APPENDIX D

WETLAND ASSESSMENT REPORTS

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WETLAND ASSESSMENT REPORT REVISED JULY 1, 2010

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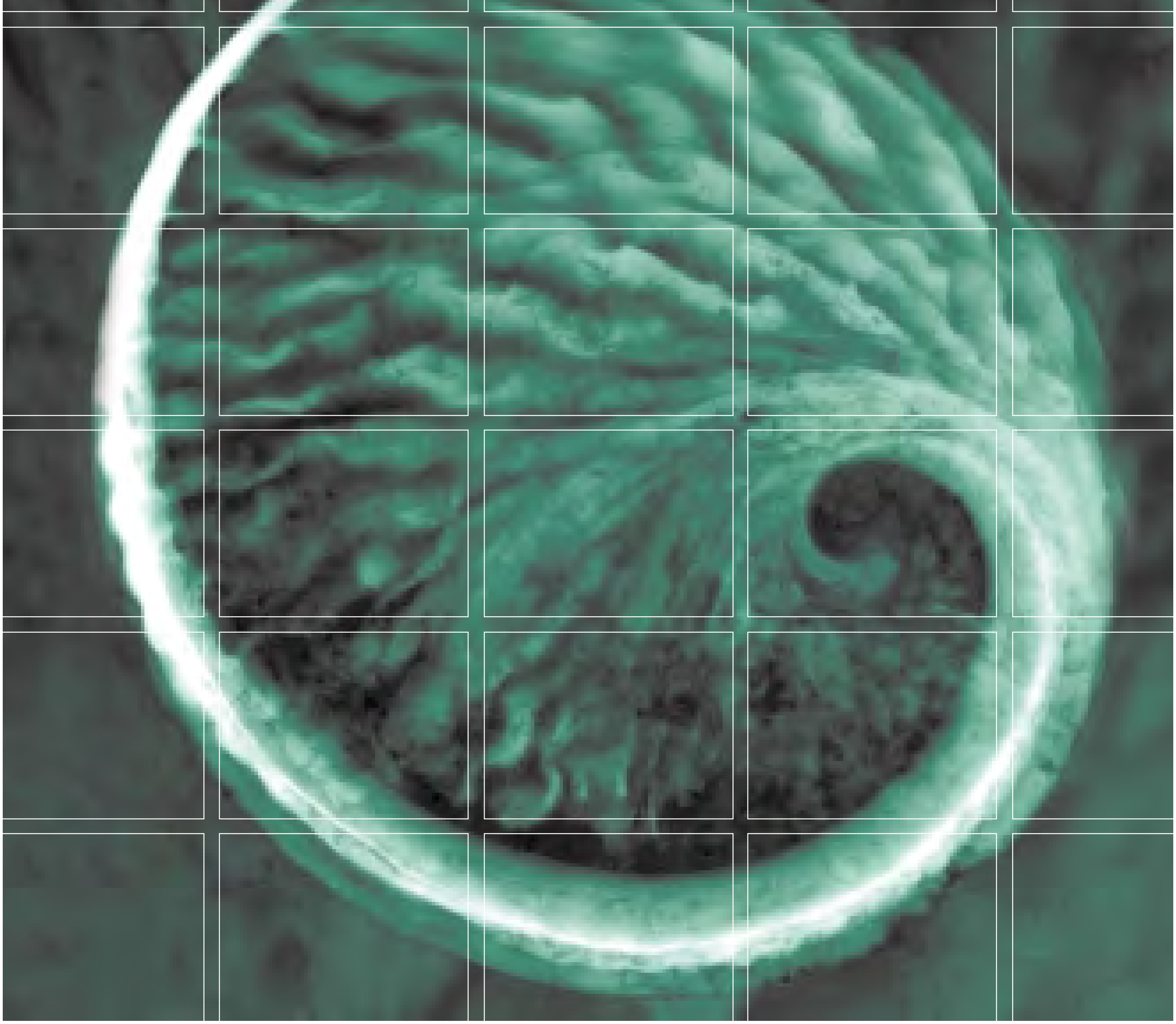

Wetland Assessment

Shell WindEnergy
Hermosa West Wind Farm Project, Albany County, Wyoming

January 11, 2010
Revised July 1, 2010

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ERM

Shell WindEnergy

Wetland Assessment: Hermosa West Wind Farm Project

January 11, 2010
Revised July 1, 2010

Project No. 0105023
Albany County, Wyoming

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EXECUTIVE SUMMARY

Environmental Resources Management Southwest, Inc. (ERM) completed a wetland delineation for the proposed Shell WindEnergy (SWE) Hermosa West Wind Farm Project (Project) in Albany County, Wyoming. Western Area Power Authority (Western) is evaluating under the National Environmental Policy Act (NEPA) the interconnection of the Project, which consists of transmission system upgrades and construction of a new substation (Proposed Action). The Project will consist of approximately 100-200 wind turbines, electrical gathering lines and transmission lines, access roads, operations and maintenance building, and other affiliated structures across an approximately 11,125 acre Project area. The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands to support Project development. The specific areas assessed (hereafter "the Survey Area") are located in southeastern Wyoming approximately 18 miles south of Laramie, Wyoming along State Highway 287. The Survey Area consists of approximately 2,198 acres of both private and State-owned land.

Field investigations were performed in August and October 2009 to identify the location and extent of any jurisdictional wetlands or waterbodies within the Survey Area. Land use and land cover designations were assigned using field observations, interpretation of 2008 aerial photography, and interpretation of U.S. Geological Survey 7.5-minute topographic maps. Land use and land cover types were classified as agricultural land primarily dedicated to cattle grazing. The Project area was sparsely populated and contained few structures, owing mostly to homesteads and barns/outbuildings associated with livestock.

Field investigations identified a total of nine (9) palustrine emergent (PEM) wetlands within the Survey Area. These wetlands are dominated by wetland vegetation, typically sedges and rush species. Eight of these wetlands were associated with waterbodies. This association may constitute a significant nexus as described in the Kennedy Test; as a result, these wetlands may be deemed jurisdictional by the U.S. Army Corps of Engineers (USACE).

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. ERM has concluded that all of the waterbodies encountered within the Survey Area are likely under the jurisdiction of Section 404 of the Clean Water Act (CWA) and the USACE. These natural features described above are likely to be deemed jurisdictional under the CWA because they have a direct connection to a traditional navigable water (TNW) or exhibit a significant nexus with a TNW. Therefore, the USACE and the Environmental Protection Area (EPA) will likely deem these features jurisdictional. It should be noted that only the USACE and EPA can make the final jurisdictional determination of these features. SWE will apply for appropriate USACE permits prior to construction and mitigate, as required, for any unavoidable impacts to wetlands and waterbodies.

The Proposed Action is anticipated to have no impacts on wetlands or waterbodies. The Project is anticipated to impact 0.12 acres of wetlands due to access road construction. Additionally, the Project is anticipated to traverse (i.e. access road and connection line crossings) 30 waterbodies. Where possible crossings of wetlands and waterbodies have been rerouted to minimize crossing and, in some cases, avoid completely. The Project was redesigned November 2009 to cross 30 waterbodies versus 45. Thirteen of these crossings are located along existing roads throughout the Project area. In addition to the waterbody crossings, the Project was redesigned to reduce wetlands impacts from 6.18 to 0.12 acres.

GLOSSARY

BMP	Best Management Practice
CFR	Code of Federal Regulations
CWA	Clean Water Act
DBH	diameter at breast height
EPA	Environmental Protection Agency
ERM	Environmental Resources Management Southwest, Inc.
FAC	Facultative Plants
FACU	Facultative Upland Plants
FACW	Facultative Wetland Plants
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
kV	kilovolts
NAD27	North America Datum of 1927
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
MET	Meteorological
MW	megawatt
OBL	Obligate Wetland Plants
OHWM	ordinary high water mark
O&M	Operations and Maintenance
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
Project	Hermosa West Wind Farm Project
PSS	Palustrine Scrub Shrub Wetland
RPW	Relatively Permanent Waterbody
SCADA	Supervisory Control and Data Acquisition
SWE	Shell Wind Energy
SWPPP	Stormwater Pollution Prevention Plan
TNW	Traditional Navigable Water
UPL	Obligate Upland Plants
US	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture

USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WEST	Western Ecosystems Technology, Inc
Western	Western Area Power Administration
WYDEQ	Wyoming Department of Environmental Quality

1.0 INTRODUCTION

Environmental Resources Management Southwest, Inc. (ERM) completed a wetland delineation for the proposed Shell WindEnergy's (SWE) Hermosa West Wind Farm Project (the Project) in Albany County, Wyoming (Figure 1-1). Western Area Power Authority (Western) is evaluating under the National Environmental Policy Act (NEPA) the interconnection of the Project, which consists of transmission system upgrades and construction of a new substation (Proposed Action). The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands to support Project development and permitting. The specific areas assessed (hereafter "the Survey Area") are located in southeastern Wyoming approximately 18 miles south of Laramie, Wyoming along State Highway 287 (Figure 1-2). The Survey Area consists of approximately 2,198 acres of both private and State-owned land, consisting of 100 to 400 foot (ft) wide corridors around Project components described below.

The environmental field investigation, including wetland assessments and delineations, and evaluation of land use, was conducted in August and October 2009. ERM performed the wetland assessment and delineation to determine if potential jurisdictional wetlands and/or waters of the United States (U.S.) exist within the Survey Area and to identify the approximate boundaries of any such features.

Field survey methods and assessment results are presented and discussed in this report, together with Project maps, copies of Regional Supplement U.S. Army Corps of Engineers (USACE) Wetland Determination Data Forms, Waterbody Data Sheets, and a Photographic Log.

1.1 OBJECTIVES AND SCOPE

The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands and/or waters of the U.S. within the Survey Area to support the Project's permitting, development and future management.

1.2 PROJECT SUMMARY

1.2.1 Project Description

SWE is proposing to develop the Project, consisting of approximately 100 to 200 wind turbines, with an anticipated total generating capacity of up to 300 megawatts (MW). The wind turbines would be arranged in roughly collinear "strings"; each turbine string would be situated within an approximately 250ft or 400ft wide corridor, depending on topography. The Project would interconnect with an existing Western-owned transmission line that traverses the Project area.

In addition to turbines, the Project would include the following:

- Access roads and truck turn-around areas;
- One permanent meteorological (met) tower;
- Supervisory Control and Data Acquisition (SCADA) equipment;
- 34.5 kilovolt (kV) power collection lines that would deliver power to the substation;
- Metering equipment for custody transfer related communication equipment;
- Operations and Maintenance (O&M) facilities, approximately 5,000 to 8,000 ft^2, including: offices, signage, spare parts storage, restrooms, telecommunications, equipment laydown areas, emergency living accommodations, shop area, conference rooms, outdoor parking, a turn-around area for larger vehicles, and potentially a welcome/information center;
- High voltage (345 kV) transmission line less than one mile in length connecting the substation to the existing Western transmission line;
- Project substation, approximately 70,000 to 85,000 ft^2 (1.6 to 2 acres), where the power from the collection system would be stepped up to the voltage required to interconnect with an existing Western-owned transmission lines (i.e., 345 kV); and
- System upgrades that would need to be made to Western's transmission line and associated facilities to accept the 300MW at the determined delivery point.

The last three Project components are part of the Proposed Action.

1.2.2 Project Area Description

The Project area is located within Albany County, Wyoming. The City of Laramie is located approximately 18 miles northwest of the Project area. The Project is located within the Upper Laramie River and South Platte River Sub-basins of the Platte River Basin.

The typical landscape of the region is low mountain slopes and nearly level floodplains, as are associated with the Mid-Elevation Forests and Shrublands of the Southern Rockies Ecoregion, and Laramie Basin of the Wyoming Basin Ecoregion (Chapman *et al*. 2004). The Mid-Elevation Forests and Shrublands Ecoregion ranges from 7,500 to 9,000 ft in elevation. The Ecoregion is generally characterized by low mountain slopes and outwash fans with moderate to high gradient (approximately 0.1 to 5% slopes) perennial streams. The Laramie Basin Ecoregion ranges from 7,100 to 7,900 ft in elevation and is characterized by nearly level floodplains and low terraces. The average elevation of the Project area is approximately 7,900 ft.

2.0 SURVEY METHODS

The following sections describe survey methodology, assumptions and site-specific information utilized to perform the wetland delineation assessment.

2.1 REGULATIONS AND DEFINITIONS

The USACE regulates "waters of the U.S.", wetlands and special aquatic sites, under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act. The USACE and the Environmental Protection Agency (EPA) define wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and other similar areas." This definition takes into consideration three distinct environmental parameters: hydrology, soil, and vegetation. Positive wetland indicators of all three parameters are normally present in wetlands.

The term "waters of the U.S." means:

a. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; these are referred to as traditional navigable waters (TNWs);

b. All interstate waters including interstate wetlands;

c. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

    1. which are or could be used by interstate or foreign travelers for recreational or other purposes; or

    2. from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

    3. which are used or could be used for industrial purpose by industries in interstate commerce;

d. All impoundments of waters otherwise defined as waters of the U.S. under the definition;

e. Tributaries of waters identified in paragraphs (a) through (d) above;

f. The territorial seas;

g. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f).
    1. The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other Waters of the U.S. by man-made dikes or

barriers, natural river berms, beach dunes and the like are "adjacent wetlands."

h. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA (other than cooling ponds as defined in 40 Code of Federal Regulations (CFR) 123.11(m) which also meet the criteria of this definition) are not waters of the U.S.; and

i. Waters of the U.S. do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with the EPA.

In 2006, the Supreme Court addressed the jurisdictional scope of Section 404 of the CWA, specifically the term "the waters of the U.S.," in *Rapanos v. U.S.* and in *Carabell v. U.S.* The decision provides two new analytical standards, which have been variously applied by lower courts, for determining whether waterbodies that are not TNWs, including wetlands adjacent to those non-TNWs, are subject to CWA jurisdiction:

1. If the waterbody is relatively permanent, or if the waterbody has a wetland that directly abuts (e.g., the wetland is not separated from the tributary by uplands, a berm, dike, or similar feature) a relatively permanent waterbody (RPW), otherwise known as the Plurality Test.
2. If a waterbody, in combination with all wetlands adjacent to that waterbody, has a significant nexus with TNWs, which can be determined using the Kennedy Test.
    a. Justice Kennedy stated during *Rapanos* that "wetlands possess the requisite nexus, and thus come within the statutory phrase 'navigable waters,' if the wetlands, either alone or in combination with similarly situated lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.'"

2.2 METHODOLOGY OVERVIEW

Methodology performed in this assessment includes conducting a desktop analysis and field survey of the Survey Area. These steps, detailed below, identify, characterize and determine connections between wetlands and waterbodies observed within the Survey Area to jurisdictional features outside the Survey Area.

2.2.1 Desktop Analysis

Prior to conducting the environmental field activities, a desktop analysis of the Survey Area and adjacent lands was performed by reviewing the following sources:

- U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle Maps (2009);

- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Maps (2009);
- Aerial Photographs (2006);
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) County Soil Surveys (2008); and
- Federal Emergency Management Agency (FEMA) Flood Hazard Maps were not available digitally for the Project area.

The analysis of these documents assisted in the planning and execution of the field survey by identifying potential drainage contours, areas of likely wetlands and waterbodies, and general habitat characteristics.

2.2.2 *Field Survey*

Environmental field surveys were performed by ERM scientists using common wetland survey tools including shovels, the Munsell Soil Color Chart, USACE Wetland Determination Data Forms, plant indicator lists, and visual observation for plant identification. The survey crews implemented the three parameter approach set forth in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) 2008 ("the Regional Supplement") to identify the boundaries of potential wetlands within the Survey Area. The three parameter approach assessed vegetation, soils, and hydrology for wetland conditions. Evaluation of these parameters is discussed below.

Surveys were conducted following the protocols set forth in the 1987 USACE Wetland Delineation Manual (USACE 1987) for areas greater than five (5) acres in size. In addition, Regional Supplement USACE Wetland Determination Data Forms, Waterbody Data Sheets and maps of Survey Area are included in Appendix A.

Landuse within the Survey Area was characterized according to land use categories (wetlands, open land, agricultural land, forested land, industrial/ commercial land, residential land, and open water). Wetland types and hydrological features located within the Survey Area are discussed in detail in Section 3.

2.2.2.1 *Wetlands*

Vegetation

When possible, dominant vegetation was identified and documented to the species level (occasionally to genus) and classified according to the National List of Plant Species that Occur in Wetlands: Region 4 (Reed 1988). The 'indicator status' identifies a range of probabilities that an individual species is estimated to be found in wetland or upland areas in a defined region (Table 2-1).

TABLE 2-1: ***Vegetation Indicator Status***

Classification	*Symbol*	*Percentage found in Wetlands*
Obligate	OBL	> 99 %
Facultative Wetland	FACW	66% - 99%
Facultative	FAC	33% - 66%
Facultative Upland	FACU	1% - 33%
Obligate Upland	UPL	< 1%

Appendix B contains the procedures for the use of the 50/20 Rule and the Prevalence Index to select dominant plant species to determine if the plant community is considered to be hydrophytic (i.e., a positive wetland indicator) as provided by the Regional Supplement.

In the Arid West, vegetative species located in specialized habitats that include riparian corridors, playas, and saline areas can be classified as either wetlands or uplands, depending on site-specific conditions. This can be problematic in areas where vegetation is a mixture of both hydrophytes and other species adapted to growing in these unique, specialized western habitats. Therefore, it is vital to consider the physiological and morphological adaptations of plant species within these areas in order to better evaluate potential wetland areas as outlined in Wetland Plants of Specialized Habitats in the Arid West (Lichvar and Dixon 2007).

Species classified as FACU that have morphological adaptations to wetland conditions are classified as hydrophytes. In the event that more than half of these hydrophytes are located within the Survey Area, the indicator status will be reassigned as FAC. As detailed in the Arid West Regional Supplement, descriptions of the observed morphological adaptations and any observations of growth habit of these species in adjacent wetland and non-wetland locations are also indicated on the data sheet.

The dominant species and their indicator status are reflected in the updated Regional Supplement USACE Wetland Determination Data Forms in Appendix A. Photographs are provided in Appendix C. Vegetation identified within the Survey Area is presented in Section 3.1.1.

Hydric Soils

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that facilitate the growth and regeneration of hydrophytic vegetation. Hydric soil indicators relate to color, structure, organic content, and the presence of reducing conditions. Color characteristics (hue, value, and chroma) were recorded using Munsell Soil Color Charts (Kollmorgen Corporation 1990). Soil observations were typically focused on the area immediately below the 'A' horizon (top most mineral horizon) or the top 12 inches, whichever was shallower.

Soils were identified using the respective county soil survey maps and examined in the field by hand-excavating test pits ranging from 6 to 12 inches in diameter and 14 to 20 inches deep along boundaries of areas exhibiting different plant communities. Soil type assessments were conducted according to the determining criteria for hydric (wetland) or non-hydric (non-wetland) soils, as outlined in the Regional Supplement.

Soils encountered within the Survey Area are documented in Section 3.1.2 and sampling points are shown in Appendix A.

Hydrology

Hydrological characteristics were characterized at each sampling point by field observation as well as examining aerial photography, USGS topographic maps, NWI maps, and FEMA Flood Hazard maps to identify primary and secondary indicators associated with wetlands and wetland hydrology. Field observations were made to determine if primary and secondary indicators of hydrology, as outlined in the Regional Supplement, were present. Primary indicators for wetland hydrology include:

- Surface water;
- High water table;
- Saturation;
- Water marks;
- Sediment and drift deposits;
- Surface soil cracks;
- Inundation visible on aerial imagery;
- Water stained leaves;
- Algal mats or salt crust;
- Aquatic invertebrates;
- Hydrogen sulfide odor;
- Oxidized rhizospheres (root channels) associated with living roots;
- Presence of reduced iron;
- Recent iron reduction in tilled soils; and
- Thin muck surfaces.

Secondary indicators for wetland hydrology include:

- Drainage patterns;
- Dry-season water table;
- Crawfish burrows;
- Saturation visible on aerial imagery;
- Geomorphic position;
- Shallow aquitard; and
- Positive FAC-Neutral test (comparative dominance of FACW and OBL vegetative species versus FACU and UPL vegetative species).

Hydrological characteristics identified within the Survey Area are discussed in Section 3.1.3 and sampling points are shown in Appendix A.

Documentation

As described in the Regional Supplement, areas with qualifying wetland criteria for all three parameters—vegetation, soils, and hydrology—were characterized as wetlands. Field data were recorded on Regional Supplement USACE Wetland Determination Data Forms found in Appendix A. These Regional Supplement USACE Wetland Determination Data Forms document wetland and upland plant communities, hydrology parameters, and soil conditions within the Survey Area.

Identified wetland boundaries were recorded in the field using sub-meter Global Positioning System (GPS) technologies. A Trimble™ GEO ProXH handheld GPS unit was used to record delineated boundaries of wetland areas identified during the field survey. Data collected in the field were collected using the North American Datum of 1927, (NAD27), State Plane Wyoming East 4901, and U.S. Survey Feet. GPS data were processed using ArcGIS and then overlaid onto orthorectified aerial imagery.

Wetland Characterization

Traditionally, the Cowardin System is used as a hierarchical system that aids resource managers and others by providing a universal language for classifying wetlands according to hydrologic, geomorphic, chemical, and biological factors. However, due to the variability of habitat and conditions of the Arid West in comparison to the habitats evaluated by Cowardin in *Classification of Wetlands and Deepwater Habitats of the United States* (1979), adaptations to the Cowardin System were necessary for this survey. In the Arid West region, wetlands are primarily ciénegas, oases, inland salt marshes, or are associated with old flood channels or man-made depressional areas in which the growth habitat of vegetation varies from that described by Cowardin.

The Cowardin System classifies wetlands into one or a combination of the following groups: palustrine emergent (PEM), palustrine scrub shrub (PSS) or palustrine forested (PFO). Wetlands recorded in combinations (i.e., PEM/PSS, PFO/PEM, PFO/PSS, and PFO/PSS/PEM) contain distinct boundaries comprising greater than five percent of the total wetland area of PEM, PSS or PFO.

PEM wetlands, as defined by Cowardin, et al. (1979), are those wetlands that are dominated by erect, rooted, herbaceous plants. These wetlands are commonly dominated by cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), and various forbs.

PSS wetlands, as defined by Cowardin, et al. (1979), are those wetlands that are dominated by woody vegetation less than 20 feet tall. These wetlands are commonly dominated by eastern false-willow (*Baccharis halimifolia*), willows (*Salix* spp.) and other shrubs. PSS wetlands are often transitional areas between herbaceous and forested habitats or are in succession from herbaceous conditions to forested conditions. PSS wetlands, therefore, often display a combination of immature species found in forested communities and species found in herbaceous wetland communities.

PFO wetlands, as defined by Cowardin, et al. (1979), occur in undisturbed, forested areas and are often associated with streams. As defined in the Arid West Regional Supplement, trees are considered any woody plant greater than three inches diameter at breast height (DBH), regardless of height. Tree species associated with wetlands in this region include arroyo willow (*Salix lasiolepis)*, narrow-leaved cottonwood (*Populus augustifolia)*, lanceleaf cottonwood (*P. x acuminate)*, Hinckley poplar *(P. x hinckleyana)*, African tamarisk (*Tamarix africana)*, and salt cedar (*T. aphylla*), among others.

2.2.2.2 *Waterbodies*

Waterbodies include any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing or an ordinary high water mark (OHWM), as defined by the USACE, and other permanent waters such as lakes and ponds. Waterbodies identified within the Survey Area were identified and surveyed. Perennial or intermediate waterbodies were differentiated according to size: minor, intermediate, and major. Minor waterbodies are 10 feet or less in width from water's edge to water's edge; intermediate waterbodies range in width from > 10 feet to < 100 feet; major waterbodies are 100 feet or greater in width. Applicable data were gathered for the waterbody feature, including: bank height, bank slope, stream-flow, direction and type, water appearance, stream substrate, aquatic habitats, channel conditions, and disturbances. Data were documented on Waterbody Data Sheets, which are provided in Appendix A. Waterbodies identified within the Survey Area are described in Section 3.2.

Due to the arid climate, waterbodies and areas that were excavated and had the potential to retain water for a short period of time were surveyed using a

Tremble™ Geo ProXH GPS unit as described above in Section 2.3.4. Data points were collected along the upper banks or edges of the features within the Survey Area.

Indicated waterbodies on USGS topographic maps were also field verified. If indicated waterbodies on the USGS topographic maps did not meet the criterion of waterbodies, as listed above, such as swales or erosional features; a GPS point was collected and the area was photographically documented. Photographs and a map detailing the location of these swales and erosion features are presented in Appendix D.

2.2.2.3 Uplands

Upland (i.e., non-wetland) samples were collected within the Survey Area and adjacent to the respective wetland where a distinguishable transition from wetland to upland communities could be identified (based on vegetation, hydrology and soil parameters outlined in the Regional Supplement). Typical indicators of habitat change include vegetative species composition, soil saturation levels, soil composition, and elevation.

3.0 RESULTS

The results of the wetland delineation are presented in the following sections. General descriptions of the vegetation, soils and hydrology are provided for each feature type. Completed Regional Supplement USACE Wetland Determination Data Forms and Waterbody Data Sheets are presented in Appendix A and a Photographic Log is provided in Appendix C

The results presented in this report were based on review of available current and historical information, a desktop evaluation, and the wetland delineation conducted in August and October 2009.

3.1 WETLANDS

A total of nine (9) wetlands (approximately 6.18 acres) were identified and delineated within the Survey Area. The delineated wetlands were all classified as PEM wetlands due to the predominance of yellow nutsedge (*Cypreus esculentus*: FACW) and Baltic rush (*Juncus balticus*: FACW), within the wetlands. The extent and location of these wetlands are shown in Figure 3-1(a-h).

Table 3-1 summarizes data for wetlands identified within the Survey Area, including the wetland location, size, type, and connectivity to a waterbody or otherwise exhibiting a significant nexus with a TNW. Detailed information for each feature is provided on the Regional Supplement USACE Wetland Determination Data Forms in Appendix A.

TABLE 3-1: *Wetlands within the Survey Area*

Feature ID	Latitude	Longitude	Type (A)	Acreage (B)	Connection to Significant Nexus	Figure
WAAL001	41.056410	-105.573166	PEM	1.29	Associated with Forest Creek	3-1a/d
WAAL002	41.047740	-105.560374	PEM	0.90	Associated with Boulder Creek	3-1d
WAAL003	41.050119	-105.535957	PEM	0.33	Associated with Willow Creek	3-1e
WAAL004	41.038912	-105.535552	PEM	1.52	Associated with Willow Creek	3-1e
WBAL001	41.068691	-105.545779	PEM	0.20	Associated with Boulder Creek	3-1b
WBAL002	41.082437	-105.546098	PEM	0.13	Isolated depressional wetland	3-1b
WBAL003	41.058457	-105.553990	PEM	0.43	Associated with Boulder Creek	3-1b
WBAL004	41.058491	-105.523914	PEM	0.16	Associated with Willow Creek	3-1c
WBAL005	41.020996	-105.516327	PEM	1.22	Associated with Fish Creek	3-1 d/e/g
				TOTAL	**6.18**	
				Total Potentially Jurisdictional Wetlands	**6.05**	

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

3.1.1 Vegetation

In the Survey Area, Herbaceous stratum observed within the wetlands were dominated by colonies of creeping bentgrass (*Agrostis stoloniferia*: FAC+), yellow nutsedge, Baltic rush, and spikerush (*Eleocharis spp*). Shrub and tree stratum, while typically not dominant, consisted of Bebb willow (*Salix bebbina*: FACW) and quaking aspen (*Populus tremuloides*: FAC). These tree species were found in wetlands associated with banks of perennial streams.

3.1.2 Soils

A desktop assessment of the soils located within the Survey Area was performed (Figure 3-2a-h). According to the USDA NRCS Soil Survey for Albany County (2008) there are 15 soil series present within the Survey Area, of these four (4) are considered partially hydric (Table 3-2). These hydric series are typically located in low-lying landforms associated with stream terraces.

Field verification of these hydric soils was accomplished through soil test pits of approximately 12 inches a diameter and up to 16 inches deep. These test pits were dug using shovels in the identified wetland and associated upland area. Mapped soils identified within the wetland contained low chroma soils (typically Munsell notations of 10 YR 2/1, black; 10 YR 3/1, very dark gray; or 7.5 YR 3/2, dark brown); the soils classification varied from muck to coarse sandy clay. The predominant indicators of hydric soils within the Survey Area were mottled and low chroma soils. Soils within the observed wetlands also met requirements for indicators F6 (Redox Dark Surface) and F3 (Depleted Matrix). Findings from the field surveys were generally consistent with those described in the USDA NRCS county soil survey. Detailed results of the identified soils encountered within the Survey Area are included in the Regional Supplement USACE Wetland Determination Data Forms (Appendix A).

TABLE 3-2: Soil Associations and Soil Series within the Survey Area

Map Unit	*Soils Series*	*Acres*	*Map Unit Symbol*	*Hydric*	*Landform*	*Drainage Class*
Boyle-Lininger association, 1 to 15 percent slopes	Boyle and Lininger	546	125	No	Uplands and mountain hill slopes	Well drained
Boyle-Rock outcrop complex, 5 to 25 percent slopes	Boyle	24	124	No	Uplands and mountain hill slopes	Well drained
Byrnie-Rock outcrop complex, 10 to 50 percent slopes	Byrnie	26	130	No	Gently sloping to very steep hills and ridges	Well drained

Map Unit	*Soils Series*	*Acres*	*Map Unit Symbol*	*Hydric*	*Landform*	*Drainage Class*
Canburn loam, 1 to 4 percent slopes	Canburn	37	132	Partially	Mountain valley bottoms, flood plains, stream terraces and lower slopes of alluvial fans at 4,800 to 8,200 feet	Poorly drained
Dalecreek-Kovich complex, 0 to 9 percent slopes	Dalecreek and Kovich	2	149	Partially	Flood-plains, stream terraces, low lying alluvial fans and broad valley floors.	Moderately well drained
Hapjack-Rogert-Amesmont complex, 3 to 25 percent slopes	Hapjack and Rogert	250	172	Partially	Mountain slopes and ridges	Well drained
Rock outcrop-Cathedral complex, 20 to 40 percent slopes	Cathedral	1	137	No	Mountain slopes, hills, and ridges	Well drained
Rock outcrop-Rogert complex, 25 to 99 percent slopes	Rogert	109	219	No	Mountain slopes and ridges	Well drained
Rogert-Rock outcrop-Amesmont complex, 5 to 25 percent slopes	Rogert	293	220	No	Mountain slopes and ridges	Well drained
Silas, gravelly substratum-Vensora loams, 0 to 6 percent slopes	Silas and Vensora	15	227	Partially	Mountain valley fills, outwash terraces, and floodplains	Somewhat poorly drained
Stunner-Tisworth-Blazon complex, 1 to 6 percent slopes	Stunner, Tisworth, and Blazon	32	230	No	Alluvial fans, fan aprons, and terraces	Well drained
Tieside-Pilotpeak-Rock outcrop complex, 3 to 10 percent slopes	Tieside and Pilotpeak	409	234	No	Uplands, structural benches, and strath terraces	Well drained
Wycolo-Alcova complex, 3 to 10 percent slopes	Wycolo and Alcova	181	241	No	Uplands, structural benches, strath terraces, pedimens, and fan aprons	Well drained
Wycolo-Thermopolis-Rock outcrop complex, 10 to 50 percent slopes	Wycolo and Thermopolis	3	244	No	Uplands, structural benches, strath terraces, ridges, and hills	Well drained

Map Unit	Soils Series	Acres	Map Unit Symbol	Hydric	Landform	Drainage Class
Wycolo-Tieside sandy loams, 3 to 10 percent slopes	Wycolo and Tieside	268	243	No	Uplands, structural benches, and strath terraces	Well drained

3.1.3 *Hydrology*

Geography and topography are primary factors influencing wetland hydrology. Rolling hills dominate the general topography within the Project area. Wetland development throughout the Survey Area can be attributed to low-lying areas between gentle undulations, natural drainage patterns, and clay soils with poor drainage capabilities.

USFWS NWI and topographic maps (Figure 3-3a-h) provide an overview of NWI-mapped wetlands within the Project area. Review of these maps prior to field mobilization indicated several potential wetland areas within the Survey Area predominately associated with stream corridors. Wetland features identified and classified during the field survey were generally similar in location to those included on NWI Maps; however, delineated types and sizes generally differed from those identified on NWI Maps.

Delineated wetlands not associated with NWI-mapped wetlands were primarily associated with named stream corridors or their tributaries; the exception being wetland WBAL002, which was an isolated depressional wetland.

Primary hydrological indicators associated with the identified wetlands include surface water (A1), saturation (A3), and water marks (B1). Secondary indicators for wetland hydrology include: drainage patterns (B10) and shallow aquatard (D3). Other indicators such as topography, local soils survey data and vegetation species composition were observed and factored into the delineations.

3.1.4 *Plurality Test*

Government Creek, Forest Creek, and Boulder Creek all flow into Willow Creek, which flows generally across the middle of the Project area. Willow Creek continues outside the Project area approximately 16 miles until joining the Laramie River. The Laramie River ultimately confluences with the North Platte River, a TNW, approximately 120 miles north of the Project area. The northern portion of the Project area is located in the North Platte Basin and drains into the Missouri Region Watershed.

Fish Creek flows generally across the southern portion of the Project area into Deadman Creek, approximately five miles outside of the Project area. Deadman Creek continues until it joins the North Fork Cache la Poudre River which ultimately confluences with the South Platte River, a TNW, approximately 60 miles southeast of the Project area. The southern portion of the Project area is located in the South Platte Basin and drains into the Missouri Region Watershed.

Seven of the nine wetlands (all except WBAL002 and WBAL005) identified in the Survey Area are ultimately connected to the North Platte River through a series of named or unnamed tributaries to Willow Creek, a RPW. An eighth wetland (WBAL005) is ultimately connected to the South Platte River through a direct connection to Fish Creek, a RPW. Due to the defined size of the Project area, field verification of a direct wetland connection to a TNW was limited to visual verifications and a desktop analysis. The desktop analysis indicates the potential for a direct connection between eight of the nine identified wetlands within the Survey Area and a TNW, specifically, the North Platte River and the South Platte River. Based on the potential for connectivity, these features may be classified under the jurisdiction of the USACE.

3.1.5 Kennedy Test

With the exception of the one isolated wetland identified within the Survey Area, the hydrologic interconnection of the eight remaining wetlands to the nearest TNW (North Platte River and South Platte River) suggests that the eight identified wetlands could support the TNW. The diminutive size of these wetlands and the distance from the TNW make them unlikely to provide substantial direct habitat or lifecycle support functions to any aquatic species found within the TNW. Biological support of wetlands within the Survey Area would therefore be limited to providing temporary habitat for avian species associated with the TNW and /or the TNW's riparian buffer. However, the presence of small fish found in a few of the wetlands and the interconnection through the series of RPWs provides a potential link between these eight wetlands and the nearest TNW. This biological connection would likely meet the requirements of the Kennedy Test for a significant nexus; therefore, these features are likely under the jurisdiction of the USACE.

3.2 WATERBODIES

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. Additionally, one headwater spring was identified within the Survey Area and another was identified outside the Survey Area in connection with identified features SAAL014 and SAAL012, respectfully. Table 3-3 summarizes the waterbodies by feature identification, name, type, and size and relation to a TNW. Waterbody Data Sheets containing detailed information regarding the waterbodies (stream flow, depth, water characteristics, etc.) are contained in Appendix A.

It should be noted several areas identified as intermittent or ephemeral waterbodies on the USGS topographic maps (identified as dashed blue lines) were field verified and deemed swales or erosion features as they did not meet the criterion discussed in Section 2.2.2.2. A map illustrating these areas and representative photolog is included in Appendix D.

3.2.1 Plurality Test

Government Creek, Forest Creek, and Boulder Creek all flow into Willow Creek, which flows generally across the middle of the Project area. Willow Creek continues outside the Project area approximately 16 miles until joining the Laramie River. The Laramie River ultimately confluences with the North Platte River, a TNW, approximately 120 miles north of the Project area. The northern portion of the Project area is located in the North Platte Basin and drains into the Missouri Region Watershed.

Fish Creek flows generally across the southern portion of the Project area into Deadman Creek, approximately five miles outside of the Project area. Deadman Creek continues until it joins the North Fork Cache la Poudre River which ultimately confluences with the South Platte River, a TNW, approximately 60 miles south east of the Project area. The southern portion of the Project area is located in the South Platte Basin and drains into the Missouri Region Watershed.

NWI and topographic mapping indicates that most likely all of the waterbodies found within the Survey Area have either a direct or indirect connection to a TNW (Table 3-3).

TABLE 3-3: Waterbodies within the Survey Area

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Length (ft)*	*Connection to TNW*	*Figure*
SAAL001	41.066863	-105.582609	Government Creek	Perennial	735	Direct connection to a TNW	3-1a
SAAL002	41.072383	-105.573911	Government Creek	Perennial	785	Direct connection to a TNW	3-1a
SAAL003	41.079602	-105.563864	Government Creek	Ephemeral	1301	Direct connection to a TNW	3-1a/b
SAAL004	41.056285	-105.573305	Forest Creek	Perennial	1299	Direct connection to a TNW	3-1a/d
SAAL005	41.062013	-105.564295	Forest Creek	Intermittent	827	Direct connection to a TNW	3-1a/b
SAAL006	41.046449	-105.562884	Tributary of Boulder Creek	Ephemeral	619	Direct connection to a TNW	3-1d
SAAL007	41.045361	-105.562785	Tributary of Boulder Creek	Ephemeral	225	Direct connection to a TNW	3-1d
SAAL008	41.047795	-105.560299	Boulder Creek	Ephemeral	1224	Direct connection to a TNW	3-1d
SAAL009	41.043325	-105.561854	Tributary of Boulder Creek	Ephemeral	3979	Indirect connection to a TNW	3-1d
SAAL010	41.042975	-105.535672	Willow Creek	Perennial	1313	Direct connection to a TNW	3-1e
SAAL012	41.038769	-105.536049	Tributary of Willow Creek	Perennial	781	Indirect connection to a TNW	3-1e
SAAL013	41.041863	-105.526986	Tributary of Willow Creek	Ephemeral	1493	Indirect connection to a TNW	3-1e
SAAL014	41.025831	-105.487344	Unnamed Tributary	Perennial	443	Direct connection to a TNW	3-1f
SAAL015	41.028552	-105.493262	Unnamed Tributary	Ephemeral	633	Indirect connection to a TNW	3-1f
SAAL016	41.027122	-105.507064	Unnamed Tributary	Ephemeral	960	Indirect connection to a TNW	3-1e/f
SAAL017	41.018978	-105.505231	Tributary of Fish Creek	Perennial	1087	Direct connection to a TNW	3-1g/h
SAAL018	41.009066	-105.515787	Tributary of Fish Creek	Ephemeral	657	Direct connection to a TNW	3-1g
SAAL019	41.019927	-105.525159	Fish Creek	Perennial	1180	Indirect connection to a TNW	3-1e/g
SAAL020	41.018891	-105.535615	Fish Creek	Perennial	809	Direct connection to a TNW	3-1g
SAAL021	41.070793	-105.522148	Willow Creek	Perennial	473	Direct connection to a TNW	3-1c
SAAL022	41.079493	-105.508033	Tributary to Grant Creek	Intermittent	341	Indirect connection to a TNW	3-1c
SBAL001	41.068364	-105.544509	Tributary to Forest Creek	Ephemeral	607	Indirect connection to a TNW	3-1b
SBAL002	41.069789	-105.545064	Forest Creek	Perennial	3034	Direct connection to a TNW	3-1b
SBAL003	41.064732	-105.554744	Forest Creek	Perennial	776	Direct connection to a TNW	3-1b
SBAL004	41.058280	-105.554093	Boulder Creek	Perennial	637	Direct connection to a TNW	3-1b
SBAL005	41.057989	-105.553673	Tributary to Boulder Creek	Perennial	268	Indirect connection to a TNW	3-1b
SBAL006	41.054440	-105.506621	Tributary to Willow Creek	Intermittent	335	Indirect connection to a TNW	3-1f
SBAL007	41.057142	-105.515617	Tributary to Willow Creek	Intermittent	336	Indirect connection to a TNW	3-1c
SBAL008	41.053209	-105.516595	Tributary to Willow Creek	Perennial	522	Indirect connection to a TNW	3-1e
SBAL009	41.051501	-105.516645	Tributary to Willow Creek	Intermittent	1744	Indirect connection to a TNW	3-1e
SBAL010	41.041411	-105.517572	Tributary to Willow Creek	Ephemeral	296	Indirect connection to a TNW	3-1e
SBAL011	41.046786	-105.516241	Tributary to Willow Creek	Ephemeral	775	Indirect connection to a TNW	3-1e
SBAL012	41.047692	-105.516305	Tributary to Willow Creek	Intermittent	390	Indirect connection to a TNW	3-1e
SBAL013	41.058449	-105.523856	Tributary to Willow Creek	Perennial	440	Indirect connection to a TNW	3-1c

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Length (ft)*	*Connection to TNW*	*Figure*
SBAL014	41.057108	-105.525356	Willow Creek	Perennial	1561	Indirect connection to a TNW	3-1b/c/e
SBAL015	41.045800	-105.527373	Tributary to Willow Creek	Intermittent	318	Indirect connection to a TNW	3-1e
SBAL016	41.045472	-105.526402	Tributary to Willow Creek	Intermittent	1040	Indirect connection to a TNW	3-1e
SBAL017	41.014666	-105.489100	Unnamed Tributary	Intermittent	1012	Indirect connection to a TNW	3-1h
SBAL018	41.015307	-105.504368	Fish Creek	Perennial	3605	Direct connection to a TNW	3-1g/h
SBAL019	41.021630	-105.516588	Tributary of Fish Creek	Perennial, man made	451	Indirect connection to a TNW	3-1e
SBAL020	41.020891	-105.516295	Fish Creek	Perennial	938	Direct connection to a TNW	3-1e/g
SBAL021	41.020444	-105.525898	Tributary of Fish Creek	Intermittent	562	Indirect connection to a TNW	3-1g
SBAL022	41.020859	-105.524967	Tributary of Fish Creek	Intermittent	307	Indirect connection to a TNW	3-1e/g
SBAL023	41.019408	-105.534696	Tributary of Fish Creek	Intermittent	303	Indirect connection to a TNW	3-1g
SBAL024	41.078858	-105.508036	Grant Creek	Perennial	329	Direct connection to a TNW	3-1c

3.2.2 Kennedy Test

All 45 surveyed waterbodies were found to have either direct or indirect biological, physical, and chemical connection with either Willow Creek, a RPW, which connects to the Laramie River (RPW) and ultimately drains in to the North Platte River, a TNW; or Fish Creek, a RPW, which connects to the North Fork Cache La Poudre River (RPW) and ultimately drains in to the South Platte River, a TNW. The surveyed waterbodies have the potential to provide biological support to a wide variety of aquatic fauna and avian species. The potential for direct connection to a RPW satisfies the criterion of the Kennedy Test for a significant nexus; therefore, these features are likely under the jurisdiction of the USACE.

3.3 UPLANDS

The upland habitat located along the majority of the Survey Area is characterized as grasslands dominated by spare ground cover including spineless horsebrush (*Tetradymia canescens*), big sagebrush (*Artemisia tridentate*), wax currant (*Ribes cereum*), Timothy grass (*Phleum pretense*), blue wildrye (*Elymus glaucus)*, elkweed (*Frasera speciosa*), Canada goldenrod (*Solidago canadensus*), big bluestem (*Andropogon geradii*), little bluestem (*Schizachyrium scoparium*), and assorted upland grasses (Whitson 2004). Regional Supplement USACE Wetland Determination Data Forms are provided in Appendix A.

4.0 SUMMARY AND CONCLUSIONS

Field investigations identified a total of nine PEM wetlands within the Survey Area. One of these features, WBAL002 (0.13 acres), was an isolated depressional wetland and showed no significant nexus to a water of the U.S. The remaining eight wetlands (6.05 acres) were associated with stream corridors and meet the requisite of the Plurality Test. Additionally these wetlands demonstrate a measureable significant nexus as described in the Kennedy Test; as a result, these wetlands may be deemed jurisdictional by the USACE.

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. ERM has concluded that all of these natural waterbodies may likely be deemed under the jurisdiction of Section 404 of the CWA and the USACE. The features described above are likely to be deemed jurisdictional under the CWA because they have the potential for a direct connection to a TNW, or exhibit a significant nexus with a TNW. Therefore, the USACE and EPA may deem these features jurisdictional.

Several areas identified as intermittent or ephemeral waterbodies on the USGS topographic maps were field verified and deemed swales or erosion features as they did not meet the criterion discussed in Section 2.2.2.2. A map illustrating these areas and representative photographic log is included in Appendix D.

Results of the assessment indicate one of the nine wetlands delineated within the Survey Area may be deemed non-jurisdictional by the USACE and the EPA as it is isolated and shows no connection to waters of the U.S.

Note: Only the USACE and EPA can make the final jurisdictional determination of the features.

4.1 ANTICIPATED IMPACTS AND MITIGATION

4.1.1 Proposed Action Impacts

The Proposed Action includes the construction of a substation, high voltage (345 kV) transmission line less than one mile long, and system upgrades to an existing 345 kV Western-owned transmission line. The Proposed Action is not anticipated to have impacts on wetlands and/or waterbodies within the Survey Area.

4.1.2 Project Impacts

The Project is anticipated to impact approximately 0.12 acres of wetlands. These impacts are entirely due to the construction of access roads and installation of underground electrical connection lines. Turbines, laydown areas, O&M areas, and the permanent met tower will be sited outside of areas likely to be considered jurisdictional wetlands.

In November 2009 the Project was redesigned to reduce wetlands impacts from 6.18 to 0.12 acres. These anticipated impacts will be both temporary and permanent. The permanent impacts are associated with the construction of new access roads and the upgrade of existing roads. To accommodate the safe construction, operation, and maintenance of the Project these roads will be 25 ft wide. The cumulative permanent impact to wetlands is approximately 0.07 acre, as identified in Table 4-1.

TABLE 4-1: Estimated Permanent Wetland Impacts

Feature ID	*Type* [(A)]	*Estimate Impact* [(B,C)] *(Acre)*	*Estimate Impact* [(B,C)] *(Sq Ft)*	*Connection to Significant Nexus*
WAAL001	PEM	0.0217	945	Associated with Forest Creek
WAAL002	PEM	0.0206	897	Associated with Boulder Creek
WAAL004	PEM	0.0061	267	Associated with Willow Creek
WBAL004	PEM	0.0195	849	Associated with Willow Creek
WBAL005	PEM	0.0003	12	Associated with Fish Creek
Total Permanent Wetland Impacts		**0.0682**	**2970**	

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

(C) Acreage calculations are based on a 25 ft wide access corridor.

In addition to these permanent wetland impacts the Project will have wetland impacts which are temporary in nature. These impacts will be associated with the temporary work areas associated with the road construction and upgrades. Following road construction these areas will be used for the installation of underground electrical connection lines. These connection lines will be collocated adjacent to the access roads and will add an additional 15 feet to the roadway corridor. It is anticipated these connection lines will result in an approximately 0.05 acre temporary impact as indicated in Table 4-2. Following the initial disturbance associated with road construction and the installation of these connection lines these areas will be allowed to naturally revegetate. Therefore these wetland impacts are considered to be temporary.

