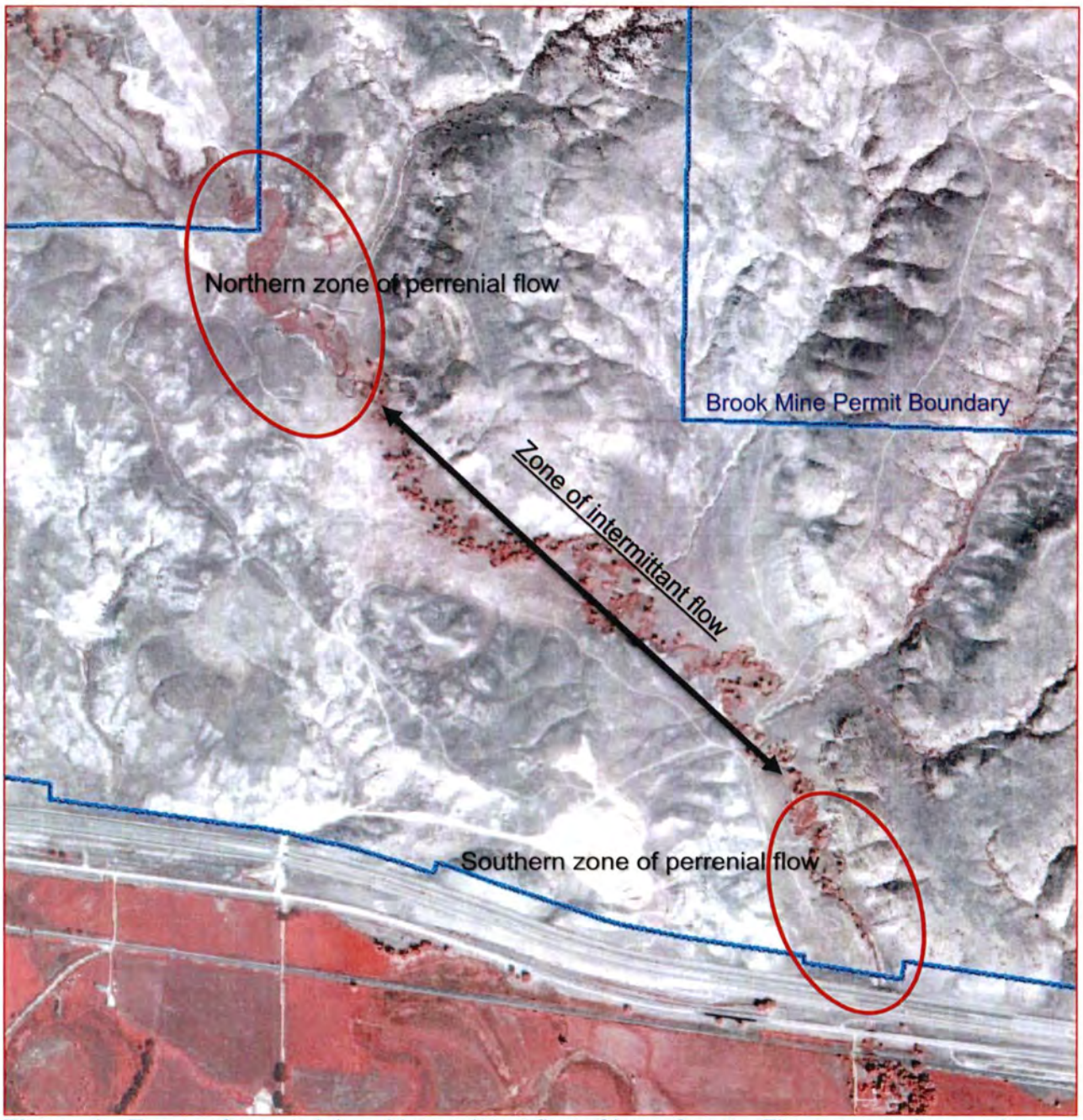

Figure 1 - Zones of perennial and intermittent flow, Slater Creek. Flows were observed on September 24, 2015 and are assumed to be constant throughout the summer months as well as the spring and fall. Color-Infrared imagery May 1, 2004.

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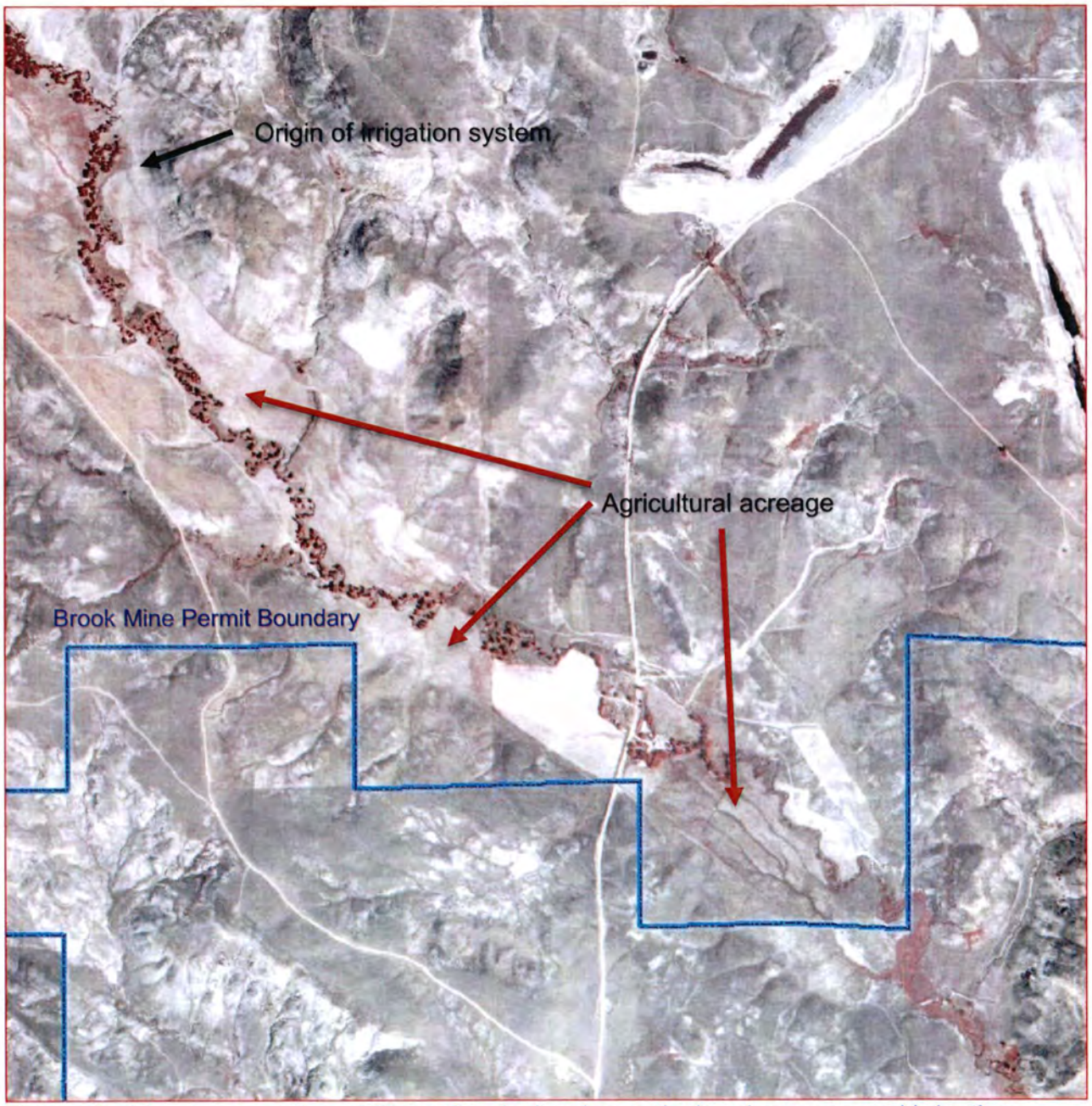