TABLE 4-2: Estimated Temporary Wetland Impacts

Feature ID	*Type (A)*	*Estimate Impact (B,C) (Acre)*	*Estimate Impact (B,C) (Sq Ft)*	*Connection to Significant Nexus*
WAAL001	PEM	0.0171	746	Associated with Forest Creek
WAAL002	PEM	0.0156	677	Associated with Boulder Creek
WAAL004	PEM	0.0040	173	Associated with Willow Creek
WBAL004	PEM	0.0112	490	Associated with Willow Creek
WBAL005	PEM	0.0031	135	Associated with Fish Creek
Total Temporary Wetland Impacts		**0.0510**	**2221**	

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

(C) Acreage calculations are based on a 15 ft wide underground electrical collections line corridor.

TABLE 4-3: Total Estimated Project Impacts by Wetland

Feature ID	*Latitude*	*Longitude*	*Type (A)*	*Estimate Impact Acreage (B,C)*	*Connection to Significant Nexus*	*Figure*
WAAL001	41.056410	-105.573166	PEM	0.0388	Associated with Forest Creek	3-1a/d
WAAL002	41.047740	-105.560374	PEM	0.0361	Associated with Boulder Creek	3-1d
WAAL004	41.038912	-105.535552	PEM	0.0101	Associated with Willow Creek	3-1e
WBAL004	41.058491	-105.523914	PEM	0.0307	Associated with Willow Creek	3-1c
WBAL005	41.020996	-105.516327	PEM	0.0034	Associated with Fish Creek	3-1 d/e/g
			TOTAL	**0.1191**		
Total Potentially Jurisdictional Wetlands				**Approximately 0.12 acre**		

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

(C) Acreage calculations are based on the assumption that the access roads and underground electrical collections lines will have a 50 ft wide corridor.

In November 2009, the Project was redesigned to avoid 15 waterbodies and use existing crossings to minimize further impact. The current Project design is anticipated to cross a total of 30 waterbodies. Of these, 12 are perennial streams, eight are intermittent streams, and ten are ephemeral streams (Table 3-3). Waterbody crossings are necessary to construct the access roads and install underground electrical connection lines. Thirteen of the 30 crossings are located along existing roads throughout the Project area. Turbines, laydown areas, O&M areas, and the permanent met tower will be sited outside of waterbodies and riparian habitats.

TABLE 4-4: *Estimated Project Waterbody Crossings*

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Crossing Length (ft)*	*Connection to TNW*	*Figure*
SAAL001	41.066863	-105.582609	Government Creek	Perennial	15	Direct connection to a TNW	3-1a
SAAL002	41.072383	-105.573911	Government Creek	Perennial	15	Direct connection to a TNW	3-1a
SAAL003	41.079602	-105.563864	Government Creek	Ephemeral	30	Direct connection to a TNW	3-1a/b
SAAL004	41.056285	-105.573305	Forest Creek	Perennial	40	Direct connection to a TNW	3-1a/d
SAAL006	41.046449	-105.562884	Tributary of Boulder Creek	Ephemeral	10	Direct connection to a TNW	3-1d
SAAL007	41.045361	-105.562785	Tributary of Boulder Creek	Ephemeral	15	Direct connection to a TNW	3-1d
SAAL008	41.047795	-105.560299	Boulder Creek	Ephemeral	2	Direct connection to a TNW	3-1d
SAAL009	41.043325	-105.561854	Tributary of Boulder Creek	Ephemeral	2	Indirect connection to a TNW	3-1d
SAAL010	41.042975	-105.535672	Willow Creek	Perennial	2	Direct connection to a TNW	3-1e
SAAL013	41.041863	-105.526986	Tributary of Willow Creek	Ephemeral	12	Indirect connection to a TNW	3-1e
SAAL014	41.025831	-105.487344	Unnamed Tributary	Perennial	10	Direct connection to a TNW	3-1f
SAAL015	41.028552	-105.493262	Unnamed Tributary	Ephemeral	10	Indirect connection to a TNW	3-1f
SAAL016	41.027122	-105.507064	Unnamed Tributary	Ephemeral	20	Indirect connection to a TNW	3-1e/f
SAAL020	41.018891	-105.535615	Fish Creek	Perennial	10	Direct connection to a TNW	3-1g
SAAL021	41.070793	-105.522148	Willow Creek	Perennial	15	Direct connection to a TNW	3-1c
SAAL022	41.079493	-105.508033	Tributary to Grant Creek	Intermittent	5	Indirect connection to a TNW	3-1c
SBAL001	41.068364	-105.544509	Tributary to Forest Creek	Ephemeral	8	Indirect connection to a TNW	3-1b
SBAL006	41.054440	-105.506621	Tributary to Willow Creek	Intermittent	10	Indirect connection to a TNW	3-1f
SBAL007	41.057142	-105.515617	Tributary to Willow Creek	Intermittent	30	Indirect connection to a TNW	3-1c
SBAL008	41.053209	-105.516595	Tributary to Willow Creek	Perennial	10	Indirect connection to a TNW	3-1e
SBAL009	41.051501	-105.516645	Tributary to Willow Creek	Intermittent	20	Indirect connection to a TNW	3-1e
SBAL011	41.046786	-105.516241	Tributary to Willow Creek	Ephemeral	10	Indirect connection to a TNW	3-1e
SBAL012	41.047692	-105.516305	Tributary to Willow Creek	Intermittent	15	Indirect connection to a TNW	3-1e
SBAL013	41.058449	-105.523856	Tributary to Willow Creek	Perennial	2	Indirect connection to a TNW	3-1c
SBAL014	41.057108	-105.525356	Willow Creek	Perennial	9	Indirect connection to a TNW	3-1b/c/e
SBAL015	41.045800	-105.527373	Tributary to Willow Creek	Intermittent	10	Indirect connection to a TNW	3-1e
SBAL016	41.045472	-105.526402	Tributary to Willow Creek	Intermittent	2	Indirect connection to a TNW	3-1e
SBAL017	41.014666	-105.489100	Unnamed Tributary	Intermittent	10	Indirect connection to a TNW	3-1h
SBAL018	41.015307	-105.504368	Fish Creek	Perennial	3	Direct connection to a TNW	3-1g/h
SBAL024	41.078858	-105.508036	Grant Creek	Perennial	2	Direct connection to a TNW	3-1c

SWE will obtain the appropriate USACE permits prior to construction and develop a mitigation plan as part of the permit process to address the minimization of impacts, restoration of temporarily disturbed wetlands and waterbodies, and compensation for lost habitat types and monitoring the revegetation of the construction corridor.

Minimization

SWE sited Project facilities outside of wetlands and riparian habitat where feasible. In November 2009, the Project was redesigned to reduce wetlands impacts from 6.18 to 0.12 acres and to cross 30 waterbodies versus 45. Thirteen of these crossings are located along existing roads throughout the Project area. In those areas where avoidance is not possible, SWE has worked to minimize impacts to the practical extent possible. Minimization includes actions taken to reduce overall wetland impacts through Project development and construction techniques.

SWE is proposing to utilize best management practices (BMPs) during Project construction to preserve and protect wetlands in order to minimize impacts. During the initial clearing phase of the construction process, woody vegetation in wetlands would be cut at ground level. This would leave the root systems intact and encourage sprouting of the existing species following construction. Small stumps of shrubs and trees may be cut at or just below ground level. Larger trees and shrubs would be removed to assure a safe, level work surface for equipment working on temporary mats. Equipment operation in wetlands would be kept to the minimum necessary to safely perform the work, and would operate on prefabricated equipment matting or acceptable substitute. Additionally, in areas where power collection lines or access roads have to take place in waterbodies BMPs will be developed and implemented to minimize impacts to water quality and sensitive species and required permits will be obtained.

In order to protect water resources, a storm water pollution prevention plan (SWPPP), which includes erosion control measures, would be generated and implemented on site for the Project. The SWPPP would be based on the U.S. EPA document entitled "Storm Water Management for Construction Activities-Developing Pollution Prevention Plans and Best Management Practices. The Project will obtain a General Stormwater Construction Permit from the Wyoming Department of Environmental Quality (WYDEQ).

Given the dry and windy nature of the area, dust control measures will be proposed as part of the SWPPP to protect water quality, minimize impacts to local residents, and minimize impacts to vehicles traveling along local roads. Examples of BMPs that can be included in the SWPPP are the use of water or other dust control measures on or near heavily used public roads, holding traffic speeds to appropriate levels to minimize dust generation, using rock to cover disturbed soil, and re-vegetating or otherwise covering soils as soon as possible following soil disturbance.

Restoration

SWE will develop a restoration plan, as part of the SWPPP, in order to further minimize permanent impacts to associated wetlands. Upon the completion of the Project, the construction corridor would be restored to pre-construction contours, with exception of the turbine foundations, access roads. and permanent Project facilities (i.e. O&M area and substation). These areas would also be allowed to naturally revegetate from the existing rootstock and supplemented with native seed mix where necessary.

Compensation

While many steps have been taken to minimize impacts to wetlands within the Project area, permanent loss of some wetlands may be unavoidable due to the nature of the Project. SWE will mitigate for unavoidable impacts to wetlands and waterbodies as part of the USACE permit process, as required.

5.0 REFERENCES

5.1 ENVIRONMENTAL INVESTIGATORS

Clark, Chris	ERM, Environmental Consultant
Johnson, Erin C.	ERM, Environmental Consultant
Wanka, Kathryn M.	ERM, Environmental Consultant
Zeisloft, Chris	ERM, Environmental Consultant
Zuniga, Amanda	ERM, Environmental Scientist

5.2 REFERENCE DOCUMENTS

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Figures

July 1, 2010
Project No. 0105023

Environmental Resources Management Southwest, Inc.
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Regional Supplemental USACE Wetlands Determination Data Forms, Waterbody Data Sheets, and Transect Map

Appendix A

July 1, 2010
Project No. 0105023

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Description of Dominance Test

Appendix B

July 1, 2010
Project No. 0105023

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Photographic Log

Appendix C

July 1, 2010

Project No. 0105023

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Identified Swales and Erosional Features

Appendix D

July 1, 2010
Project No. 0105023

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WETLAND ASSESSMENT REPORT, JANUARY 11, 2010

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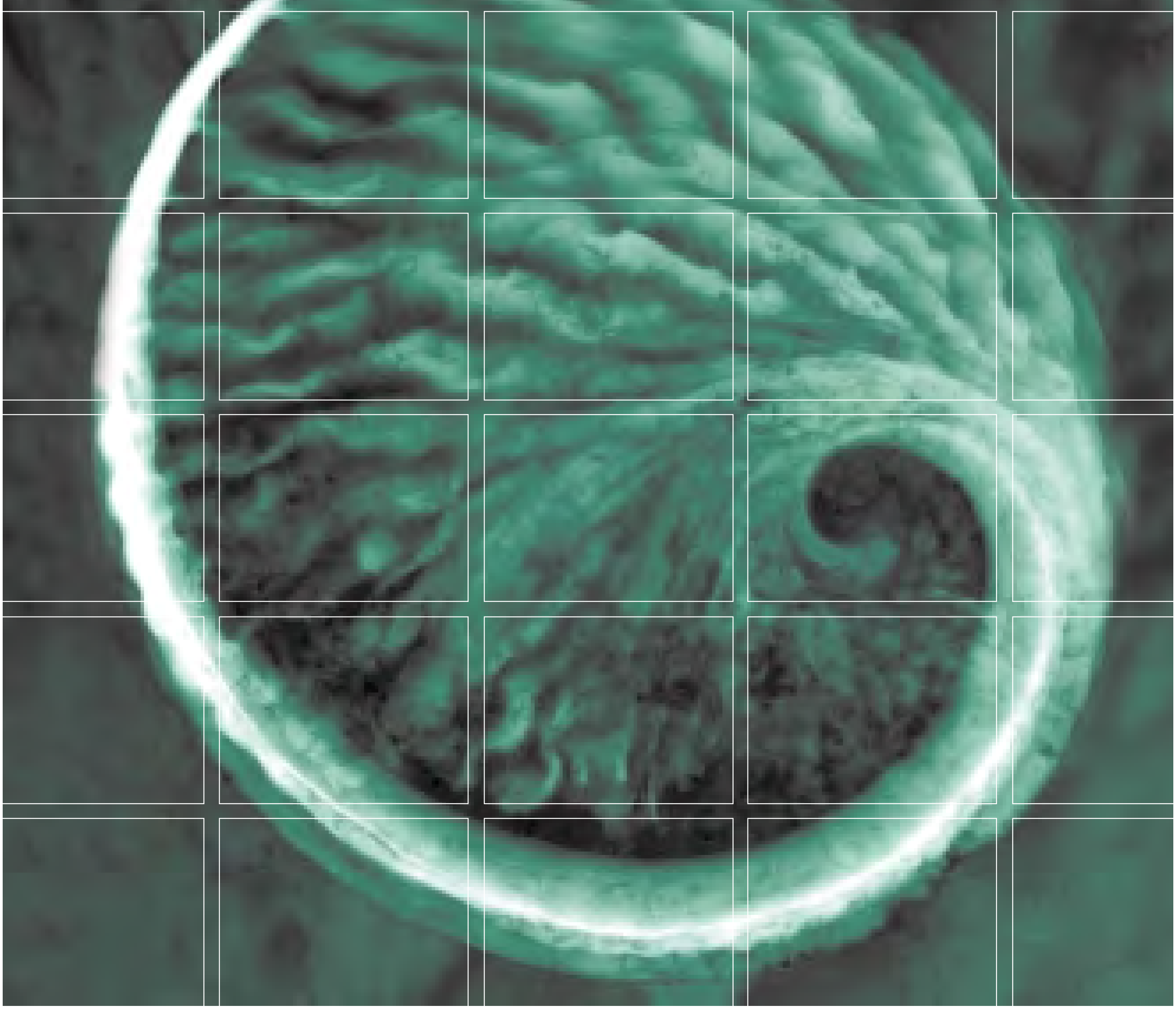

Wetland Assessment

Shell WindEnergy
Hermosa West Wind Farm Project, Albany County, Wyoming

January 11, 2010

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Shell WindEnergy

Wetland Assessment: Hermosa West Wind Farm Project

January 11, 2010

Project No. 0105023
Albany County, Wyoming

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EXECUTIVE SUMMARY

Environmental Resources Management Southwest, Inc. (ERM) completed a wetland delineation for the proposed Shell WindEnergy (SWE) Hermosa West Wind Farm Project (Project) in Albany County, Wyoming. Western Area Power Authority (Western) is evaluating under the National Environmental Policy Act (NEPA) the interconnection of the Project, which consists of transmission system upgrades and construction of a new substation (Proposed Action). The Project will consist of approximately 100-200 wind turbines, electrical gathering lines and transmission lines, access roads, operations and maintenance building, and other affiliated structures across an approximately 11,125 acre Project area. The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands to support Project development. The specific areas assessed (hereafter "the Survey Area") are located in southeastern Wyoming approximately 18 miles south of Laramie, Wyoming along State Highway 287. The Survey Area consists of approximately 2,198 acres of both private and State-owned land.

Field investigations were performed in August and October 2009 to identify the location and extent of any jurisdictional wetlands or waterbodies within the Survey Area. Land use and land cover designations were assigned using field observations, interpretation of 2008 aerial photography, and interpretation of U.S. Geological Survey 7.5-minute topographic maps. Land use and land cover types were classified as agricultural land primarily dedicated to cattle grazing. The Project area was sparsely populated and contained few structures, owing mostly to homesteads and barns/outbuildings associated with livestock.

Field investigations identified a total of nine (9) palustrine emergent (PEM) wetlands within the Survey Area. These wetlands are dominated by wetland vegetation, typically sedges and rush species. Eight of these wetlands were associated with waterbodies. This association may constitute a significant nexus as described in the Kennedy Test; as a result, these wetlands may be deemed jurisdictional by the U.S. Army Corps of Engineers (USACE).

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. ERM has concluded that all of the waterbodies encountered within the Survey Area are likely under the jurisdiction of Section 404 of the Clean Water Act (CWA) and the USACE. These natural features described above are likely to be deemed jurisdictional under the CWA because they have a direct connection to a traditional navigable water (TNW) or exhibit a significant nexus with a TNW. Therefore, the USACE and the Environmental Protection Area (EPA) will likely deem these features jurisdictional. It should be noted that only the USACE and EPA can make the final jurisdictional determination of these features. SWE will apply for appropriate USACE permits prior to construction and mitigate, as required, for any unavoidable impacts to wetlands and waterbodies.

The Proposed Action is anticipated to have no impacts on wetlands or waterbodies. The Project is anticipated to impact 0.17 acres of wetlands due to access road construction. Additionally, the Project is anticipated to traverse (i.e. access road and connection line crossings) 30 waterbodies. Where possible crossings of wetlands and waterbodies have been rerouted to minimize crossing and, in some cases, avoid completely. The Project was redesigned November 2009 to cross 30 waterbodies versus 45. Thirteen of these crossings are located along existing roads throughout the Project area. In addition to the waterbody crossings, the Project was redesigned to reduce wetlands impacts from 6.18 to 0.17 acres.

GLOSSARY

BMP	Best Management Practice
CFR	Code of Federal Regulations
CWA	Clean Water Act
DBH	diameter at breast height
EPA	Environmental Protection Agency
ERM	Environmental Resources Management Southwest, Inc.
FAC	Facultative Plants
FACU	Facultative Upland Plants
FACW	Facultative Wetland Plants
FEMA	Federal Emergency Management Agency
GPS	Global Positioning System
kV	kilovolts
NAD27	North America Datum of 1927
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
MET	Meteorological
MW	megawatt
OBL	Obligate Wetland Plants
OHWM	ordinary high water mark
O&M	Operations and Maintenance
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
Project	Hermosa West Wind Farm Project
PSS	Palustrine Scrub Shrub Wetland
RPW	Relatively Permanent Waterbody
SCADA	Supervisory Control and Data Acquisition
SWE	Shell Wind Energy
SWPPP	Stormwater Pollution Prevention Plan
TNW	Traditional Navigable Water
UPL	Obligate Upland Plants
US	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture

USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WEST	Western Ecosystems Technology, Inc
Western	Western Area Power Administration
WYDEQ	Wyoming Department of Environmental Quality

1.0 INTRODUCTION

Environmental Resources Management Southwest, Inc. (ERM) completed a wetland delineation for the proposed Shell WindEnergy's (SWE) Hermosa West Wind Farm Project (the Project) in Albany County, Wyoming (Figure 1-1). Western Area Power Authority (Western) is evaluating under the National Environmental Policy Act (NEPA) the interconnection of the Project, which consists of transmission system upgrades and construction of a new substation (Proposed Action). The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands to support Project development and permitting. The specific areas assessed (hereafter "the Survey Area") are located in southeastern Wyoming approximately 18 miles south of Laramie, Wyoming along State Highway 287 (Figure 1-2). The Survey Area consists of approximately 2,198 acres of both private and State-owned land, consisting of 100 to 400 foot (ft) wide corridors around Project components described below.

The environmental field investigation, including wetland assessments and delineations, and evaluation of land use, was conducted in August and October 2009. ERM performed the wetland assessment and delineation to determine if potential jurisdictional wetlands and/or waters of the United States (U.S.) exist within the Survey Area and to identify the approximate boundaries of any such features.

Field survey methods and assessment results are presented and discussed in this report, together with Project maps, copies of Regional Supplement U.S. Army Corps of Engineers (USACE) Wetland Determination Data Forms, Waterbody Data Sheets, and a Photographic Log.

1.1 OBJECTIVES AND SCOPE

The purpose of this delineation is to identify, characterize, and map the extent of jurisdictional wetlands and/or waters of the U.S. within the Survey Area to support the Project's permitting, development and future management.

1.2 PROJECT SUMMARY

1.2.1 Project Description

SWE is proposing to develop the Project, consisting of approximately 100 to 200 wind turbines, with an anticipated total generating capacity of up to 300 megawatts (MW). The wind turbines would be arranged in roughly collinear "strings"; each turbine string would be situated within an approximately 250ft or 400ft wide corridor, depending on topography. The Project would interconnect with an existing Western-owned transmission line that traverses the Project area.

In addition to turbines, the Project would include the following:

- Access roads and truck turn-around areas;
- One permanent meteorological (met) tower;
- Supervisory Control and Data Acquisition (SCADA) equipment;
- 34.5 kilovolt (kV) power collection lines that would deliver power to the substation;
- Metering equipment for custody transfer related communication equipment;
- Operations and Maintenance (O&M) facilities, approximately 5,000 to 8,000 ft^2, including: offices, signage, spare parts storage, restrooms, telecommunications, equipment laydown areas, emergency living accommodations, shop area, conference rooms, outdoor parking, a turn-around area for larger vehicles, and potentially a welcome/information center;
- High voltage (345 kV) transmission line less than one mile in length connecting the substation to the existing Western transmission line;
- Project substation, approximately 70,000 to 85,000 ft^2 (1.6 to 2 acres), where the power from the collection system would be stepped up to the voltage required to interconnect with an existing Western-owned transmission lines (i.e., 345 kV); and
- System upgrades that would need to be made to Western's transmission line and associated facilities to accept the 300MW at the determined delivery point.

The last three Project components are part of the Proposed Action.

1.2.2 Project Area Description

The Project area is located within Albany County, Wyoming. The City of Laramie is located approximately 18 miles northwest of the Project area. The Project is located within the Upper Laramie River and South Platte River Sub-basins of the Platte River Basin.

The typical landscape of the region is low mountain slopes and nearly level floodplains, as are associated with the Mid-Elevation Forests and Shrublands of the Southern Rockies Ecoregion, and Laramie Basin of the Wyoming Basin Ecoregion (Chapman *et al*. 2004). The Mid-Elevation Forests and Shrublands Ecoregion ranges from 7,500 to 9,000 ft in elevation. The Ecoregion is generally characterized by low mountain slopes and outwash fans with moderate to high gradient (approximately 0.1 to 5% slopes) perennial streams. The Laramie Basin Ecoregion ranges from 7,100 to 7,900 ft in elevation and is characterized by nearly level floodplains and low terraces. The average elevation of the Project area is approximately 7,900 ft.

2.0 SURVEY METHODS

The following sections describe survey methodology, assumptions and site-specific information utilized to perform the wetland delineation assessment.

2.1 REGULATIONS AND DEFINITIONS

The USACE regulates “waters of the U.S.”, wetlands and special aquatic sites, under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act. The USACE and the Environmental Protection Agency (EPA) define wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and other similar areas.” This definition takes into consideration three distinct environmental parameters: hydrology, soil, and vegetation. Positive wetland indicators of all three parameters are normally present in wetlands.

The term "waters of the U.S." means:

a. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; these are referred to as traditional navigable waters (TNWs);

b. All interstate waters including interstate wetlands;

c. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

    1. which are or could be used by interstate or foreign travelers for recreational or other purposes; or

    2. from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

    3. which are used or could be used for industrial purpose by industries in interstate commerce;

d. All impoundments of waters otherwise defined as waters of the U.S. under the definition;

e. Tributaries of waters identified in paragraphs (a) through (d) above;

f. The territorial seas;

g. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f).

    1. The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other Waters of the U.S. by man-made dikes or

barriers, natural river berms, beach dunes and the like are "adjacent wetlands."

h. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the CWA (other than cooling ponds as defined in 40 Code of Federal Regulations (CFR) 123.11(m) which also meet the criteria of this definition) are not waters of the U.S.; and

i. Waters of the U.S. do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with the EPA.

In 2006, the Supreme Court addressed the jurisdictional scope of Section 404 of the CWA, specifically the term "the waters of the U.S.," in *Rapanos v. U.S.* and in *Carabell v. U.S.* The decision provides two new analytical standards, which have been variously applied by lower courts, for determining whether waterbodies that are not TNWs, including wetlands adjacent to those non-TNWs, are subject to CWA jurisdiction:

1. If the waterbody is relatively permanent, or if the waterbody has a wetland that directly abuts (e.g., the wetland is not separated from the tributary by uplands, a berm, dike, or similar feature) a relatively permanent waterbody (RPW), otherwise known as the Plurality Test.

2. If a waterbody, in combination with all wetlands adjacent to that waterbody, has a significant nexus with TNWs, which can be determined using the Kennedy Test.
   a. Justice Kennedy stated during *Rapanos* that "wetlands possess the requisite nexus, and thus come within the statutory phrase 'navigable waters,' if the wetlands, either alone or in combination with similarly situated lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.'"

2.2 METHODOLOGY OVERVIEW

Methodology performed in this assessment includes conducting a desktop analysis and field survey of the Survey Area. These steps, detailed below, identify, characterize and determine connections between wetlands and waterbodies observed within the Survey Area to jurisdictional features outside the Survey Area.

2.2.1 Desktop Analysis

Prior to conducting the environmental field activities, a desktop analysis of the Survey Area and adjacent lands was performed by reviewing the following sources:

- U.S. Geological Survey (USGS) 7.5-minute Topographic Quadrangle Maps (2009);

- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Maps (2009);
- Aerial Photographs (2006);
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) County Soil Surveys (2008); and
- Federal Emergency Management Agency (FEMA) Flood Hazard Maps were not available digitally for the Project area.

The analysis of these documents assisted in the planning and execution of the field survey by identifying potential drainage contours, areas of likely wetlands and waterbodies, and general habitat characteristics.

2.2.2 *Field Survey*

Environmental field surveys were performed by ERM scientists using common wetland survey tools including shovels, the Munsell Soil Color Chart, USACE Wetland Determination Data Forms, plant indicator lists, and visual observation for plant identification. The survey crews implemented the three parameter approach set forth in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) 2008 ("the Regional Supplement") to identify the boundaries of potential wetlands within the Survey Area. The three parameter approach assessed vegetation, soils, and hydrology for wetland conditions. Evaluation of these parameters is discussed below.

Surveys were conducted following the protocols set forth in the 1987 USACE Wetland Delineation Manual (USACE 1987) for areas greater than five (5) acres in size. In addition, Regional Supplement USACE Wetland Determination Data Forms, Waterbody Data Sheets and maps of Survey Area are included in Appendix A.

Landuse within the Survey Area was characterized according to land use categories (wetlands, open land, agricultural land, forested land, industrial/ commercial land, residential land, and open water). Wetland types and hydrological features located within the Survey Area are discussed in detail in Section 3.

2.2.2.1 *Wetlands*

Vegetation

When possible, dominant vegetation was identified and documented to the species level (occasionally to genus) and classified according to the National List of Plant Species that Occur in Wetlands: Region 4 (Reed 1988). The 'indicator status' identifies a range of probabilities that an individual species is estimated to be found in wetland or upland areas in a defined region (Table 2-1).

Table 2-1 ***Vegetation Indicator Status***

Classification	*Symbol*	*Percentage found in Wetlands*
Obligate	OBL	> 99 %
Facultative Wetland	FACW	66% - 99%
Facultative	FAC	33% - 66%
Facultative Upland	FACU	1% - 33%
Obligate Upland	UPL	< 1%

Appendix B contains the procedures for the use of the 50/20 Rule and the Prevalence Index to select dominant plant species to determine if the plant community is considered to be hydrophytic (i.e., a positive wetland indicator) as provided by the Regional Supplement.

In the Arid West, vegetative species located in specialized habitats that include riparian corridors, playas, and saline areas can be classified as either wetlands or uplands, depending on site-specific conditions. This can be problematic in areas where vegetation is a mixture of both hydrophytes and other species adapted to growing in these unique, specialized western habitats. Therefore, it is vital to consider the physiological and morphological adaptations of plant species within these areas in order to better evaluate potential wetland areas as outlined in Wetland Plants of Specialized Habitats in the Arid West (Lichvar and Dixon 2007).

Species classified as FACU that have morphological adaptations to wetland conditions are classified as hydrophytes. In the event that more than half of these hydrophytes are located within the Survey Area, the indicator status will be reassigned as FAC. As detailed in the Arid West Regional Supplement, descriptions of the observed morphological adaptations and any observations of growth habit of these species in adjacent wetland and non-wetland locations are also indicated on the data sheet.

The dominant species and their indicator status are reflected in the updated Regional Supplement USACE Wetland Determination Data Forms in Appendix A. Photographs are provided in Appendix C. Vegetation identified within the Survey Area is presented in Section 3.1.1.

Hydric Soils

Hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that facilitate the growth and regeneration of hydrophytic vegetation. Hydric soil indicators relate to color, structure, organic content, and the presence of reducing conditions. Color characteristics (hue, value, and chroma) were recorded using Munsell Soil Color Charts (Kollmorgen Corporation 1990). Soil observations were typically focused on the area immediately below the 'A' horizon (top most mineral horizon) or the top 12 inches, whichever was shallower.

Soils were identified using the respective county soil survey maps and examined in the field by hand-excavating test pits ranging from 6 to 12 inches in diameter and 14 to 20 inches deep along boundaries of areas exhibiting different plant communities. Soil type assessments were conducted according to the determining criteria for hydric (wetland) or non-hydric (non-wetland) soils, as outlined in the Regional Supplement.

Soils encountered within the Survey Area are documented in Section 3.1.2 and sampling points are shown in Appendix A.

Hydrology

Hydrological characteristics were characterized at each sampling point by field observation as well as examining aerial photography, USGS topographic maps, NWI maps, and FEMA Flood Hazard maps to identify primary and secondary indicators associated with wetlands and wetland hydrology. Field observations were made to determine if primary and secondary indicators of hydrology, as outlined in the Regional Supplement, were present. Primary indicators for wetland hydrology include:

- Surface water;
- High water table;
- Saturation;
- Water marks;
- Sediment and drift deposits;
- Surface soil cracks;
- Inundation visible on aerial imagery;
- Water stained leaves;
- Algal mats or salt crust;
- Aquatic invertebrates;
- Hydrogen sulfide odor;
- Oxidized rhizospheres (root channels) associated with living roots;
- Presence of reduced iron;
- Recent iron reduction in tilled soils; and
- Thin muck surfaces.

Secondary indicators for wetland hydrology include:

- Drainage patterns;
- Dry-season water table;
- Crawfish burrows;
- Saturation visible on aerial imagery;
- Geomorphic position;
- Shallow aquitard; and
- Positive FAC-Neutral test (comparative dominance of FACW and OBL vegetative species versus FACU and UPL vegetative species).

Hydrological characteristics identified within the Survey Area are discussed in Section 3.1.3 and sampling points are shown in Appendix A.

Documentation

As described in the Regional Supplement, areas with qualifying wetland criteria for all three parameters—vegetation, soils, and hydrology—were characterized as wetlands. Field data were recorded on Regional Supplement USACE Wetland Determination Data Forms found in Appendix A. These Regional Supplement USACE Wetland Determination Data Forms document wetland and upland plant communities, hydrology parameters, and soil conditions within the Survey Area.

Identified wetland boundaries were recorded in the field using sub-meter Global Positioning System (GPS) technologies. A Trimble™ GEO ProXH handheld GPS unit was used to record delineated boundaries of wetland areas identified during the field survey. Data collected in the field were collected using the North American Datum of 1927, (NAD27), State Plane Wyoming East 4901, and U.S. Survey Feet. GPS data were processed using ArcGIS and then overlaid onto orthorectified aerial imagery.

Wetland Characterization

Traditionally, the Cowardin System is used as a hierarchical system that aids resource managers and others by providing a universal language for classifying wetlands according to hydrologic, geomorphic, chemical, and biological factors. However, due to the variability of habitat and conditions of the Arid West in comparison to the habitats evaluated by Cowardin in *Classification of Wetlands and Deepwater Habitats of the United States* (1979), adaptations to the Cowardin System were necessary for this survey. In the Arid West region, wetlands are primarily ciénegas, oases, inland salt marshes, or are associated with old flood channels or man-made depressional areas in which the growth habitat of vegetation varies from that described by Cowardin.

The Cowardin System classifies wetlands into one or a combination of the following groups: palustrine emergent (PEM), palustrine scrub shrub (PSS) or palustrine forested (PFO). Wetlands recorded in combinations (i.e., PEM/PSS, PFO/PEM, PFO/PSS, and PFO/PSS/PEM) contain distinct boundaries comprising greater than five percent of the total wetland area of PEM, PSS or PFO.

PEM wetlands, as defined by Cowardin, et al. (1979), are those wetlands that are dominated by erect, rooted, herbaceous plants. These wetlands are commonly dominated by cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), and various forbs.

PSS wetlands, as defined by Cowardin, et al. (1979), are those wetlands that are dominated by woody vegetation less than 20 feet tall. These wetlands are commonly dominated by eastern false-willow (*Baccharis halimifolia*), willows (*Salix* spp.) and other shrubs. PSS wetlands are often transitional areas between herbaceous and forested habitats or are in succession from herbaceous conditions to forested conditions. PSS wetlands, therefore, often display a combination of immature species found in forested communities and species found in herbaceous wetland communities.

PFO wetlands, as defined by Cowardin, et al. (1979), occur in undisturbed, forested areas and are often associated with streams. As defined in the Arid West Regional Supplement, trees are considered any woody plant greater than three inches diameter at breast height (DBH), regardless of height. Tree species associated with wetlands in this region include arroyo willow (*Salix lasiolepis)*, narrow-leaved cottonwood (*Populus augustifolia)*, lanceleaf cottonwood (*P. x acuminate)*, Hinckley poplar *(P. x hinckleyana)*, African tamarisk (*Tamarix africana)*, and salt cedar (*T. aphylla*), among others.

2.2.2.2 *Waterbodies*

Waterbodies include any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing or an ordinary high water mark (OHWM), as defined by the USACE, and other permanent waters such as lakes and ponds. Waterbodies identified within the Survey Area were identified and surveyed. Perennial or intermediate waterbodies were differentiated according to size: minor, intermediate, and major. Minor waterbodies are 10 feet or less in width from water's edge to water's edge; intermediate waterbodies range in width from > 10 feet to < 100 feet; major waterbodies are 100 feet or greater in width. Applicable data were gathered for the waterbody feature, including: bank height, bank slope, stream-flow, direction and type, water appearance, stream substrate, aquatic habitats, channel conditions, and disturbances. Data were documented on Waterbody Data Sheets, which are provided in Appendix A. Waterbodies identified within the Survey Area are described in Section 3.2.

Due to the arid climate, waterbodies and areas that were excavated and had the potential to retain water for a short period of time were surveyed using a

Tremble™ Geo ProXH GPS unit as described above in Section 2.3.4. Data points were collected along the upper banks or edges of the features within the Survey Area.

Indicated waterbodies on USGS topographic maps were also field verified. If indicated waterbodies on the USGS topographic maps did not meet the criterion of waterbodies, as listed above, such as swales or erosional features; a GPS point was collected and the area was photographically documented. Photographs and a map detailing the location of these swales and erosion features are presented in Appendix D.

2.2.2.3 Uplands

Upland (i.e., non-wetland) samples were collected within the Survey Area and adjacent to the respective wetland where a distinguishable transition from wetland to upland communities could be identified (based on vegetation, hydrology and soil parameters outlined in the Regional Supplement). Typical indicators of habitat change include vegetative species composition, soil saturation levels, soil composition, and elevation.

3.0 RESULTS

The results of the wetland delineation are presented in the following sections. General descriptions of the vegetation, soils and hydrology are provided for each feature type. Completed Regional Supplement USACE Wetland Determination Data Forms and Waterbody Data Sheets are presented in Appendix A and a Photographic Log is provided in Appendix C

The results presented in this report were based on review of available current and historical information, a desktop evaluation, and the wetland delineation conducted in August and October 2009.

3.1 WETLANDS

A total of nine (9) wetlands (approximately 6.18 acres) were identified and delineated within the Survey Area. The delineated wetlands were all classified as PEM wetlands due to the predominance of yellow nutsedge (*Cypreus esculentus*: FACW) and Baltic rush (*Juncus balticus*: FACW), within the wetlands. The extent and location of these wetlands are shown in Figure 3-1(a-h).

Table 3-1 summarizes data for wetlands identified within the Survey Area, including the wetland location, size, type, and connectivity to a waterbody or otherwise exhibiting a significant nexus with a TNW. Detailed information for each feature is provided on the Regional Supplement USACE Wetland Determination Data Forms in Appendix A.

Table 3-1 Wetlands within the Survey Area

Feature ID	Latitude	Longitude	Type (A)	Acreage (B)	Connection to Significant Nexus	Figure
WAAL001	41.056410	-105.573166	PEM	1.29	Associated with Forest Creek	3-1a/d
WAAL002	41.047740	-105.560374	PEM	0.90	Associated with Boulder Creek	3-1d
WAAL003	41.050119	-105.535957	PEM	0.33	Associated with Willow Creek	3-1e
WAAL004	41.038912	-105.535552	PEM	1.52	Associated with Willow Creek	3-1e
WBAL001	41.068691	-105.545779	PEM	0.20	Associated with Boulder Creek	3-1b
WBAL002	41.082437	-105.546098	PEM	0.13	Isolated depressional wetland	3-1b
WBAL003	41.058457	-105.553990	PEM	0.43	Associated with Boulder Creek	3-1b
WBAL004	41.058491	-105.523914	PEM	0.16	Associated with Willow Creek	3-1c
WBAL005	41.020996	-105.516327	PEM	1.22	Associated with Fish Creek	3-1 d/e/g
				TOTAL	**6.18**		
Total Potentially Jurisdictional Wetlands				**6.05**		

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

3.1.1 *Vegetation*

In the Survey Area, Herbaceous stratum observed within the wetlands were dominated by colonies of creeping bentgrass (*Agrostis stoloniferia*: FAC+), yellow nutsedge, Baltic rush, and spikerush (*Eleocharis spp*). Shrub and tree stratum, while typically not dominant, consisted of Bebb willow (*Salix bebbina*: FACW) and quaking aspen (*Populus tremuloides*: FAC). These tree species were found in wetlands associated with banks of perennial streams.

3.1.2 *Soils*

A desktop assessment of the soils located within the Survey Area was performed (Figure 3-2a-h). According to the USDA NRCS Soil Survey for Albany County (2008) there are 15 soil series present within the Survey Area, of these four (4) are considered partially hydric (Table 3-2). These hydric series are typically located in low-lying landforms associated with stream terraces.

Field verification of these hydric soils was accomplished through soil test pits of approximately 12 inches a diameter and up to 16 inches deep. These test pits were dug using shovels in the identified wetland and associated upland area. Mapped soils identified within the wetland contained low chroma soils (typically Munsell notations of 10 YR 2/1, black; 10 YR 3/1, very dark gray; or 7.5 YR 3/2, dark brown); the soils classification varied from muck to coarse sandy clay. The predominant indicators of hydric soils within the Survey Area were mottled and low chroma soils. Soils within the observed wetlands also met requirements for indicators F6 (Redox Dark Surface) and F3 (Depleted Matrix). Findings from the field surveys were generally consistent with those described in the USDA NRCS county soil survey. Detailed results of the identified soils encountered within the Survey Area are included in the Regional Supplement USACE Wetland Determination Data Forms (Appendix A).

Table 3-2 Soil Associations and Soil Series within the Survey Area

Map Unit	*Soils Series*	*Acres*	*Map Unit Symbol*	*Hydric*	*Landform*	*Drainage Class*
Boyle-Lininger association, 1 to 15 percent slopes	Boyle and Lininger	546	125	No	Uplands and mountain hill slopes	Well drained
Boyle-Rock outcrop complex, 5 to 25 percent slopes	Boyle	24	124	No	Uplands and mountain hill slopes	Well drained
Byrnie-Rock outcrop complex, 10 to 50 percent slopes	Byrnie	26	130	No	Gently sloping to very steep hills and ridges	Well drained
Canburn loam, 1 to 4 percent slopes	Canburn	37	132	Partially	Mountain valley bottoms, flood	Poorly drained

Map Unit	Soils Series	Acres	Map Unit Symbol	Hydric	Landform	Drainage Class
					plains, stream terraces and lower slopes of alluvial fans at 4,800 to 8,200 feet	
Dalecreek-Kovich complex, 0 to 9 percent slopes	Dalecreek and Kovich	2	149	Partially	Flood-plains, stream terraces, low lying alluvial fans and broad valley floors.	Moderately well drained
Hapjack-Rogert-Amesmont complex, 3 to 25 percent slopes	Hapjack and Rogert	250	172	Partially	Mountain slopes and ridges	Well drained
Rock outcrop-Cathedral complex, 20 to 40 percent slopes	Cathedral	1	137	No	Mountain slopes, hills, and ridges	Well drained
Rock outcrop-Rogert complex, 25 to 99 percent slopes	Rogert	109	219	No	Mountain slopes and ridges	Well drained
Rogert-Rock outcrop-Amesmont complex, 5 to 25 percent slopes	Rogert	293	220	No	Mountain slopes and ridges	Well drained
Silas, gravelly substratum-Vensora loams, 0 to 6 percent slopes	Silas and Vensora	15	227	Partially	Mountain valley fills, outwash terraces, and floodplains	Somewhat poorly drained
Stunner-Tisworth-Blazon complex, 1 to 6 percent slopes	Stunner, Tisworth, and Blazon	32	230	No	Alluvial fans, fan aprons, and terraces	Well drained
Tieside-Pilotpeak-Rock outcrop complex, 3 to 10 percent slopes	Tieside and Pilotpeak	409	234	No	Uplands, structural benches, and strath terraces	Well drained
Wycolo-Alcova complex, 3 to 10 percent slopes	Wycolo and Alcova	181	241	No	Uplands, structural benches, strath terraces, pedimens, and fan aprons	Well drained
Wycolo-Thermopolis-Rock outcrop complex, 10 to 50 percent slopes	Wycolo and Thermopolis	3	244	No	Uplands, structural benches, strath terraces, ridges, and hills	Well drained

Map Unit	Soils Series	Acres	Map Unit Symbol	Hydric	Landform	Drainage Class
Wycolo-Tieside sandy loams, 3 to 10 percent slopes	Wycolo and Tieside	268	243	No	Uplands, structural benches, and strath terraces	Well drained

3.1.3 *Hydrology*

Geography and topography are primary factors influencing wetland hydrology. Rolling hills dominate the general topography within the Project area. Wetland development throughout the Survey Area can be attributed to low-lying areas between gentle undulations, natural drainage patterns, and clay soils with poor drainage capabilities.

USFWS NWI and topographic maps (Figure 3-3a-h) provide an overview of NWI-mapped wetlands within the Project area. Review of these maps prior to field mobilization indicated several potential wetland areas within the Survey Area predominately associated with stream corridors. Wetland features identified and classified during the field survey were generally similar in location to those included on NWI Maps; however, delineated types and sizes generally differed from those identified on NWI Maps.

Delineated wetlands not associated with NWI-mapped wetlands were primarily associated with named stream corridors or their tributaries; the exception being wetland WBAL002, which was an isolated depressional wetland.

Primary hydrological indicators associated with the identified wetlands include surface water (A1), saturation (A3), and water marks (B1). Secondary indicators for wetland hydrology include: drainage patterns (B10) and shallow aquatard (D3). Other indicators such as topography, local soils survey data and vegetation species composition were observed and factored into the delineations.

3.1.4 *Plurality Test*

Government Creek, Forest Creek, and Boulder Creek all flow into Willow Creek, which flows generally across the middle of the Project area. Willow Creek continues outside the Project area approximately 16 miles until joining the Laramie River. The Laramie River ultimately confluences with the North Platte River, a TNW, approximately 120 miles north of the Project area. The northern portion of the Project area is located in the North Platte Basin and drains into the Missouri Region Watershed.

Fish Creek flows generally across the southern portion of the Project area into Deadman Creek, approximately five miles outside of the Project area. Deadman Creek continues until it joins the North Fork Cache la Poudre River which ultimately confluences with the South Platte River, a TNW, approximately 60 miles southeast of the Project area. The southern portion of the Project area is located in the South Platte Basin and drains into the Missouri Region Watershed.

Seven of the nine wetlands (all except WBAL002 and WBAL005) identified in the Survey Area are ultimately connected to the North Platte River through a series of named or unnamed tributaries to Willow Creek, a RPW. An eighth wetland (WBAL005) is ultimately connected to the South Platte River through a direct connection to Fish Creek, a RPW. Due to the defined size of the Project area, field verification of a direct wetland connection to a TNW was limited to visual verifications and a desktop analysis. The desktop analysis indicates the potential for a direct connection between eight of the nine identified wetlands within the Survey Area and a TNW, specifically, the North Platte River and the South Platte River. Based on the potential for connectivity, these features may be classified under the jurisdiction of the USACE.

3.1.5 Kennedy Test

With the exception of the one isolated wetland identified within the Survey Area, the hydrologic interconnection of the eight remaining wetlands to the nearest TNW (North Platte River and South Platte River) suggests that the eight identified wetlands could support the TNW. The diminutive size of these wetlands and the distance from the TNW make them unlikely to provide substantial direct habitat or lifecycle support functions to any aquatic species found within the TNW. Biological support of wetlands within the Survey Area would therefore be limited to providing temporary habitat for avian species associated with the TNW and /or the TNW's riparian buffer. However, the presence of small fish found in a few of the wetlands and the interconnection through the series of RPWs provides a potential link between these eight wetlands and the nearest TNW. This biological connection would likely meet the requirements of the Kennedy Test for a significant nexus; therefore, these features are likely under the jurisdiction of the USACE.

3.2 WATERBODIES

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. Additionally, one headwater spring was identified within the Survey Area and another was identified outside the Survey Area in connection with identified features SAAL014 and SAAL012, respectfully. Table 3-3 summarizes the waterbodies by feature identification, name, type, and size and relation to a TNW. Waterbody Data Sheets containing detailed information regarding the waterbodies (stream flow, depth, water characteristics, etc.) are contained in Appendix A.

It should be noted several areas identified as intermittent or ephemeral waterbodies on the USGS topographic maps (identified as dashed blue lines) were field verified and deemed swales or erosion features as they did not meet the criterion discussed in Section 2.2.2.2. A map illustrating these areas and representative photolog is included in Appendix D.

3.2.1 Plurality Test

Government Creek, Forest Creek, and Boulder Creek all flow into Willow Creek, which flows generally across the middle of the Project area. Willow Creek continues outside the Project area approximately 16 miles until joining the Laramie River. The Laramie River ultimately confluences with the North Platte River, a TNW, approximately 120 miles north of the Project area. The northern portion of the Project area is located in the North Platte Basin and drains into the Missouri Region Watershed.

Fish Creek flows generally across the southern portion of the Project area into Deadman Creek, approximately five miles outside of the Project area. Deadman Creek continues until it joins the North Fork Cache la Poudre River which ultimately confluences with the South Platte River, a TNW, approximately 60 miles south east of the Project area. The southern portion of the Project area is located in the South Platte Basin and drains into the Missouri Region Watershed.

NWI and topographic mapping indicates that most likely all of the waterbodies found within the Survey Area have either a direct or indirect connection to a TNW (Table 3-3).

Table 3-3 ***Waterbodies within the Survey Area***

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Length (ft)*	*Connection to TNW*	*Figure*
SAAL001	41.066863	-105.582609	Government Creek	Perennial	735	Direct connection to a TNW	3-1a
SAAL002	41.072383	-105.573911	Government Creek	Perennial	785	Direct connection to a TNW	3-1a
SAAL003	41.079602	-105.563864	Government Creek	Ephemeral	1301	Direct connection to a TNW	3-1a/b
SAAL004	41.056285	-105.573305	Forest Creek	Perennial	1299	Direct connection to a TNW	3-1a/d
SAAL005	41.062013	-105.564295	Forest Creek	Intermittent	827	Direct connection to a TNW	3-1a/b
SAAL006	41.046449	-105.562884	Tributary of Boulder Creek	Ephemeral	619	Direct connection to a TNW	3-1d
SAAL007	41.045361	-105.562785	Tributary of Boulder Creek	Ephemeral	225	Direct connection to a TNW	3-1d
SAAL008	41.047795	-105.560299	Boulder Creek	Ephemeral	1224	Direct connection to a TNW	3-1d
SAAL009	41.043325	-105.561854	Tributary of Boulder Creek	Ephemeral	3979	Indirect connection to a TNW	3-1d
SAAL010	41.042975	-105.535672	Willow Creek	Perennial	1313	Direct connection to a TNW	3-1e
SAAL012	41.038769	-105.536049	Tributary of Willow Creek	Perennial	781	Indirect connection to a TNW	3-1e
SAAL013	41.041863	-105.526986	Tributary of Willow Creek	Ephemeral	1493	Indirect connection to a TNW	3-1e
SAAL014	41.025831	-105.487344	Unnamed Tributary	Perennial	443	Direct connection to a TNW	3-1f
SAAL015	41.028552	-105.493262	Unnamed Tributary	Ephemeral	633	Indirect connection to a TNW	3-1f
SAAL016	41.027122	-105.507064	Unnamed Tributary	Ephemeral	960	Indirect connection to a TNW	3-1e/f
SAAL017	41.018978	-105.505231	Tributary of Fish Creek	Perennial	1087	Direct connection to a TNW	3-1g/h
SAAL018	41.009066	-105.515787	Tributary of Fish Creek	Ephemeral	657	Direct connection to a TNW	3-1g
SAAL019	41.019927	-105.525159	Fish Creek	Perennial	1180	Indirect connection to a TNW	3-1e/g
SAAL020	41.018891	-105.535615	Fish Creek	Perennial	809	Direct connection to a TNW	3-1g
SAAL021	41.070793	-105.522148	Willow Creek	Perennial	473	Direct connection to a TNW	3-1c
SAAL022	41.079493	-105.508033	Tributary to Grant Creek	Intermittent	341	Indirect connection to a TNW	3-1c
SBAL001	41.068364	-105.544509	Tributary to Forest Creek	Ephemeral	607	Indirect connection to a TNW	3-1b
SBAL002	41.069789	-105.545064	Forest Creek	Perennial	3034	Direct connection to a TNW	3-1b
SBAL003	41.064732	-105.554744	Forest Creek	Perennial	776	Direct connection to a TNW	3-1b
SBAL004	41.058280	-105.554093	Boulder Creek	Perennial	637	Direct connection to a TNW	3-1b
SBAL005	41.057989	-105.553673	Tributary to Boulder Creek	Perennial	268	Indirect connection to a TNW	3-1b
SBAL006	41.054440	-105.506621	Tributary to Willow Creek	Intermittent	335	Indirect connection to a TNW	3-1f
SBAL007	41.057142	-105.515617	Tributary to Willow Creek	Intermittent	336	Indirect connection to a TNW	3-1c
SBAL008	41.053209	-105.516595	Tributary to Willow Creek	Perennial	522	Indirect connection to a TNW	3-1e
SBAL009	41.051501	-105.516645	Tributary to Willow Creek	Intermittent	1744	Indirect connection to a TNW	3-1e
SBAL010	41.041411	-105.517572	Tributary to Willow Creek	Ephemeral	296	Indirect connection to a TNW	3-1e
SBAL011	41.046786	-105.516241	Tributary to Willow Creek	Ephemeral	775	Indirect connection to a TNW	3-1e
SBAL012	41.047692	-105.516305	Tributary to Willow Creek	Intermittent	390	Indirect connection to a TNW	3-1e
SBAL013	41.058449	-105.523856	Tributary to Willow Creek	Perennial	440	Indirect connection to a TNW	3-1c

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Length (ft)*	*Connection to TNW*	*Figure*
SBAL014	41.057108	-105.525356	Willow Creek	Perennial	1561	Indirect connection to a TNW	3-1b/c/e
SBAL015	41.045800	-105.527373	Tributary to Willow Creek	Intermittent	318	Indirect connection to a TNW	3-1e
SBAL016	41.045472	-105.526402	Tributary to Willow Creek	Intermittent	1040	Indirect connection to a TNW	3-1e
SBAL017	41.014666	-105.489100	Unnamed Tributary	Intermittent	1012	Indirect connection to a TNW	3-1h
SBAL018	41.015307	-105.504368	Fish Creek	Perennial	3605	Direct connection to a TNW	3-1g/h
SBAL019	41.021630	-105.516588	Tributary of Fish Creek	Perennial, man made	451	Indirect connection to a TNW	3-1e
SBAL020	41.020891	-105.516295	Fish Creek	Perennial	938	Direct connection to a TNW	3-1e/g
SBAL021	41.020444	-105.525898	Tributary of Fish Creek	Intermittent	562	Indirect connection to a TNW	3-1g
SBAL022	41.020859	-105.524967	Tributary of Fish Creek	Intermittent	307	Indirect connection to a TNW	3-1e/g
SBAL023	41.019408	-105.534696	Tributary of Fish Creek	Intermittent	303	Indirect connection to a TNW	3-1g
SBAL024	41.078858	-105.508036	Grant Creek	Perennial	329	Direct connection to a TNW	3-1c

3.2.2 Kennedy Test

All 45 surveyed waterbodies were found to have either direct or indirect biological, physical, and chemical connection with either Willow Creek, a RPW, which connects to the Laramie River (RPW) and ultimately drains in to the North Platte River, a TNW; or Fish Creek, a RPW, which connects to the North Fork Cache La Poudre River (RPW) and ultimately drains in to the South Platte River, a TNW. The surveyed waterbodies have the potential to provide biological support to a wide variety of aquatic fauna and avian species. The potential for direct connection to a RPW satisfies the criterion of the Kennedy Test for a significant nexus; therefore, these features are likely under the jurisdiction of the USACE.

3.3 UPLANDS

The upland habitat located along the majority of the Survey Area is characterized as grasslands dominated by spare ground cover including spineless horsebrush (*Tetradymia canescens*), big sagebrush (*Artemisia tridentate*), wax currant (*Ribes cereum*), Timothy grass (*Phleum pretense*), blue wildrye (*Elymus glaucus)*, elkweed (*Frasera speciosa*), Canada goldenrod (*Solidago canadensus*), big bluestem (*Andropogon geradii*), little bluestem (*Schizachyrium scoparium*), and assorted upland grasses (Whitson 2004). Regional Supplement USACE Wetland Determination Data Forms are provided in Appendix A.

4.0 SUMMARY AND CONCLUSIONS

Field investigations identified a total of nine PEM wetlands within the Survey Area. One of these features, WBAL002 (0.13 acres), was an isolated depressional wetland and showed no significant nexus to a water of the U.S. The remaining eight wetlands (6.05 acres) were associated with stream corridors and meet the requisite of the Plurality Test. Additionally these wetlands demonstrate a measureable significant nexus as described in the Kennedy Test; as a result, these wetlands may be deemed jurisdictional by the USACE.

The Survey Area contained a total of 45 waterbodies. Of these, 21 are perennial streams, 12 are intermittent streams, and 12 are ephemeral streams. ERM has concluded that all of these natural waterbodies may likely be deemed under the jurisdiction of Section 404 of the CWA and the USACE. The features described above are likely to be deemed jurisdictional under the CWA because they have the potential for a direct connection to a TNW, or exhibit a significant nexus with a TNW. Therefore, the USACE and EPA may deem these features jurisdictional.

Several areas identified as intermittent or ephemeral waterbodies on the USGS topographic maps were field verified and deemed swales or erosion features as they did not meet the criterion discussed in Section 2.2.2.2. A map illustrating these areas and representative photographic log is included in Appendix D.

Results of the assessment indicate one of the nine wetlands delineated within the Survey Area may be deemed non-jurisdictional by the USACE and the EPA as it is isolated and shows no connection to waters of the U.S.

Note: Only the USACE and EPA can make the final jurisdictional determination of the features.

4.1 ANTICIPATED IMPACTS AND MITIGATION

4.1.1 Proposed Action Impacts

The Proposed Action includes the construction of a substation, high voltage (345 kV) transmission line less than one mile long, and system upgrades to an existing 345 kV Western-owned transmission line. The Proposed Action is not anticipated to have impacts on wetlands and/or waterbodies within the Survey Area.

4.1.2 Project Impacts

The Project is anticipated to impact approximately 0.17 acres of wetlands. These impacts are entirely due to the construction of access roads and installation of underground electrical connection lines. Turbines, laydown areas, O&M areas, and the permanent met tower will be sited outside of areas likely to be considered jurisdictional wetlands. In November 2009 the Project was redesigned to reduce wetlands impacts from 6.18 to 0.17 acres.

Table 4-1 Estimated Project Impacts by Wetland

Feature ID	*Latitude*	*Longitude*	*Type (A)*	*Estimate Impact Acreage (B,C)*	*Connection to Significant Nexus*	*Figure*
WAAL001	41.056410	-105.573166	PEM	0.06	Associated with Forest Creek	3-1a/d
WAAL002	41.047740	-105.560374	PEM	0.05	Associated with Boulder Creek	3-1d
WAAL004	41.038912	-105.535552	PEM	0.01	Associated with Willow Creek	3-1e
WBAL004	41.058491	-105.523914	PEM	0.04	Associated with Willow Creek	3-1c
WBAL005	41.020996	-105.516327	PEM	0.01	Associated with Fish Creek	3-1 d/e/g
			TOTAL	**0.17**		
			Total Potentially Jurisdictional Wetlands	**0.17**		

(A) Wetland types: PEM = palustrine emergent;

(B) Wetland acreages are based on GPS boundaries surveyed.

(C) Acreage calculations are based on the assumption that the access roads and underground electrical collections lines will have a 50 ft wide corridor.

In November 2009, the Project was redesigned to avoid 15 waterbodies and use existing crossings to minimize further impact. The current Project design is anticipated to cross a total of 30 waterbodies. Of these, 12 are perennial streams, eight are intermittent streams, and ten are ephemeral streams (Table 3-3). Waterbody crossings are necessary to construct the access roads and install underground electrical connection lines. Thirteen of the 30 crossings are located along existing roads throughout the Project area. Turbines, laydown areas, O&M areas, and the permanent met tower will be sited outside of waterbodies and riparian habitats.

Table 4-2 Estimated Project Waterbody Crossings

Feature ID	*Latitude*	*Longitude*	*Name*	*Type*	*Crossing Length (ft)*	*Connection to TNW*	*Figure*
SAAL001	41.066863	-105.582609	Government Creek	Perennial	15	Direct connection to a TNW	3-1a
SAAL002	41.072383	-105.573911	Government Creek	Perennial	15	Direct connection to a TNW	3-1a
SAAL003	41.079602	-105.563864	Government Creek	Ephemeral	30	Direct connection to a TNW	3-1a/b
SAAL004	41.056285	-105.573305	Forest Creek	Perennial	40	Direct connection to a TNW	3-1a/d
SAAL006	41.046449	-105.562884	Tributary of Boulder Creek	Ephemeral	10	Direct connection to a TNW	3-1d
SAAL007	41.045361	-105.562785	Tributary of Boulder Creek	Ephemeral	15	Direct connection to a TNW	3-1d
SAAL008	41.047795	-105.560299	Boulder Creek	Ephemeral	2	Direct connection to a TNW	3-1d
SAAL009	41.043325	-105.561854	Tributary of Boulder Creek	Ephemeral	2	Indirect connection to a TNW	3-1d
SAAL010	41.042975	-105.535672	Willow Creek	Perennial	2	Direct connection to a TNW	3-1e
SAAL013	41.041863	-105.526986	Tributary of Willow Creek	Ephemeral	12	Indirect connection to a TNW	3-1e
SAAL014	41.025831	-105.487344	Unnamed Tributary	Perennial	10	Direct connection to a TNW	3-1f
SAAL015	41.028552	-105.493262	Unnamed Tributary	Ephemeral	10	Indirect connection to a TNW	3-1f
SAAL016	41.027122	-105.507064	Unnamed Tributary	Ephemeral	20	Indirect connection to a TNW	3-1e/f
SAAL020	41.018891	-105.535615	Fish Creek	Perennial	10	Direct connection to a TNW	3-1g
SAAL021	41.070793	-105.522148	Willow Creek	Perennial	15	Direct connection to a TNW	3-1c
SAAL022	41.079493	-105.508033	Tributary to Grant Creek	Intermittent	5	Indirect connection to a TNW	3-1c
SBAL001	41.068364	-105.544509	Tributary to Forest Creek	Ephemeral	8	Indirect connection to a TNW	3-1b
SBAL006	41.054440	-105.506621	Tributary to Willow Creek	Intermittent	10	Indirect connection to a TNW	3-1f
SBAL007	41.057142	-105.515617	Tributary to Willow Creek	Intermittent	30	Indirect connection to a TNW	3-1c
SBAL008	41.053209	-105.516595	Tributary to Willow Creek	Perennial	10	Indirect connection to a TNW	3-1e
SBAL009	41.051501	-105.516645	Tributary to Willow Creek	Intermittent	20	Indirect connection to a TNW	3-1e
SBAL011	41.046786	-105.516241	Tributary to Willow Creek	Ephemeral	10	Indirect connection to a TNW	3-1e
SBAL012	41.047692	-105.516305	Tributary to Willow Creek	Intermittent	15	Indirect connection to a TNW	3-1e
SBAL013	41.058449	-105.523856	Tributary to Willow Creek	Perennial	2	Indirect connection to a TNW	3-1c
SBAL014	41.057108	-105.525356	Willow Creek	Perennial	9	Indirect connection to a TNW	3-1b/c/e
SBAL015	41.045800	-105.527373	Tributary to Willow Creek	Intermittent	10	Indirect connection to a TNW	3-1e
SBAL016	41.045472	-105.526402	Tributary to Willow Creek	Intermittent	2	Indirect connection to a TNW	3-1e
SBAL017	41.014666	-105.489100	Unnamed Tributary	Intermittent	10	Indirect connection to a TNW	3-1h
SBAL018	41.015307	-105.504368	Fish Creek	Perennial	3	Direct connection to a TNW	3-1g/h
SBAL024	41.078858	-105.508036	Grant Creek	Perennial	2	Direct connection to a TNW	3-1c

SWE will obtain the appropriate USACE permits prior to construction and develop a mitigation plan as part of the permit process to address the minimization of impacts, restoration of temporarily disturbed wetlands and waterbodies, and compensation for lost habitat types and monitoring the revegetation of the construction corridor.

Minimization

SWE sited Project facilities outside of wetlands and riparian habitat where feasible. In November 2009, the Project was redesigned to reduce wetlands impacts from 6.18 to 0.17 acres and to cross 30 waterbodies versus 45. Thirteen of these crossings are located along existing roads throughout the Project area. In those areas where avoidance is not possible, SWE has worked to minimize impacts to the practical extent possible. Minimization includes actions taken to reduce overall wetland impacts through Project development and construction techniques.

SWE is proposing to utilize best management practices (BMPs) during Project construction to preserve and protect wetlands in order to minimize impacts. During the initial clearing phase of the construction process, woody vegetation in wetlands would be cut at ground level. This would leave the root systems intact and encourage sprouting of the existing species following construction. Small stumps of shrubs and trees may be cut at or just below ground level. Larger trees and shrubs would be removed to assure a safe, level work surface for equipment working on temporary mats. Equipment operation in wetlands would be kept to the minimum necessary to safely perform the work, and would operate on prefabricated equipment matting or acceptable substitute. Additionally, in areas where power collection lines or access roads have to take place in waterbodies BMPs will be developed and implemented to minimize impacts to water quality and sensitive species and required permits will be obtained.

In order to protect water resources, a storm water pollution prevention plan (SWPPP), which includes erosion control measures, would be generated and implemented on site for the Project. The SWPPP would be based on the U.S. EPA document entitled "Storm Water Management for Construction Activities-Developing Pollution Prevention Plans and Best Management Practices. The Project will obtain a General Stormwater Construction Permit from the Wyoming Department of Environmental Quality (WYDEQ).

Given the dry and windy nature of the area, dust control measures will be proposed as part of the SWPPP to protect water quality, minimize impacts to local residents, and minimize impacts to vehicles traveling along local roads. Examples of BMPs that can be included in the SWPPP are the use of water or other dust control measures on or near heavily used public roads, holding traffic speeds to appropriate levels to minimize dust generation, using rock to cover disturbed soil, and re-vegetating or otherwise covering soils as soon as possible following soil disturbance.

Restoration

SWE will develop a restoration plan, as part of the SWPPP, in order to further minimize permanent impacts to associated wetlands. Upon the completion of the Project, the construction corridor would be restored to pre-construction contours, with exception of the turbine foundations, access roads. and permanent Project facilities (i.e. O&M area and substation). These areas would also be allowed to naturally revegetate from the existing rootstock and supplemented with native seed mix where necessary.

Compensation

While many steps have been taken to minimize impacts to wetlands within the Project area, permanent loss of some wetlands may be unavoidable due to the nature of the Project. SWE will mitigate for unavoidable impacts to wetlands and waterbodies as part of the USACE permit process, as required.

5.0 REFERENCES

5.1 ENVIRONMENTAL INVESTIGATORS

Clark, Chris	ERM, Environmental Consultant
Johnson, Erin C.	ERM, Environmental Consultant
Wanka, Kathryn M.	ERM, Environmental Consultant
Zeisloft, Chris	ERM, Environmental Consultant
Zuniga, Amanda	ERM, Environmental Scientist

5.2 REFERENCE DOCUMENTS

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Figures

January 11, 2010
Project No. 0105023

Environmental Resources Management Southwest, Inc.
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

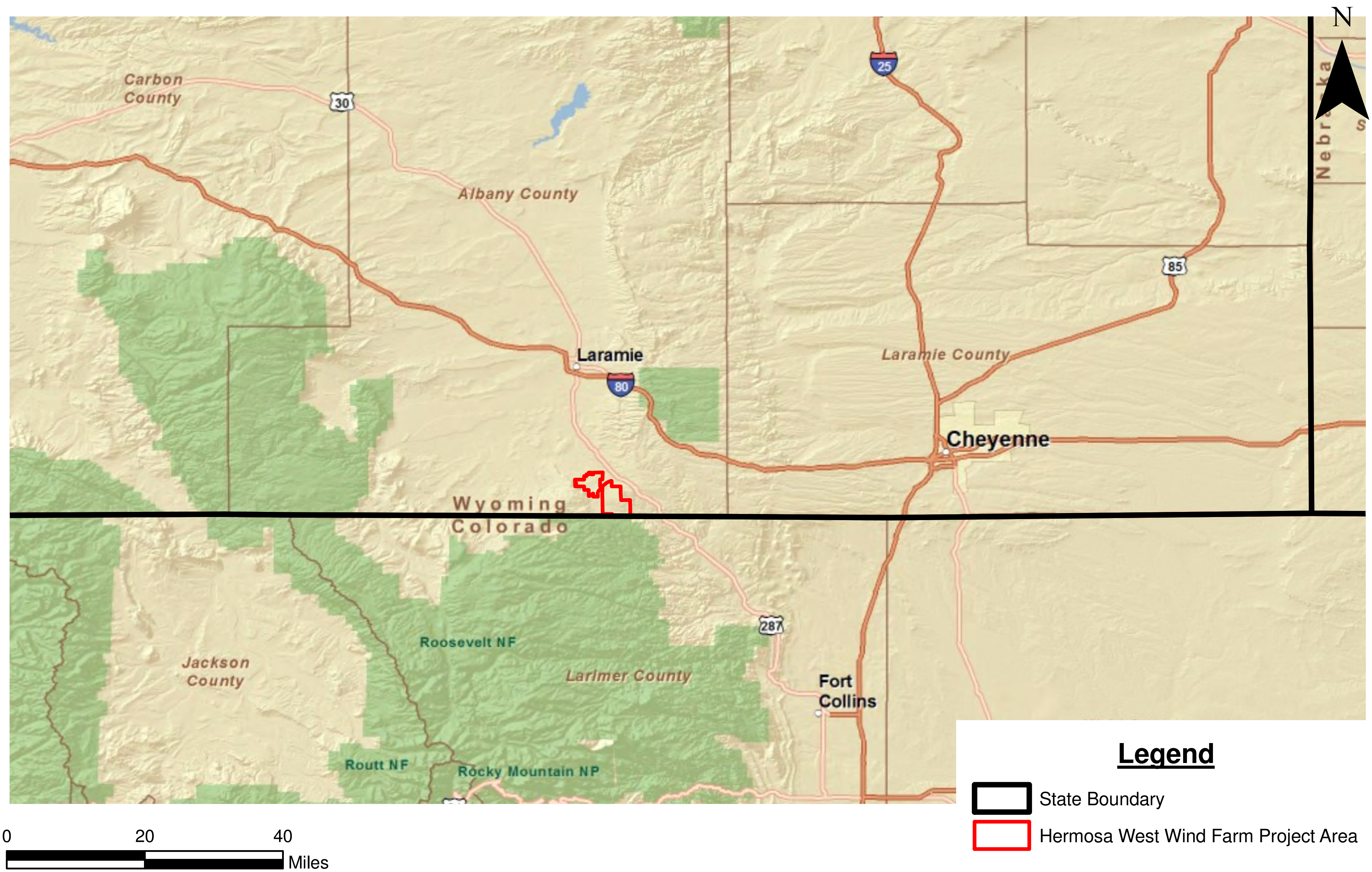

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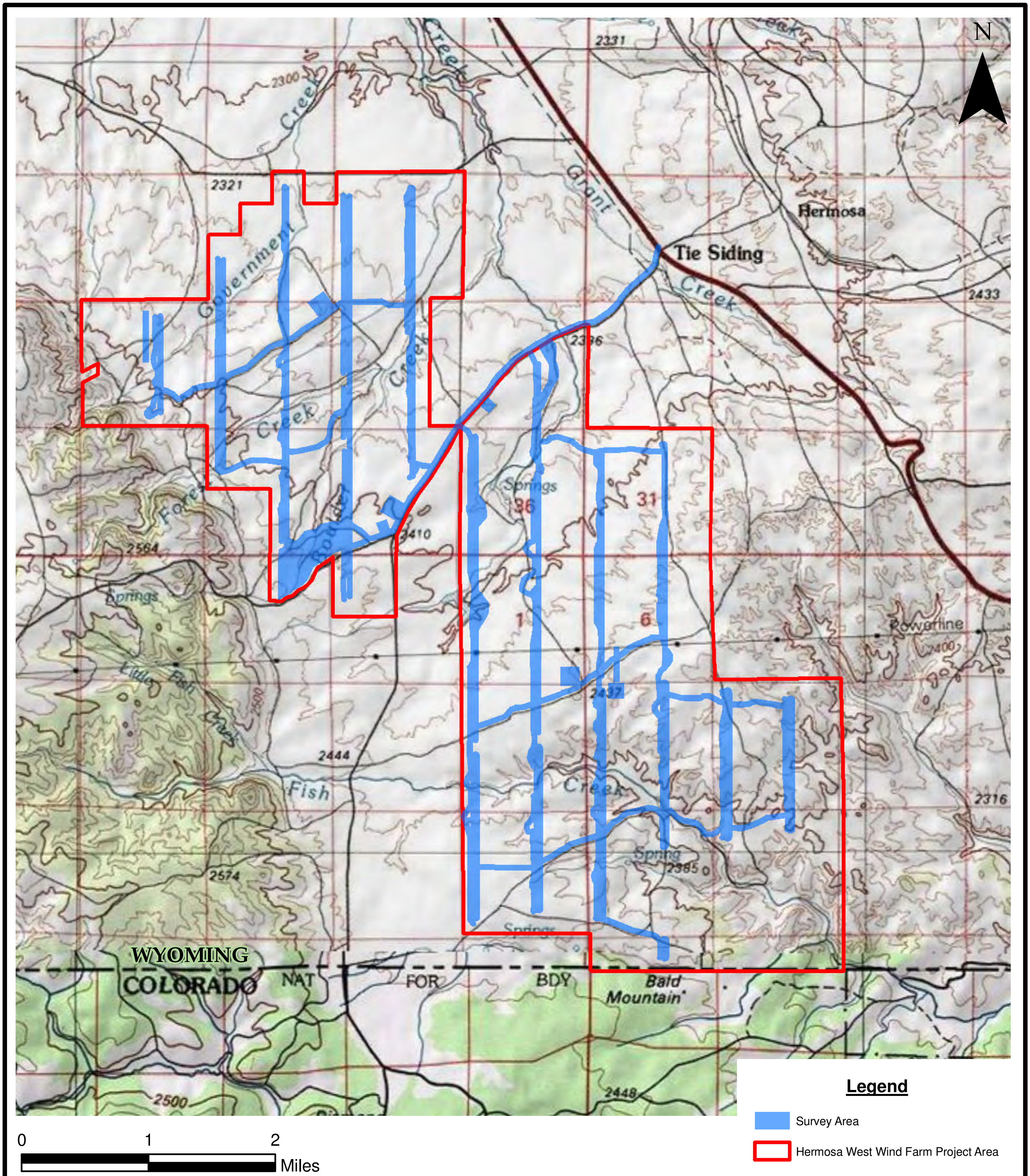
FIGURE 1-1
VICINITY MAP
Shell Wind Energy
Hermosa West Wind Farm Project

ERM



Environmental Resources Management

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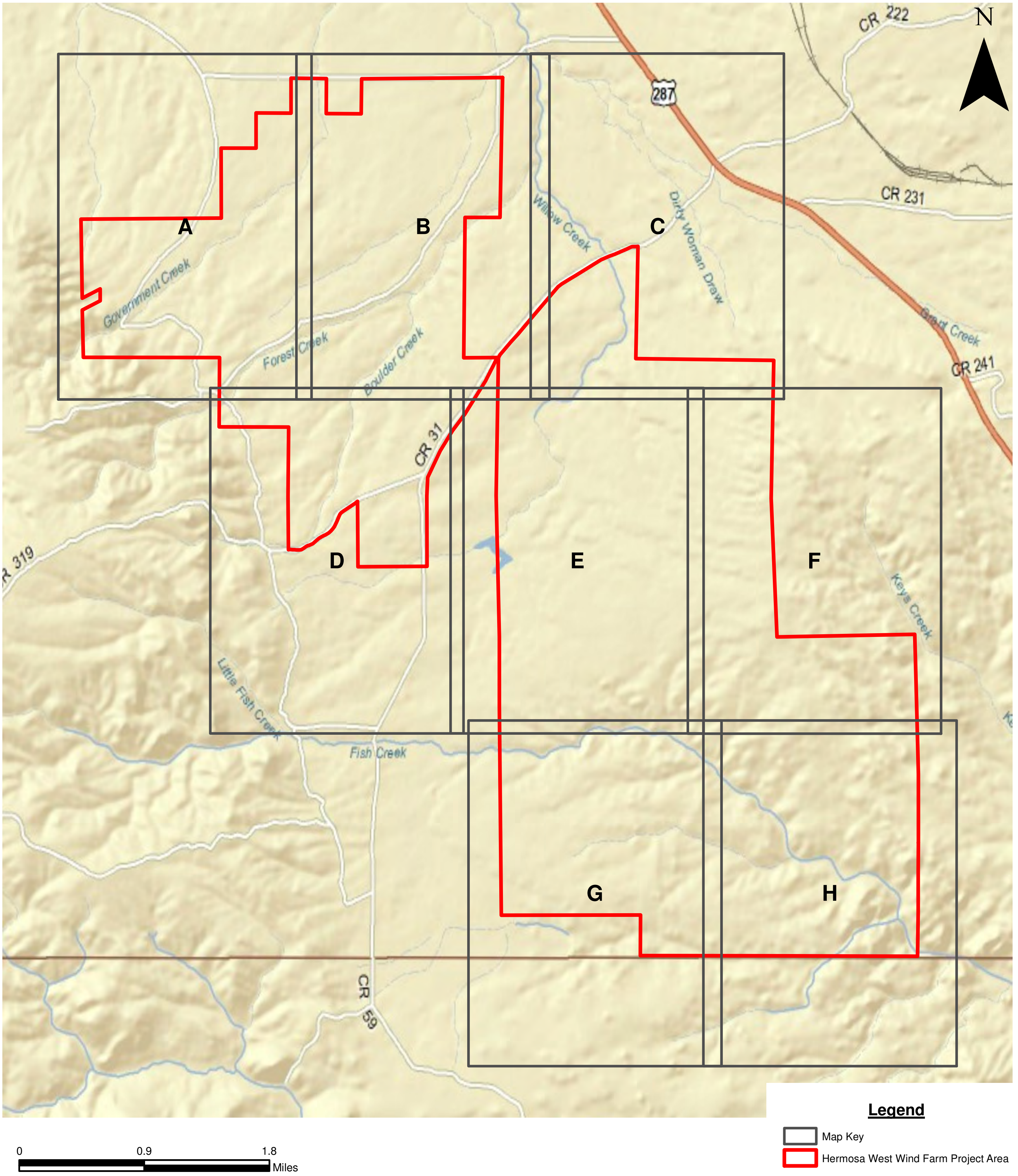
FIGURE 1-2
SITE PLAN
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM



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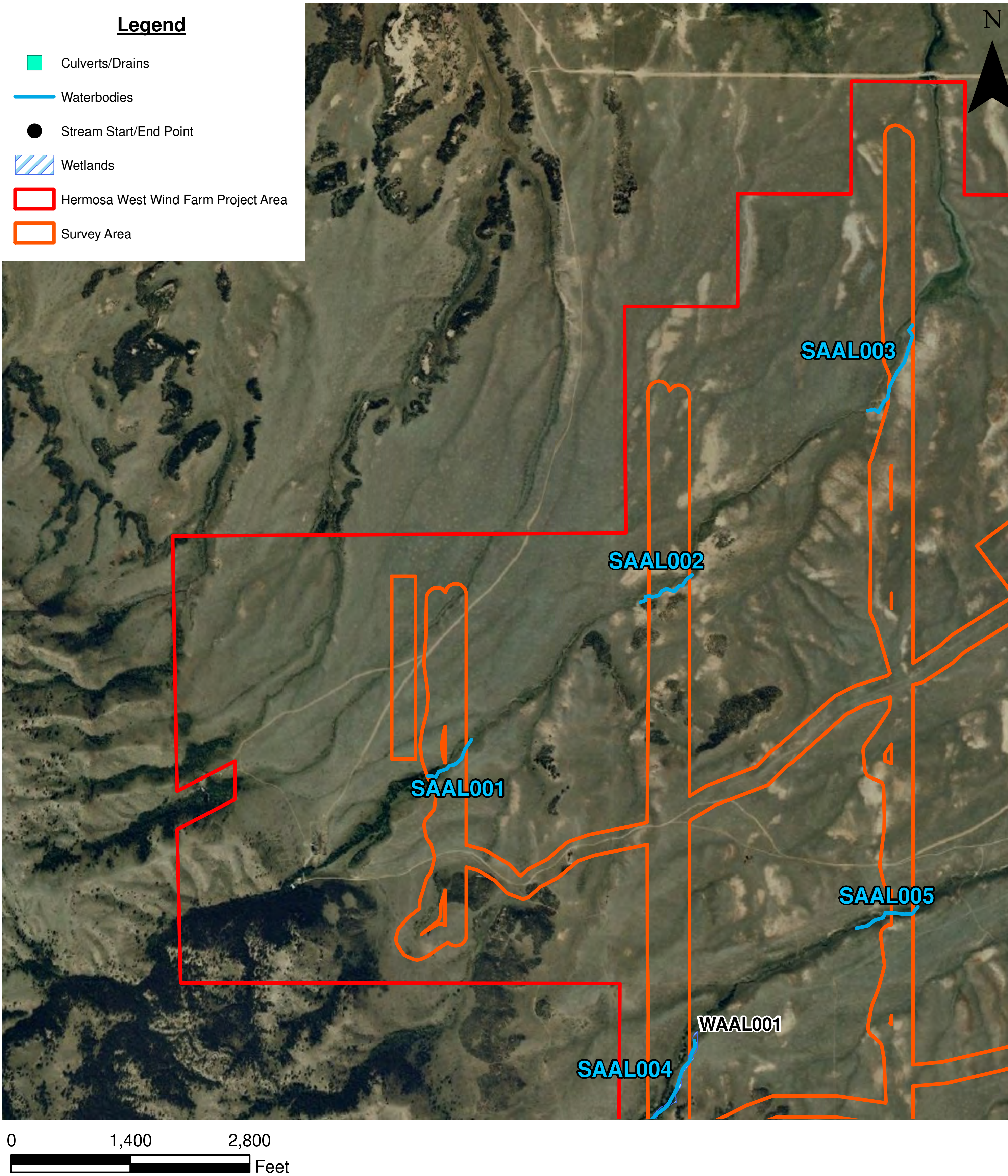
MAP KEY
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



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DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
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FIGURE 3-1a
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

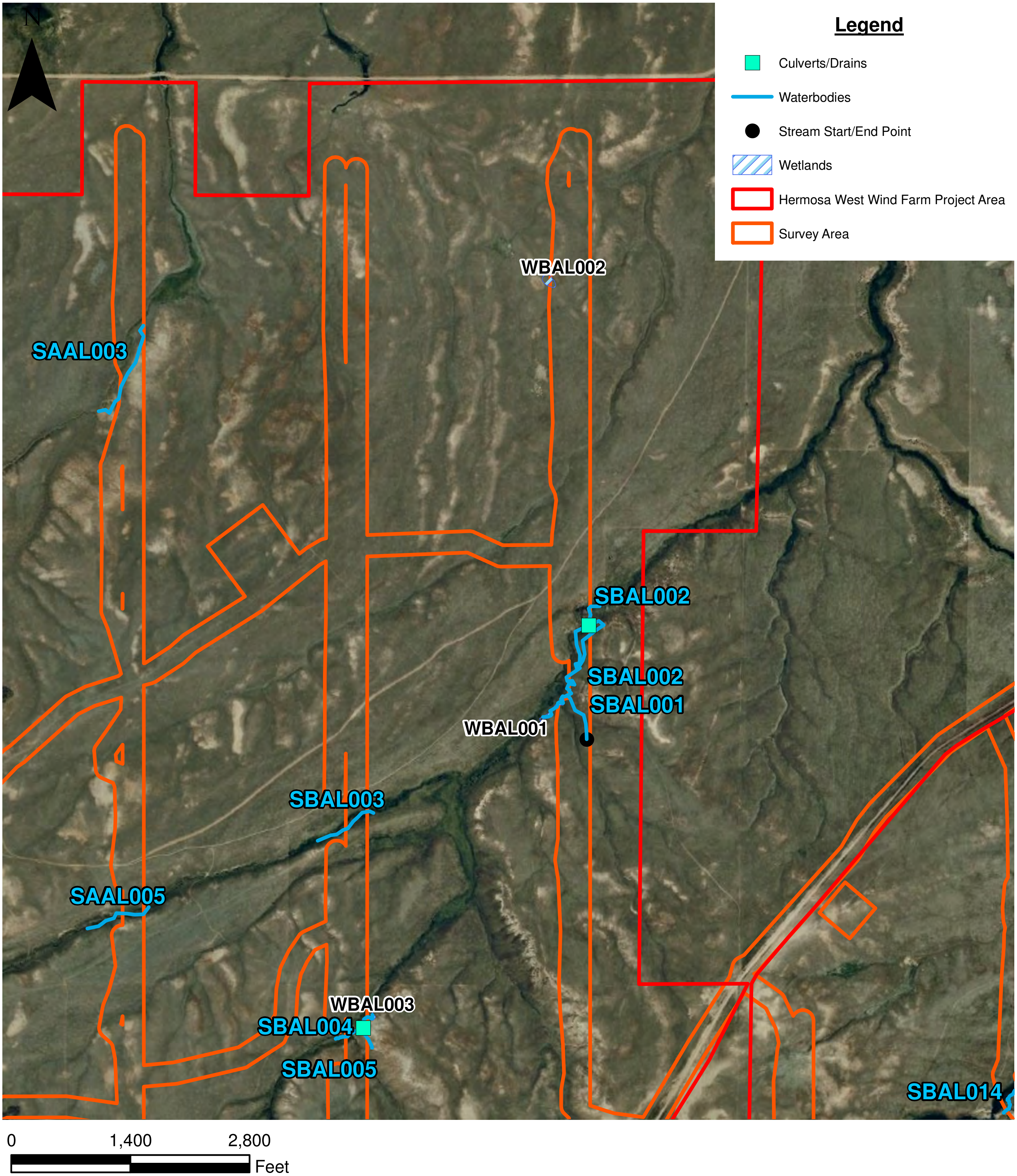

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FIGURE 3-1b
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

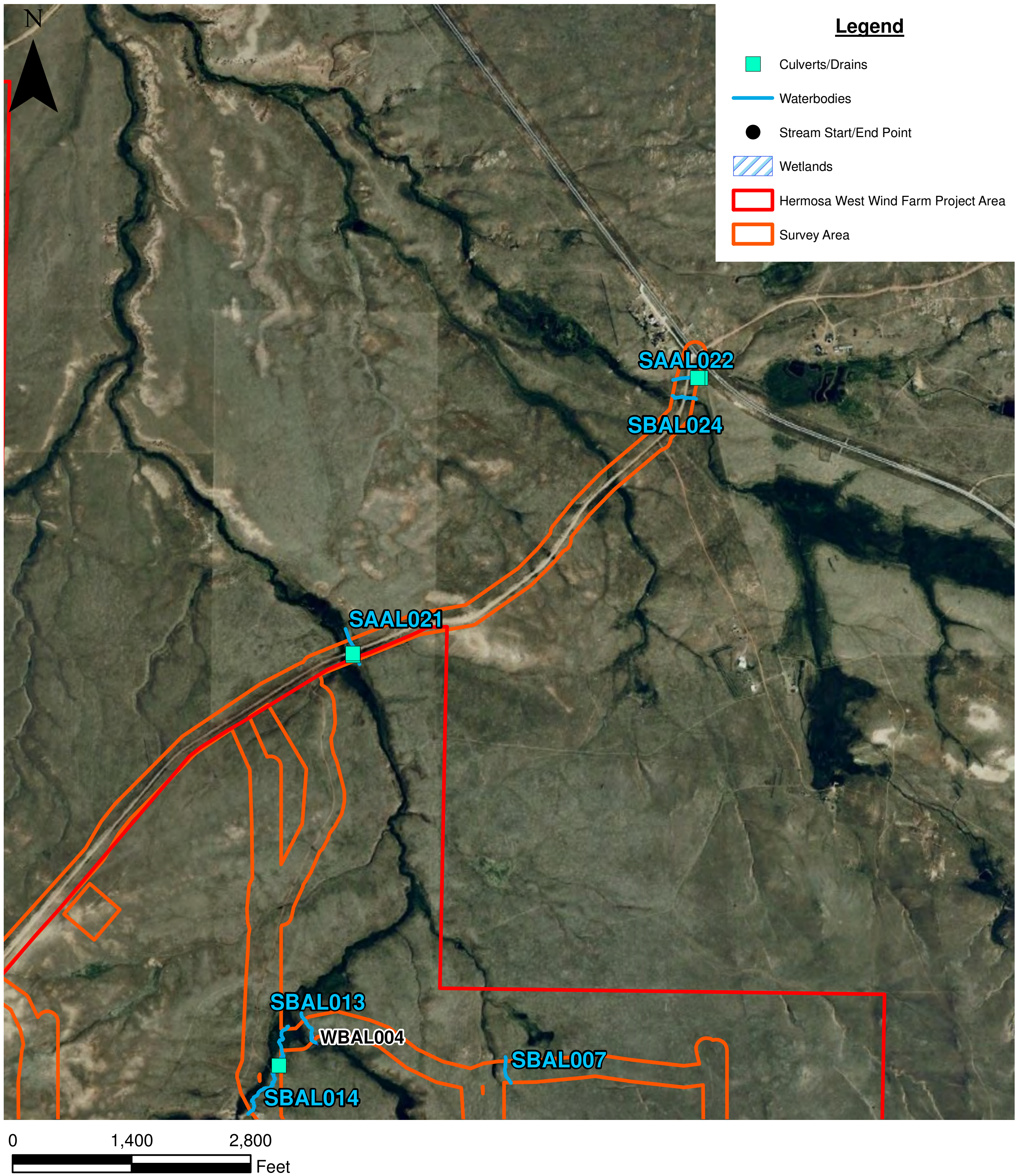

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FIGURE 3-1c
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

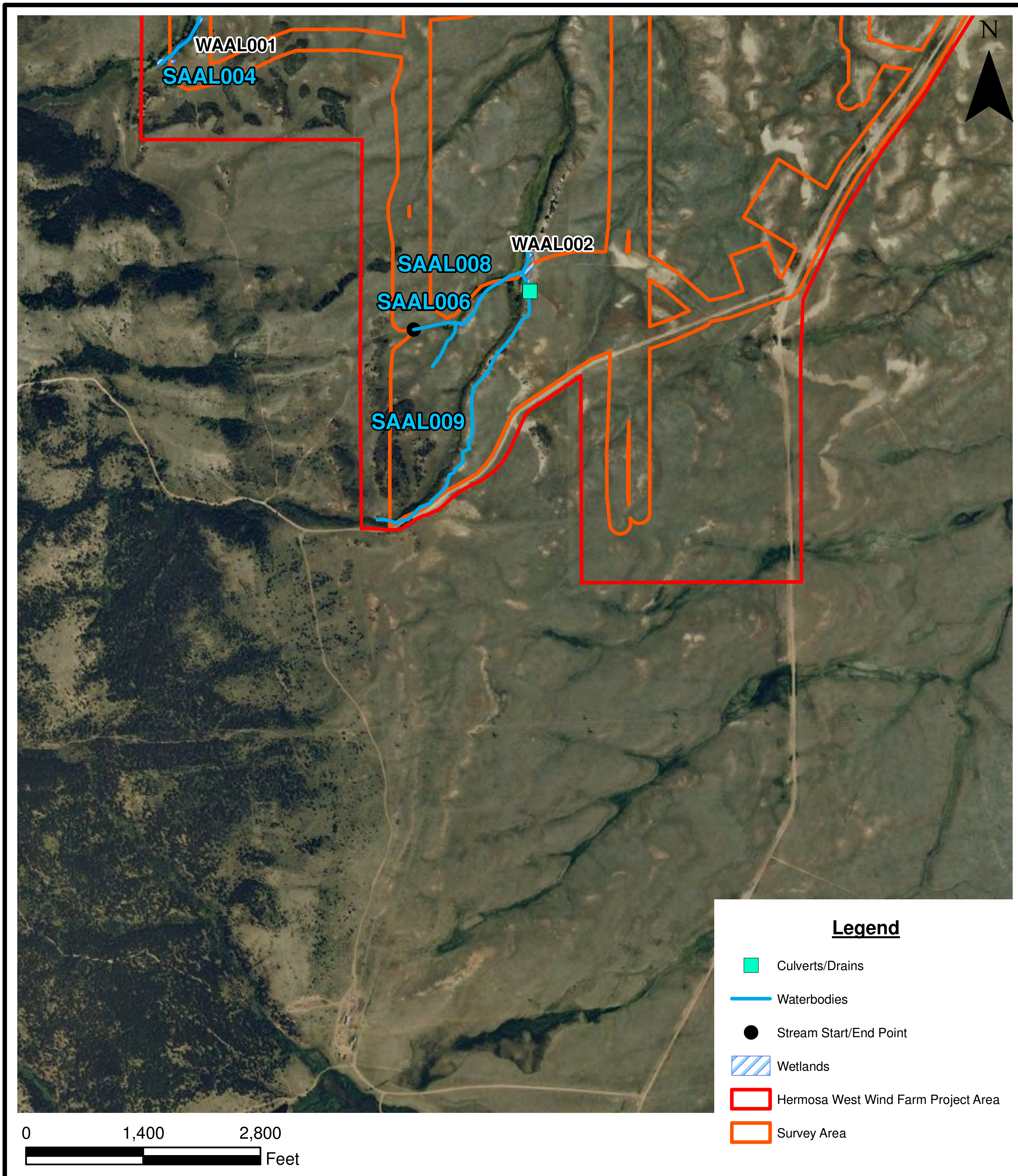

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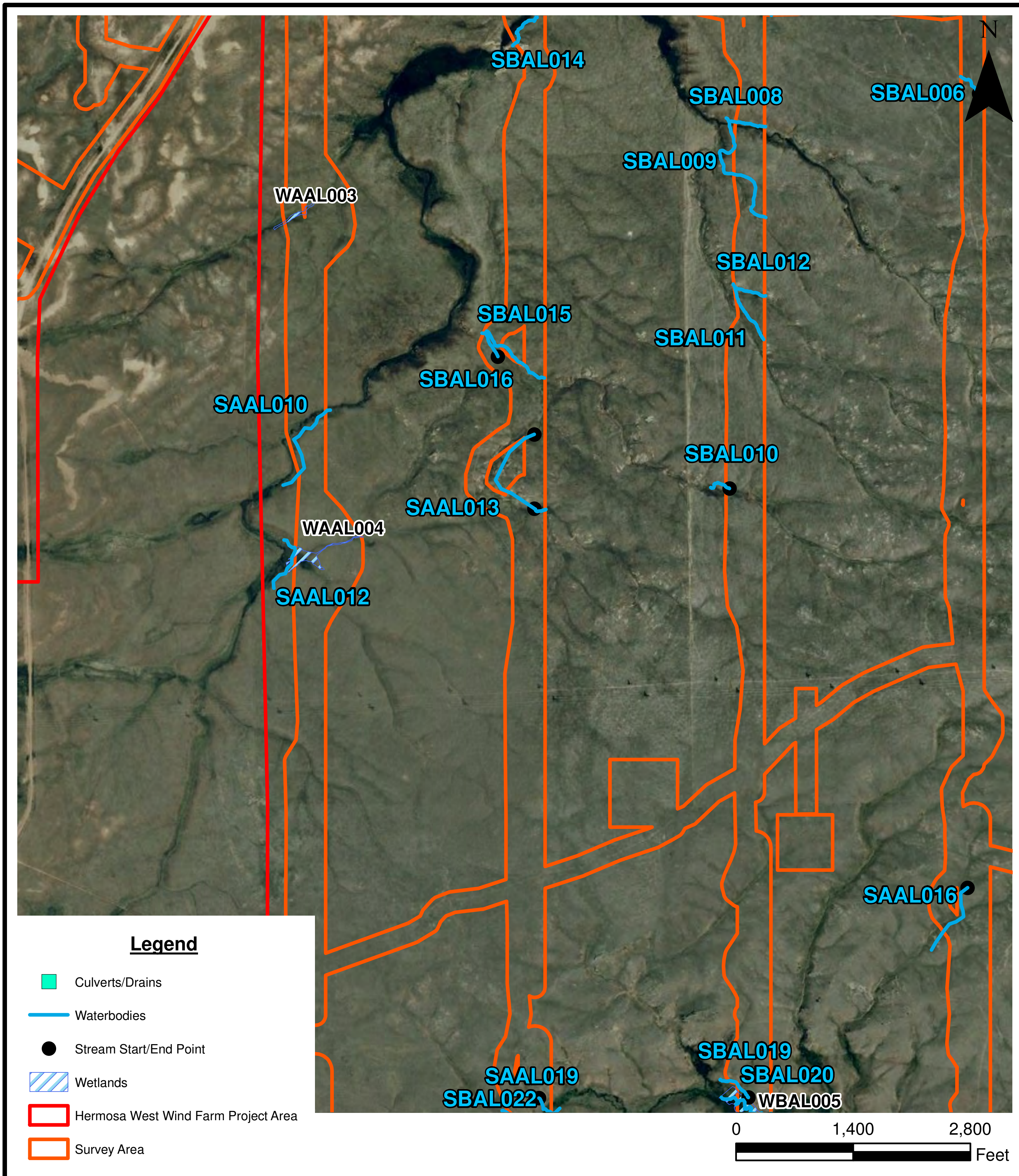
FIGURE 3-1d
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