Figure 2 - Upstream section of Slater Creek showing agricultural acreage and irrigation system origination.

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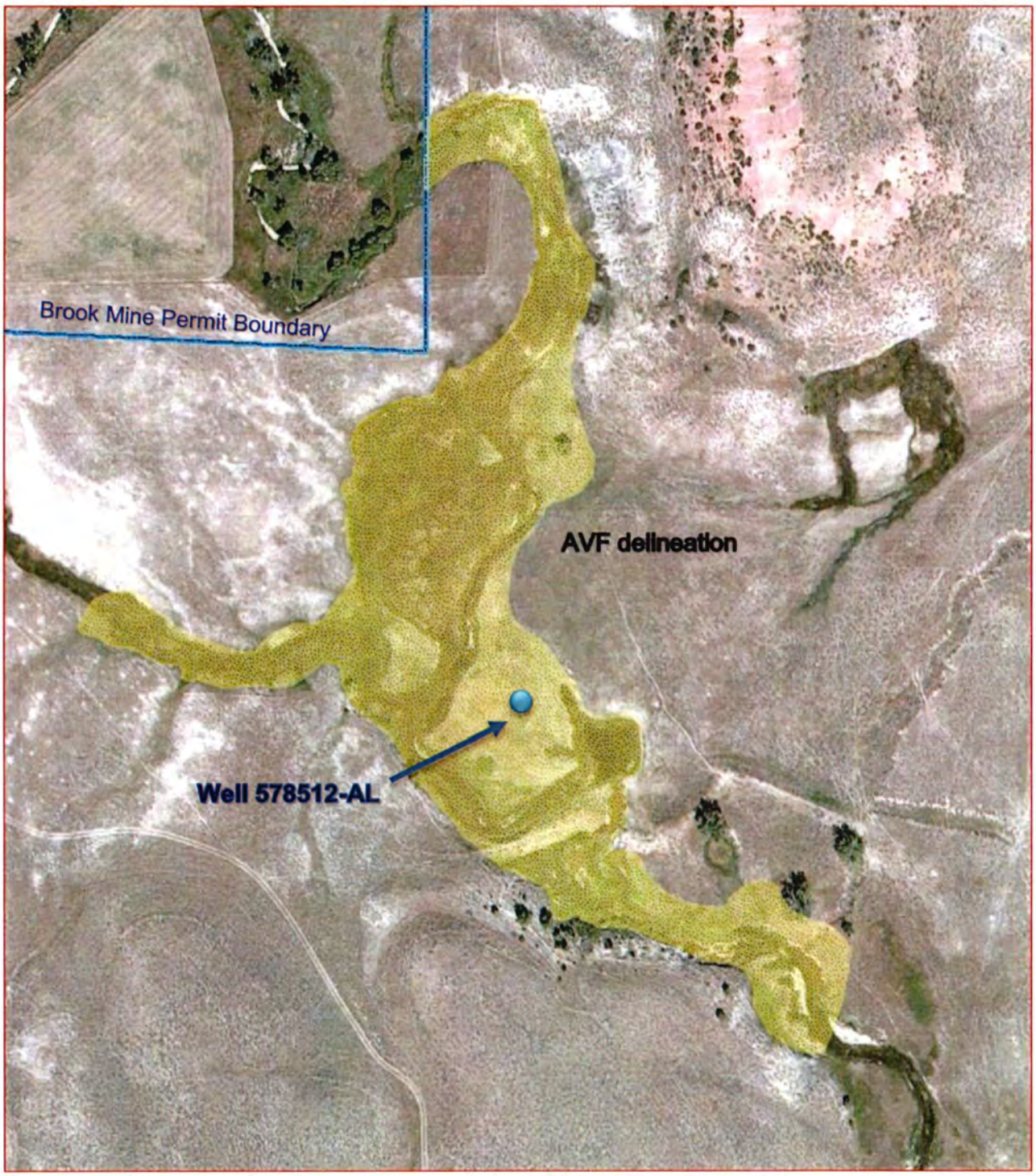

Figure 3 - Slater Creel AVF location, consisting of 13.11 acres.