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FIGURE 3-1e
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

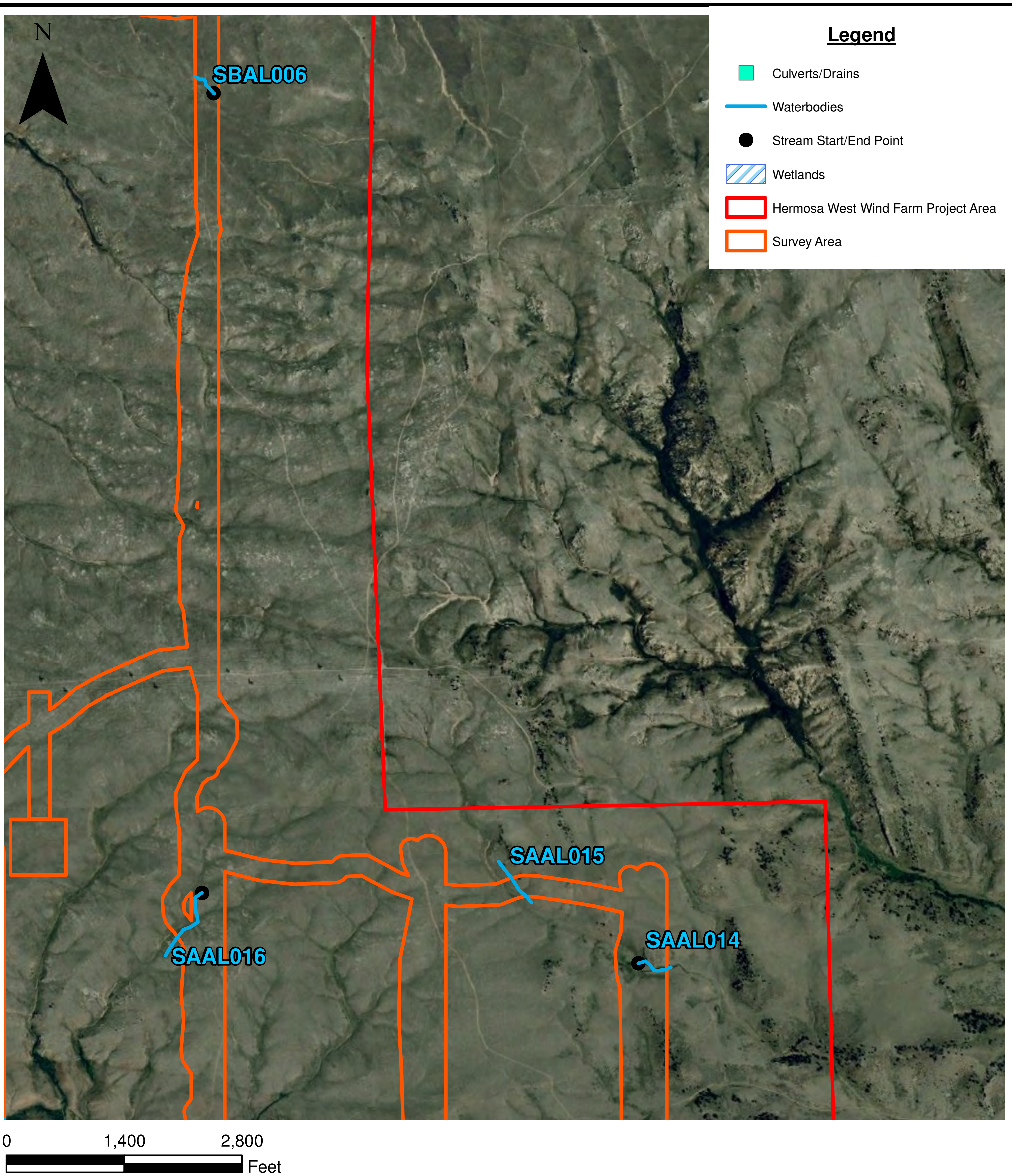

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FIGURE 3-1f
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

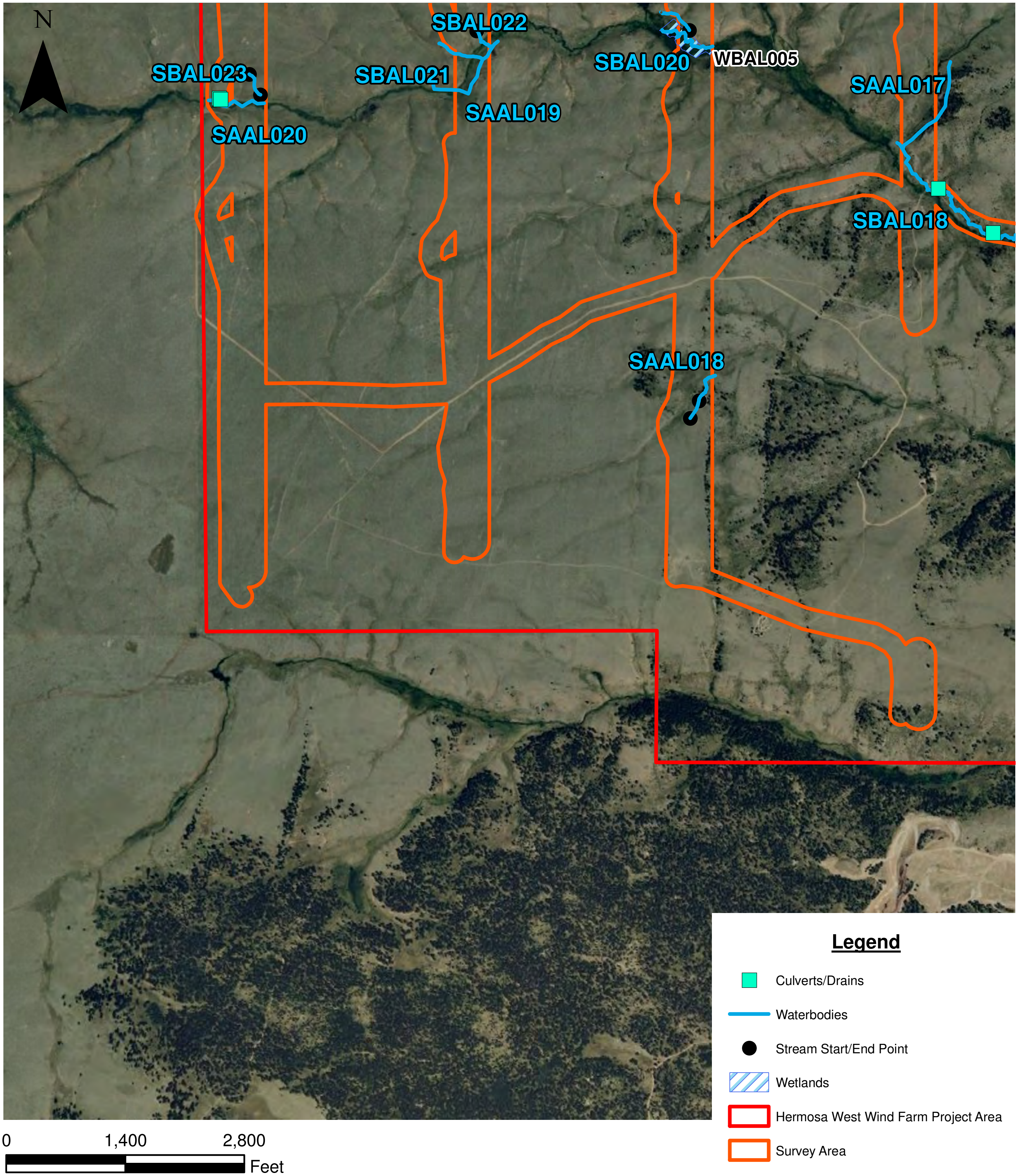

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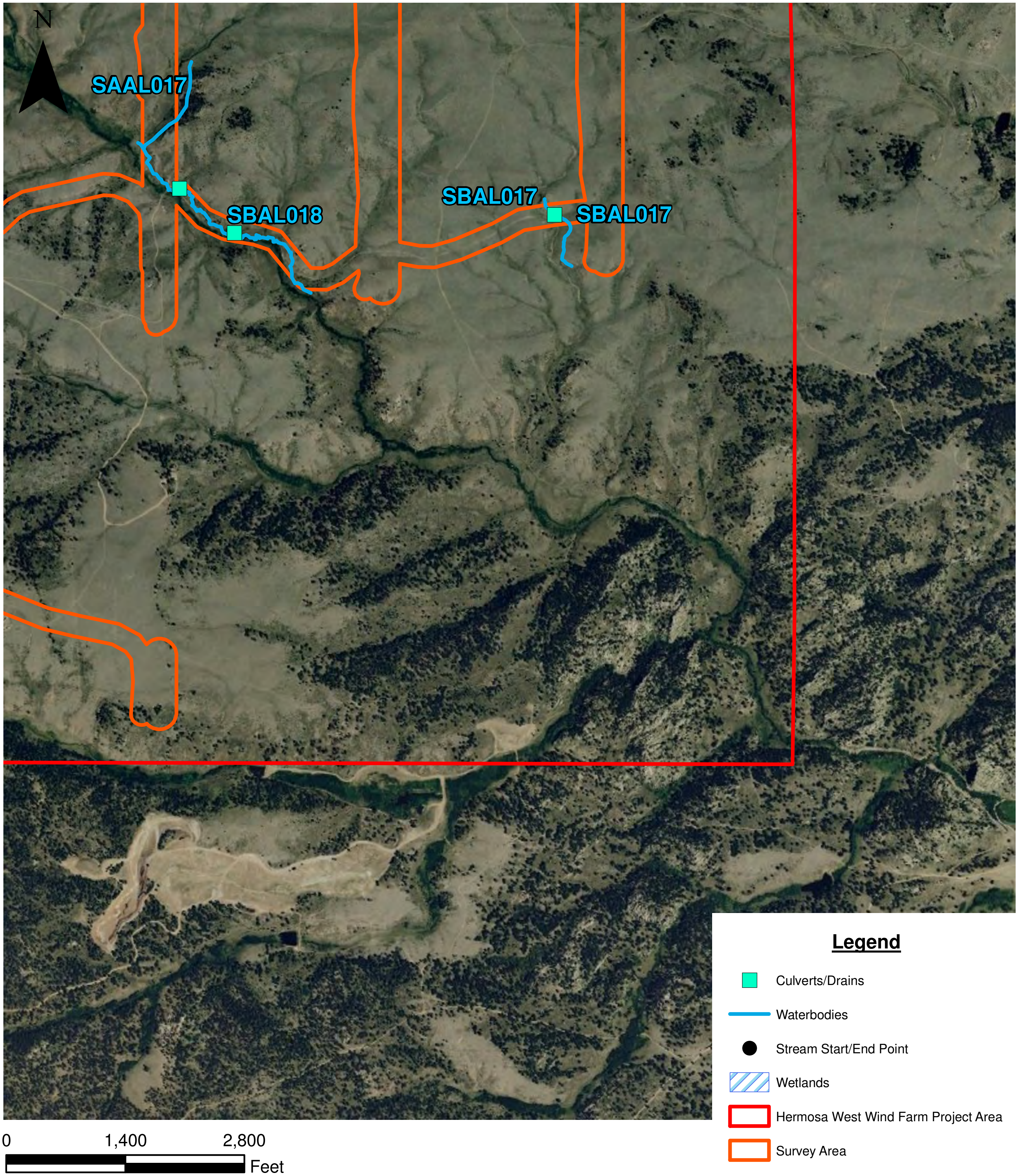
FIGURE 3-1g
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Legend

- Culverts/Drains
- Waterbodies
- Stream Start/End Point
- Wetlands
- Hermosa West Wind Farm Project Area
- Survey Area

Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
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FIGURE 3-1h
AERIAL MAP
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

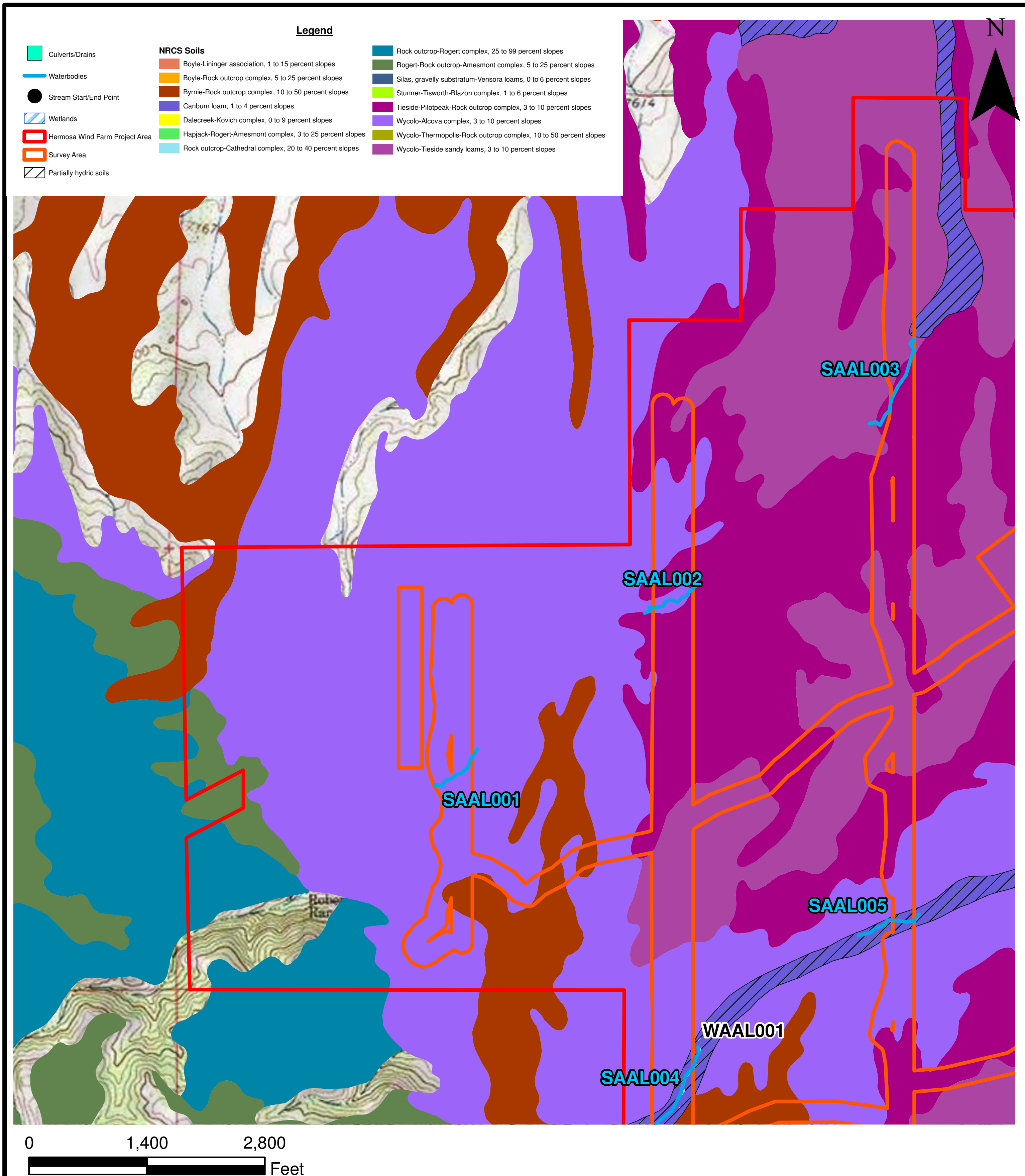

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FIGURE 3-2a
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

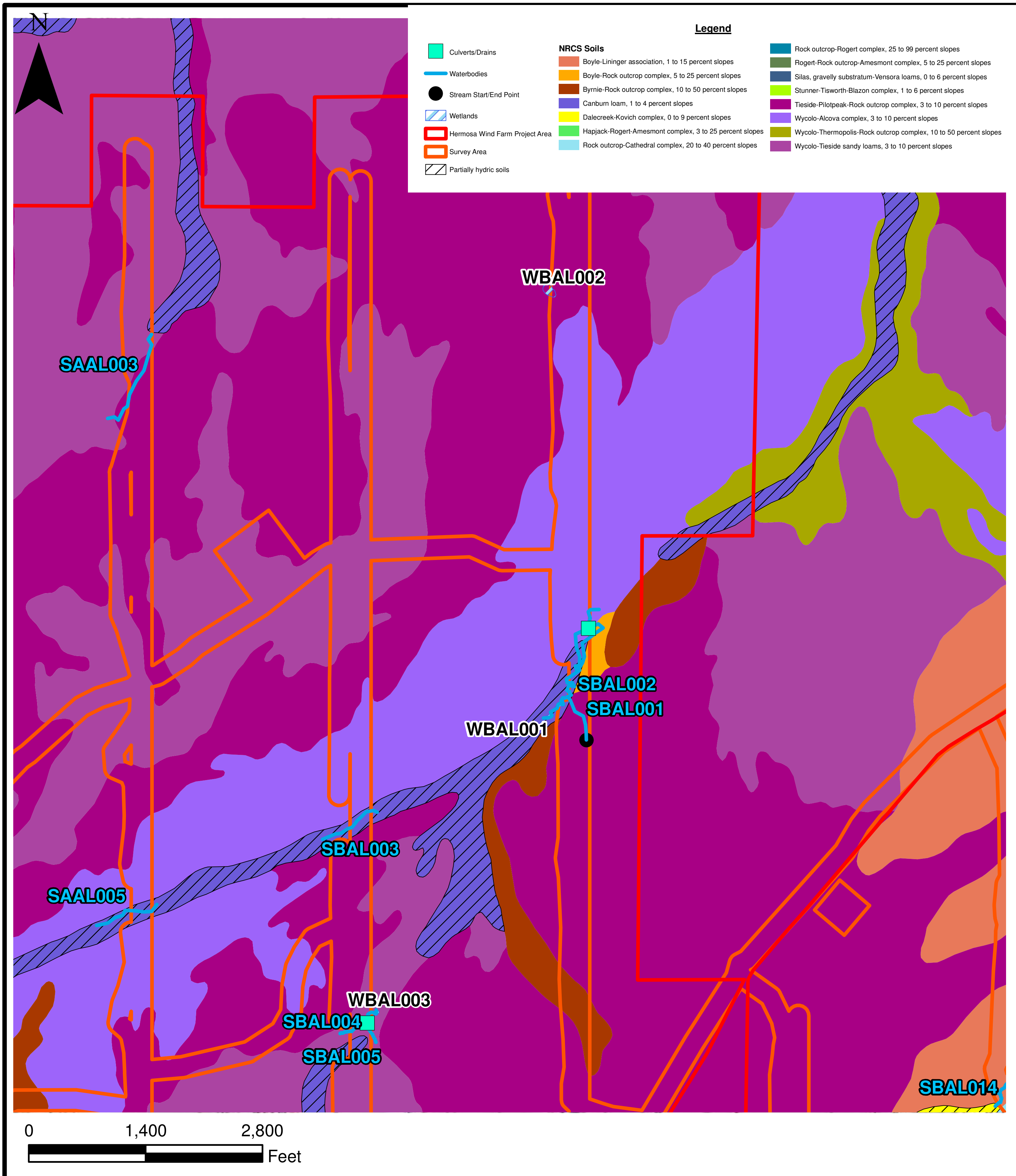

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FIGURE 3-2b
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

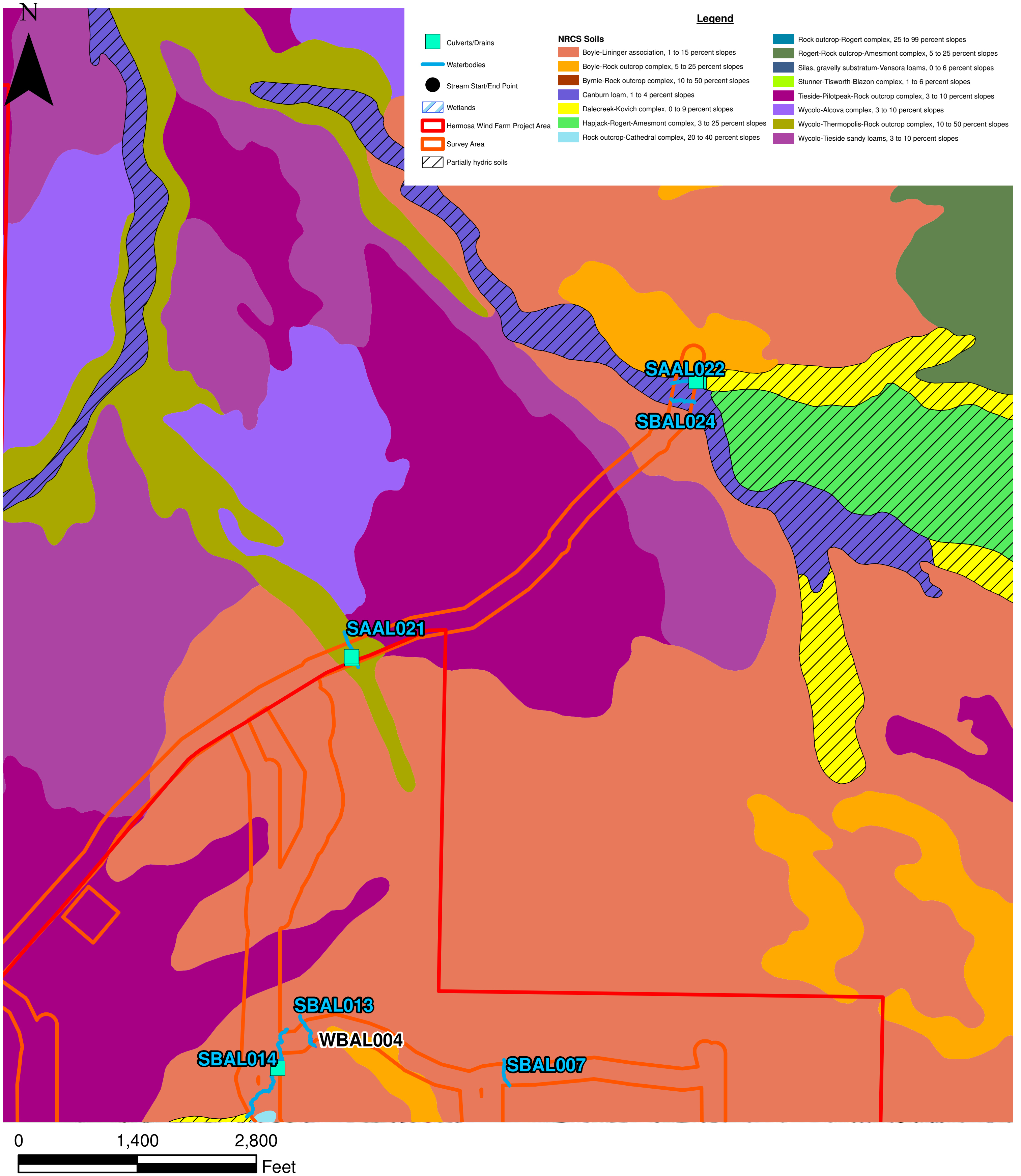

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FIGURE 3-2c
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

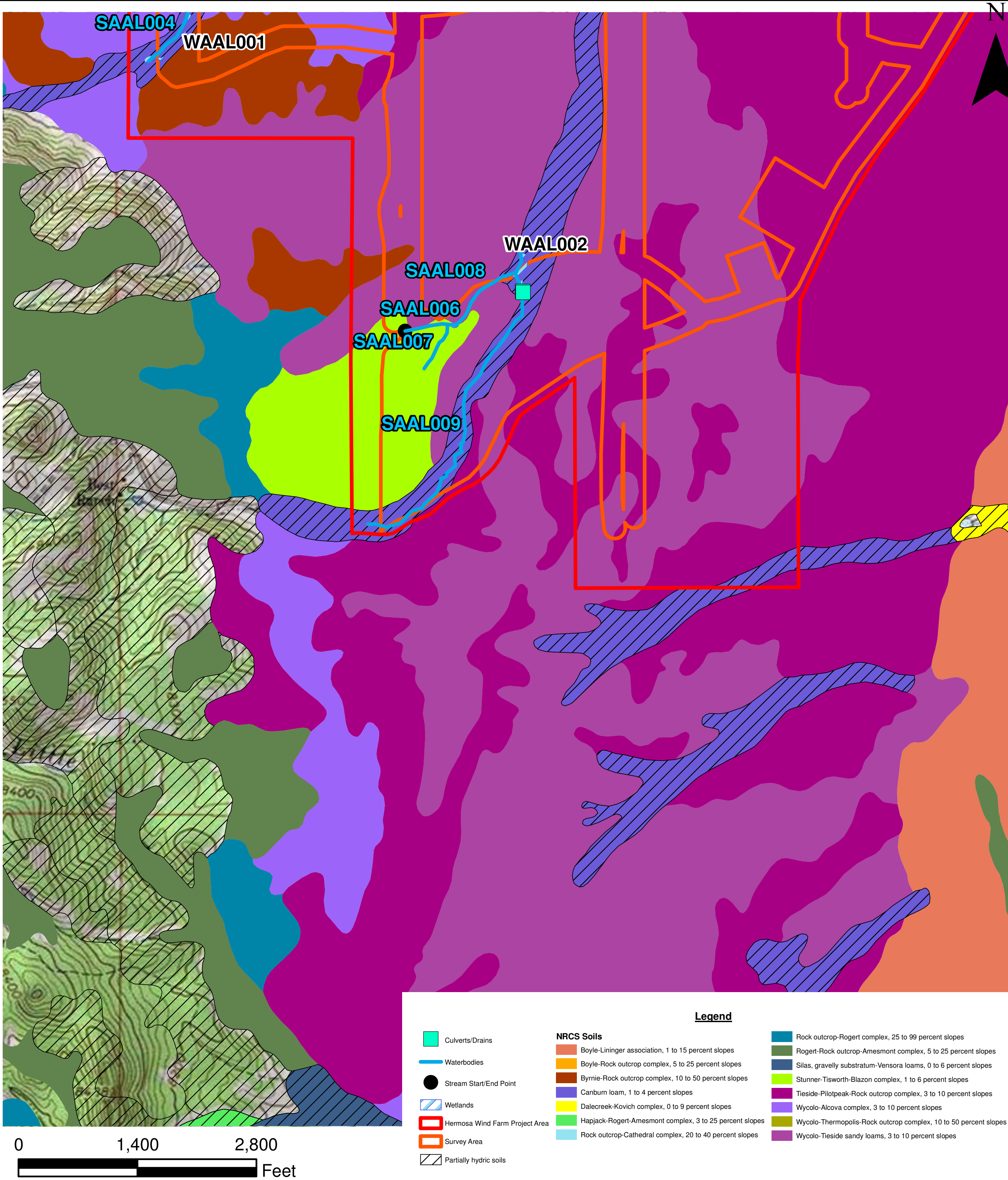

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FIGURE 3-2d
SOILS MAP
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Hermosa Wind Farm Project
Albany County, Wyoming

ERM

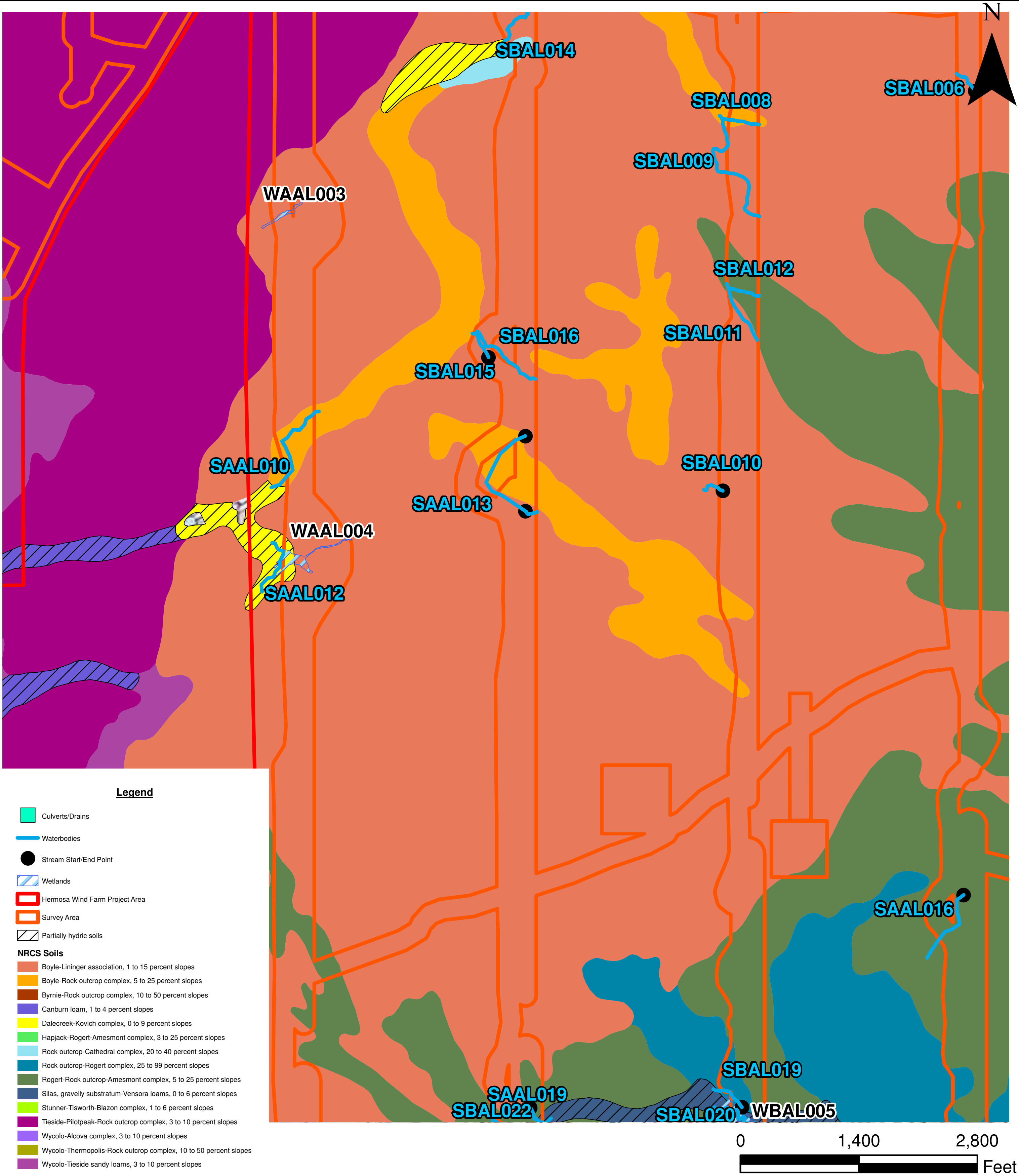

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FIGURE 3-2e
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

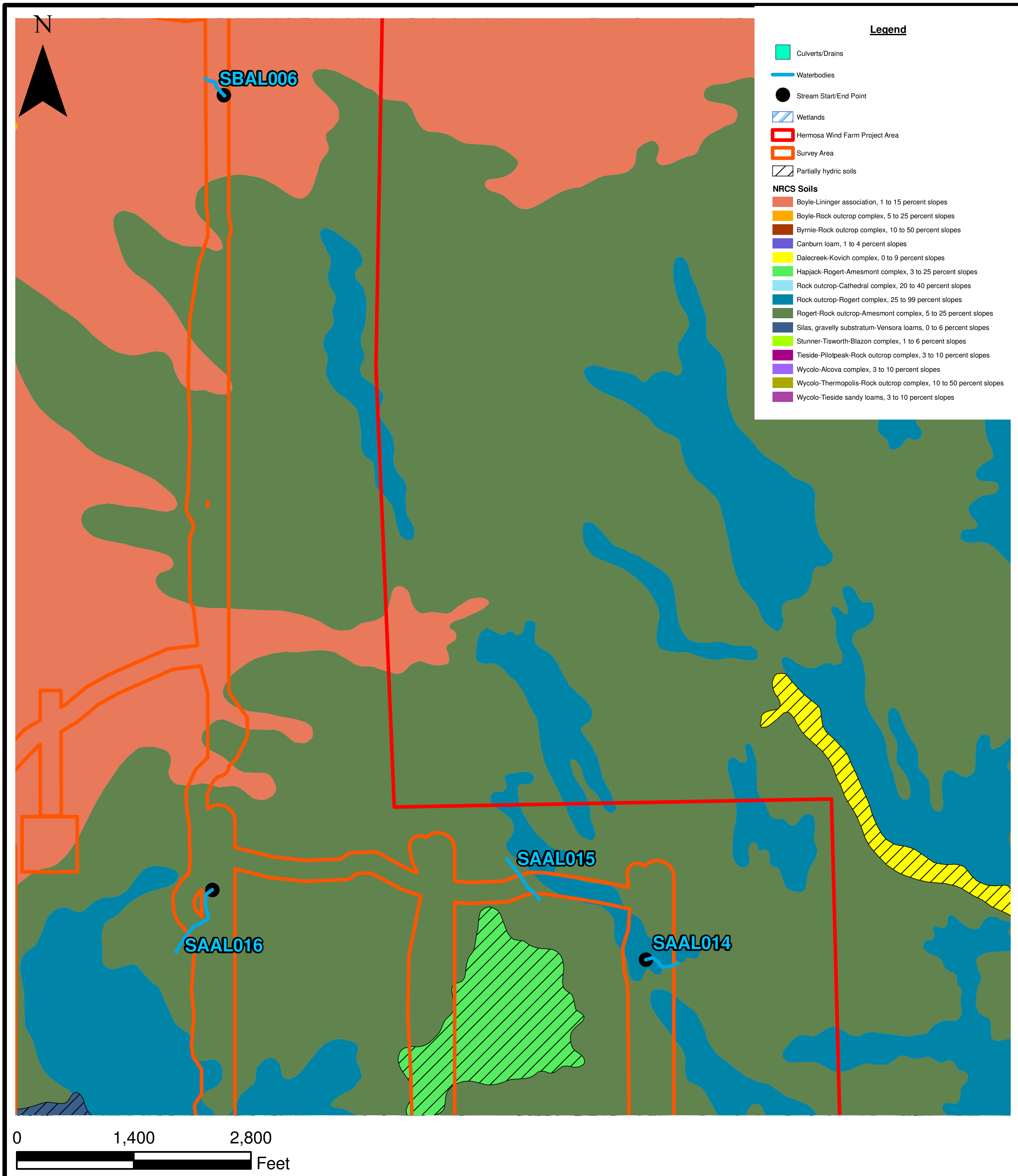

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FIGURE 3-2f
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

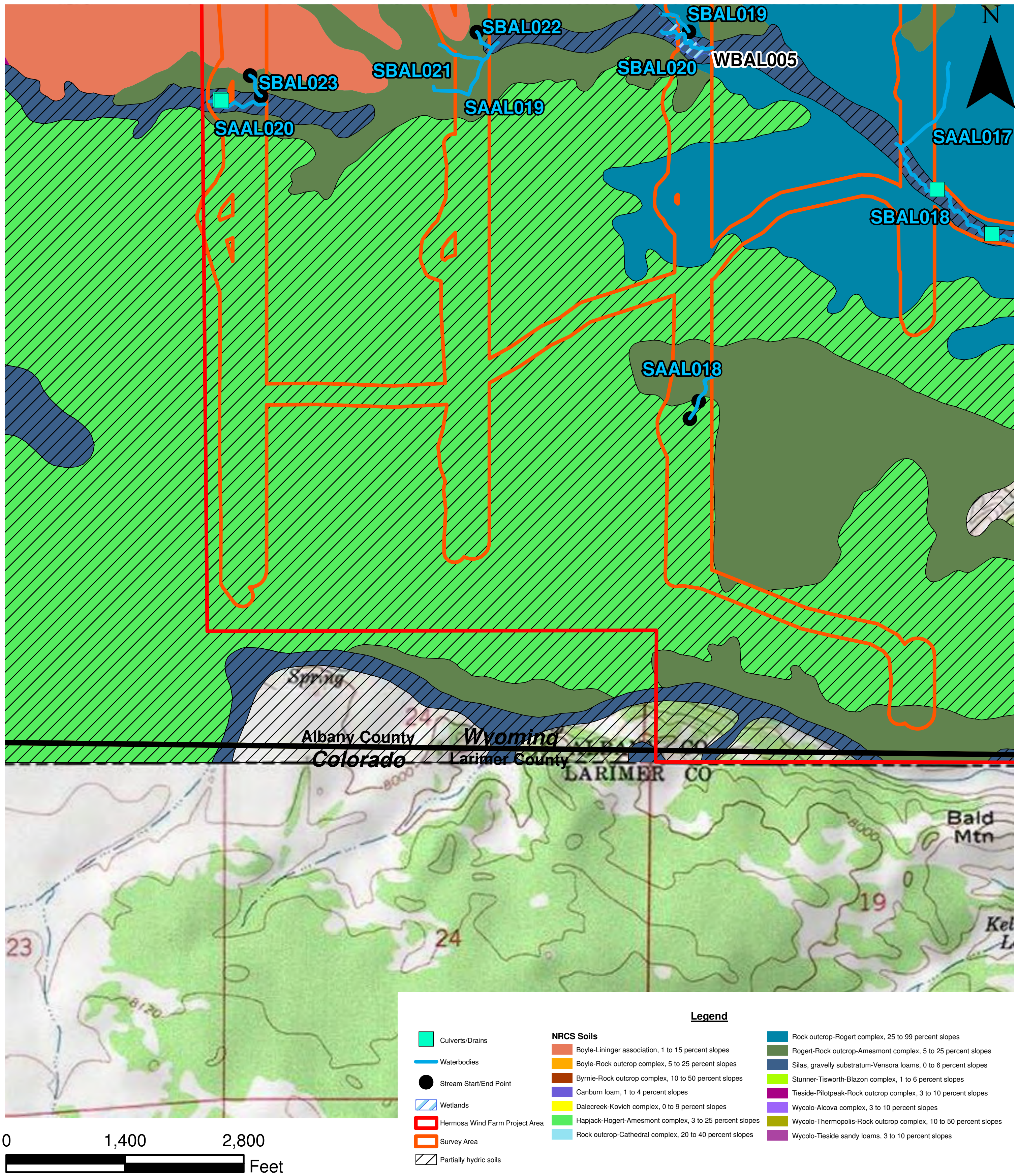

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FIGURE 3-2g
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM

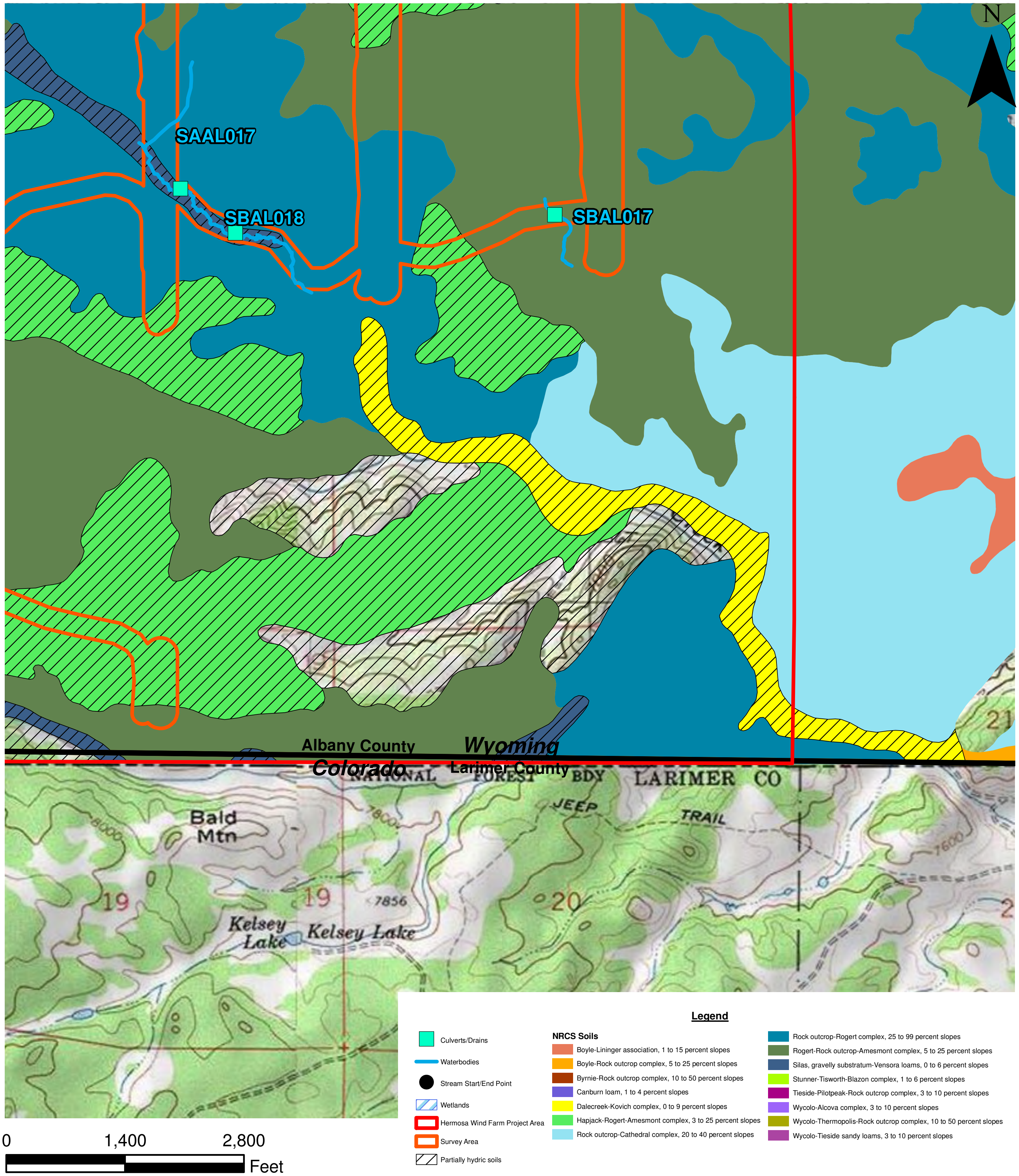

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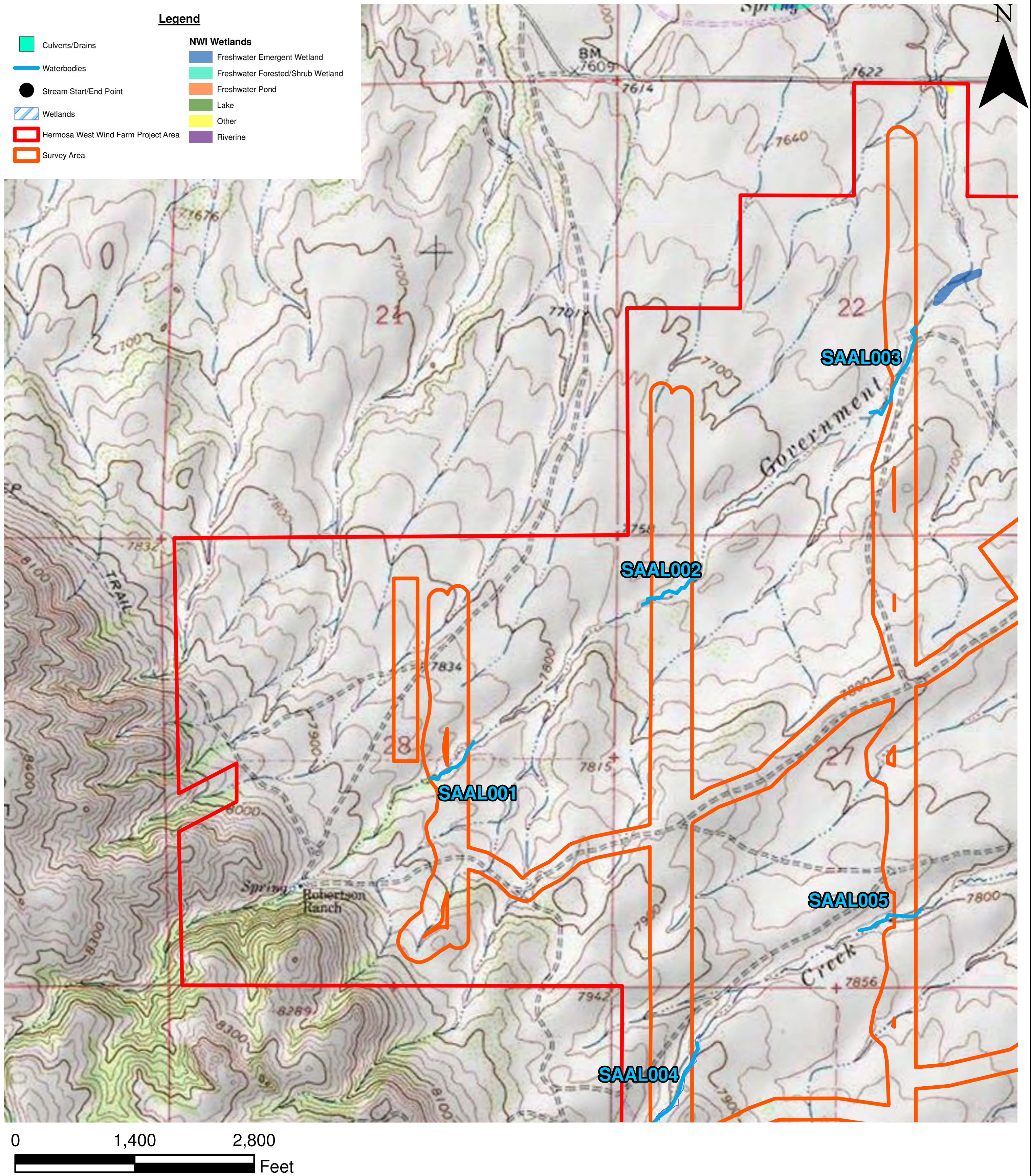
FIGURE 3-2h
SOILS MAP
Shell WindEnergy
Hermosa Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