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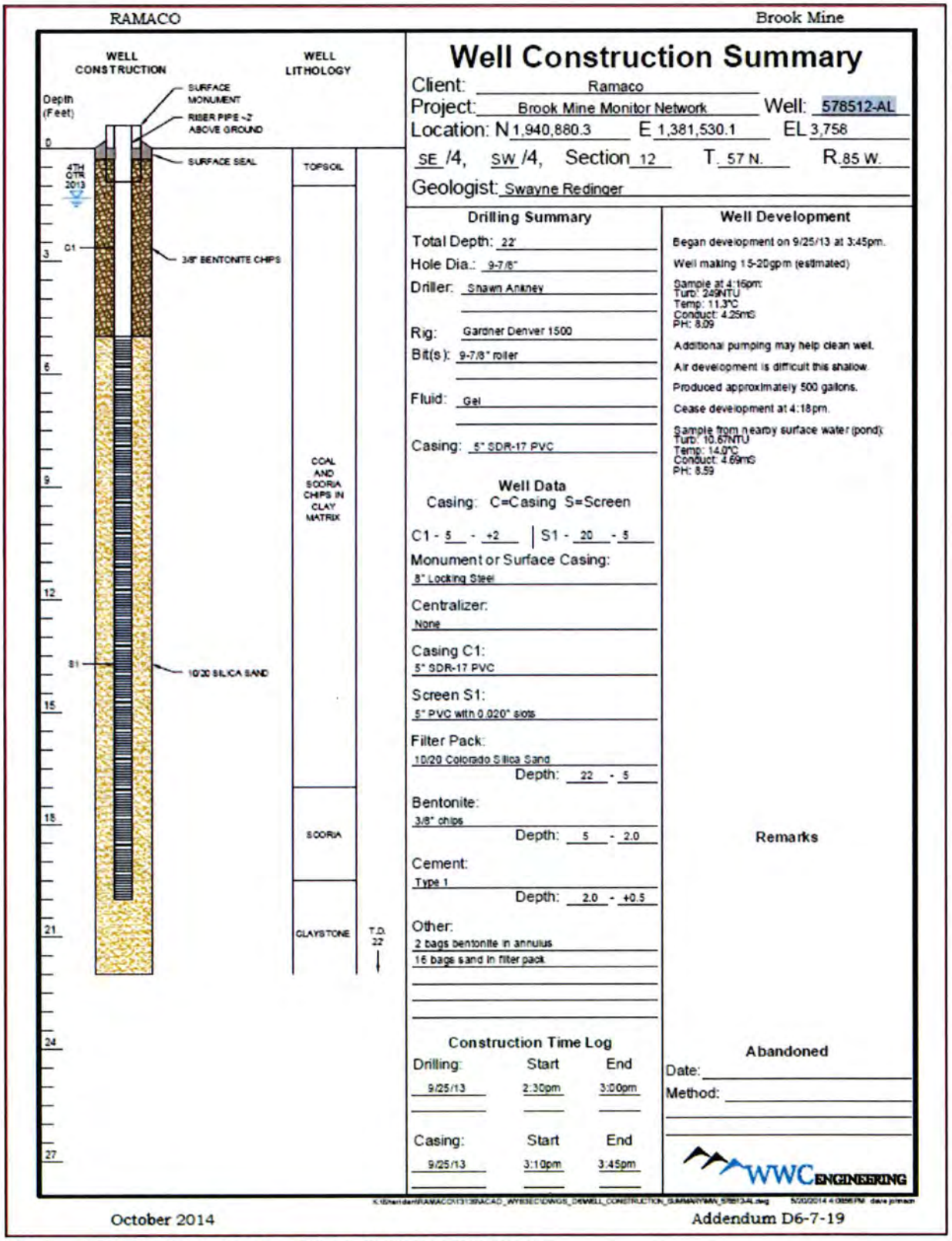

Figure 4 - Lithologic log for Alluvial Well 578512-AL

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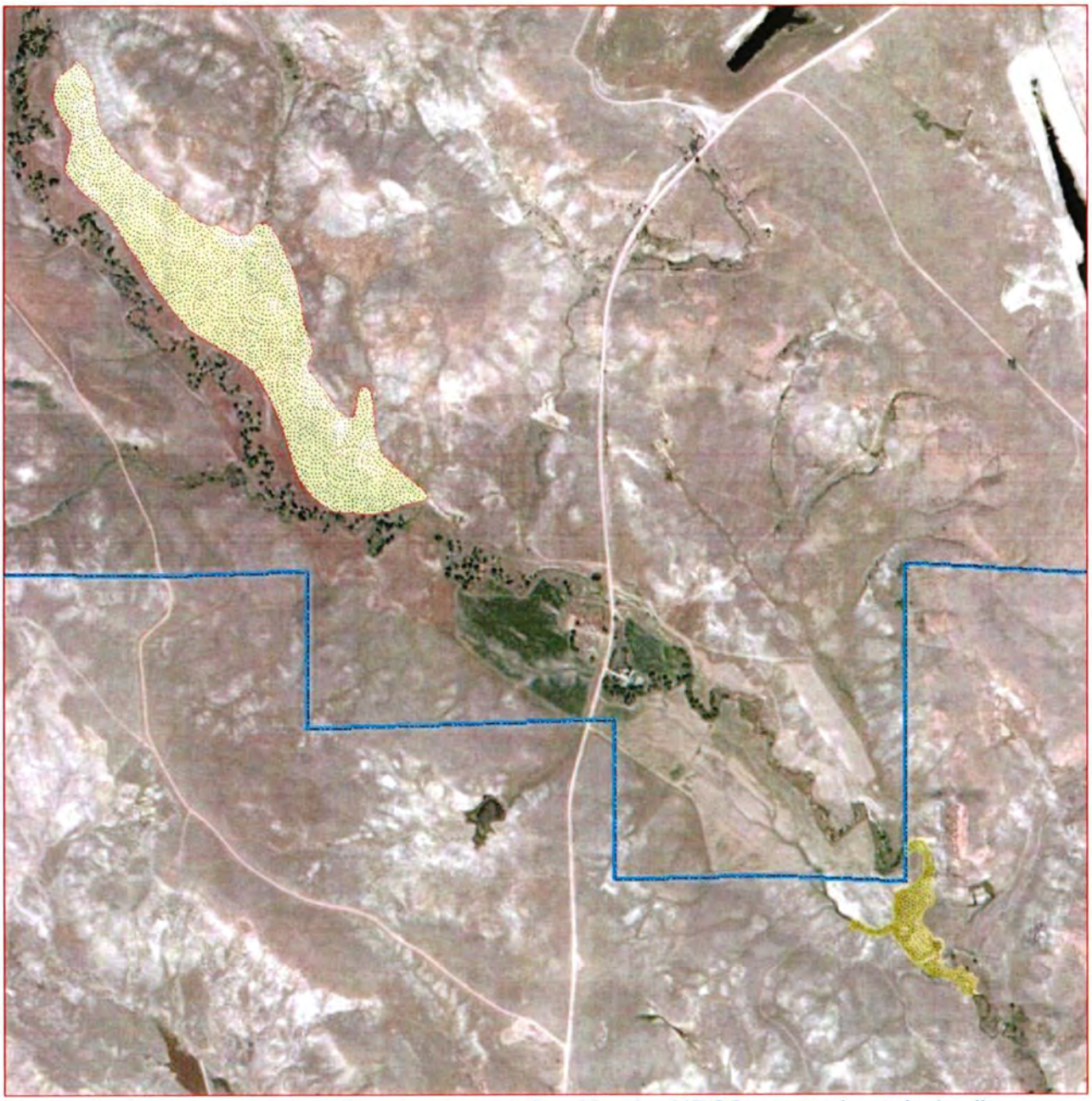