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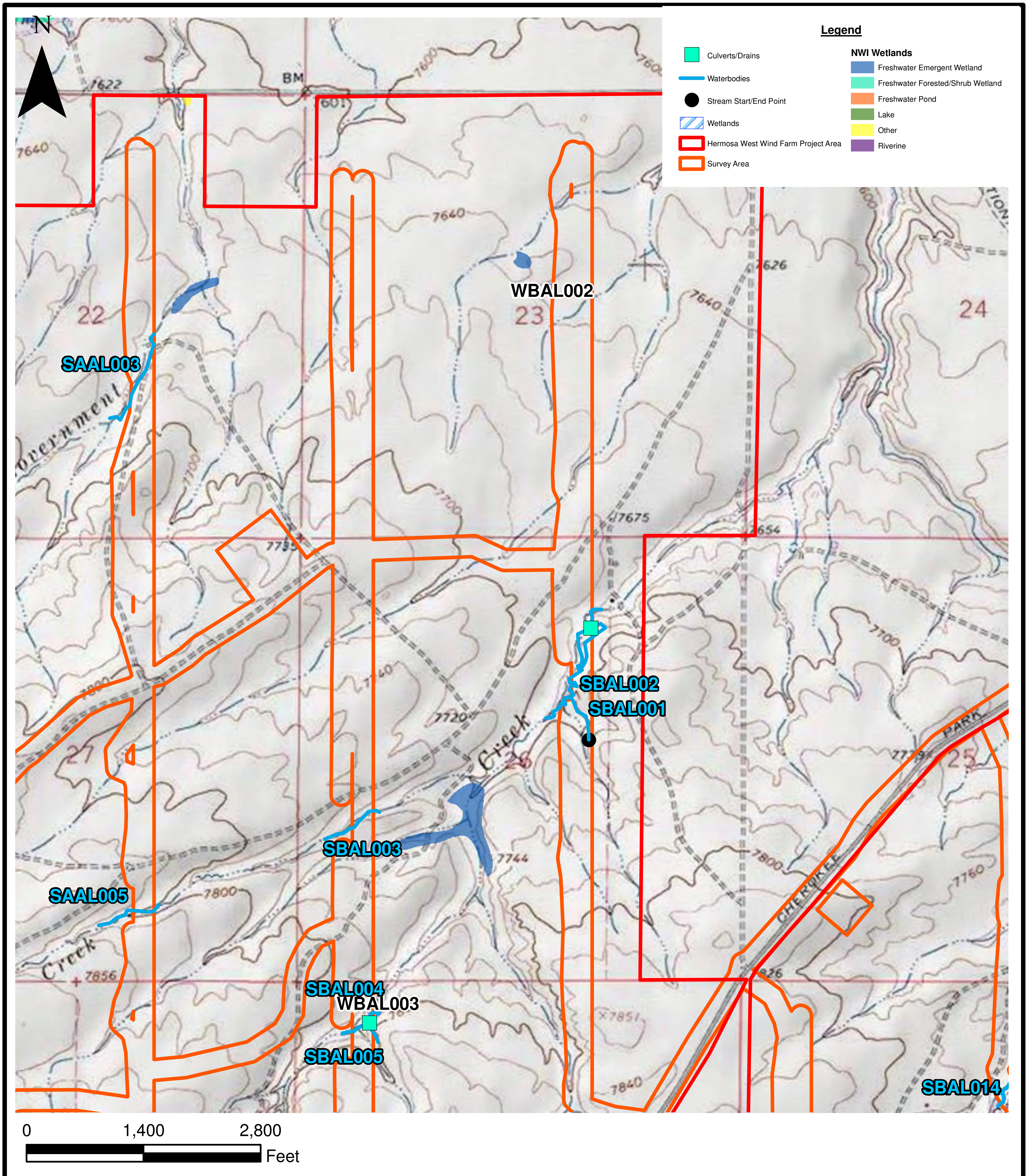
FIGURE 3-3a
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
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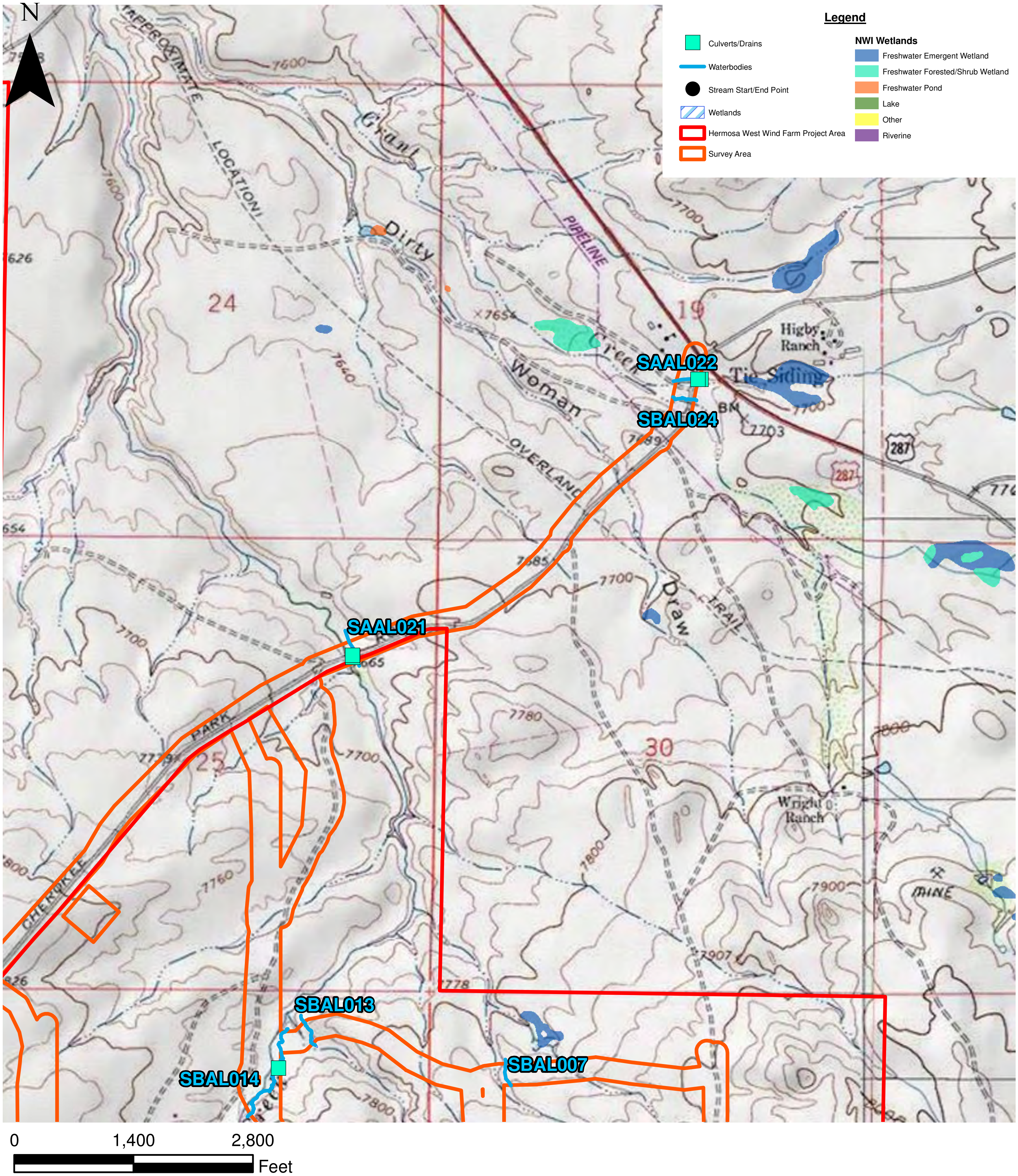
FIGURE 3-3b
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management	FIGURE 3-3c TOPOGRAPHIC MAP WITH NWI WETLANDS Shell WindEnergy Hermosa West Wind Farm Project Albany County, Wyoming	ERM
DESIGN: E Johnson / DRAWN: S King / CHKD.: A Smith		
DATE: 10/02/2009 / SCALE: AS SHOWN / REVISION: 0		
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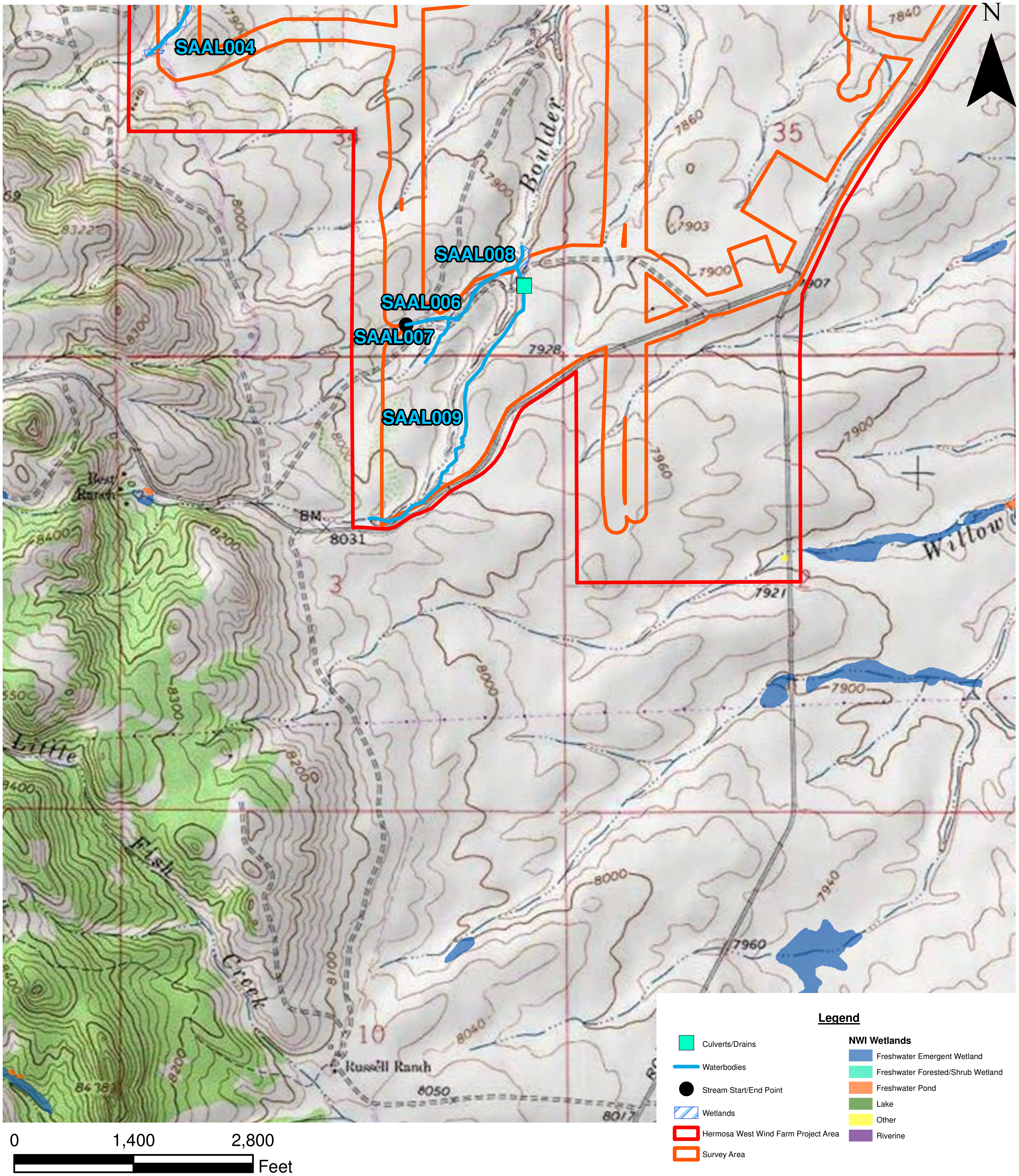

Environmental Resources Management

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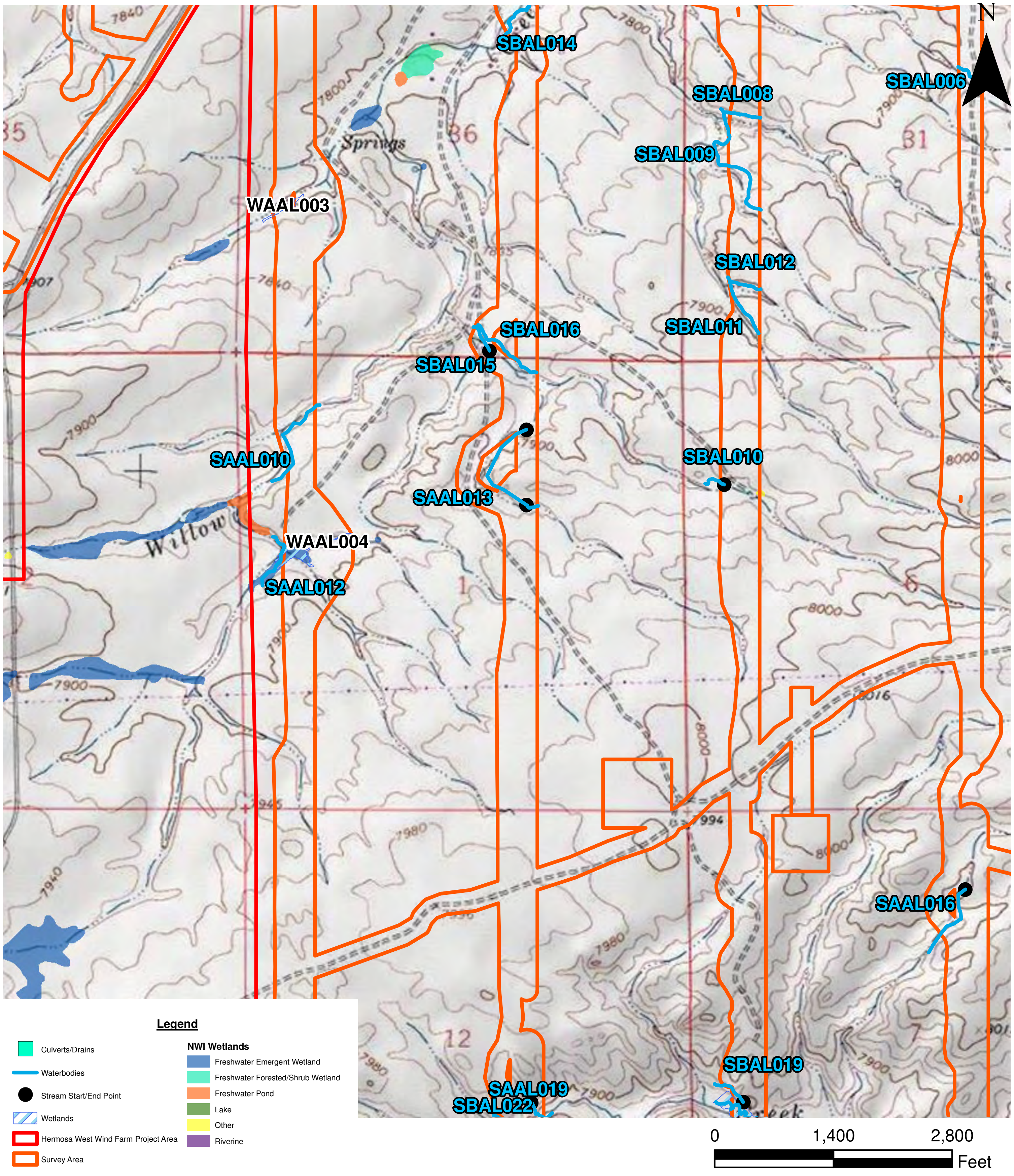
FIGURE 3-3d
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

FIGURE 3-3e
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

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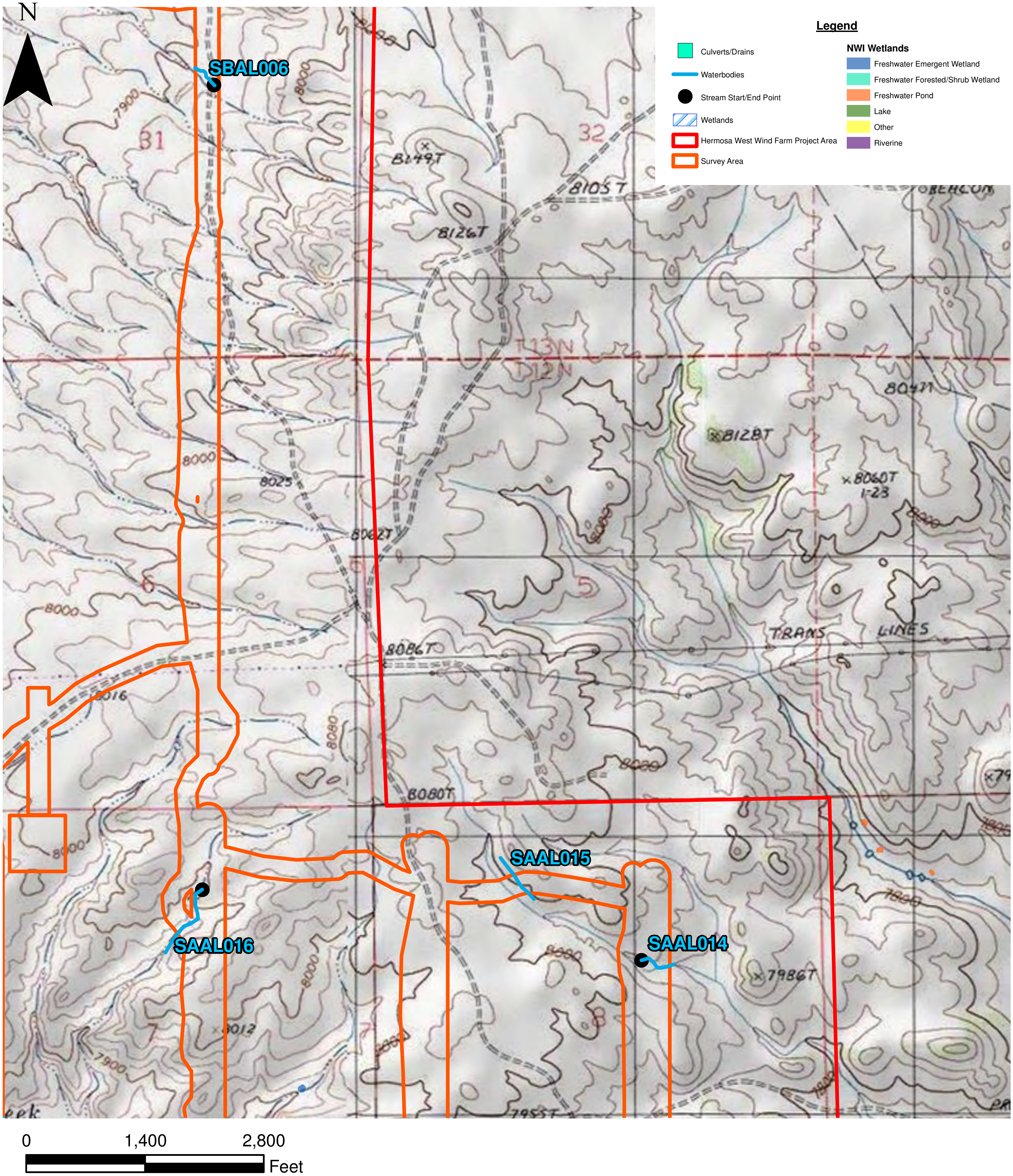

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FIGURE 3-3f
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

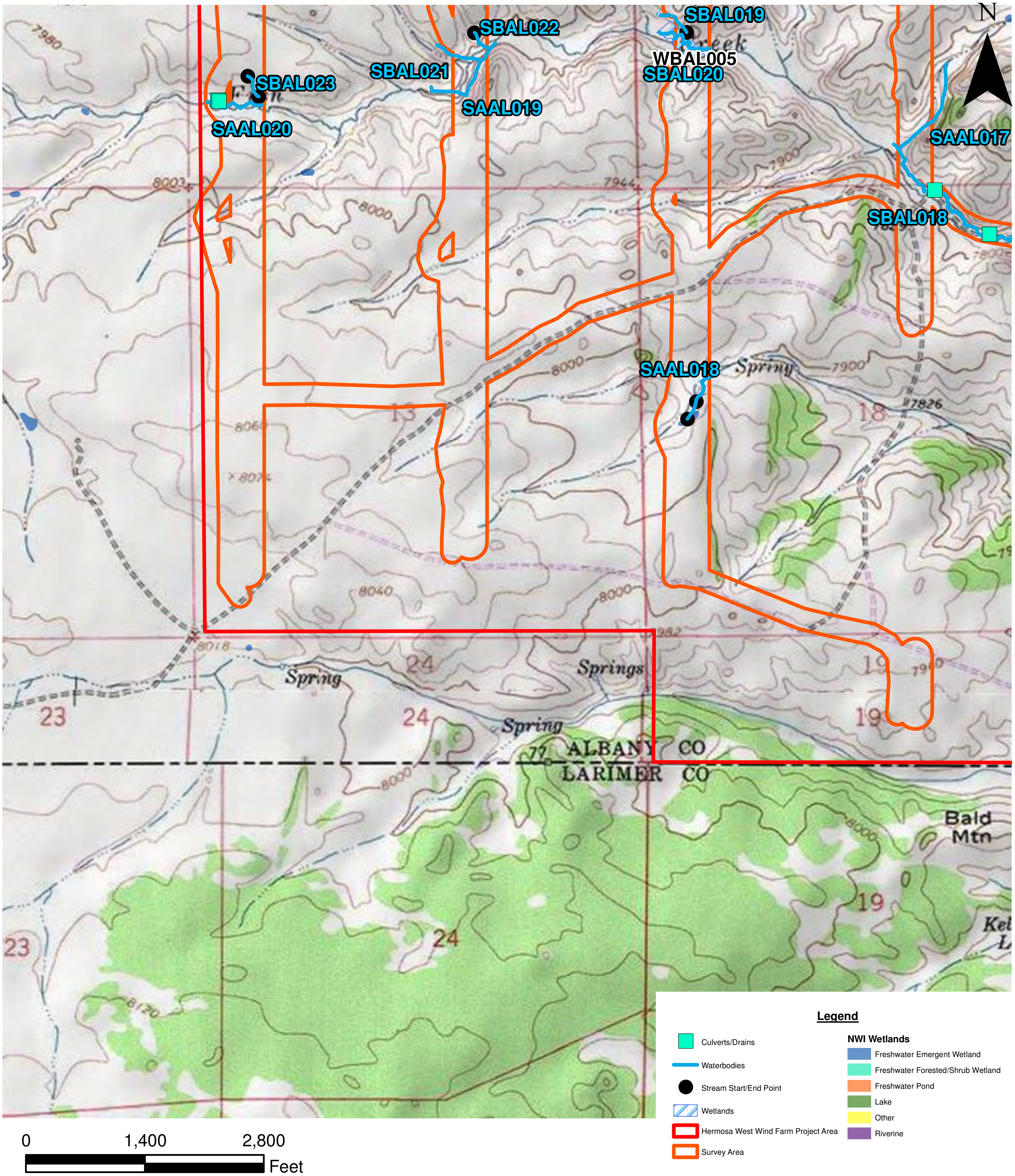

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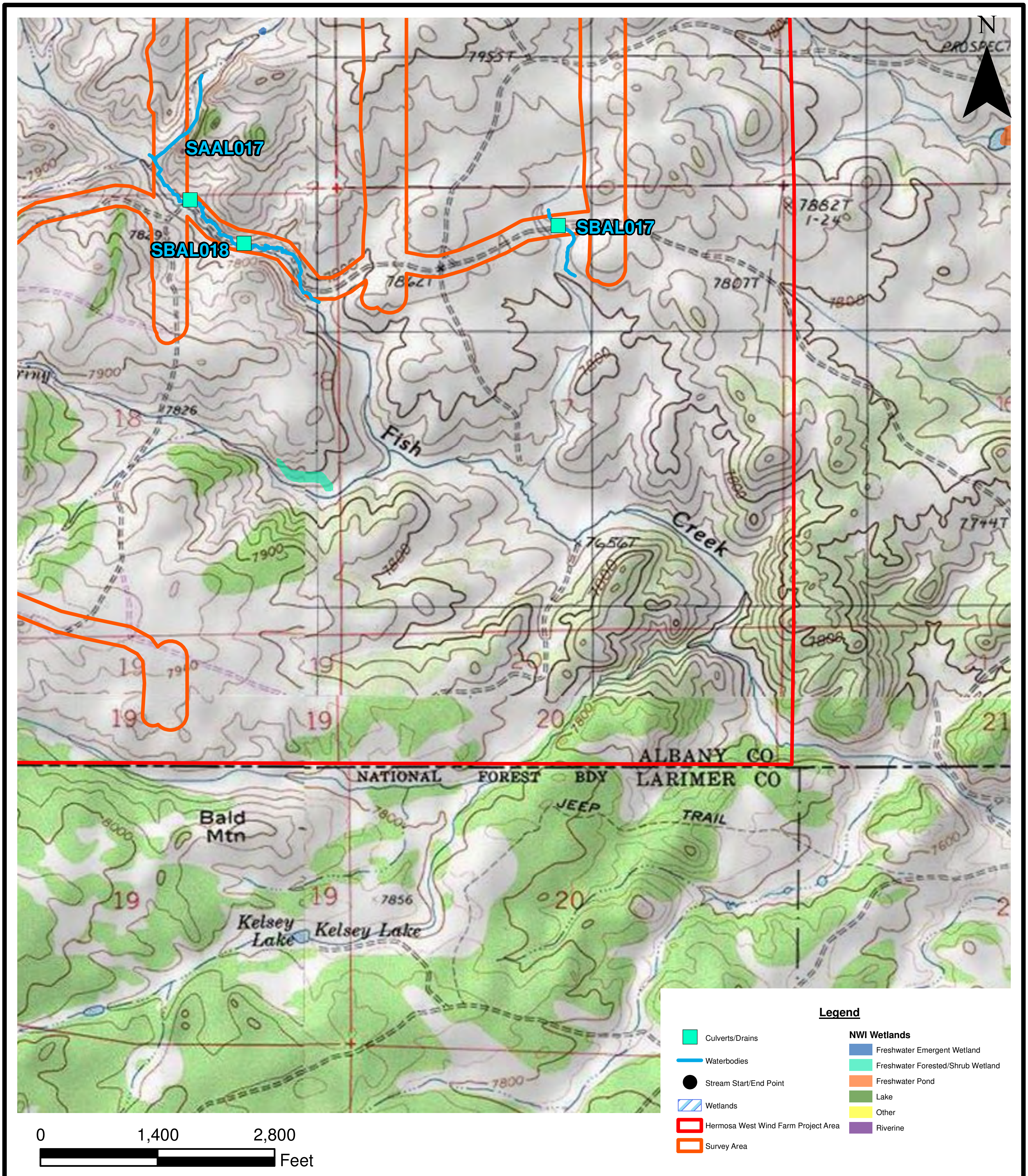
FIGURE 3-3g
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

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FIGURE 3-3h
TOPOGRAPHIC MAP WITH NWI WETLANDS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

Regional Supplemental USACE Wetlands Determination Data Forms, Waterbody Data Sheets, and Transect Map

Appendix A

January 11, 2010
Project No. 0105023

Environmental Resources Management Southwest Inc.
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa City/County: Albany Sampling Date: 8-25-09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WAAL 001

Investigator(s): Clark, Zeisloft Section, Township, Range: ____

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 15%

Subregion (LRR): LLRD Lat: 41.0564 Long: -105.573 Datum: ____

Soil Map Unit Name: Canburn loam 1-4% slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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:

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: 100 sf)			
1. Amaranthus rudis	10	No	
2. Agrostis stolonifera	35	yes	FAC+
3. Phalaris arundinaceae	35	yes	FACW+
4.			
5.			
6.			
7.			
8.			
= Total Cover	80		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

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 Are 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:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ 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:

SOIL

Sampling Point: WAAL001

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
0-6	10YR 3/2	100					muck	sat to surf & ponded

[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.)

- X Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- X 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ 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)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ 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 Soil Present? Yes X No ___

Remarks: Sat to surface & ponded

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) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 0"

Water Table Present? Yes X No ___ Depth (inches): 0"

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 inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-25-09
Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL001U
Investigator(s): CLARK; ZEISLOFT Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): convex Slope (%): 1-2%
Subregion (LRR): LRRD Lat: 41.05[illegible]64 Long: -105.57[illegible]3 Datum: ______
Soil Map Unit Name: Canburn loam 1-4% slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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.

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: 100 SF)			
1. Solidago canadiensis	25	YES	FACU
2. Phleum pratse	30	YES	FACU
3. Phalaris arundinaceae	10	NO	
4.			
5.			
6.			
7.			
8.			
= Total Cover	65		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

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 Are OBL, FACW, or FAC: 0 (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:

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ 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:

SOIL

Sampling Point: WAAC01U

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 %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 5/2	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 C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ 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)
__ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ 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 Soil 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) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): NA

Water Table Present? Yes ____ No X Depth (inches): >12"

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): >12"

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-26-09

Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL002

Investigator(s): CLARK; ZEISLOFT Section, Township, Range: ____

Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): concave Slope (%): 3%

Subregion (LRR): LRR D Lat: 41.04774 Long: -105.56 Datum: ____

Soil Map Unit Name: Cushman loam 1-4% slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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:

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: 100SF)			
1. Agrostis stolonifera	25	YES	FAC+
2. Eleocharis sp	5	YES	OBL
3. Amaranthus tuberculatus	1	NO	FACW+
4. Phalaris arundinacea	1	NO	NI
5. Cyperus esculentus	15	YES	FACW
6. Phleum pratense	5	YES	FACU
7. Aristida oligantha	2	No	NI
8.			
= Total Cover	54		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (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:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ 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:

SOIL

Sampling Point: WAAL-002

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 %	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR3/2	100					f 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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil Present? Yes X No ___

Remarks: some redox (FAINT) @12"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3) 12"
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 12"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa City/County: Albany Sampling Date: WAAL002U

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: 8-26-09

Investigator(s): CLARK; ZEISLOFT Section, Township, Range:

Landform (hillslope, terrace, etc.): Hill Slope Local relief (concave, convex, none): Convex Slope (%): 30%

Subregion (LRR): LRR D Lat: 41.04774 Long: -105.56 Datum:

Soil Map Unit Name: Cowburn loam 8 1-4% slopes NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? NO (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.

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: 100 SF)			
1. Rudbeckia hirta	25	YES	FACU
2. Solidago canadensis	10	YES	FACU
3. Codeaum variegata	1	NO	
4. Circium arvense	16	YES	FACU
5. Salvia olianiaes	1	NO	
6.			
7.			
8.			
= Total Cover	53		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ___ % Cover of Biotic Crust ___

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 Are OBL, FACW, or FAC: 0 (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:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WAAL002U

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 %	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR 4/3	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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

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 inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-26-09

Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL003

Investigator(s): CLARK; ZEISLOFT Section, Township, Range: _____

Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): NONE Slope (%): 2

Subregion (LRR): LLRD Lat: 41.05012 Long: -105.536 Datum: _____

Soil Map Unit Name: Canburn loam 1-4% slopes NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation X, Soil X, or Hydrology X significantly disturbed? Are "Normal Circumstances" present? Yes ____ No X

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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: site severly grazed & compacted; altered by livestock hummocky look from hooves. All vegetation is cropped.

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: 100 SF)			
1. Cyperus esculatus	50	YES	FACW
2. Juncus balticus	20	YES	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	70	= Total Cover	
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

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 Are 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:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ 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:

SOIL

Sampling Point: WAAL003

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 2/1	100					silt loam	
4-16	10YR 3/2	80	7.5YR 6/8	20	D	M	silty 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 C**)
- [ ] 1 cm Muck (A9) (**LRR D**)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Sandy Mucky Mineral (S1)
- [ ] 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)
- [ ] Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (**LRR C**)
- [ ] 2 cm Muck (A10) (**LRR B**)
- [ ] Reduced Vertic (F18)
- [ ] Red Parent Material (TF2)
- [ ] 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 Soil Present? Yes X No ___

Remarks: Redox concentrations on ped faces 4-16"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1) (**Nonriverine**)
- [ ] Sediment Deposits (B2) (**Nonriverine**)
- [ ] Drift Deposits (B3) (**Nonriverine**)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Salt Crust (B11)
- [ ] Biotic Crust (B12)
- [ ] Aquatic Invertebrates (B13)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water Marks (B1) (**Riverine**)
- [ ] Sediment Deposits (B2) (**Riverine**)
- [ ] Drift Deposits (B3) (**Riverine**)
- [x] Drainage Patterns (B10)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): Most @ 16"

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation on day of visit, but site obviously ponds; large deep hoof prints sunk below surface

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-26-09

Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL003U

Investigator(s): CLARK; ZEISLOFT Section, Township, Range:

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): convex Slope (%): 15%

Subregion (LRR): LLRD Lat: 41.05012 Long: -105.536 Datum:

Soil Map Unit Name: Cowburn loam 1-4% slopes NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: 100 sf)			
1. unidentified pea	–	–	–
2. Ambrosia artemisiifolia	20	YES	FACU-
3. Circium arvense	5	YES	FACU
4.			
5.			
6.			
7.			
8.			
= Total Cover	25		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

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 Are OBL, FACW, or FAC: 0 (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:

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ 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: mole mounds - indicative of low water table

SOIL

Sampling Point: WAAL 003U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	7.5YR 3/3	100					gravelly loam	
3-12	7.5YR 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 C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ 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)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ 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 Soil 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) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

Wetland Hydrology Present? Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-26-09

Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL004

Investigator(s): CLARK; ZELSLOFT Section, Township, Range: ______

Landform (hillslope, terrace, etc.): TERRACE Local relief (concave, convex, none): NONE Slope (%): 2%

Subregion (LRR): LLR D Lat: 41.03891 Long: -105.536 Datum: ______

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? NO Are "Normal Circumstances" present? Yes ____ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? NO (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:

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: 100 SF)			
1. Cyperus esculentus	15	YES	OBL
2. Eleocharis sp	5	YES	OBL
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	20		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

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 Are 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:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ 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:

SOIL

Sampling Point: WAAL 004

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
0-9	10YR 3/1	100					muck	

[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.)

X Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
X 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ 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)
__ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ 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 Soil 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) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
X Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ____ Depth (inches): 0-2"
Water Table Present? Yes X No ____ Depth (inches): 0"
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 inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: HERMOSA City/County: ALBANY Sampling Date: 8-26-09

Applicant/Owner: SHELL WIND ENERGY State: WY Sampling Point: WAAL004U

Investigator(s): CLARK, ZEISLOFT Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): convex Slope (%): 20

Subregion (LRR): LLRD Lat: 41.03891 Long: -105.536 Datum: ______

Soil Map Unit Name: Coburn loam 1-4% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? NO (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.

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: 100sf)			
1. Solidago canadensis	2	NO	FACU
2. Stachys palustris ssp pilosa	2	NO	FAC
3. Andropogon gerardii	80	YES	FACU
4.			
5.			
6.			
7.			
8.			
	84	= Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum ___ % Cover of Biotic Crust ___

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 Are OBL, FACW, or FAC: 0 (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:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WAAL004-U

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 %	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5YR3/4						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 C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ 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)
- __ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ 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 Soil 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) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

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 inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/25/09

Applicant/Owner: Shell WindEnergy State: WY Sampling Point: WBAL001

Investigator(s): Erin Johnson, Amanda Zunige Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Concave Slope (%): 1

Subregion (LRR): LRR D Lat: 41.0687 Long: -105.5458 Datum: ______

Soil Map Unit Name: Cenburn loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N 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 ______
Hydric Soil Present?	Yes X	No ______
Wetland Hydrology Present?	Yes X	No ______

Is the Sampled Area within a Wetland? Yes X No ______

Remarks: Associated with stream features SBAL001 and SBAL002

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1. Salix bebbiana	10	Y	FACW
2.			
3.			
4.			
5.			
	______ = Total Cover		
Herb Stratum (Plot size: ______)			
1. Phleum pratense	35	Y	FACU
2. Agrostis stolonifera	35	Y	FAC+
3. Juncus sp.	5		FAC
4. Cyperus esculentus	5		FACW
5. Amaranthus rudis	5		FAC
6.			
7.			
8.			
	85 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

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 Are OBL, FACW, or FAC: 67% (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:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WBALØØ1

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 %	Type[1]	Loc[2]	Texture	Remarks
10	7.5 YR 2.5/2						silt 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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 6 in

Water Table Present? Yes X No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/25/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL001U

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ____

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): none Slope (%): 1

Subregion (LRR): LRR D Lat: 41.0687 Long: -105.5458 Datum: ____

Soil Map Unit Name: Carbon loam 1-4% NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N 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 ____
Hydric Soil Present?	Yes ____	No X
Wetland Hydrology Present?	Yes ____	No X

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1. NA			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ____)			
1. Phleum pratense	40	Y	FACU
2. Distichlis spicata	40	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	80		
Woody Vine Stratum (Plot size: ____)			
1. NA			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 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 Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	40	x 2 = 80
FAC species		x 3 =
FACU species	40	x 4 = 160
UPL species		x 5 =
Column Totals:	80 (A)	240 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- X Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WBAL0010

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 %	Type[1]	Loc[2]	Texture	Remarks
10	5YR 3/3						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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ______

Water Table Present? Yes ___ No ___ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ______

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 010502 3 City/County: Albany Co Sampling Date: 8/25/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL002

Investigator(s): Erin Johnson, Amanda Zunse Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR): LRR D Lat: 41.0824 Long: -105.5461 Datum: ______

Soil Map Unit Name: Canborn loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N Soil Y, or Hydrology N 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 ___ No ___
Hydric Soil Present? problematic	Yes ___ No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:
likely non-jurisdictional
vernal pool-like topography

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
	Ø = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
5.			
	Ø = Total Cover		
Herb Stratum (Plot size: ______)			
1. Hordeum jubatum	30	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	___ = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
	Ø = Total Cover		

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust ______

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 Are 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:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ 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:

SOIL

Sampling Point: WBAL002

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 %	Type[1]	Loc[2]	Texture	Remarks
6	5YR5/6						Coarse 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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- X Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: hard surface

Depth (inches): 6 in

Hydric Soil Present? Yes ___ No ___

Remarks: Red parent soil, saturated, and supporting a significantly different type and pattern of vegetation. Difficult to dig below 6 in. Holds water. Vernal pool-like shape

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): throughout

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co Sampling Date: 8/25/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL002U

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): ______ Slope (%): <1

Subregion (LRR): LRR D Lat: 41.0824 Long: -105.576 Datum: ______

Soil Map Unit Name: Canburn loam 1-4%. NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil Y, or Hydrology N 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 ___	Is the Sampled Area within a Wetland?	Yes ___ No X
Hydric Soil Present?	Yes ___ No ___		
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: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1. Unknown grass	80	Y	
2.			
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	80		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (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:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ 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 ___

Remarks:

SOIL

Sampling Point: W BAL ØØ2 U

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 %	Type[1]	Loc[2]	Texture	Remarks
6	5 YR 5/6						fine, silty sand	

[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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- X Red Parent Material (TF2)
- ___ 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 Soil Present? Yes ______ 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ______ Depth (inches): ______

Water Table Present? Yes ______ No ______ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ______ No ______ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/25/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WDAL003

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR): LRR D Lat: 41.0585 Long: -105.5540 Datum: ______

Soil Map Unit Name: Carbon loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N 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: Associated with stream features SBAL004 and SBAL005

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1. Agrostis stolonifera	30	Y	FAC+
2. Phleum pratense	25	Y	FACU
3. Juncus sp.	15	Y	FAC
4. Miscellaneous species	<10% ea		
5.			
6.			
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
= Total Cover			

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust ______

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 Are 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:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WBAL003

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 %	Type[1]	Loc[2]	Texture	Remarks
10	7.5YR 2.5/2		7.5YR 3/4	20	RM	M	loamy,	faint mottling

[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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No _____ Depth (inches): surface

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes X No _____ Depth (inches): throughout

Wetland Hydrology Present? Yes X No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/26/09

Applicant/Owner: Shell WindEnergy State: WY Sampling Point: WBA L004

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ____

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 4

Subregion (LRR): LRR D Lat: 41.0585 Long: -105.5239 Datum: ____

Soil Map Unit Name: Cenbum loam 1-4% NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N 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:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1. NA			
2.			
3.			
4.			
	Ø	= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1. Salix bebbiana	10	Y	FACW
2.			
3.			
4.			
5.			
	10	= Total Cover	
Herb Stratum (Plot size: ____)			
1. Phalaris arundinacea	80	Y	FACW
2. Phleum pratense	<5	N	FACU
3. Juncus sp.	<5	N	FAC
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	Ø	= Total Cover	

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust ____

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 Are 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:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ 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:

SOIL

Sampling Point: WBAL004

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
1	10YR 3/2		10YR 5/6	5			fine sandy loam	
6-12	7.5YR 3/2		7.5YR 4/6	10	D	M	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 C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 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)
___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ 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 Soil 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) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 1 inch
Water Table Present? Yes ___ No ___ Depth (inches): ___
Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/26/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL004U

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): ______ Slope (%): 4

Subregion (LRR): LRR D Lat: 41.0585 Long: -105.5239 Datum: ______

Soil Map Unit Name: Cambum loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N 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 ______
Hydric Soil Present?	Yes X	No ______
Wetland Hydrology Present?	Yes ______	No X

Is the Sampled Area within a Wetland? Yes ______ No X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
= Total Cover	Ø		
Sapling/Shrub Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
5.			
= Total Cover	Ø		
Herb Stratum (Plot size: ______)			
1. Phalaris arundinacea	95	Y	FACW
2. Phleum pratense	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
= Total Cover	100		
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
= Total Cover	Ø		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

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 Are 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:

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ 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:

SOIL

Sampling Point: WBAL004U

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 %	Type[1]	Loc[2]	Texture	Remarks
6	7.5YR 2.5/1	100					Sandy, silty 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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil Present? Yes X 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co Sampling Date: 8/27/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL005

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Concave Slope (%): 18

Subregion (LRR): LRR D Lat: 41.0210 Long: -105.5163 Datum: ______

Soil Map Unit Name: Carbon loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N 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 ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
= Total Cover	Ø		
Sapling/Shrub Stratum (Plot size: ______)			
1. Salix bebbiana	5	Y	FACW
2.			
3.			
4.			
5.			
= Total Cover	5		
Herb Stratum (Plot size: ______)			
1. Phleum pratense	40	Y	FACU
2. Agrostis stolonifera	20	Y	FAC+
3. Carex nebrascensis	25	Y	OBL
4. Deschampsia cespitosa	5		FACW
5. unidentified red plumed herb	<2		
6. miscellaneous	~3		
7.			
8.			
= Total Cover	95		
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
= Total Cover	Ø		

% Bare Ground in Herb Stratum Ø % Cover of Biotic Crust ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (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:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ 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:

SOIL

Sampling Point: WBAL~~00~~5

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
6	7.5YR 3/1		7.5YR 3/4		D	PL, M	silty 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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ______

Water Table Present? Yes ___ No ___ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ______

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Hermosa 0105023 City/County: Albany Co. Sampling Date: 8/27/09

Applicant/Owner: Shell Wind Energy State: WY Sampling Point: WBAL005U

Investigator(s): Erin Johnson, Amanda Zuniga Section, Township, Range: ______

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Concave Slope (%): 10

Subregion (LRR): LRR D Lat: 41.0210 Long: -105.5163 Datum: ______

Soil Map Unit Name: Canburn loam 1-4% NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N 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 ___	Is the Sampled Area within a Wetland?	Yes ___ No X
Hydric Soil Present?	Yes X	No ___		
Wetland Hydrology Present?	Yes ___	No X		

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. NA			
2.			
3.			
4.			
= Total Cover	Ø		
Sapling/Shrub Stratum (Plot size: ______)			
1. NA			
2.			
3.			
4.			
5.			
= Total Cover	Ø		
Herb Stratum (Plot size: ______)			
1. Artemisia arbuscula	50	Y	NO
2. Aster	30	Y	NO
3. Distichlis spicata	20	Y	FACW
4.			
5.			
6.			
7.			
8.			
= Total Cover			
Woody Vine Stratum (Plot size: ______)			
1. NA			
2.			
= Total Cover	Ø		

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

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 Are OBL, FACW, or FAC: 33 (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:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ 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:

SOIL

Sampling Point: WBAL005U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
6	7.5YR 3/2							

[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 C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 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)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ 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 Soil 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) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: SAAL 001 Government Creek   Waterbody ID No.: SAAL 001

Centerline   Re-Route   Access Road   Warehouse Site   Other:

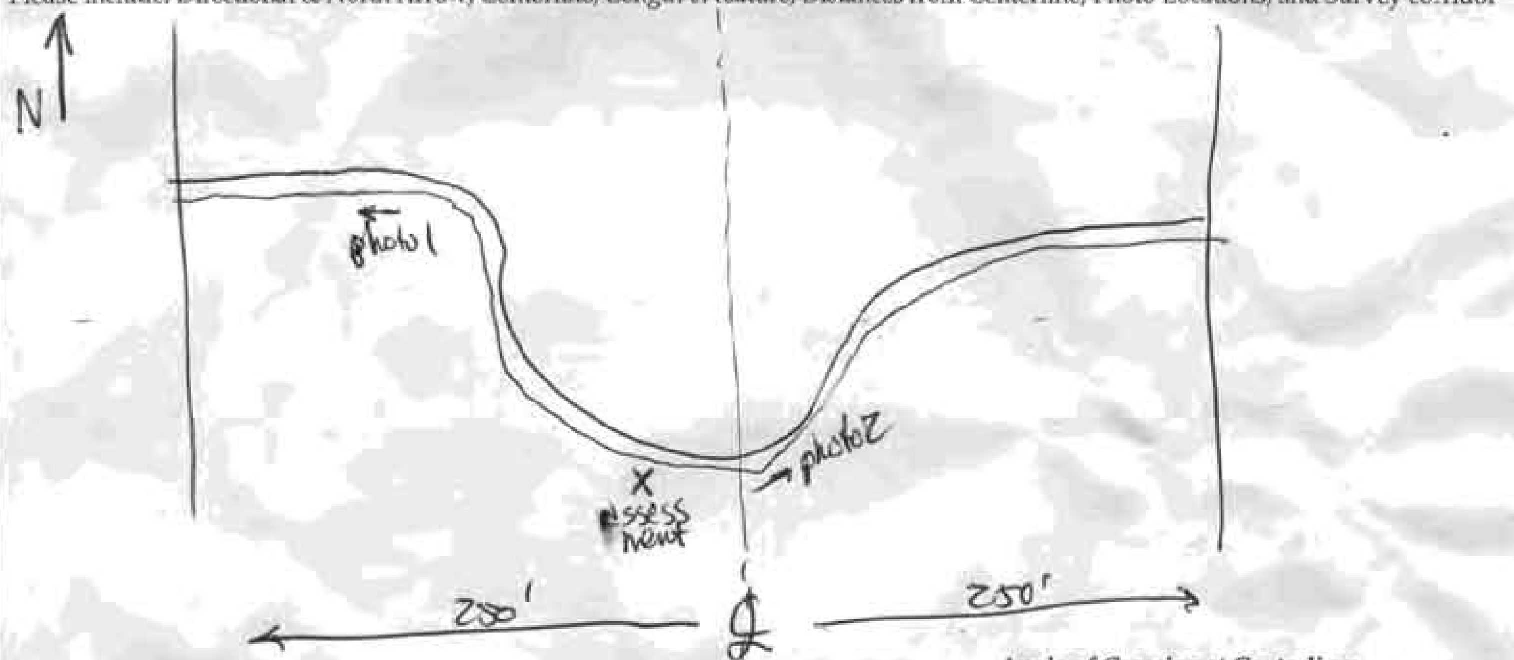
Associated Wetland No.:

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY
Milepost: HERMOSA	
Investigators: CLARK; ZEISLOFT	Quad Name:
State/County/Municipality: WY / ALBANY	Picture No.: ~~19,20~~ A11, A12

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: [illegible]	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E/NE Months of estimated flow: 6-8	
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris

Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	~~3-6~~	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 15'				Water Surface (at crossing location): 3'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL 001

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY - HERMOSA	Milepost:			
QUALITATIVE ATTRIBUTES					
Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 30%	Sand 10%	Silt/Clay 60%	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 10%	In-stream submerged plants % Cover____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 2-3' (ft)				
	Circle vegetative layers: trees shrubs herbs				
	❑ Significant bare areas within riparian zone		❑ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		❑ Manure in stream or on banks		
	❑ Waste discharge pipes present		❑ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	❑ High	☒ Moderate	■ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