Figure 5 - Location of Prime Farmland, as defined by the NRCS, approximately 1 mile upstream from the study area.

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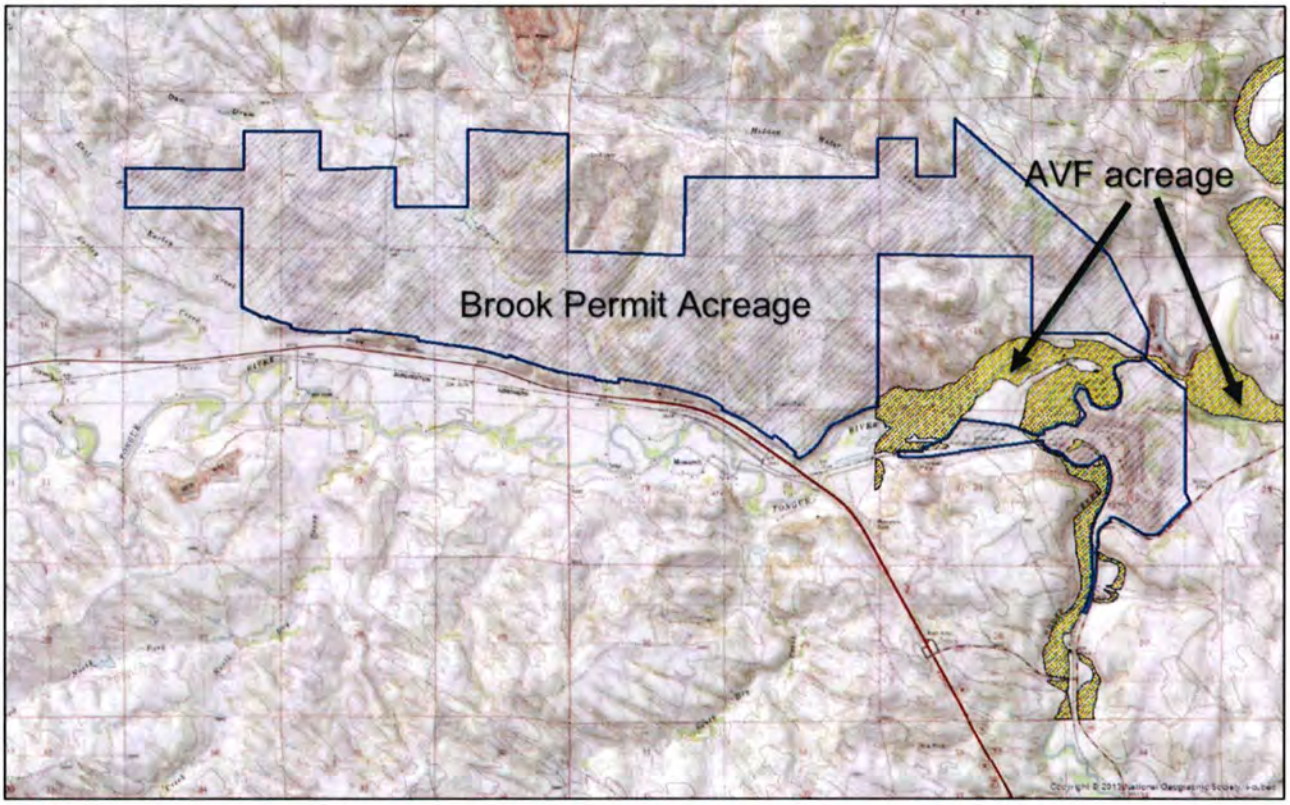

Figure 6 - AVF determinations along Tongue River (TR) and Goose Creek performed for the Big Horn Coal Company Mine Permit 213 T-1, 1981. Declared AVF in yellow stipple pattern.

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Mr. Randall Atkins
c/o WWC Engineering
1849 Terra Ave.
Sheridan, WY 82801

RE: Alluvial Valley Floor Determination for the Proposed Brook Mine, TFN 6 2/025

Dear Mr. Atkins:

This office has completed a review of the Alluvial Valley Floor investigation conducted for the Brook Mine, TFN 6 2/025, as contained in the permit application. As indicated in Coal Rules and Regulations Chapter 12, Section(1)(a)(i) the Administrator shall make a determination in writing as to the existence and extent of an alluvial valley floor within the proposed permit area or on adjacent areas where the proposed mining operation may affect surface water or groundwater that supply an alluvial valley floor.

The alluvial valley floor determination is utilized to exclude lands from mining under W.S. § 35-11-406(n)(v)(A) which requires that a permit application not be approved where a proposed operation would *"interrupt, discontinue, or preclude farming on alluvial valley floors that are irrigated or naturally subirrigated, but, excluding – those lands as to which the administrator finds that if the farming that will be interrupted, discontinued or precluded is of such small acreage as to be of negligible impact on the farm's agricultural production"*. The purpose of this letter is two-fold: 1) determine if alluvial valley floors exist within the proposed permit or on adjacent areas; and 2) should the presence of alluvial valley floors be confirmed, determine if the farming that will be interrupted, discontinued or precluded would be of negligible impact to the farm's agricultural production.

As cited above Coal Rules and Regulations Chapter 12, Section(1)(a)(i) indicates that the Administrator will make a determination of the presence of an alluvial valley floor where it is found that

1) Unconsolidated streamlaid deposits holding streams are present and;
2) There is sufficient water to support subirrigation or flood irrigation agricultural activities.

For the sake of the alluvial valley floor determination, the Brook Mine mapped streamlaid deposits as detailed in Section D11.3 of the permit application. The permit application illustrates the extent of alluvial valley floors mapped for the purpose of the permit application on Exhibit D11.6-1. LQD verified the Brook Mine AVF declared lands along the Tongue River with a field inspection conducted on October 14, 2019, as outlined below.

This office has determined that those areas shown as declared alluvial valley floors on Exhibit D11.6-1 are found to be alluvial valley floors in fact. I therefore conclude that alluvial valley floors do occur within the proposed permit and on adjacent areas as shown on Exhibit D11.6-1 of the permit application. The Slater Creek AVF was identified by LQD staff in a memorandum

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dated January 7, 2016 as well as a letter written to Mr. Randall Atkins on February 24, 2016. These references are located within the permit application in Addendum D11-5. Further work on lands along Slater Creek to a ½ mile distance upstream from the Brook Mine permit boundary were conducted by LQD staff between September 2015 and October 2019.

The above-mentioned materials were included within TFN 6 2/025. Lands contiguous to and within ½ mile of the proposed permit boundary along the Tongue River were investigated for AVF verification from late 2014 to October, 2019. These acreages were field verified on October 14, 2019. The findings are located in the Tongue River AVF Inspection Report dated December 20, 2019 found in the TFN 6 2/025 materials.

When lands classified as alluvial valley floors will be affected by mining, LQD evaluates whether any anticipated interruption or disturbance will be significant to a farm's agricultural production. Chapter 3, Section 2(f) of the Land Quality-Coal Rules outlines the approved test for measuring signficance to farming. For the Brook Mine application under review, however, LQD does not identify any potential for mining activities to interrupt, discontinue, or preclude agricultural activities on lands identified as AVFs. Because no lands classified as AVFs will be affected, the test for significance to farming is unnecessary.

Since the Brook Mine permit application Mine Plan indicates that no AVF lands will be affected by mining and LQD, after independent review, concurs in this finding, W.S. § 35-11-406(n)(v)(A) does not require that the permit application be denied approval on the basis of alluvial valley floors.

Please insert this letter into the permit application document verifying the determination of alluvial valley floors for the mine permit and adjacent areas.

If you have any questions please feel free to contact Bj Kristiansen at (307) 675-5615 or Mark Rogaczewski at (307) 675-5616.

Sincerely,

Alan Edwards

January 10, 2020

Alan Edwards
Acting Administrator
Wyoming Department of Environmental Quality
Land Quality Division

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MEMORANDUM

TO:	File, TFN 6 2/025
FROM:	Bj Kristiansen, PG
RE:	Inspection Report: AVF Verification Survey of materials provided by Brook Mine; Tongue River Valley and upper Slater Creek.
DATE:	Friday, December 20, 2019

A crew of specialists from LQD performed an on-site evaluation of the Tongue River Alluvial Valley Floor mapping performed by the Brook Mine hydrogeologists as part of their coal mine permit application. The field work for the AVF concurrence was performed on October 14, 2019. LQD staff visited multiple sites along the Tongue River from the western extent of the Big Horn Coal AVF mapping to a location approximately 5 miles upstream. There were 16 locations selected by LQD to be representative of the AVF material along Tongue River (Exhibit 1, below).