Waterbody Name: Government Creek   Waterbody ID No.: SAAL002

Centerline   Re-Route   Access Road   Warehouse Site   Other:

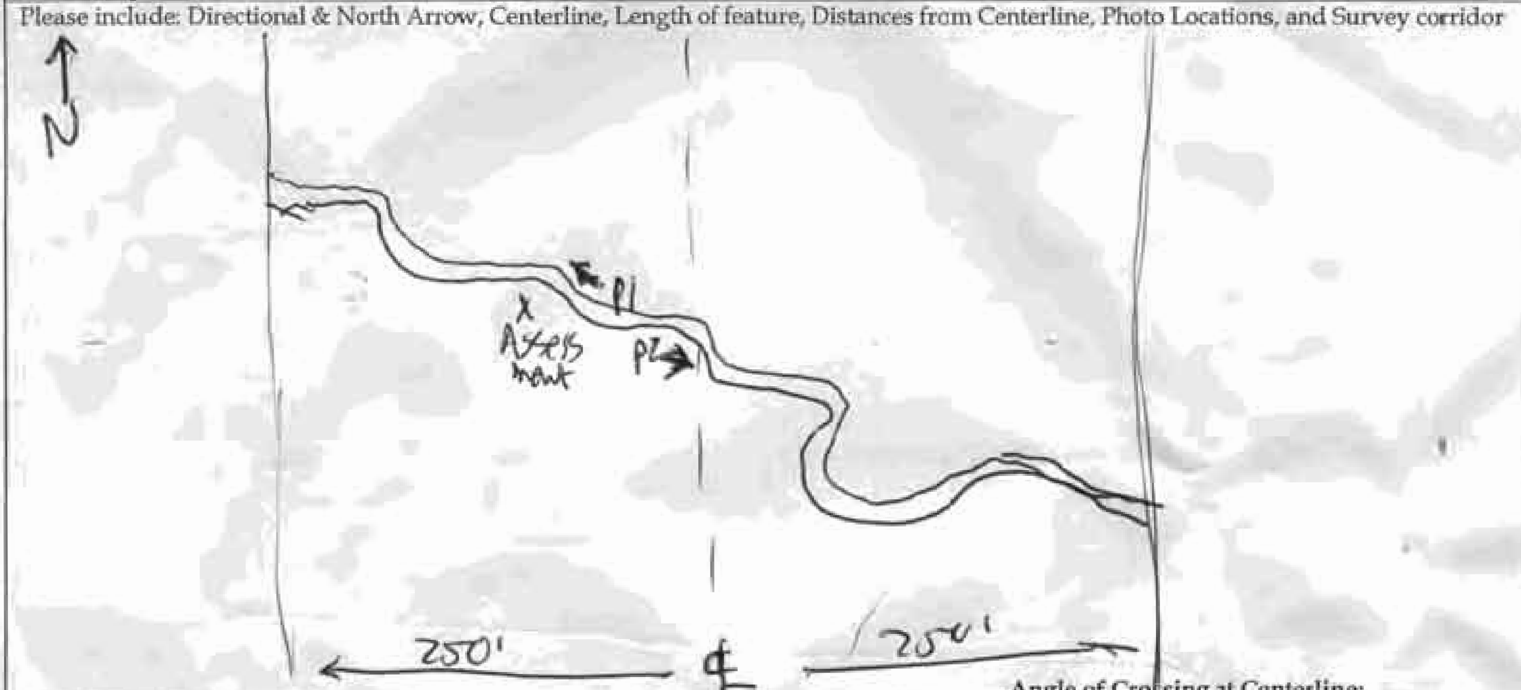
Associated Wetland No.:

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY
Milepost: HERMOSA	
Investigators: CLARK; ZEISLOFT	Quad Name:
State/County/Municipality:: WY / ALBANY	Picture No.: ~~30-31~~ A21 A22

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate		Slow		Very Slow / None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E/NE Months of estimated flow: 6

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering	Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 15'			Water Surface (at crossing location): 4'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SAAL 002

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY / HERMOSA	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100%	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover 80	Bank root systems	Fringing Wetlands observed upstream off project
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ____ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☐ Moderate	☒ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Government Creek   Waterbody ID No.: SAAL 003

Centerline   Re-Route   Access Road   Warehouse Site   Other:

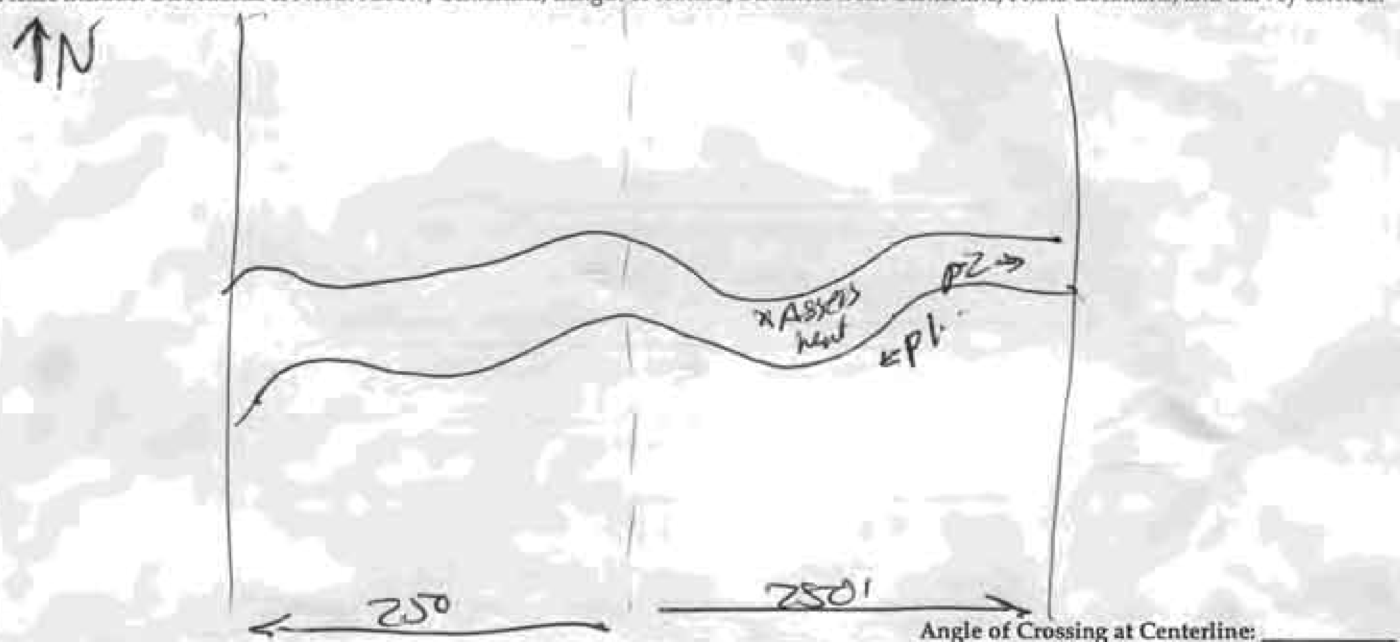
Associated Wetland No.:

Date: 8-25-09	Client/Project Name & No.: SHELL WIND FARM	Milepost: Hermosa
Investigators: CLARK / ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: A25 A26

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 2-3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 30'				Water Surface (at crossing location): 10'				

Bank Height (ft.) (looking downstream else give direction you are facing here: ______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here: ______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL003

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY HERMOSA				Milepost:
QUALITATIVE ATTRIBUTES					
Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100%	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 100	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 0 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☒ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: FOREST CREEK Waterbody ID No.: SAAL-007

Centerline Re-Route Access Road Warehouse Site Other:

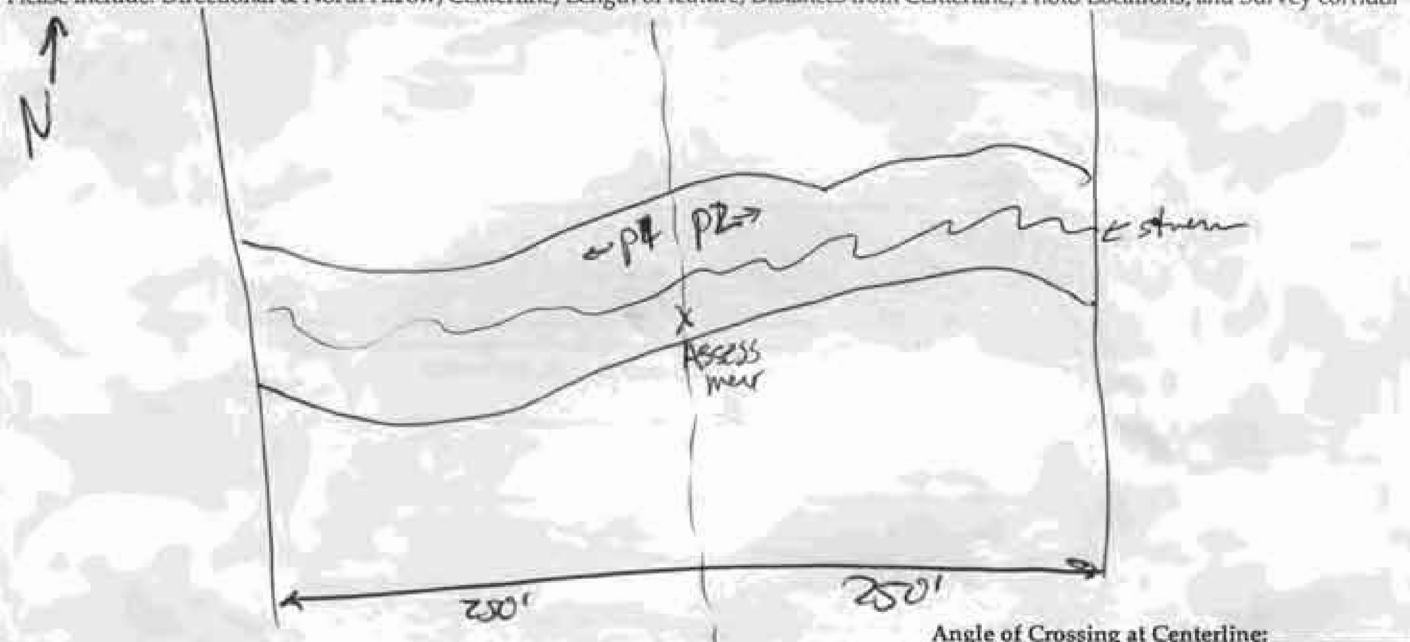
Associated Wetland No.: WAAL 001

Date: 8-25-09 / Client/Project Name & No.: SHELL WIND ENERGY	Milepost: Armore
Investigators: CLARK; ZEISLOFT	Quad Name:
State/County/Municipality: WY/ALBANY	Picture No.: A33 A34

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: ______ Months of estimated flow: ______		
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change				Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 40'				Water Surface (at crossing location): 12'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

Waterbody ID No.: SAAL 004

ERM.

Date: 8-25-09	Client/Project Name & No.: SHELL WIND ENERGY - HERMOSA			Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery, any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: FOREST CREEK **Waterbody ID No.:** SAAL005

(Centerline) Re-Route Access Road Warehouse Site Other:

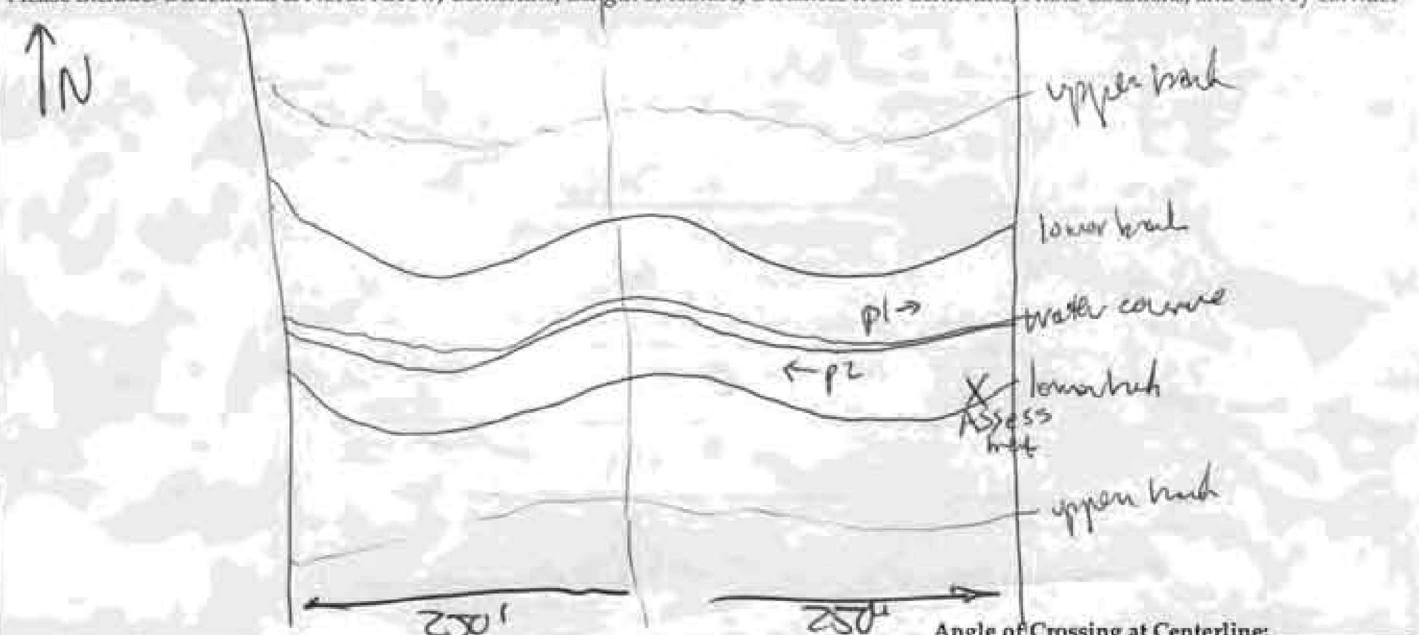
Associated Wetland No.:

Date: 8-26-09 **Client/Project Name & No.:** SHELL WIND ENERGY	**Milepost:** HERMOSA
Investigators: CLARK; ZEISLOFT	**Quad Name:**
State/County/Municipality: WY / ALBANY	**Picture No.:** A38 A39

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline:

Waterbody Type	Lake	Pond	Borrow Pit	River	(Stream)	Ag. Ditch	Other: dry wash	
Stream Flow	Fast		Moderate		~~Slow~~		Very Slow	(None)
Flow type	Perennial (Flows > 3 months annually)		(Intermittent)/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 2-3	

OHWM Indicator	Clear natural line on bank	(Shelving)	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		(Meandering)		**Subsurface Flow?**		Yes	(No)	Unknown
Stream Depth (in.)	(0-3)	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location):				Water Surface (at crossing location):				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	(2-4)	4-6	6-8	8+
	Right	0-2	(2-4)	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	(40-60)	60-80	80+
	Right	0-20	20-40	(40-60)	60-80	80+

ERM.

Waterbody ID No.: SAAL005

Date: 8-26-09	Client/Project Name & No.: Shell Niwo Energy	Milepost: Harmosa

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel______	Sand 60	Silt/Clay 40	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 60	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Upper bank much higher

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: BOULDER CREEK

Waterbody ID No.: SAAL006

Centerline Re-Route Access Road Warehouse Site Other:

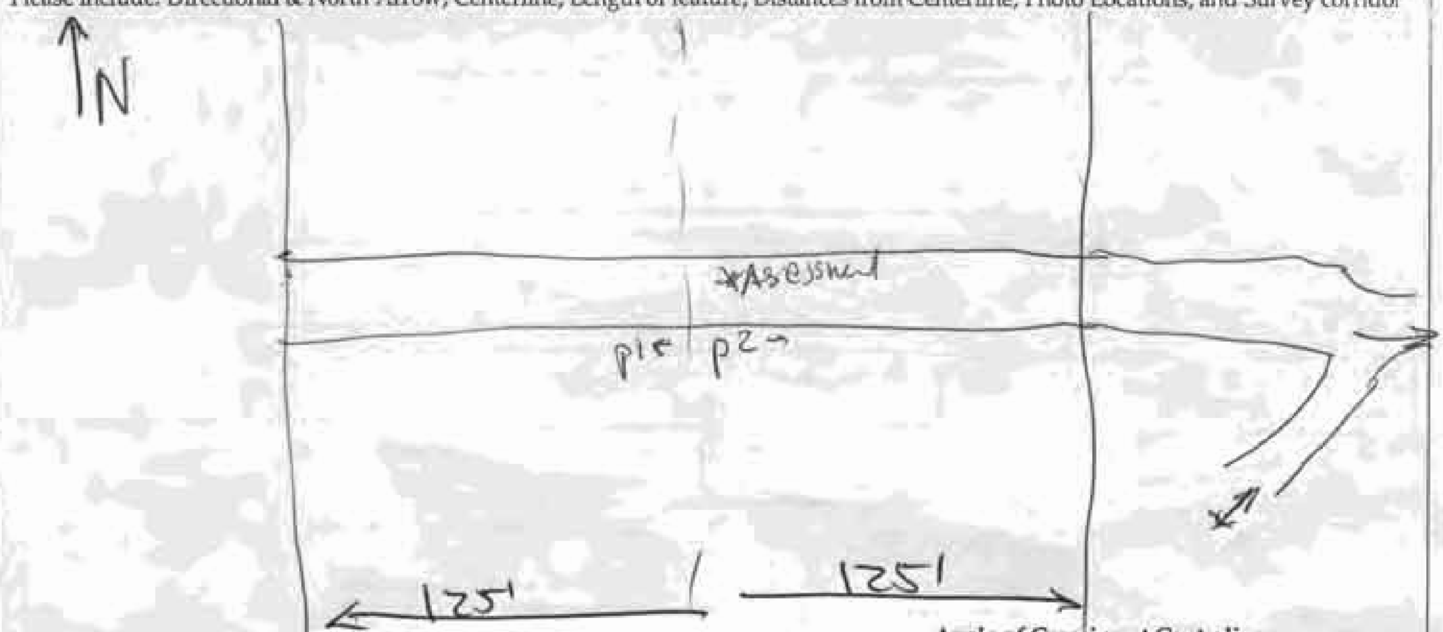
Associated Wetland No.:

Date: 8-26-09	Client/Project Name & No.: SHELL WINDENERGY	Milepost: HERMOSA
Investigators: CLARK ; ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: 450 451

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 2-3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location): 5'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL006

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY			Milepost: HERMAN

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 35	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: — (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes, no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
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Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: BOULDER CREEK **Waterbody ID No.:** SAAL007

Centerline Re-Route Access Road Warehouse Site Other:

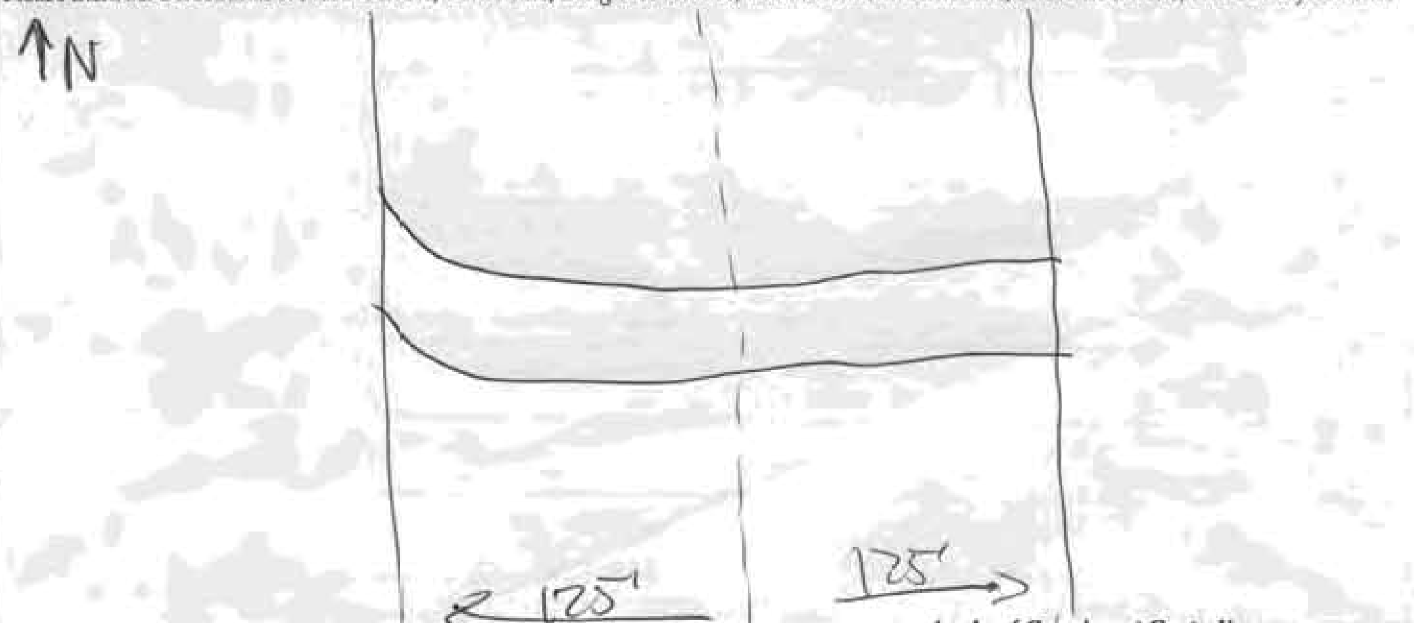
Associated Wetland No.:

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY	Milepost: HERMOSA
Investigators: CLARK & ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: A52 A53

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: ______ Months of estimated flow: 2-3	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining	
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris	

Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 15'				Water Surface (at crossing location): 2'				

Bank Height (ft.) (looking downstream else give direction you are facing here: ______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here: ______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL 007

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY			Milepost: HERMOSA	
QUALITATIVE ATTRIBUTES					
Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand 50	Silt/Clay 50	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 25	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ______ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:______		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
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Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: BOULDER CREEK   Waterbody ID No.: SAAL 008

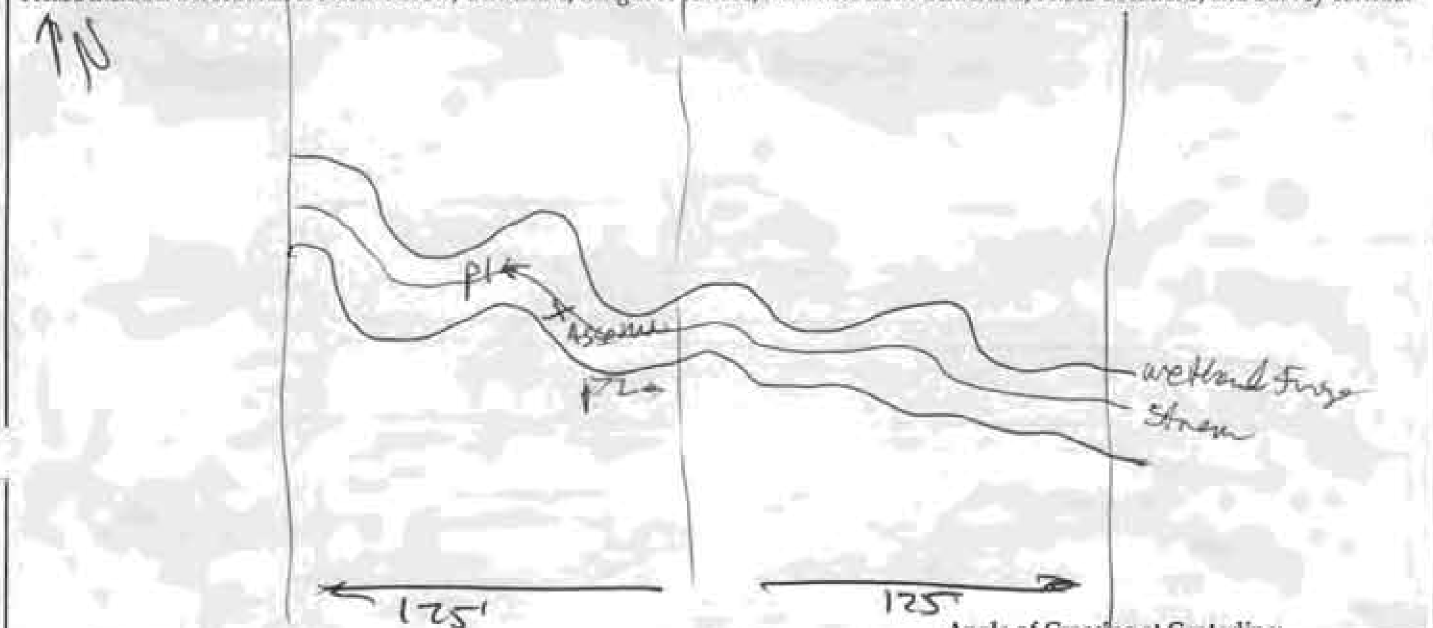
Centerline Re-Route Access Road Warehouse Site Other: Associated Wetland No.: WAAL 002

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY	Milepost: HERMOSA
Investigators: CLARK; ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: A57 A58

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 2-3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2'				Water Surface (at crossing location): 2'				
Bank Height (ft.) (looking downstream else give direction you are facing here: ______)	Left	0-2	2-4		4-6		6-8		8+
	Right	0-2	2-4		4-6		6-8		8+
Bank Slope (°) (looking downstream else give direction you are facing here: ______)	Left	0-20	20-40		40-60		60-80		80+
	Right	0-20	20-40		40-60		60-80		80+

ERM.

Waterbody ID No.: SAAL008

Date: 8-26-09	Client/Project Name & No.: SHELL	Milepost: ALEMOSA

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel______	Sand______	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover _____	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: _________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:_______		

T/E SPECIES / SUITABLE HABITAT

Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: tributary of Boulder Creek   Waterbody ID No.: SAAL 009

Centerline   Re-Route   Access Road   Warehouse Site   Other:

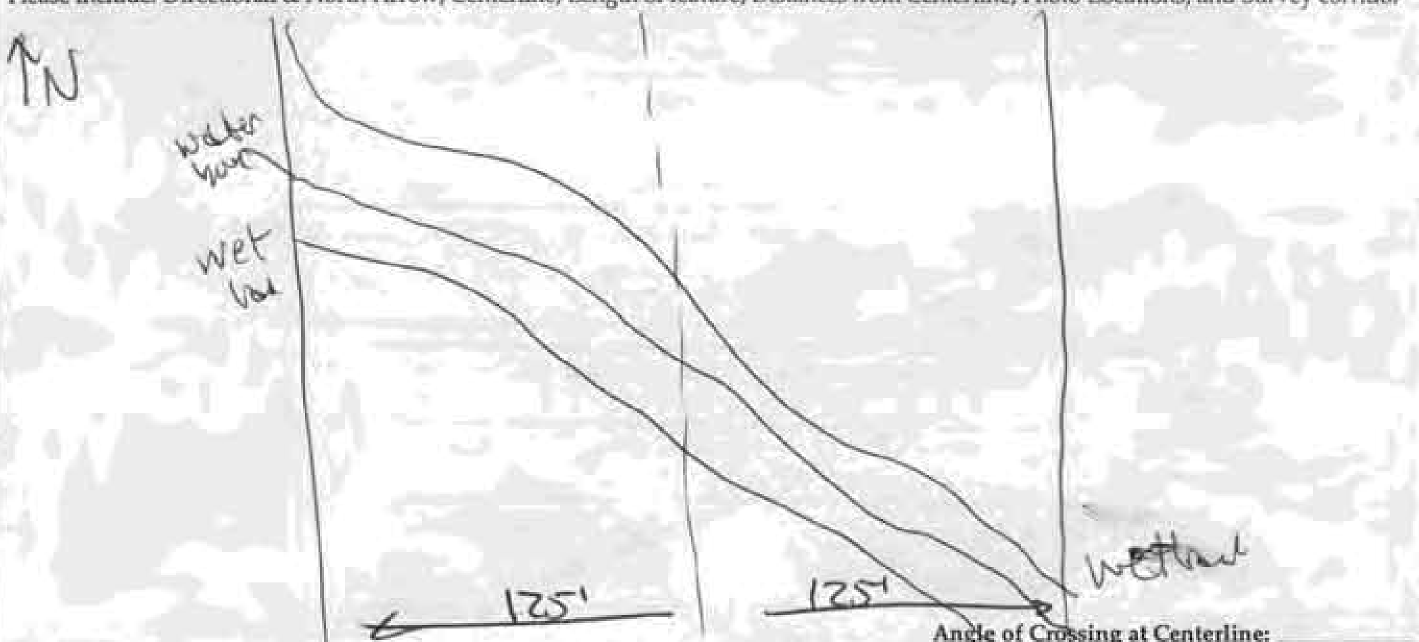
Associated Wetland No.: WAAL 002

Date: 8-26-09	Client/Project Name & No.: Shell Wind Energy
Milepost: HERMOSA	
Investigators: CLARK / ZEISLOFT	Quad Name:
State/County/Municipality:: Wy / ALBANY	Picture No.: A59 A60

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast	Moderate	Slow	Very Slow	None		
Flow type	Perennial (Flows > 3 months annually)	Intermittent/Seasonal (Flows <3 months annually)	Ephemeral (Flows only in response to rainfall)	Direction: ______ Months of estimated flow: 2-3			

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change	Wrack line	Litter and debris	

Sinuosity	Straight	Meandering	Subsurface Flow?	Yes	No	Unknown		
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 1'			Water Surface (at crossing location): 2'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

Waterbody ID No.: SAAL009 ~~WAAL~~

ERM.

Date: 08-26-09	Client/Project Name & No.: SHELL WIND ENERGY			Milepost: Arrowsa
QUALITATIVE ATTRIBUTES				

Water Appearance N/A	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 10	Sand 50	Silt/Clay 40	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 25	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms; construction constraints; erosion potential; existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery, any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Wit-- Creek Waterbody ID No.: SAAL 010

Centerline Re-Route Access Road Warehouse Site Other:

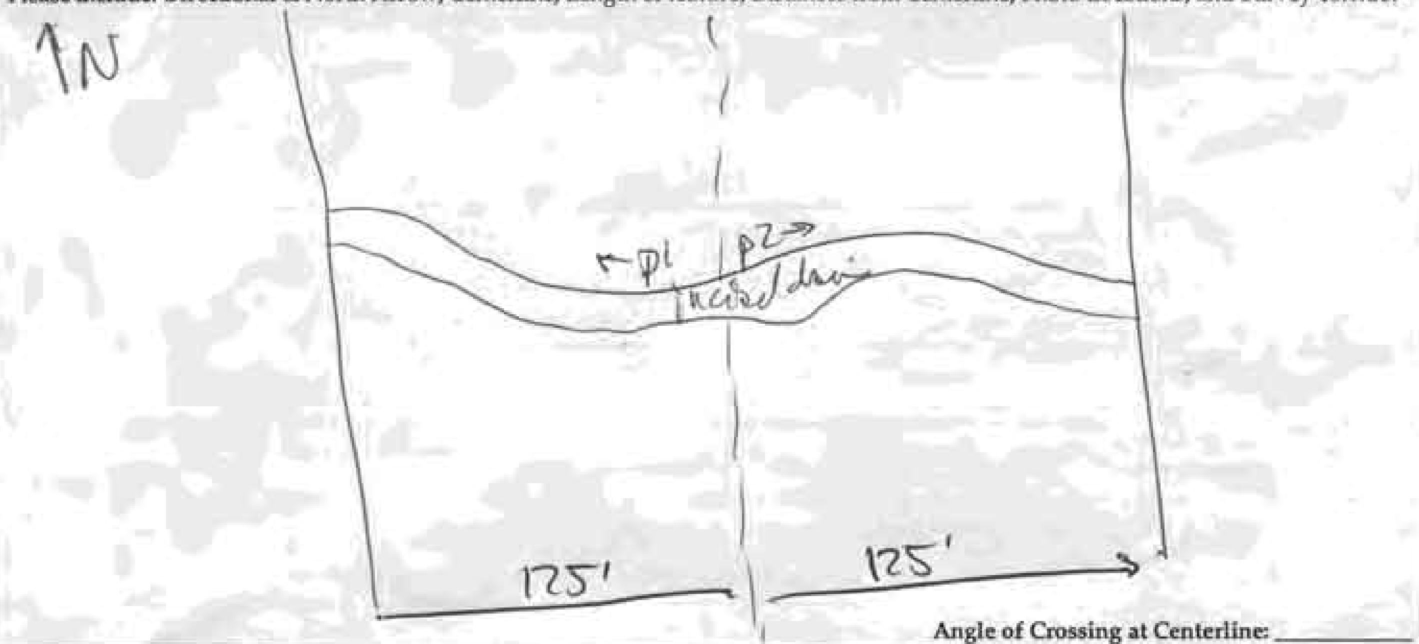
Associated Wetland No.: —

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY
Milepost: HERMOSA	
Investigators: CLARK ; ZEISLOFT	Quad Name:
State/County/Municipality:: WY / ALBANY	Picture No.: A70 A71

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 12		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change				Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2'				Water Surface (at crossing location): 2'				
Bank Height (ft.) (looking downstream else give direction you are facing here:____)	Left	0-2	2-4		4-6		6-8		8+
	Right	0-2	2-4		4-6		6-8		8+
Bank Slope (°) (looking downstream else give direction you are facing here:____)	Left	0-20	20-40		40-60		60-80		80+
	Right	0-20	20-40		40-60		60-80		80+

ERM.

Waterbody ID No.: SAAL ~~008~~ 010

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY			Milepost: Hermaid

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand 30	Silt/Clay 70	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 70	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown

Waterbody ID No.: SAAL011

Centerline Re-Route Access Road Warehouse Site Other:

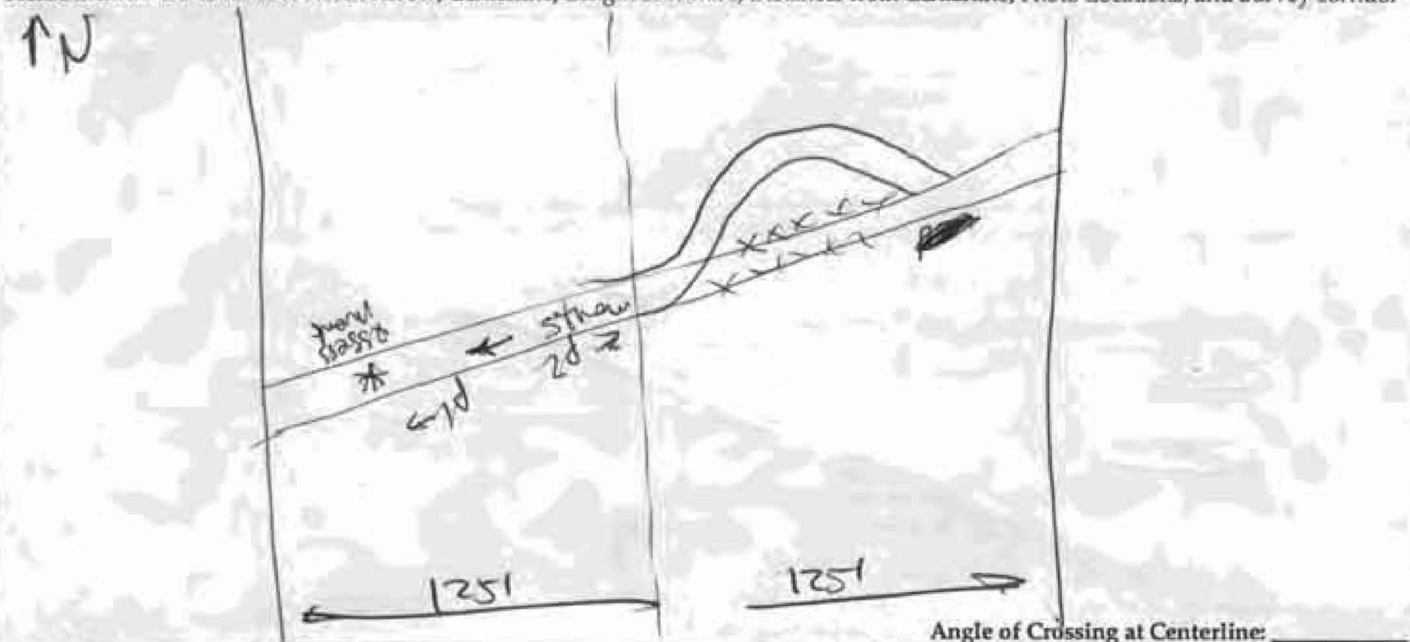
Associated Wetland No.: WAAL004

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY	Milepost: HERMOSA
Investigators: CLARK; ZEISLOFT		Quad Name:
State/County/Municipality::		Picture No.: A72 A73

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: ________ Months of estimated flow: 2-3 wk	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 12'				Water Surface (at crossing location): 5'			
Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4		4-6		6-8	8+
	Right	0-2	2-4		4-6		6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40		40-60		60-80	80+
	Right	0-20	~~20-40~~		40-60		60-80	80+

ERM.

Waterbody ID No.: SAAL011

Date: 8-26-09	Client/Project Name & No.: Shell Wyo Energy - Hermosa				Milepost:
QUALITATIVE ATTRIBUTES					
Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 20	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands ends & wetland
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown

Waterbody ID No.: SAAL 012

Centerline Re-Route Access Road Warehouse Site Other:

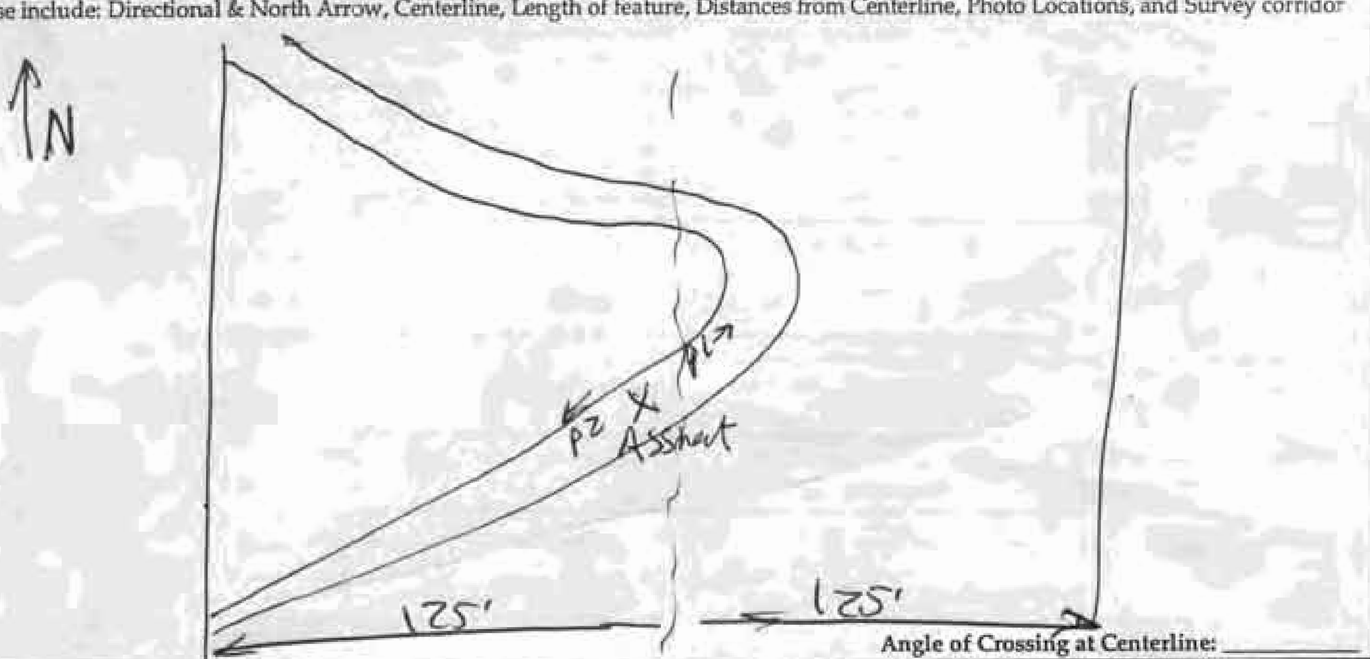
Associated Wetland No.: WAA004

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY
Milepost: HERMOSA	
Investigators: CLARK; ZEISLOFT	Quad Name:
State/County/Municipality: WY / ALBANY	Picture No.: A77 A78

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate		Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)	Direction: NW Months of estimated flow: 12	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location):				Water Surface (at crossing location):				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL002

Date: 8-26-09	Client/Project Name & No.: Shell Wind Energy			Milepost: Hermosa

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 50	Organic 50
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 30	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other: ________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown   Waterbody ID No.: SAAL 013

Centerline   Re-Route   Access Road   Warehouse Site   Other:

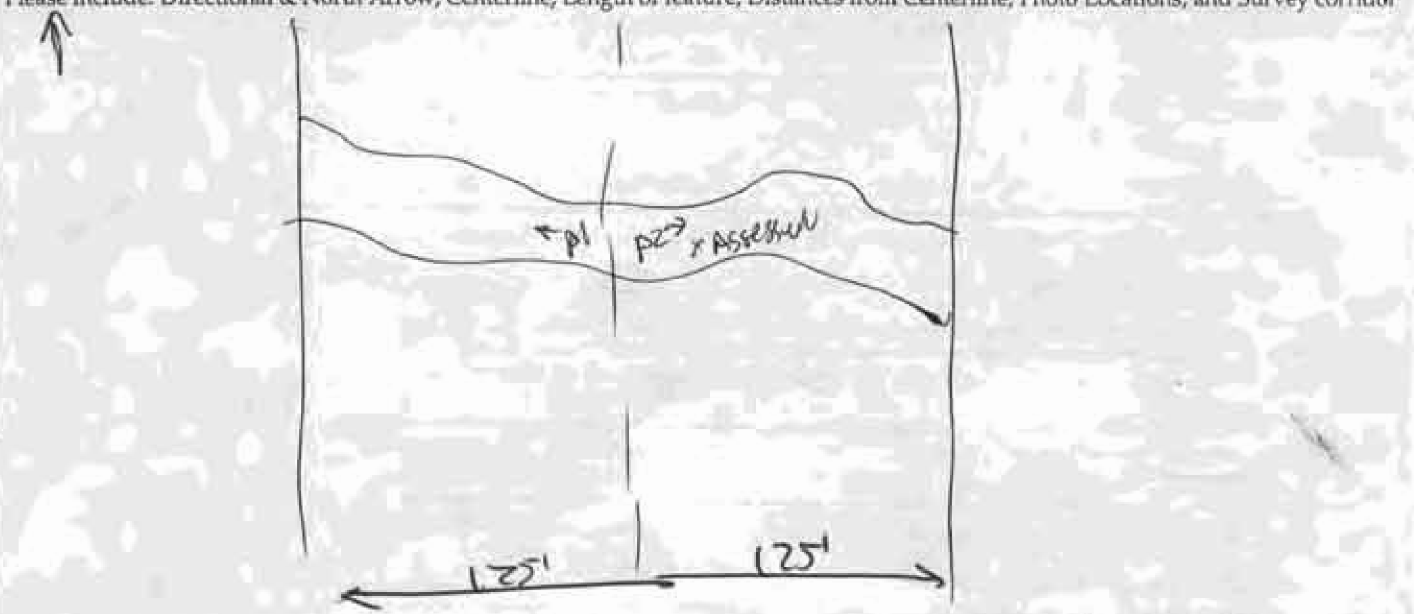
Associated Wetland No.:

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY	Milepost: HERMOSA
Investigators: CLARK; ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: A87 A88

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: ________ Months of estimated flow: ________		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location):				Water Surface (at crossing location):				

Bank Height (ft.) (looking downstream else give direction you are facing here:____)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:____)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL013

Date: 8-26-09	Client/Project Name & No.: SHELL WIND ENERGY				Milepost: Hermosa
QUALITATIVE ATTRIBUTES					
Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 80	Sand 20	Silt/Clay____	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders):

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown Solid Line on Topo **Waterbody ID No.:** SAAL01A

Centerline Re-Route Access Road Warehouse Site Other:

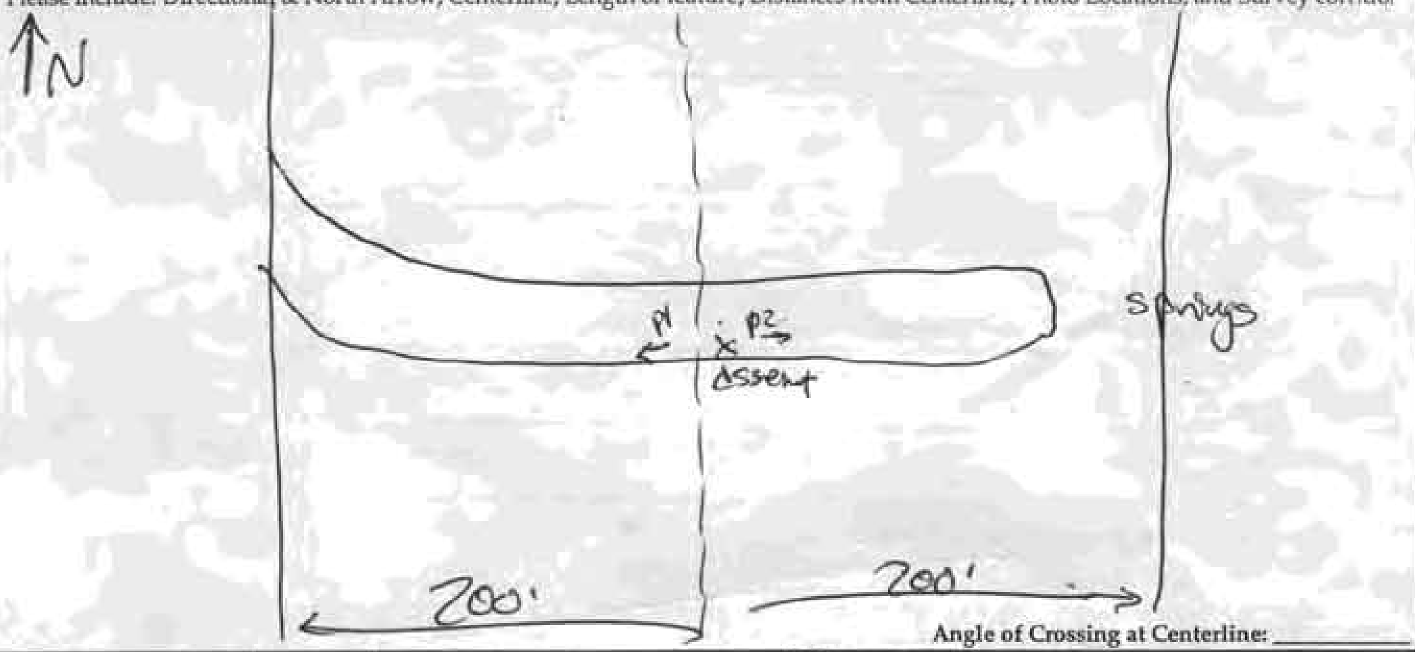
Associated Wetland No.: –

Date: 8-27-09 / Client/Project Name & No.: Shell Wind Energy	Milepost: Hermosa
Investigators: Clark; Zeislott	Quad Name:
State/County/Municipality: NY / Albany	Picture No.: A93 A94

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch / Other:
Stream Flow	Fast		Moderate	Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)	Ephemeral (Flows only in response to rainfall)	Direction: E Months of estimated flow: 6	
OHWM Indicator	Clear natural line on bank		Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes		Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown poss
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location):				