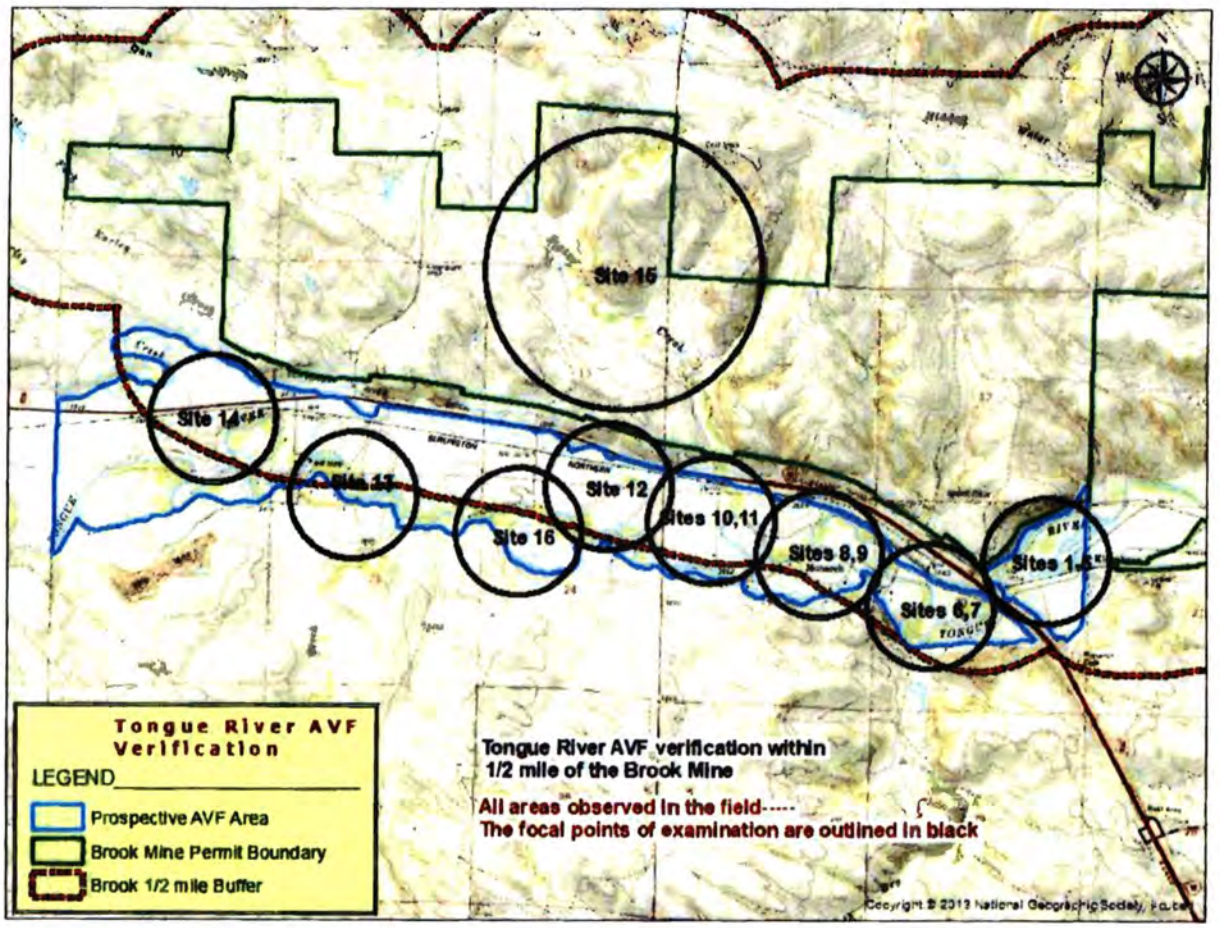

Exhibit 1 - Location map of AVF determination locations used to verify alluvial contacts and sediment characteristics.

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The sites for field verification were selected by LQD personnel using field visits, Google Earth, Geologic logs, surface maps, and cross sections provided by Brook Mine in the permit application over the past two years. The "ground-truthing" was accomplished by use of a tablet computer that held maps of the area, and could take photos while generating coordinates for the individual sites visited. The LQD staff were myself, a professional geologist, Mark Rogaczewski, a Range and Water Quality Ecology specialist, and Peter Rakowski, a surface water engineering specialist.

The following narrative describes the field work performed during the Tongue River AVF evaluation:

SITES 1 - 5

The eastern extension of the Tongue River Alluvium where it butts up against the historical AVF mapping performed by Big Horn Coal. This general area is predominantly composed of spoil materials deposited by a dragline during a historic coal mining operation. The disturbed materials were noted and used as a starting point. The survey moved upstream to the current I-90 overpass and to a terrace exposure along the southern flanks of the Tongue River. The Brook Mine AVF characteristics were accurate at these locations.

Picture 1- Tongue River east of the I-90 Bridge. Gravel beds and sandy alluvium compose the riverbed. View southwest of site 1.

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Picture 2 - Riverbed in area of old mining disturbance. Materials generally consist of gravels, scoria chips, and mud.

Site 6

Western edge of Ramaco property in an area that was underground mined in the early part of the 20th Century. Alluvium is found in and around the old workings and gob piles. The visit provided a better example of the AVF in the area of the Monarch Mine. Definition of what was alluvium and what was mine waste was expanded through the review of aerial imagery.

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Picture 3 - View to the east towards Interstate 90. This area has been used for coal mining, including support facilities, for over 100 years. There are numerous examples of human activity affecting the surface of the alluvium but not compromising the underlying, native materials. Because of this ubiquitous condition, acreage similar to this would be classified as AVF despite facilities.

SITES 7 - 9

Acreage at the beginning of Monarch Road was examined for AVF characteristics. The area is almost wholly underlain by alluvium and is used as hay meadows. Sub irrigation is obvious with supplemental irrigation water being used to assist hay growth. The alluvium here is very characteristic of the entire stretch of the river that was examined. In areas not used for hay crops, a diverse range of vegetation grows naturally. A landowner was driving past the state vehicle and stopped to inquire about our purpose. After a brief introduction, the LQD staff were given permission to view the AVF at the landowner's home.

Picture 4 – Site 8; Looking south across the AVF to its contact with an old, upland terrace. Surface AVF determination is difficult in these areas that were once town sites. Most of the shallow alluvium was affected by the building of homes in these areas as the bulk of the construction rested directly on the alluvial materials.

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SITE 10

This location was centered around a landowners home that was built along the margins of Slater Creek where it flows south beneath I90 to its confluence with the Tongue River. The landowners and friends were present to assist LQD in viewing tracts of alluvial materials used for a small farming plot. The soil was a rich, dark brown loam that appeared to be homogenous in nature. This dirt represents the uppermost characteristics of the alluvial material that has been in place for a significant period of time. Slater Creek was observed at close range and it was noted that the stream was flowing and appeared to be perennial at this site.

Picture 5 - Slater Creek approximately 325 feet from the confluence with Tongue River. Flow during the fall is low. Flow varies from season to season but remains perennial at this location. Water volume at the time of the site visit was estimated to be 0.1 cfs at this location. The stream channel consists primarily of gravel and silt.

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SITE 11

This location was selected due to the ability of investigators to access the Tongue River directly. Stream-laid deposits at this location were typical of the river throughout most of its length in the study area. These materials consisted of gravel deposits in the main course of the river with silt and clay along the active banks. The gravels generally consist of well sorted, well rounded cobbles ranging in size from 2-3 centimeters to 10 centimeters and more.

Picture 6 - Property immediately adjacent to the Tongue River. The river is hidden behind the line of bushes approximately 100 feet in the background. Careful examination of the ground indicates that this location is slightly elevated above the principal alluvial floor. These upper terrace deposits indicate that AVF materials may exist at significant depths. Drill hole logs reviewed in the application indicate alluvium may be up to 50 to 60 feet thick.

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SITE 12

This is a location selected to show the nature of the large-scale extent of the primary terrace and floodplain that is typical of the Tongue River throughout the AVF study area. These alluvial flats are used for growing hay. Much of this acreage is either subirrigated or conventionally irrigated by center pivot or side-roll sprinkler systems.

Picture 8 - View looking to the Northwest from the banks of the river. The character of the valley in its wider extent indicates vegetation that represents native species of the area. Additionally, greener swaths of the valley bottom indicate the presence of irrigation.

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SITE 13

This site provides an example of alluvial deposition compared to colluvium derived from the side hills above the river bed. These upper terraces are used to grow grass and clover through conventional irrigation, but are dependent on artificial water supplies for survival. The alluvial sediments generally are subirrigated throughout much of their extent.

Picture 8 - Taken looking northwards from a site on the second level terrace above the AVF. This topography is generally 10 to 20 feet above the floodplain and represents older materials deposited by erosion of the hills bordering the valley. Crops are grown in this location utilizing sprinkler systems. Note that the upper terrace is brown and dry. The lower alluvial material is greener and subirrigated. The AVF contact would be placed along the base of the upper terrace represented by the red line.

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SITE 14

This location is near the westernmost part of the mapped AVF in the Brook Mine permit application Appendix D11. It is located at the confluence of Early Creek and Tongue River and depicts zones where side drainages impinge upon the primary Tongue River AVF.

Picture 8 - Taken viewing the valley to the south. The AVF analysis and delineation for the Brook Mine application diagonally through the field and terminates at a point behind the photographer.

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SITE 15

Site 15 was a broad overview of the lower Slater Creek valley, with attention paid to available materials for transport to the Tongue River alluvial system. The ridges on the north side of Slater Creek are characteristically composed of poorly sorted materials that act as the source for most of the scoria and shale chips found at the bottom of the active channel. Though the creek is perennial at it's confluence with Tongue River, it carries minimal alluvium to the Tongue River through most of the year. The Slater Creek AVF acfeage inside the Brook Mine permit boundary was identified by LQD in a letter dated January 7, 2016 and in a letter to Mr. Randall Atkins on February 24, 2016. AVF lands were also investigated outside of the permit boundary to a 1/2 mile distance. These investigations are documented in a timeline attached to this document as an Addendum documenting field visits occuring on September 24, 2016 and May 29, 2019.

Picture 9 - Slater Creek looking north. This stretch of the creek provides little sediment to the Tongue River system as a whole. The classification of this location does not qualify as an AVF since it is less than 50 feet wide. This is characteristic of Slater Creek throughout the Brook Mine permit application acreage, except for where it enters the Brook Mine permit boundary in the SW1/4 sec 12, T57N, R85W, as defined in the Slater Creek AVF determination dated January 7, 2016.

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SITE 16

Site 16 was selected as a site where the Tongue River bottom was available to be viewed. The ranch where these observations were made has a ford directly across the Tongue River. LQD staff were driven across the riverbed where the water was 12 to 18 inches deep. The bottom of the river is generally armored with gravel and cobbles throughout its reach. Viewed up close, the cobbles are very well rounded and imbricated on the riverbed. This condition favors a long-term river crossing that is fairly stable. Even after the May, 2019 floods along the river, the ford was still competent. It is expected that the other reaches of the river may have also survived voluminous flows without changing their basic nature. Additionally, one of Brook Mine's recent alluvial monitor wells was placed at this ranch for generation of baseline information of the AVF sediments and water quality.

Picture 10 - Recent alluvial well installed for the Brook Mine. It is located approximately 40 feet north of exposed Tongue River alluvium.

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Picture 11 - View looking north from the high terrace south of the Tongue River. The river flows through the middle of the photo. The AVF in this area is approximately 3,500 feet wide. The fields north of the river (green patches behind the trees) are irrigated while the acreage south of the river (tan foreground) is a slightly elevated terrace that receives atmospheric water in the spring and early summer but is dry thereafter. The dual nature of the alluvium is exemplified here. The Alluvial well from the preceding page is located on this photo by a red X.

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CONCLUSION

The alluvial materials examined throughout the length of the Tongue River from sites 1 - 5 near the Kleenburn Pits to a point approximately 4.8 miles upstream are characteristic of a fluvial system that carries enough of a sediment load to lead to the formation of an AVF. Low terrace and floodplain materials consist of black to grey, clayey silt with gravel lenses and stream bed armoring with small to medium sized cobbles. The gravels are well sorted, as are the cobble deposits. The rounding on the rock indicates an active river system originating in the Big Horn Mountains.

In areas of reduced or constricted flow, overbank deposits are characterized by sand sized particles grading down to a clay fraction that completely covers the riverbed and banks. These silty materials are most affected by flooding and, historically, are the primary component for alluvial deposition leading to the creation of large scale floodplains defined as Alluvial Valley Floors.

Cross sections and geologic maps provided in the Brook Mine application (Appendix D5 and D11) indicate that the Tongue River alluvium ranges in thickness from 5 or 10 feet to 50 to 60 feet thick. The lateral extent of the alluvial sediments are found throughout the floodplain and vary in width from 1,400 to 3,600 feet.

The AVF analysis provided for the Brook Mine Application in Appendix D11 was found to be accurate and inclusive of the mappable alluvial sediments. All exhibits and narrative in the Appendix were determined to be accurate by LQD field verification and records review for both upper Slater Creek and the adjacent Tongue River Valley.

Bjarne Kristiansen, WPG-787 BjK
Natural Resources Program Principal
WDEQ/LQD District III

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ADDENDUM TO FIELD INSPECTION REPORT

TIMELINE FOR AVF VERIFICATION PROCESS

For TFN 6 2/025

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MEMORANDUM

TO: File, TFN 6 2/025
FROM Bj Kristiansen, PG
RE: Slater Creek and Tongue River AVF analyses - timeline of activities
DATE: December 19, 2019

The proposed Brook Mine is located along the backslopes of prominent ridge systems north of the Tongue River, adjacent to the Big Horn Coal Company's historical coal mining. A small portion of the Slater Creek drainage having Alluvial Valley Floor (AVF) characteristics was studied by the Land Quality Division (LQD) in a field visit to the proposed Brook Mine permit area. Approximately 6.6 acres of Slater Creek was determined to be an AVF. This analysis was addressed in a memorandum by Bj Kristiansen on February 10, 2016 and was updated on March 4, 2019. An alluvial monitor well in this location, along with a well log and several cross sections provided by Brook Mine were used by LQD in evaluating AVF characteristics of Slater Creek where it flows into the proposed Brook Mine permit boundary in the SW1/4, sec. 12, T57N, R85W.