Bank Height (ft.) (looking downstream else give direction you are facing here:____)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:____)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SAAL014

Date: 8-27-09	Client/Project Name & No.: SHELL WIND ENERGY	Milepost: HERMOSA

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 30	Sand 20	Silt/Clay 50	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 80	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: unknown - Upstream [illegible]   Waterbody ID No.: SAAL015

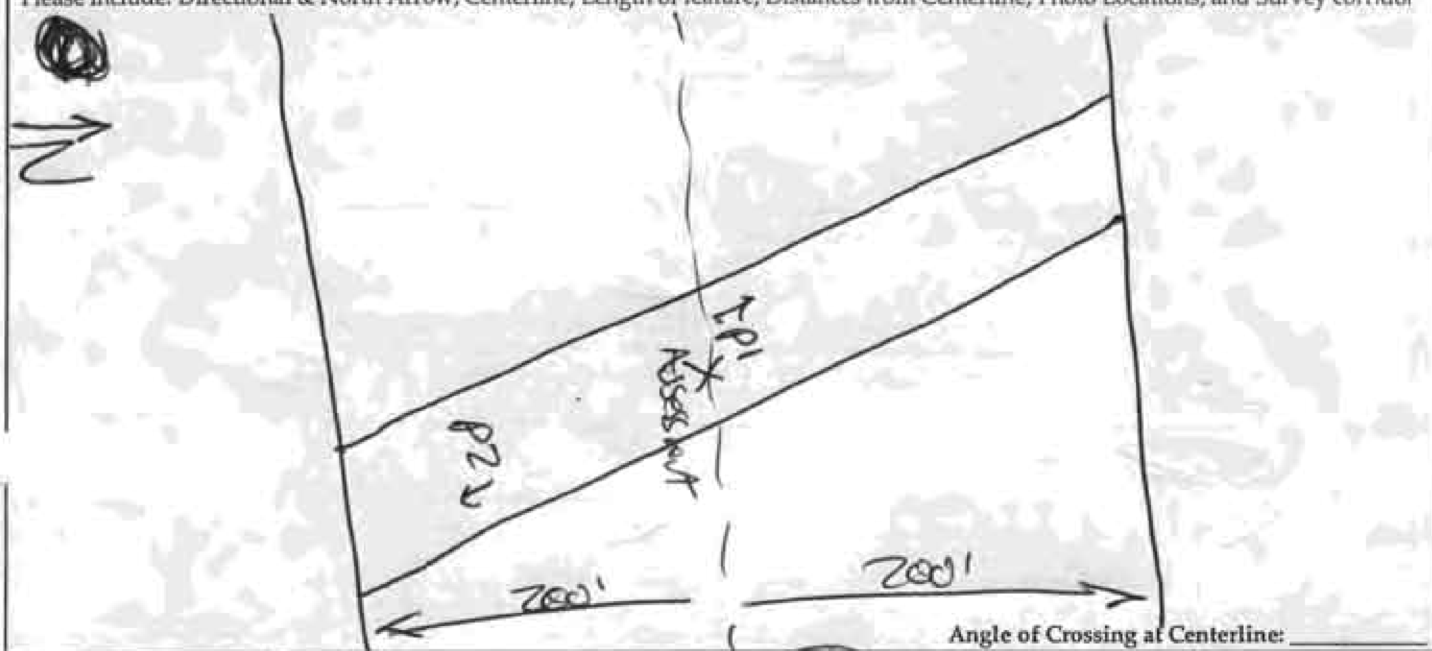
Centerline   Re-Route   Access Road   Warehouse Site   Other:

Date: 8-27-09 Client/Project Name & No.: SHELL WIND ENRGY	Associated Wetland No.: Milepost: Hermosa
Investigators: CARO ZEISLOFT	Quad Name:
State/County/Municipality: WY / ALBANY	Picture No.: A95 A96

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash
Stream Flow	Fast		Moderate		Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)	Direction: SE Months of estimated flow: 1	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location): 2'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (º) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL 015

Date: 8-27-08	Client/Project Name & No.: Sitele			Milepost: Hermosa

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 60	Sand 20	Silt/Clay 20	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 60	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

NW end more deeply incised

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown   Waterbody ID No.: SAAL016

Centerline   Re-Route   Access Road   Warehouse Site   Other:

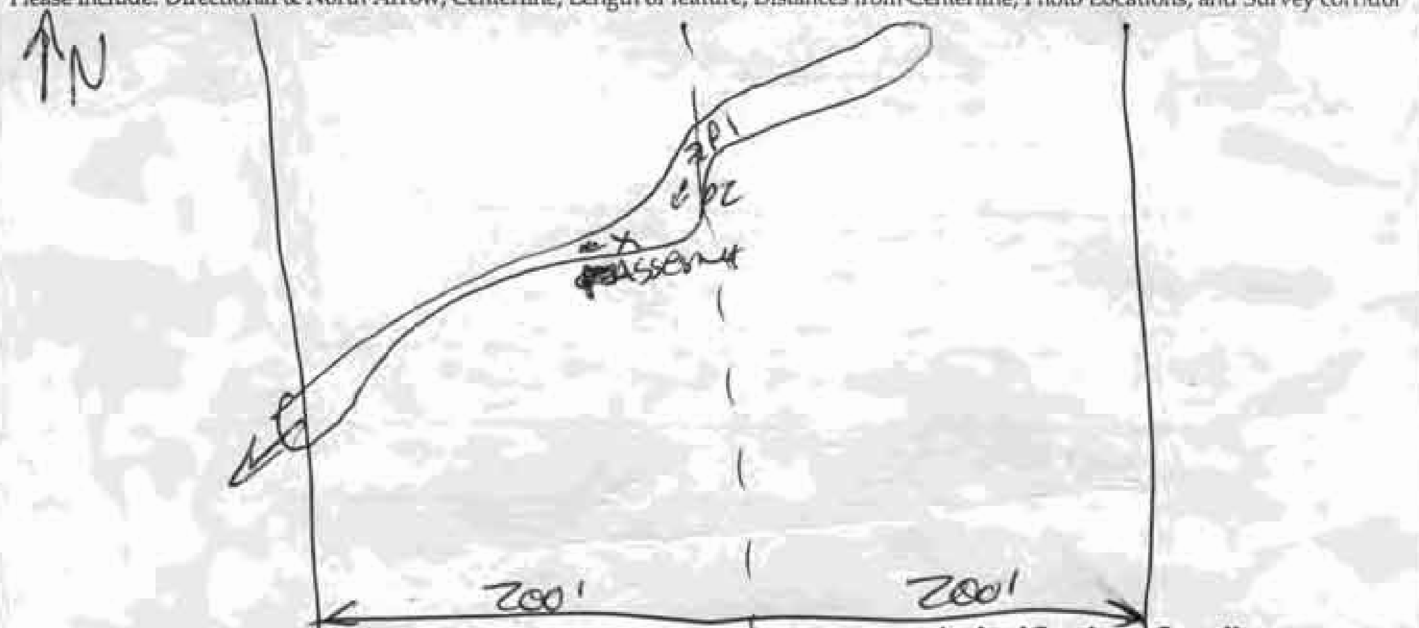
Associated Wetland No.:

Date: 8-27-09	Client/Project Name & No.: Shell Wind Energy	Milepost: Hermosa
Investigators: Clark ; Zeisloft		Quad Name:
State/County/Municipality: WY / Albany		Picture No.: A101 A102

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: SW Months of estimated flow: 1		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change				Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 20'				Water Surface (at crossing location): 7'				

Bank Height (ft.) (looking downstream else give direction you are facing here:_____)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:_____)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL 016

Date: 8-27-09	Client/Project Name & No.: SHELL WIND ENERGY				Milepost: ARMUSA
QUALITATIVE ATTRIBUTES					
Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 70	Sand 20	Silt/Clay 10	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 50	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery, any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown

Waterbody ID No.: SAAL017

Centerline Re-Route Access Road Warehouse Site Other:

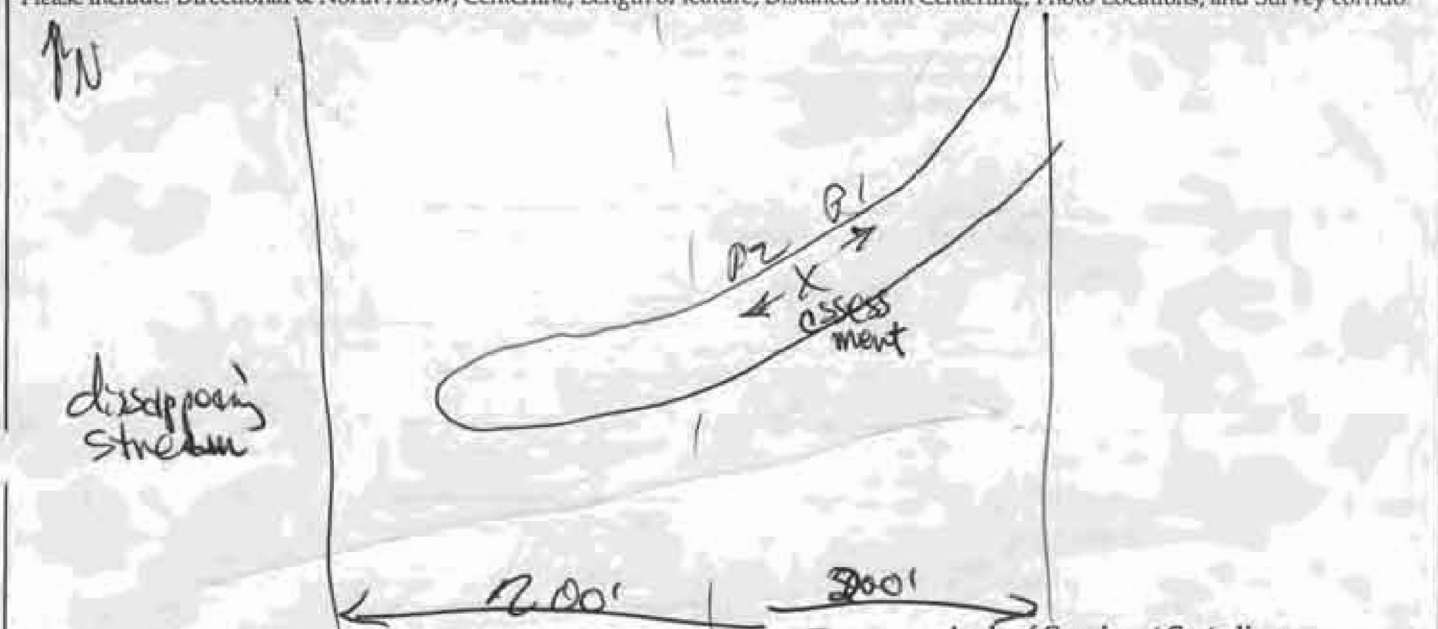
Associated Wetland No.:

Date: 8-27-09	Client/Project Name & No.: Shell	Milepost: Hermosa
Investigators: Clark, Zeisloft		Quad Name:
State/County/Municipality: WY / Albany		Picture No.: A103 A104

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: W; Months of estimated flow: 6		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location): 3'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL007

Date: 8-27-09	Client/Project Name & No.: Shell	Milepost: Hernon

QUALITATIVE ATTRIBUTES

Water Appearance N/A	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel______	Sand_____	Silt/Clay_____	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 80	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	❑ Significant bare areas within riparian zone		❑ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	~~Channelization/Braiding~~	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	❑ Waste discharge pipes present		❑ Other:________		

Hzo to west goes under grue

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Water to west goes undaground

STREAM QUALITY (indicate) ❑ High ☒ Moderate ❑ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: unknown

Waterbody ID No.: SAA 018

Centerline   Re-Route   Access Road   Warehouse Site   Other:

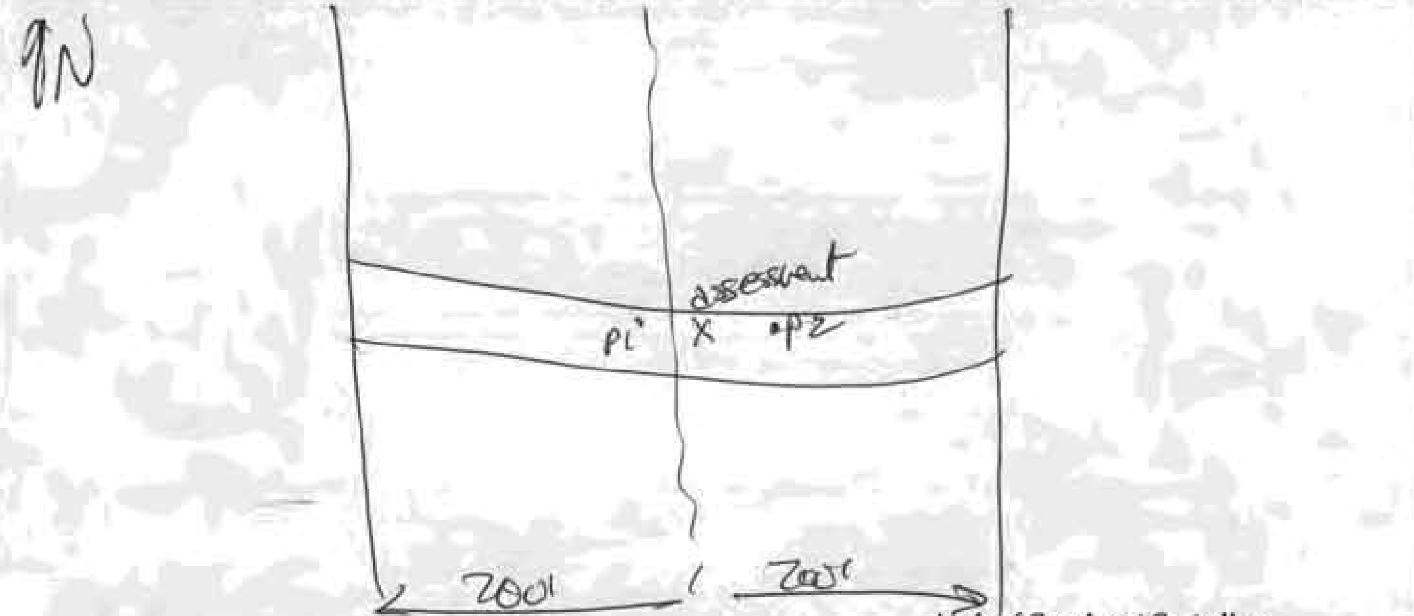
Associated Wetland No.:

Date: 8-27-09	Client/Project Name & No.: Shell	Milepost: Hermosa
Investigators: CLARK; ZEISLOFT		Quad Name:
State/County/Municipality:: Wy, Albany		Picture No.: A109 A110

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 1-3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location): 2'				
Bank Height (ft.) (looking downstream else give direction you are facing here:_____)	Left	0-2	2-4		4-6		6-8	8+	
	Right	0-2	2-4		4-6		6-8	8+	
Bank Slope (°) (looking downstream else give direction you are facing here:_____)	Left	0-20	20-40		40-60		60-80	80+	
	Right	0-20	20-40		40-60		60-80	80+	

ERM.

Waterbody ID No.: SAAL 018

Date: 8-27-09	Client/Project Name & No.: SHAM			Milepost: Hamosa
QUALITATIVE ATTRIBUTES				

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 20	Sand 20	Silt/Clay 60	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate)	☐ High	☒ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: FISH CREEK

Waterbody ID No.: SAAL019

Centerline Re-Route Access Road Warehouse Site Other:

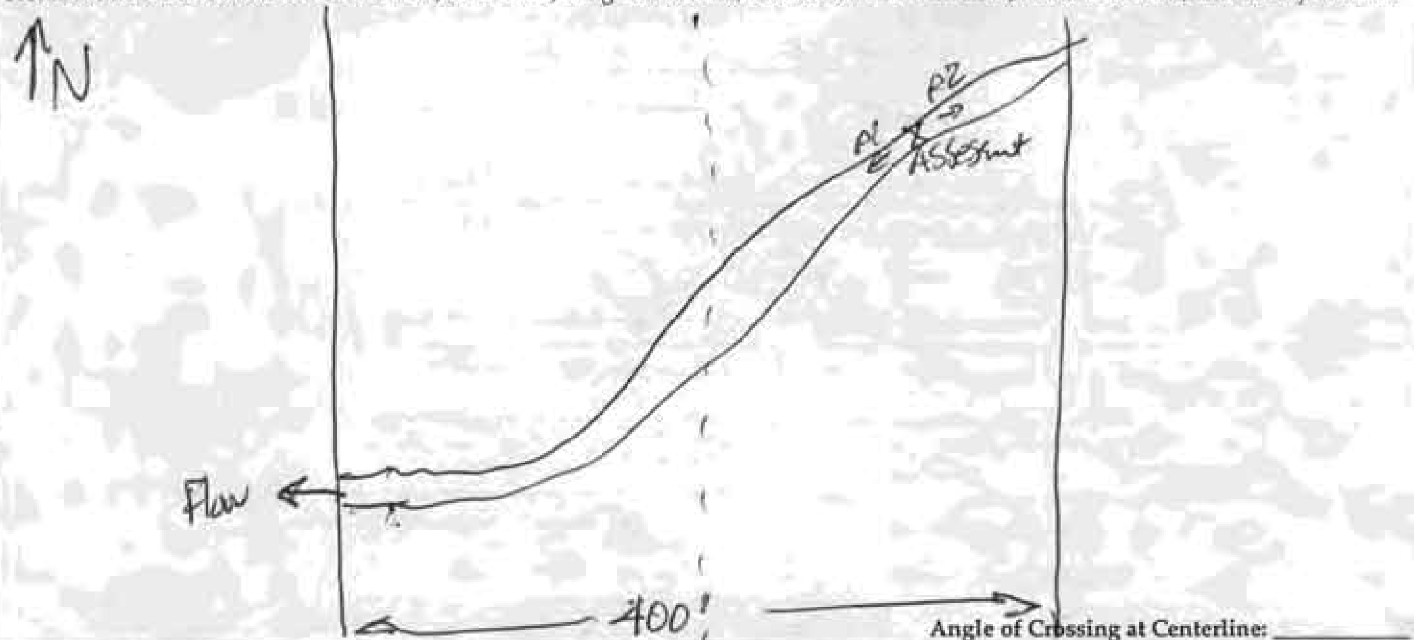
Associated Wetland No.:

Date: 8-27-09	Client/Project Name & No.: SHELL WIND EN.	Milepost: Hermosa
Investigators: CLARK; ZEISLOFT		Quad Name:
State/County/Municipality: WY / ALBANY		Picture No.: A114 A115

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 12		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10-12'				Water Surface (at crossing location): 5'				
Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4		4-6		6-8		8+
	Right	0-2	2-4		4-6		6-8		8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40		40-60		60-80		80+
	Right	0-20	20-40		40-60		60-80		80+

ERM.

Waterbody ID No.: WAAL019

Date: 8-27-09	Client/Project Name & No.: SHELL	Milepost: HERMOSA

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay____	Organic____
Aquatic Habitats	Sand Bar 5&6	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 10	In-stream submerged plants % Cover 10	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. information useful for JD forms, construction constraints, erosion potential/existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Fish Creek Waterbody ID No.: SAAL070

Centerline Re-Route Access Road Warehouse Site Other:

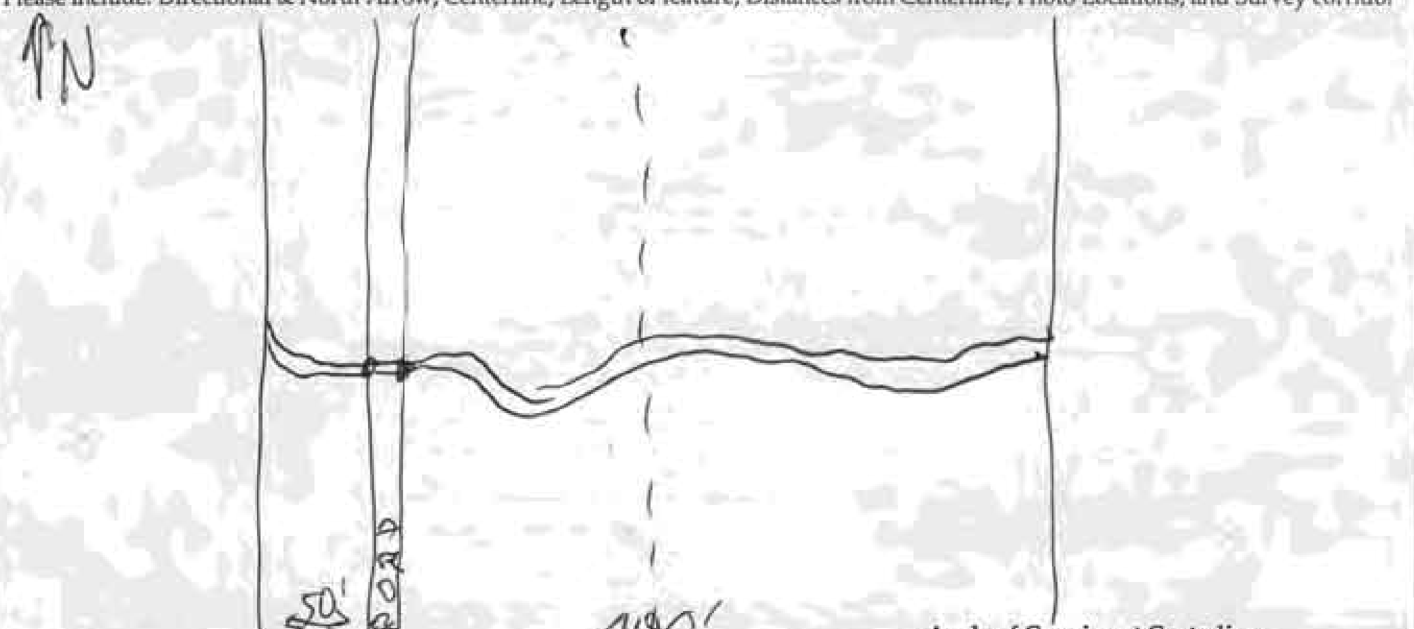
Associated Wetland No.:

Date: 9-27-09 Client/Project Name & No.: Shell Wind	Milepost: Hermosa
Investigators: CLARK ; ZEISCOFT	Quad Name:
State/County/Municipality: WY-/ALBANY	Picture No.: A120 A121

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 10	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10'				Water Surface (at crossing location): 5'				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)						
	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)						
	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL020

Date: 9-27-09	Client/Project Name & No.: Shell Wind Energy			Milepost: Harmosa
QUALITATIVE ATTRIBUTES				

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface some slight	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 30	Sand 30	Silt/Clay 40	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 10	In-stream submerged plants % Cover 10	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

Much cow piss smell & manure

STREAM QUALITY (indicate)	☐ High	☐ Moderate	☒ Low

High Quality: Natural channel (no structures or dikes. no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: probably (unknown)   Waterbody ID No.: SAAL021

Centerline   Re-Route   Access Road   Warehouse Site   Other:

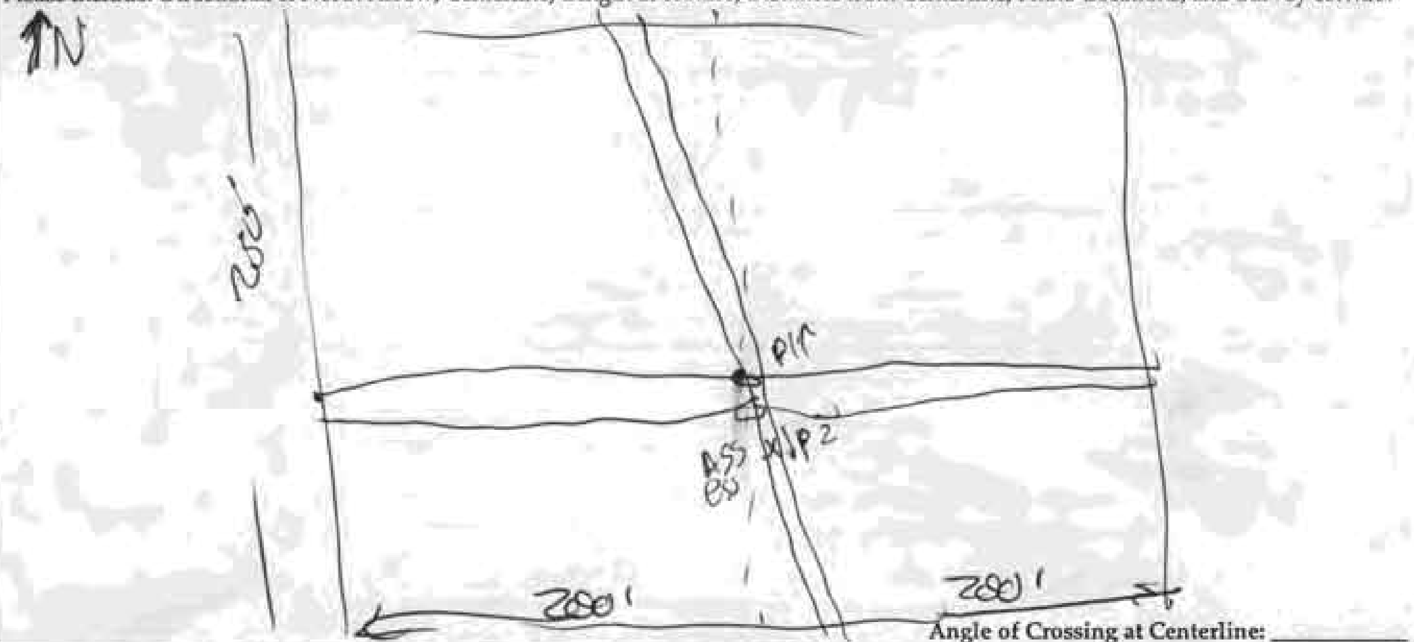
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Shell
	Milepost: Harmore
Investigators: CLARK, ZEISLOFT	Quad Name:
State/County/Municipality: WY, ALBANY	Picture No.: A122 A123

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: 12		
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 15'				Water Surface (at crossing location): 8'				
Bank Height (ft.) (looking downstream else give direction you are facing here:____)	Left	0-2	2-4		4-6		6-8		8+
	Right	0-2	2-4		4-6		6-8		8+
Bank Slope (°) (looking downstream else give direction you are facing here:____)	Left	0-20	20-40		40-60		60-80		80+
	Right	0-20	20-40		40-60		60-80		80+

ERM.

Waterbody ID No.: SAAL021

Date: 8-27-09	Client/Project Name & No.: Shell			Milepost: Hermosa

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 10	Sand 10	Silt/Clay 80	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: Unknown   Waterbody ID No.: SAAL022

Centerline Re-Route Access Road Warehouse Site Other:

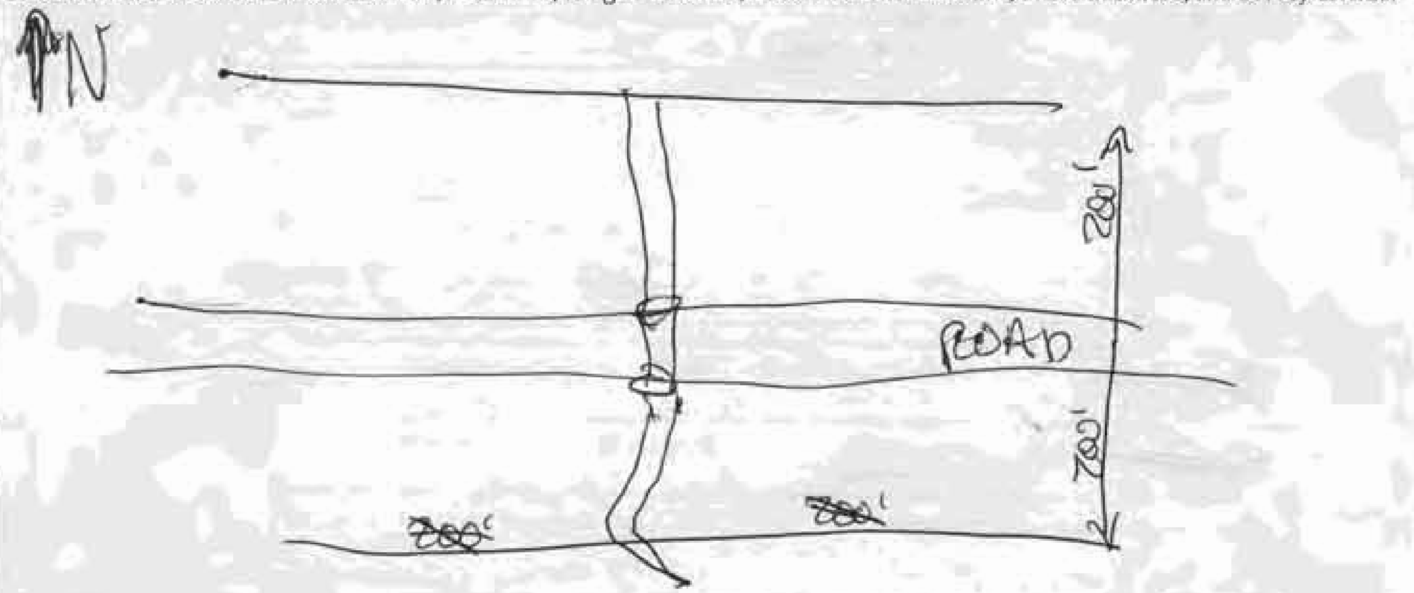
Associated Wetland No.:

Date: 8-27-09	Client/Project Name & No.: Shell
Milepost: Hermosa	
Investigators: CLARK, ZEASLOFF	Quad Name:
State/County/Municipality:: WY, ALBANY	Picture No.: A124 A125

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other: dry wash	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: 2-3	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 5'				Water Surface (at crossing location): 2'			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SAAL022

Date: 8-27-09	Client/Project Name & No.: Shell	Milepost: Harwood

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 10	Sand 10	Silt/Clay 80	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 60	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT — Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants [algal mats, surface scum, surface sheen]; heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Unnamed Tributary   Waterbody ID No.: SBALØØ1

Centerline   Re-Route   Access Road   Warehouse Site   Other:

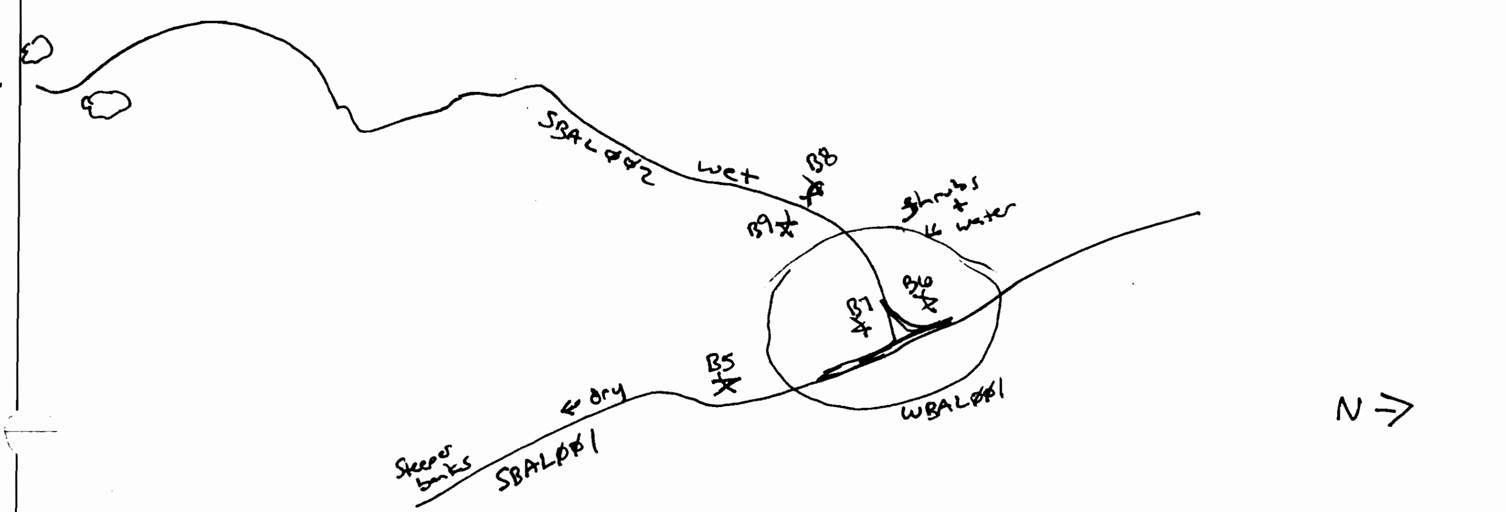
Associated Wetland No.: WBALØØ1

Date: 8/25/09 / Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co., Wyoming	Picture No.: B5

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: ________		
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation	Soil character changes		Abrupt plant community change				Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2-8 ft				Water Surface (at crossing location): NA				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBALØØ1

Date: 8/25/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
N/A	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel______	Sand_____	Silt/Clay 100	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 50	In-stream submerged plants % Cover 20	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 10-100 (ft) Steeper banks to south				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: ______________ **Waterbody ID No.:** SBAL002

Centerline Re-Route Access Road Warehouse Site Other:

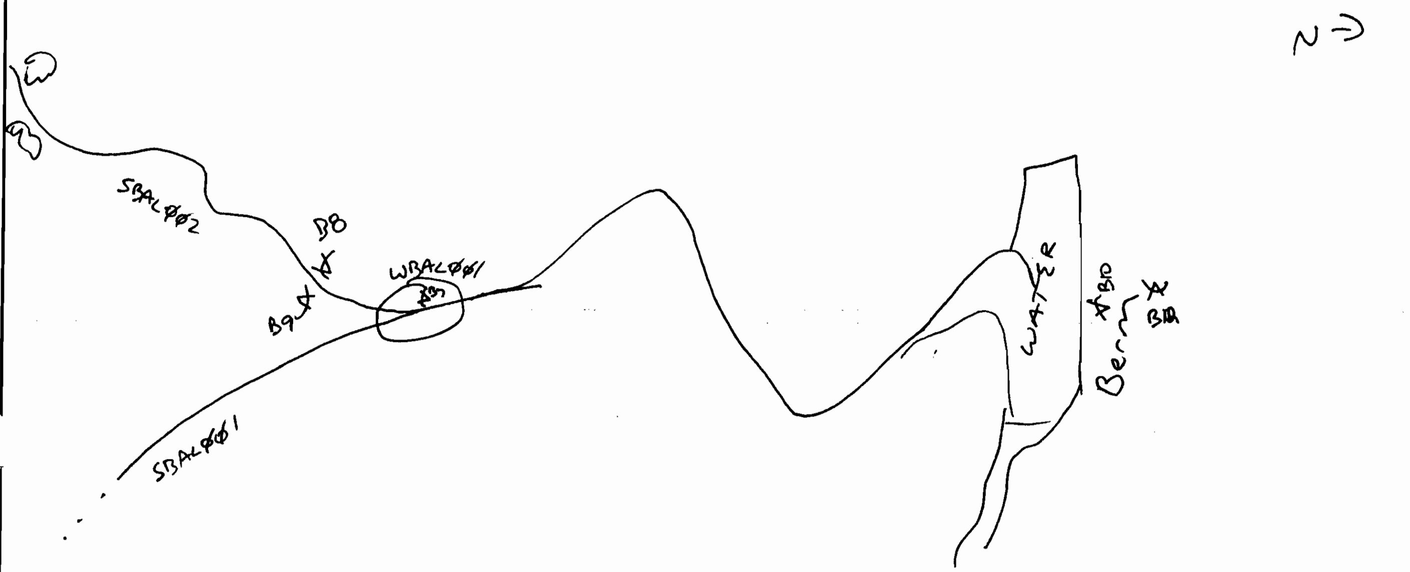
Associated Wetland No.: WBAL001

Date: 8/25/09	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co., Wyoming		**Picture No.:** B7-14

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: ______ Months of estimated flow: ______		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2-5				Water Surface (at crossing location): 1-2				
Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4		4-6		6-8	8+	
	Right	0-2	2-4		4-6		6-8	8+	
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40		40-60		60-80	80+	
	Right	0-20	20-40		40-60		60-80	80+	

South reach north reach

ERM.

Waterbody ID No.: SBAL002

Date: 8/25/09	Client/Project Name & No.: Hermosa 010023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 30	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ______ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural South reach	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms north reach	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:______		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g., information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Presence of aquatic organisms is likely, although none were seen. Large dirt berm on the northern portion of the surveyed area holding a pool of water.

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Forest Creek Waterbody ID No.: SBALØØ3

Centerline Re-Route Access Road Warehouse Site Other:

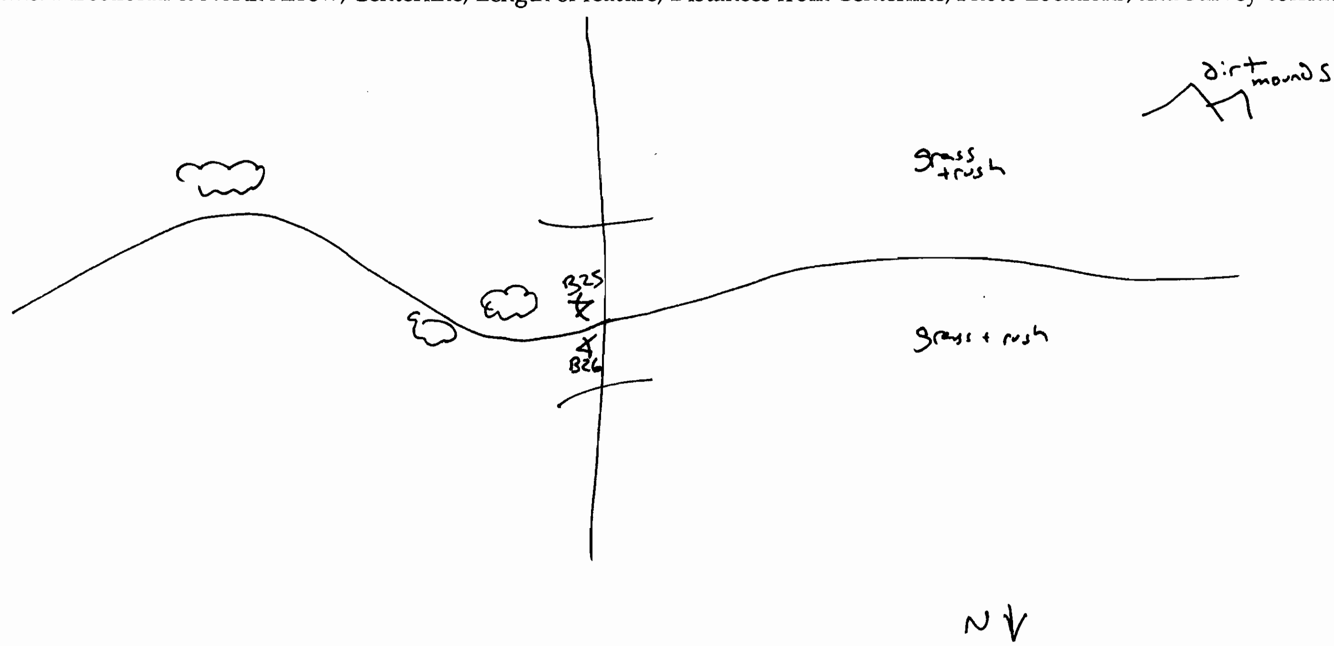
Associated Wetland No.:

Date:	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co, Wyoming		**Picture No.:** B25 + 26

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast	Moderate	Slow	Very Slow	None		
Flow type	Perennial (Flows > 3 months annually)	Intermittent/Seasonal (Flows <3 months annually)	Ephemeral (Flows only in response to rainfall)	Direction: E; Months of estimated flow: 9			
OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining		
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change	Wrack line	Litter and debris			
Sinuosity	Straight	Meandering	**Subsurface Flow?**	Yes	No	Unknown	

Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+

Stream Width (ft.)	Top of Bank (at crossing location): 2	Water Surface (at crossing location): 2

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

Waterbody ID No.: SBAC ØØ3

ERM

Date: 8/25/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel_______	Sand______	Silt/Clay 100	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 100	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands veg. along banks
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes holes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 20 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:_______________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

aterbody Name: ______ Waterbody ID No.: SBAL004

Centerline Re-Route Access Road Warehouse Site Other:

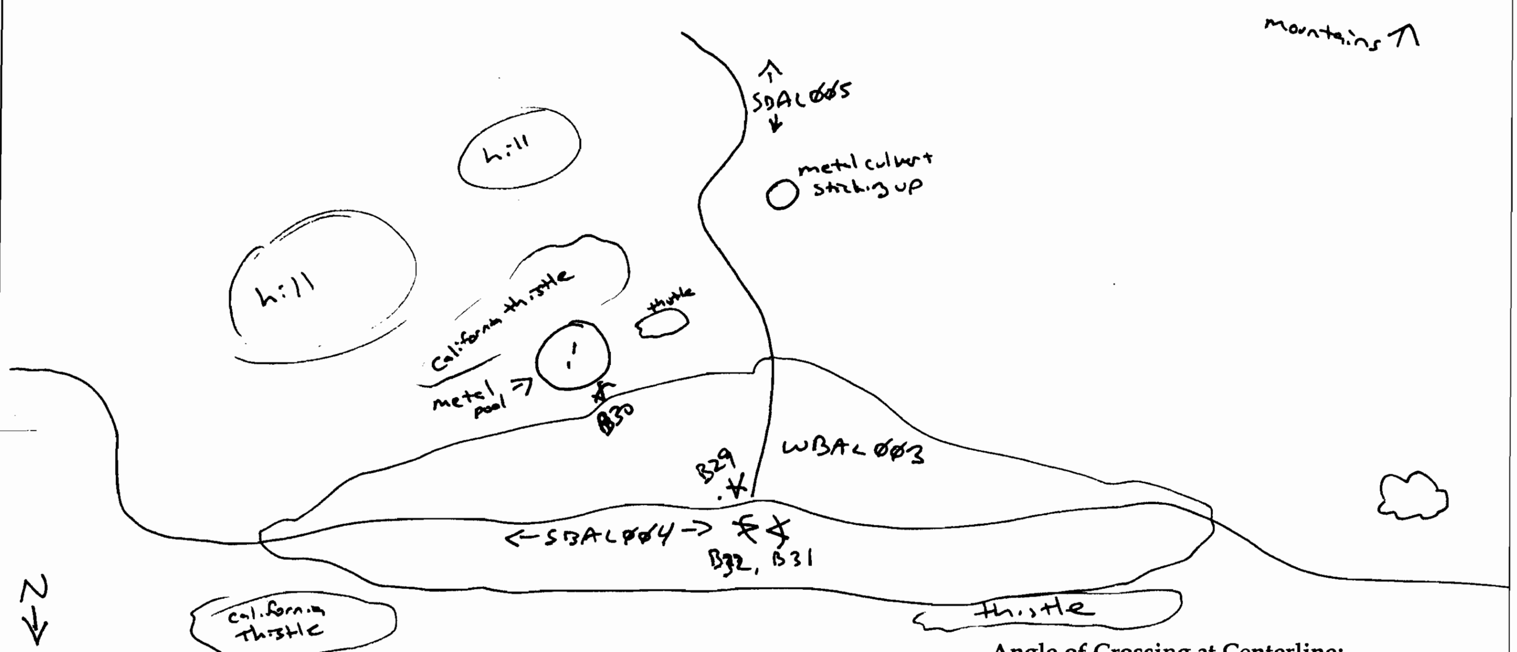
Associated Wetland No.: WBAL003

Date:	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co, Wyoming		Picture No.: B31 + B32

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 12	
OHWM Indicator	Clear natural line on bank		Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 40				Water Surface (at crossing location): 2			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SDAL004

Date: 8/25/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 30	Sand____	Silt/Clay 70	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 5	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 40 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Clumps of california thistle present. Aquatic organisms likely present, though not seen.