The potential AVF materials in the Tongue River valley within ½ mile of the permit boundary were identified as targets to be verified by LQD. The initial draft of approximate AVF locations along the river was produced at the same time the Slater Creek analysis was performed, on February 10, 2016. Further work on the Tongue River valley AVF review was not initiated until the Alluvial Valley Floor Analysis in Appendix D11 was submitted to the LQD. The Round 10 responses from Brook Mine containing the AVF map of the Tongue River was submitted on September 20, 2019. This map (in Exhibit D11.6-1) was used by LQD as the blueprint for evaluating the accuracy of the AVF analysis provided in the Brook Mine permit application.

The following timeline itemizes the actions taken by LQD to verify the boundaries of the Tongue River Alluvial Valley Floor:

Early September 2014 – begin familiarization with potential AVFs in and adjacent to the Brook Mine proposed permit boundary. Most of this work was accomplished through use of Google Earth and ArcGIS software. These early analyses were performed as informal, undocumented efforts to begin familiarizing staff with approximate AVF characteristics.

September 24, 2015 – LQD personnel visit the Slater Creek drainage and observe the stream characteristics through the entire length of the creek bed within the Brook Mine permit application acreage. This review covered all 8,800 feet of Slater Creek inside the boundary. Additionally, visual observations of Slater Creek from the permit boundary northwesterly to the closest ranch house (approximately 3,000 feet) were also used to delineate AVF characteristics within ½ mile of the proposed mine property.

October 2015 through February 2016 – LQD reviewed geologic information presented in drill holes and cross sections with field observations to verify the Slater Creek AVF inside the permit boundary. LQD

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began their evaluation of the Tongue River valley to prepare for the Appendix D11 materials submitted on September 20, 2019.

February 2016 – September 20, 2019 – There were sporadic evaluations during this time of "field truthing" locations to be used as potential AVF contact points. Also during this period, LQD continued to review new geology data as it became available from Brook Mine. "Final" AVF map of the Tongue River valley adjacent to the Brook Mine proposed permit boundary arrived with the Round 10 responses from Brook Mine, on September 20, 2019.

September 21, 2018 to September 20, 2019 – LQD began preparations to verify the Tongue River AVF determinations of the proposed Brook Mine permit application, Appendix D11 and Exhibit D11.6-1:

1. Gather and examine geologic drill logs to be used for AVF verification. This establishes alluvial thickness in the study area. Logs used in analysis are found in Addendum D5-2 (Appendix D5; Geology)

2. The length of the Tongue River to be verified for AVF is defined by the width of the adjacent lands within ½ mile of the proposed permit boundary. This generates a ½ mile wide study area with an east to west horizontal distance of 4.8 miles. This defines the AVF assessment polygon starting from the southeastern boundary at the Kleenburn pits to a point 1,000 feet west of the confluence of Early Creek and the Tongue River.

3. Examine the Cross Sections that trend north/south through the Tongue River for lithology over distance. These consist of Cross Section D-D' through I-I'. This section depicts alluvial thickness as it exists on the floodplain.

4. Aerial views of the study area are used to locate alluvial contacts:

    a. Google Earth layers over time, from 1994 to 2017 were reviewed,

    b. Color Infrared photography to locate subirrigated alluvium were reviewed,

    c. Surface Geology map presented in the Brook Mine permit application, Exhibit 11.3-1,

    d. ArcGIS base maps and other available layers from LQD archives,

    e. Brook Mine permit application AVF map to define the areas of highest priority,

October 3, 2018 – Perform a drive-through of the previously located alluvial contact from above and occurrences of terrace deposits overlying alluvium. Located the 1/2 mile buffer in the field, as it relates to the mapped areas illustrated on Exhibit D11.6-1. The LQD personnel on this trip were Bj Kristiansen, PG, Natural Resources Program Principal and Reo Barney, PE, Wyoming State Blasting Coordinator. Landowners that would qualify for a pre-blast survey were identified, as well as landowners that were on the margins of the ½ mile pre-blast survey boundary.

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May 29, 2019 – Muthu Kuchanur, LQD Cheyenne support staff, toured May flooding of the Tongue River. It was readily apparent that the Tongue River fluvial system is dynamic, changing the AVF surface characteristics overnight. Mr. Kuchanur also viewed Slater Creek at a distance, starting at the John Bocek ranch and extending to Padlock Ranch acreage to the northwest. This verified that the stretches of Slater Creek mapped by Brook Mine within ½ mile of the proposed permit boundary were accurate.

October 10, 2019 – LQD contacted landowners and concerned parties living along the section of Tongue River within the AVF study to inform them that LQD personnel would be present in the field on Monday, October 14, 2019. These LQD employees would be verifying the AVF outline presented in the Brook Mine permit application, Appendix D11, Exhibit 11.6-1. LQD attempted to contact 18 residents living along Tongue River from Early Creek to the Kleenburn Pits in the east. Contact was established with 11 of the individuals or their representatives and left voicemail with 5 others. The remaining 2 landowners could not be contacted.

October 14, 2019 – Performed field evaluations of the Alluvial Valley Floor Map, Exhibit 11.3-1, presented by Brook Mine in Round 10 responses of the permit application. LQD personnel consisted of Bj Kristiansen, PG, Geologist and hydrogeologist, Mark Rogaczewski, a Range and Water Quality Ecology specialist, and Peter Rakowski, a surface water engineering specialist. LQD traversed public roads (Kleenburn, Slater Creek, Monarch, and Kooi Roads, as well as Slater Creek Lane) and access to private lands provided by landowners. LQD staff met with 3 landowners who were outside of their homes at the time of the LQD AVF evaluation.

December 5, 2019 – LQD completed Inspection Report for the AVF verification field trip.

BjK

Bjarne Kristiansen, PG
Natural Resources Program Principal
WDEQ – LQD District 3
Sheridan, WY

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