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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WATERBODY DATA SHEET

Waterbody Name: ____________

Waterbody ID No.: SBAL005

Centerline Re-Route Access Road Warehouse Site Other:

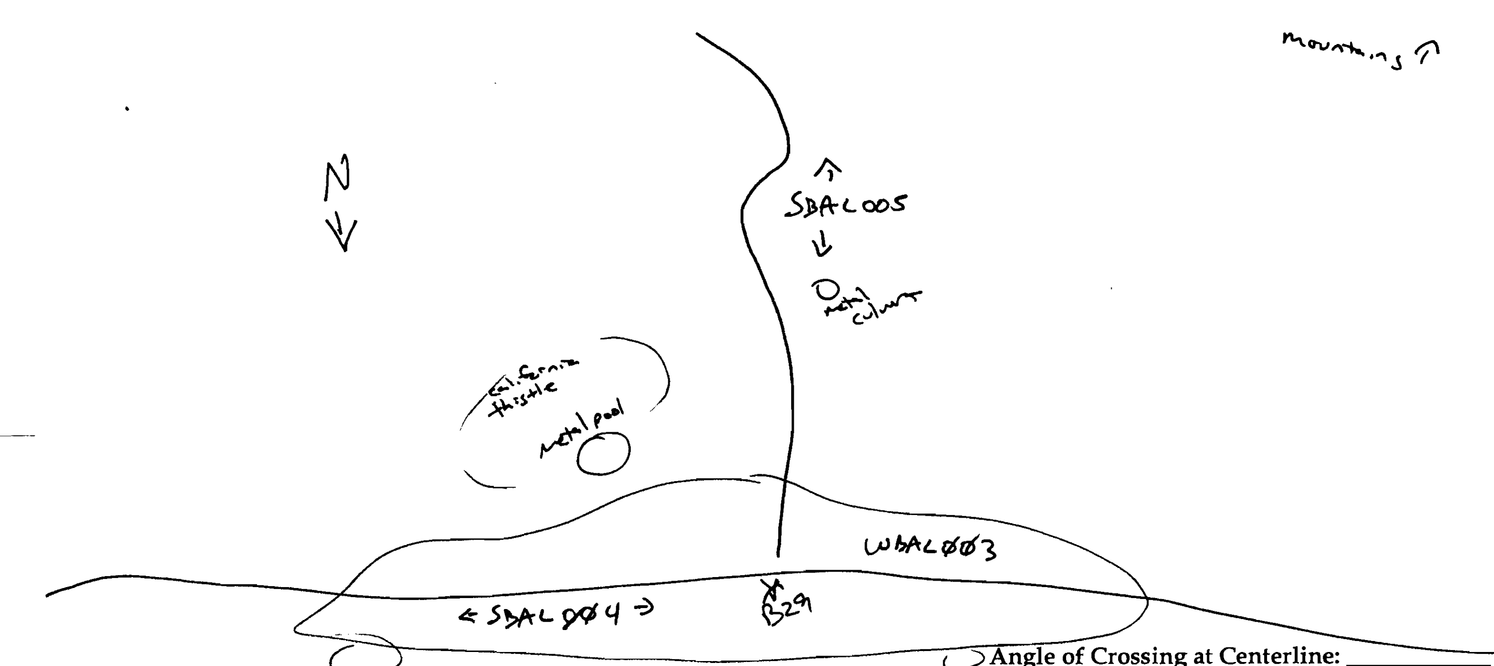
Associated Wetland No.: WBAL003

Date:	Client/Project Name & No.: Hermosa 0105023
Milepost:	
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co, Wyoming	Picture No.: B29

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan SAME AS SBAL004

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast	Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)	Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: 12		
OHWM Indicator	Clear natural line on bank		Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation	Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight	Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 15			Water Surface (at crossing location): 2				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAL009

Date: 8/25/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel______	Sand______	Silt/Clay 100	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover _____	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 15 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:_______________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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WATERBODY DATA SHEET

aterbody Name: ______________________ **Waterbody ID No.:** SBA2ØØ6

Centerline Re-Route Access Road Warehouse Site Other:

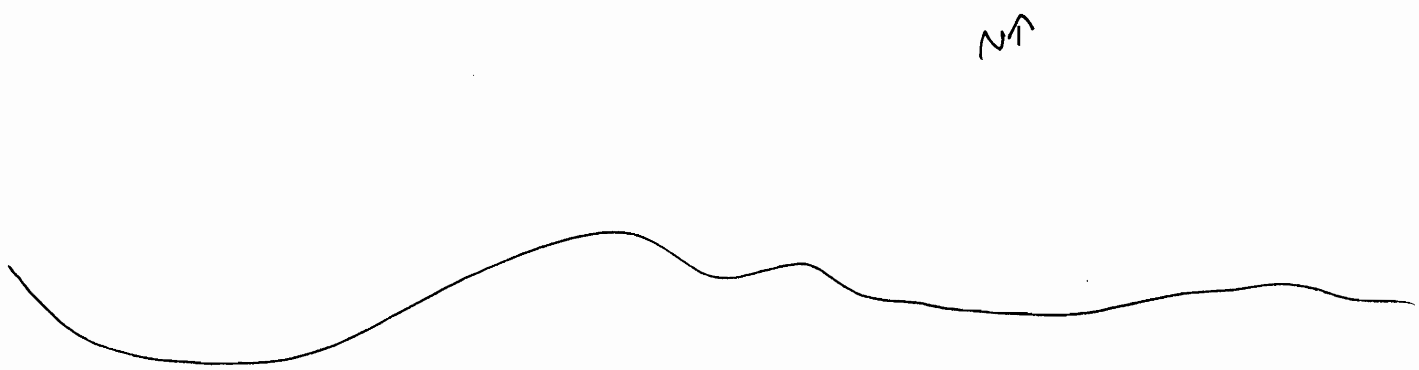
Associated Wetland No.:

Date: 8/26/09 **Client/Project Name & No.:** Hermosa 010023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga	**Quad Name:**
State/County/Municipality:: Albany Co., Wyoming	**Picture No.:**

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: __________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: W Months of estimated flow: <3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10				Water Surface (at crossing location): NA				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAL006

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 5	Sand____	Silt/Clay 95	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 50	In-stream submerged plants % Cover 30	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: ________ (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☒ Significant bare areas within riparian zone			☐ Evidence of non-buffered concentrated flows	
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone			☒ Manure in stream or on banks	
	☐ Waste discharge pipes present			☐ Other:________	

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☐ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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WATERBODY DATA SHEET

aterbody Name: ______________________ Waterbody ID No.: SBAL 007

Centerline Re-Route Access Road Warehouse Site Other:

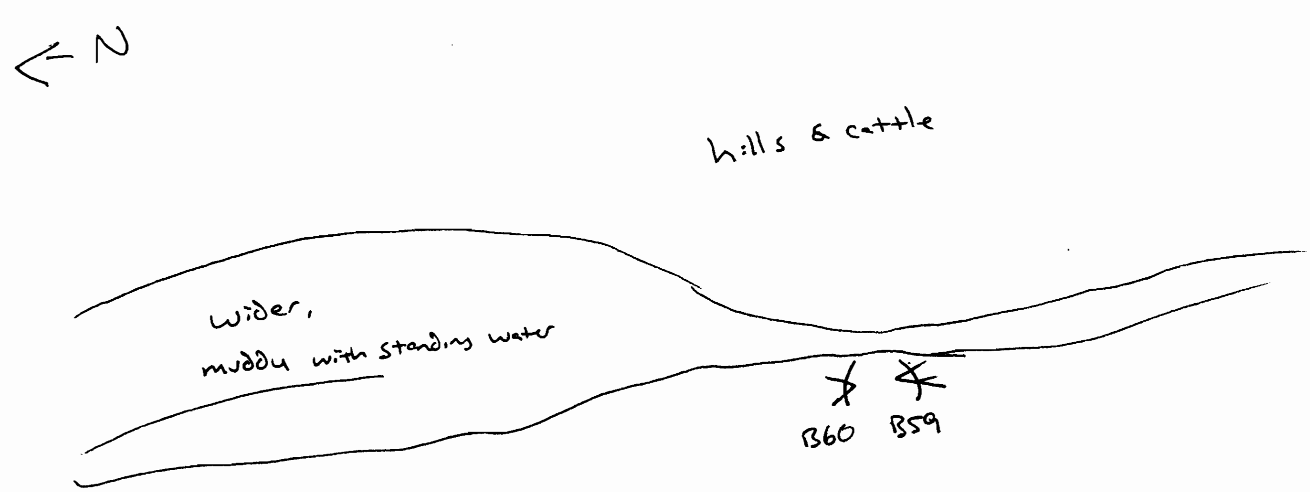
Associated Wetland No.:

Date: 8/26/09 Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co., Wyoming	Picture No.: B59 + B60

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ___________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow STANDING		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: ~3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 30				Water Surface (at crossing location): 15				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left W	0-20	20-40	40-60	60-80	80+
	Right E	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAL007

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 60	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 30 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

cattle

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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ERM.

WATERBODY DATA SHEET

aterbody Name: ______________________ Waterbody ID No.: SBAL008

Centerline Re-Route Access Road Warehouse Site Other:

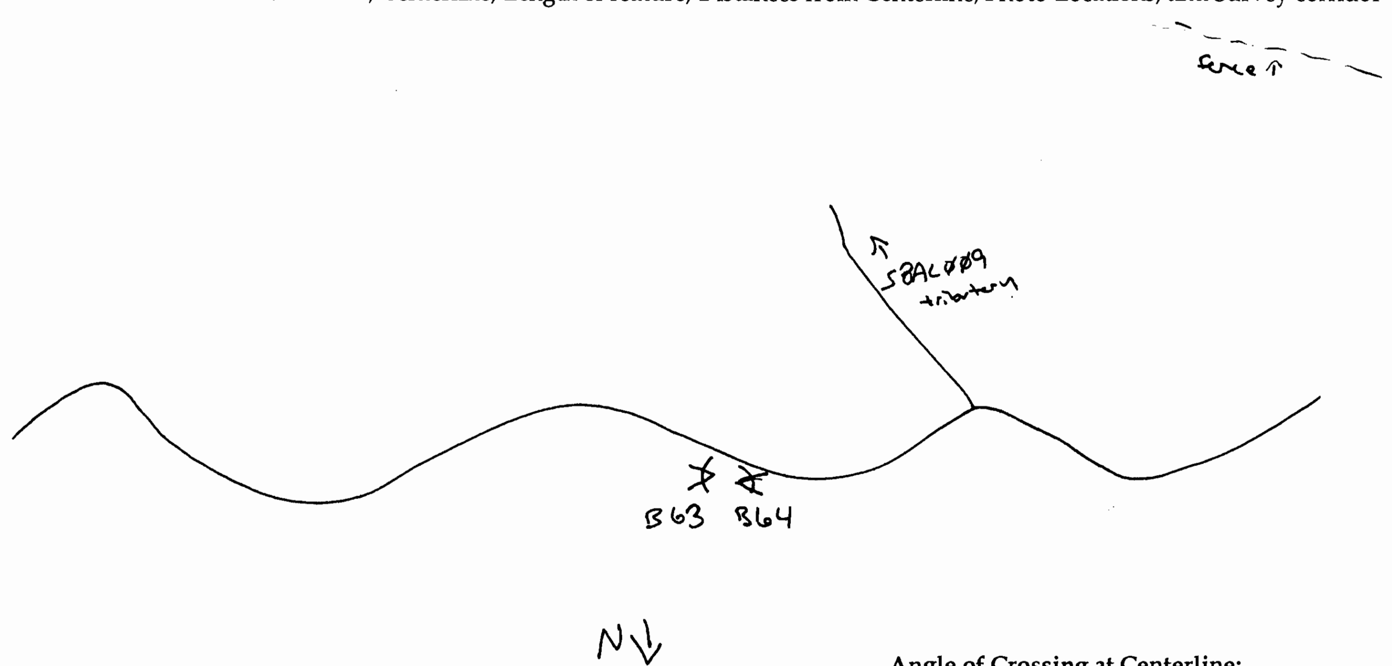
Associated Wetland No.:

Date:	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B63 + B64

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: __________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: NW Months of estimated flow: 6*		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10				Water Surface (at crossing location): 6				
Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4		4-6		6-8		8+
	Right	0-2	2-4		4-6		6-8		8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40 east		40-60 west		60-80		80+
	Right	0-20	20-40		40-60		60-80		80+

ERM

Waterbody ID No.: SBALØØ8

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid Brown	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel____	Sand____	Silt/Clay 100	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 30	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 15 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	~~Channelization~~/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

cattle

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

aterbody Name: ____________________ Waterbody ID No.: SBAL009 (tributary to SBAL008)

Centerline Re-Route Access Road Warehouse Site Other:

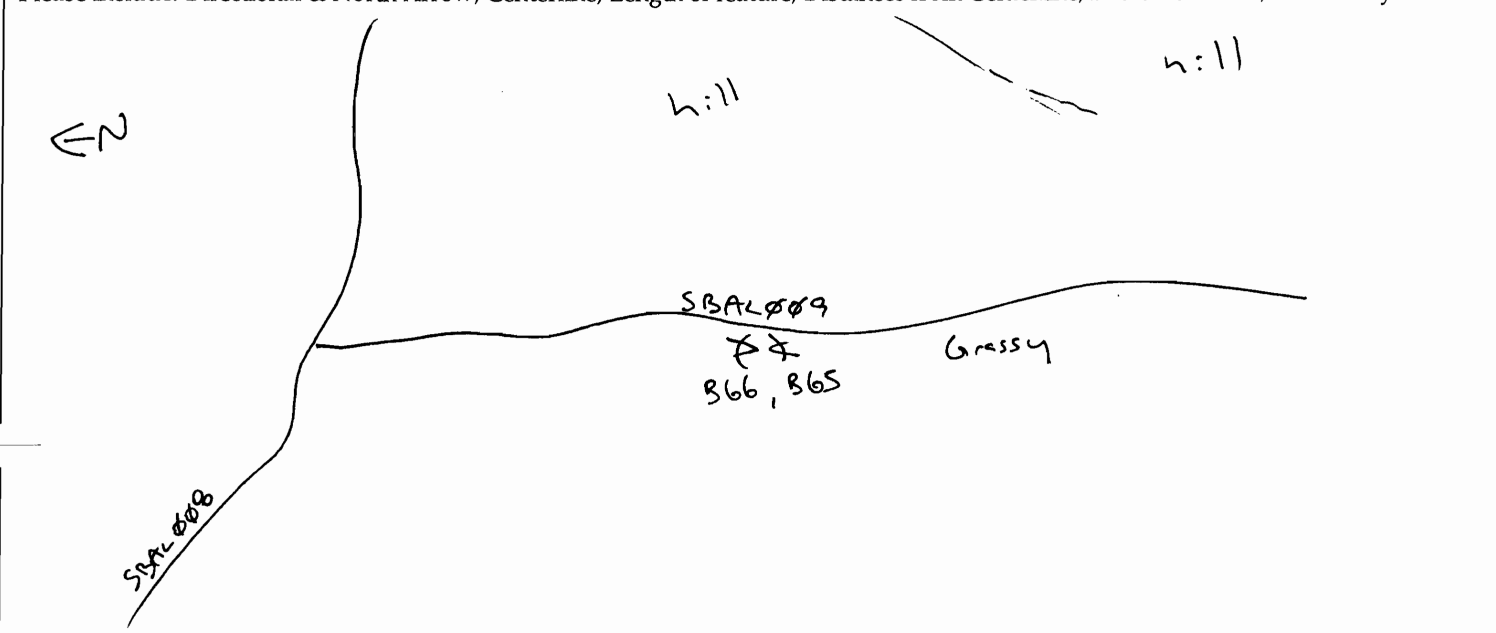
Associated Wetland No.:

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B65 + B66

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate		Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)	Direction: N Months of estimated flow: ~3	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+

Stream Width (ft.) Top of Bank (at crossing location): 20 Water Surface (at crossing location): Ø

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM®

Waterbody ID No.: SBAL009

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel_______	Sand______	Silt/Clay 50	Organic 50
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 100	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 8 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____________________		

T/E SPECIES / SUITABLE HABITAT

Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

WATERBODY DATA SHEET

ERM.

aterbody Name: ______________________ Waterbody ID No.: SBALØ1Ø

Centerline Re-Route Access Road Warehouse Site Other:

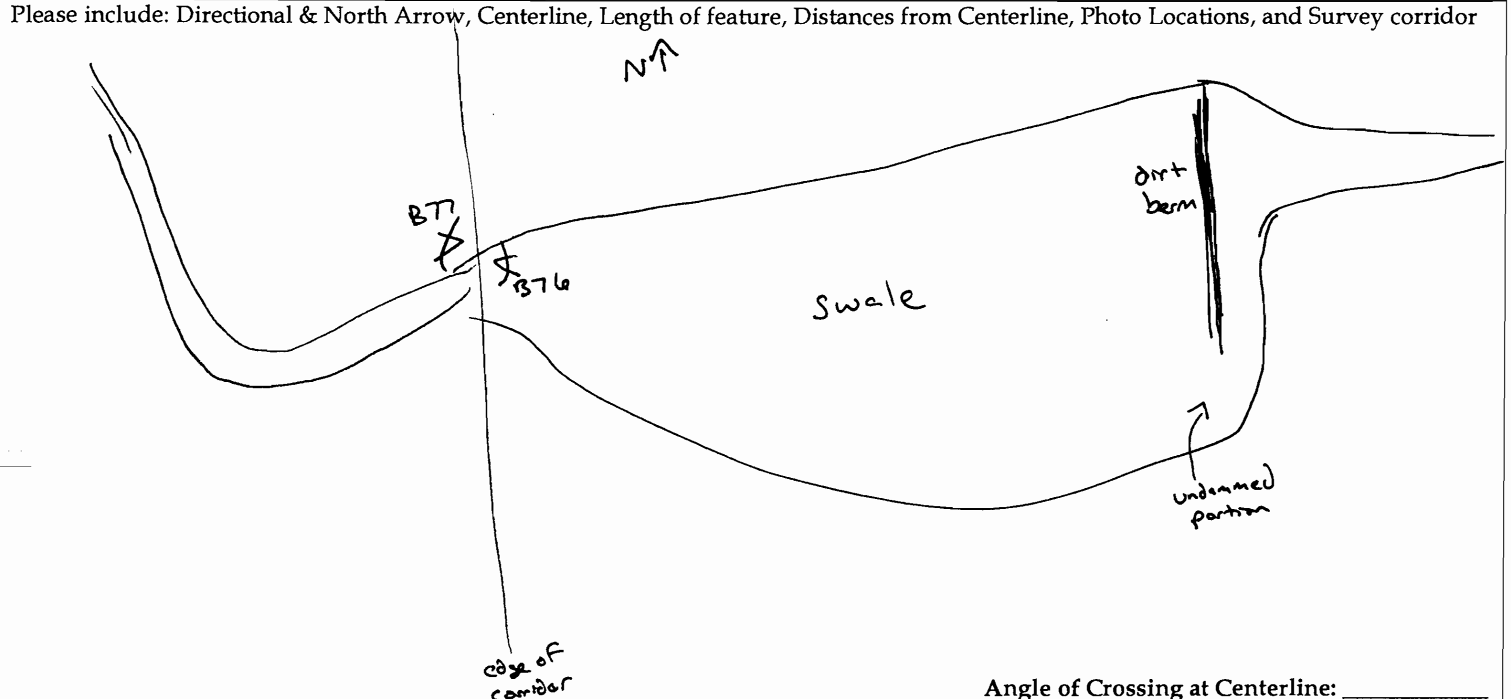
Associated Wetland No.:

Date: 8/26/09 / Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co, Wyoming	Picture No.: B76 + B77

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: NW Months of estimated flow: ________		
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 5				Water Surface (at crossing location): Ø				
Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4 NW	4-6	6-8	8+			
	Right	0-2	2-4	4-6	6-8	8+			
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40 NW	40-60	60-80	80+			
	Right	0-20	20-40	40-60	60-80	80+			

deeper cut west,
out of survey area

ERM

Waterbody ID No.: SBAL010

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 50	Sand_____	Silt/Clay 50	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 40	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5 (ft)				
	Circle vegetative layers: trees shrubs Herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT

Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

A dirt berm/partial dam is present to the east (upstream); however, it appears as though water can pass by the barrier on the southern edge of the berm.

STREAM QUALITY (indicate)	☒ High	☐ Moderate	☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: ______________________ Waterbody ID No.: SBAL011

Centerline Re-Route Access Road Warehouse Site Other:

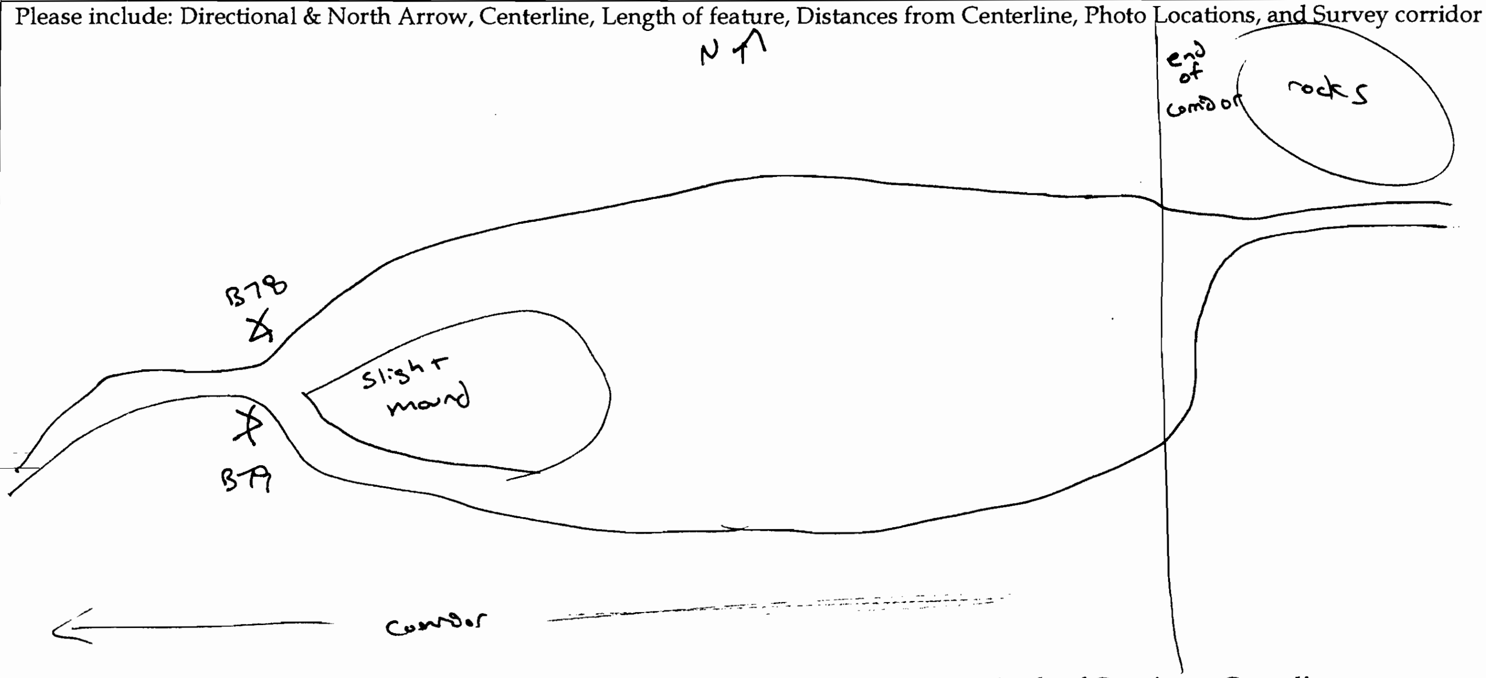
Associated Wetland No.:

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B78 + B79

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate		Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)	Direction: NW Months of estimated flow: ________	
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24 / 24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 10				Water Surface (at crossing location): Ø		

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBAC Ø11

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel 20	Sand_____	Silt/Clay 80	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 75	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 40 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:_____		

T/E SPECIES / SUITABLE HABITAT **Habitat ID No.:**

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: ______________________ Waterbody ID No.: SBAL∅12

Centerline   Re-Route   Access Road   Warehouse Site   Other:

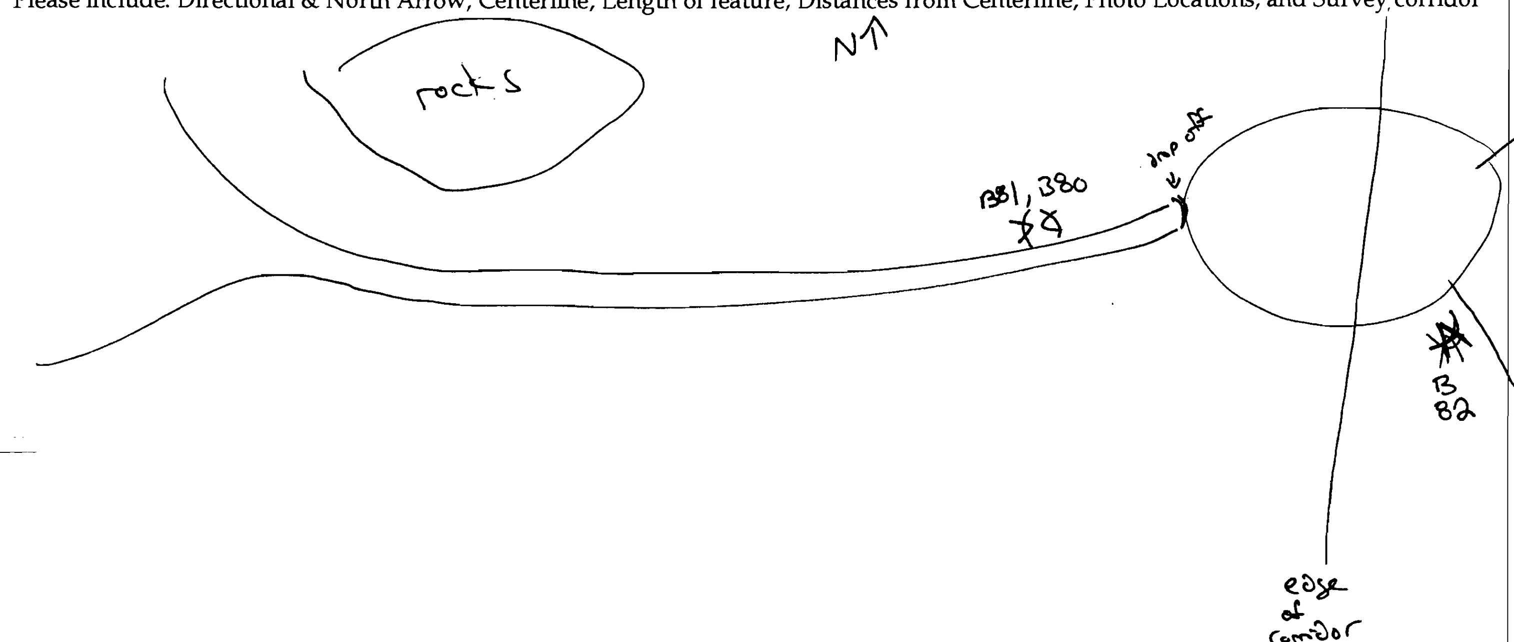
Associated Wetland No.:

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B80 - 82

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: W; Months of estimated flow: ~3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 15				Water Surface (at crossing location): ∅				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBAC Ø12

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 70	Sand____	Silt/Clay 30	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 50	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None

Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5 (ft)	
	Circle vegetative layers: trees shrubs herbs	
	☐ Significant bare areas within riparian zone	☐ Evidence of non-buffered concentrated flows

Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)	Stable / Unstable

Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion

Disturbances	☒ Livestock access to riparian zone	☒ Manure in stream or on banks
	☐ Waste discharge pipes present	☐ Other:____________

T/E SPECIES / SUITABLE HABITAT

Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Erosional feature to the east ("drop off" in sketch)

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: ______________________ Waterbody ID No.: SBALØ13

Centerline Re-Route Access Road Warehouse Site Other:

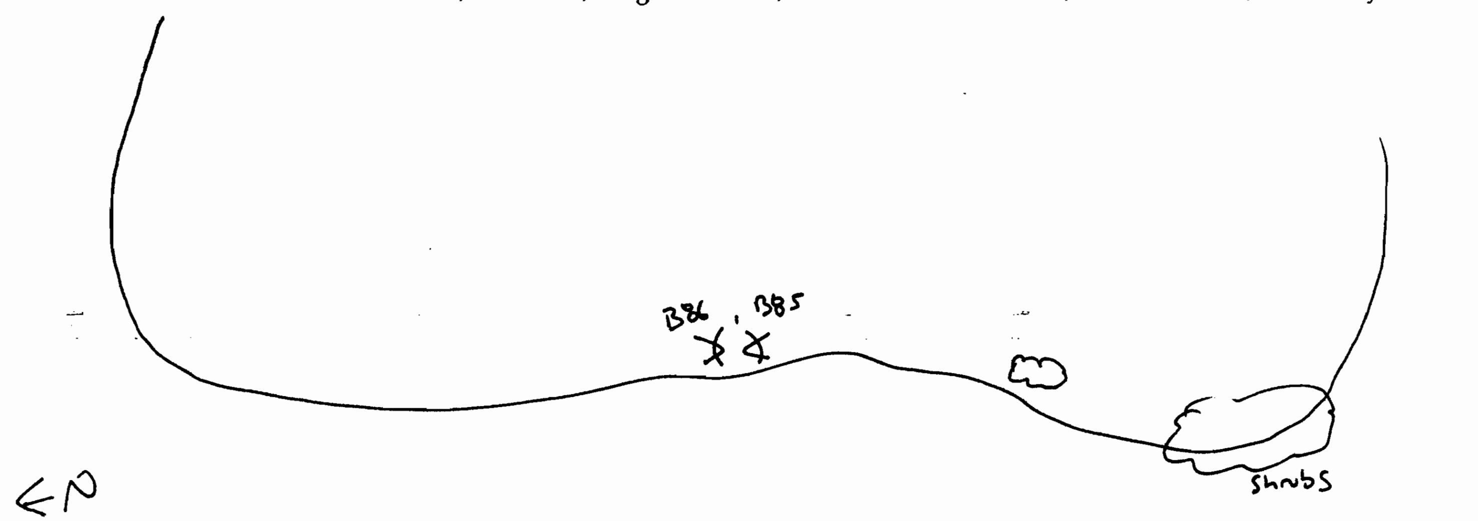
Associated Wetland No.: WBALØØ4

Date: 8/26/09 Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co., Wyoming	Picture No.: B85 + B86

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N	Months of estimated flow: 12
OHWM Indicator	Clear natural line on bank		Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		Subsurface Flow?	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 2				Water Surface (at crossing location): 2 + wetland			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAL013

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel______	Sand______	Silt/Clay 100	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 90	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 10 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:______________________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

WATERBODY DATA SHEET

ERM

Waterbody Name: ______________________ **Waterbody ID No.:** SBAL Ø14

Centerline Re-Route Access Road Warehouse Site Other:

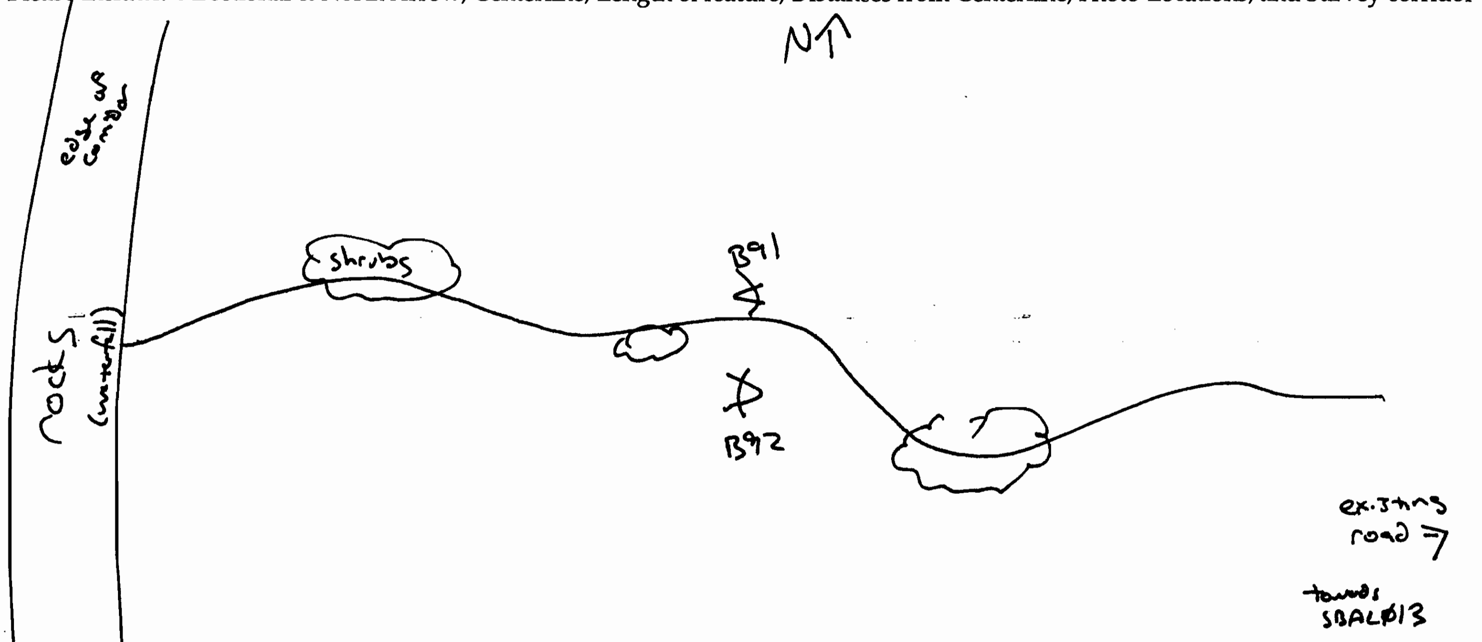
Associated Wetland No.:

Date: 8/26/09	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co., Wyoming		**Picture No.:** B91 + B92

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:			
Stream Flow	Fast		Moderate		Slow		Very Slow			None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 12			
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining		
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris		
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown	
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+	
Stream Width (ft.)	Top of Bank (at crossing location): 9				Water Surface (at crossing location): 3					

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (º) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAC014

Date: 8/26/09	Client/Project Name & No.: Hermosa 010S023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel 30	Sand_____	Silt/Clay 70	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover _____	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult) small	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 20 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	❑ Significant bare areas within riparian zone		❑ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	❑ Waste discharge pipes present		❑ Other:_____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ❑ Moderate ❑ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
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Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: ______________________ Waterbody ID No.: SBAC015

Centerline Re-Route Access Road Warehouse Site Other:

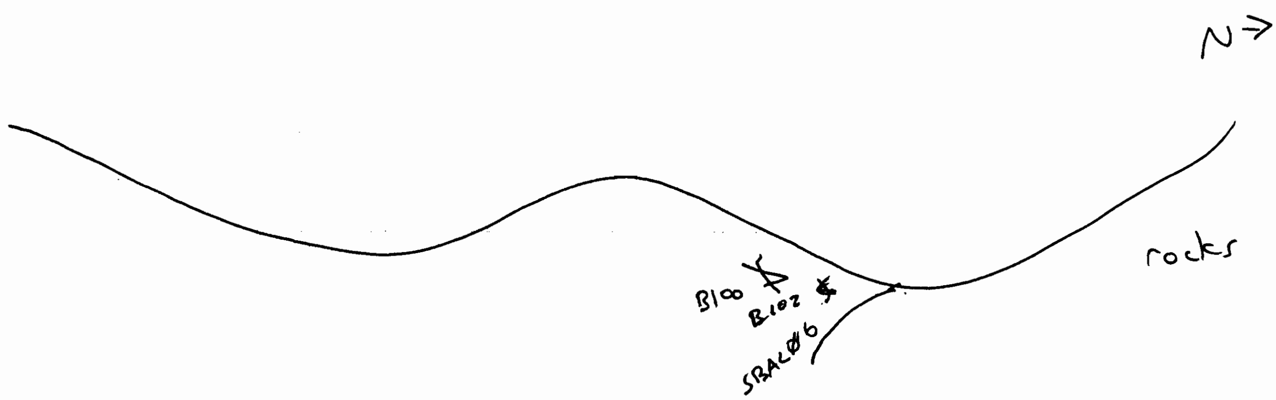
Associated Wetland No.:

Date: 8/26/09 Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga	Quad Name:
State/County/Municipality:: Albany Co., Wyoming	Picture No.: B100, B102

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: __________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: ~3	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes	Abrupt plant community change				Wrack line	Litter and debris
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10				Water Surface (at crossing location): 0				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left W	0-2	2-4	4-6	6-8	8+
	Right E	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left W	0-20	20-40	40-60	60-80	80+
	Right E	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBALØ15

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 50	Sand____	Silt/Clay 50	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 5	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5 - 10 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone			☐ Evidence of non-buffered concentrated flows	
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☐ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. information useful for ID forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: ____________________ **Waterbody ID No.:** SBALØ16

Centerline Re-Route Access Road Warehouse Site Other:

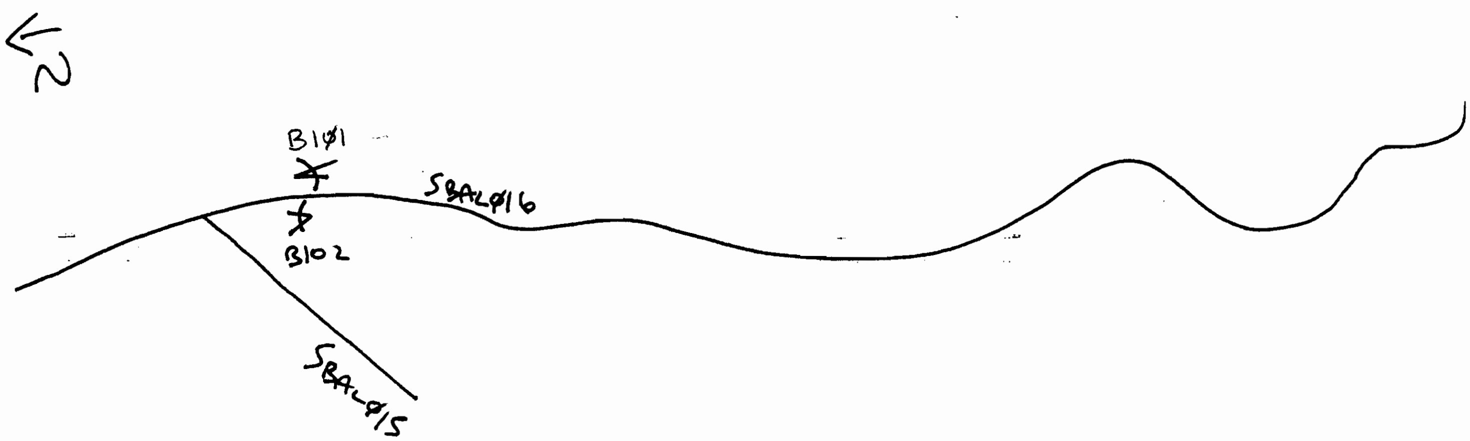
Associated Wetland No.:

Date: 8/26/09	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co., Wyoming		**Picture No.:** B1Ø1, B1Ø2

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: ~3		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2				Water Surface (at crossing location): Ø				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (º) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAC016

Date: 8/26/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 100	Sand____	Silt/Clay____	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None

Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 10 (ft)
	Circle vegetative layers: trees shrubs herbs
	☐ Significant bare areas within riparian zone ☐ Evidence of non-buffered concentrated flows

Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion

Disturbances	☐ Livestock access to riparian zone	☐ Manure in stream or on banks
	☐ Waste discharge pipes present	☐ Other:____

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

All gravel, slender, no plants in pathway

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM

WATERBODY DATA SHEET

Waterbody Name: ______________________ **Waterbody ID No.:** SBALØ17

Centerline Re-Route Access Road Warehouse Site Other:

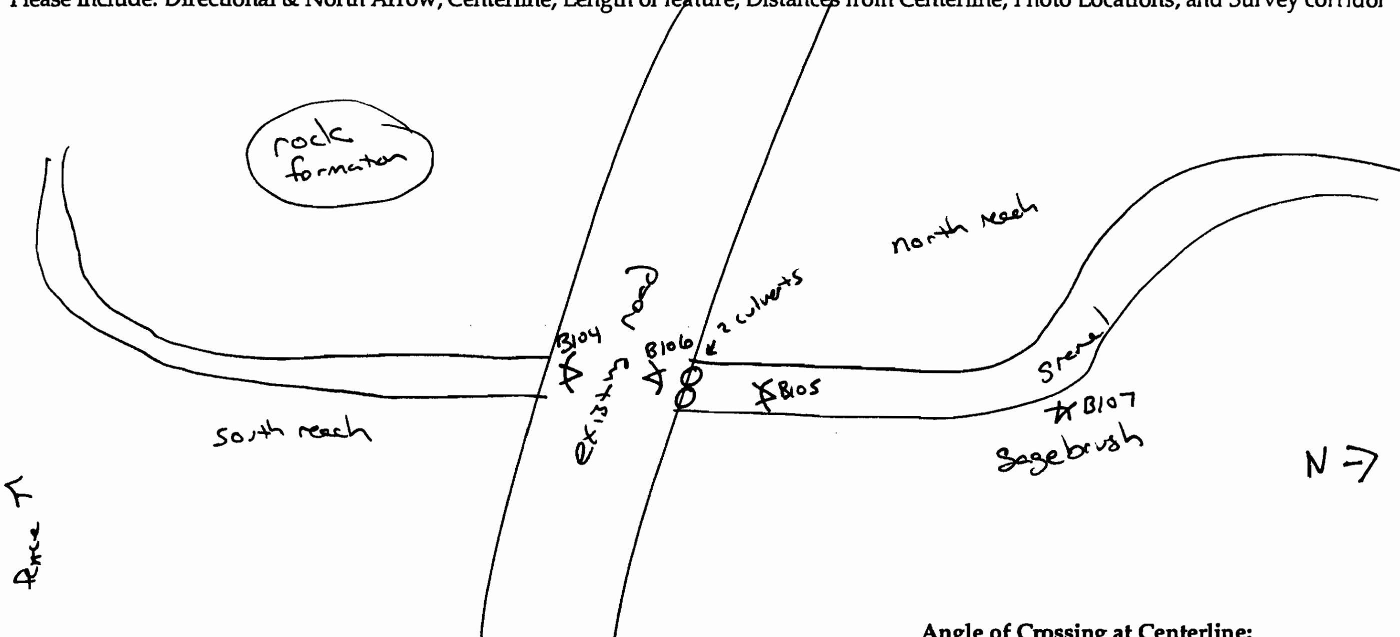
Associated Wetland No.:

Date: 8/27/09	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co., Wyoming		**Picture No.:** B104 - 107

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: __________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: N Months of estimated flow: 6	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation	Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change		Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 10				Water Surface (at crossing location): Ø			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

South Reach north reach

ERM®

Waterbody ID No.: SBALØ17

Date: 8/27/09	Client/Project Name & No.: Hermosa 010502B	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 50	Sand____	Silt/Clay 50	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 40	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5-10 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone			☐ Evidence of non-buffered concentrated flows	
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone			☒ Manure in stream or on banks	
	☐ Waste discharge pipes present			☐ Other:____	

woody debris

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Sagebrush in stream to the south. More bare gravel to the north w/less sage and more grasses. Small woody debris. culverts slightly obstructed by silt.

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Fish Creek　　　　Waterbody ID No.: SBALØ18

Centerline　Re-Route　Access Road　Warehouse Site　Other:

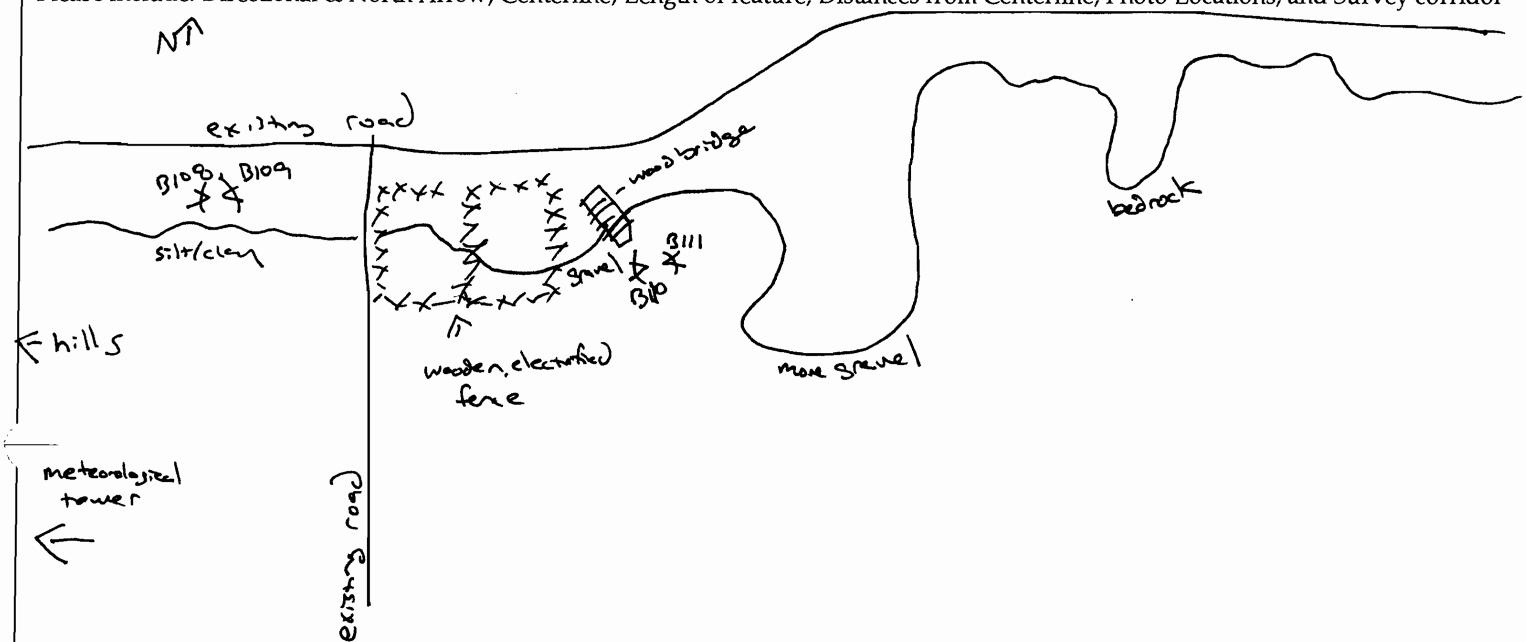
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co, Wyoming		Picture No.: B108 - 111

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ___________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: E Months of estimated flow: 12	
OHWM Indicator	Clear natural line on bank		Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change		Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 3				Water Surface (at crossing location): 3			
Bank Height (ft.) (looking downstream else give direction you 're facing here:______)	Left	0-2	2-4	4-6	6-8	8+		
	Right	0-2	2-4	4-6	6-8	8+		
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+		
	Right	0-20	20-40	40-60	60-80	80+		

ERM

Waterbody ID No.: SBAL018

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel Comments	Sand____	Silt/Clay Comments	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover 20	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl Great Blue Heron	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 30 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone			☐ Evidence of non-buffered concentrated flows	
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone			☒ Manure in stream or on banks	
	☐ Waste discharge pipes present			☐ Other:____	

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

Substrate shifts from silt/clay with some gravel (10/90%) on the NW to bedrock and gravel to the east (gravel 50/silt 50) Canada thistle present

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Tributary

Waterbody ID No.: SBALØ19

Centerline | Re-Route | Access Road | Warehouse Site | Other:

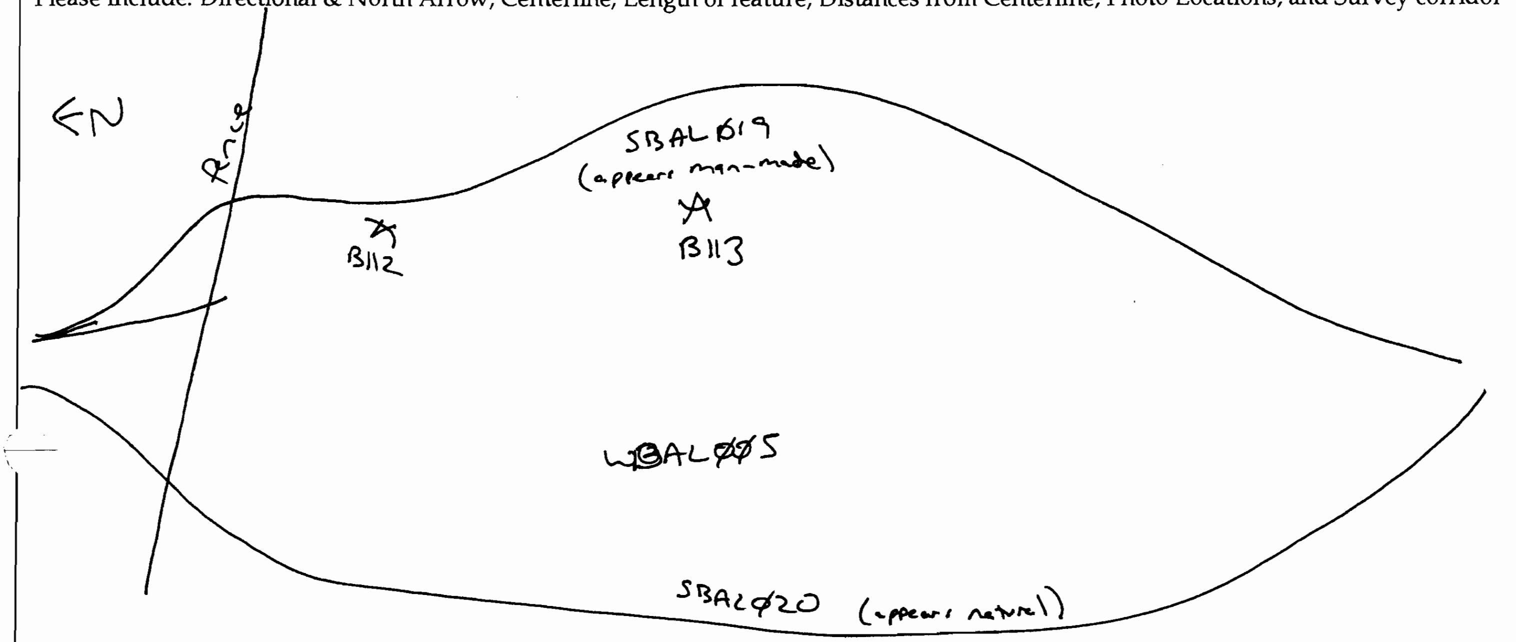
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B112

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ___________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:		
Stream Flow	Fast		Moderate		Slow		Very Slow		None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: S Months of estimated flow: 9		
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining	
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris	
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 2				Water Surface (at crossing location): 2				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBALØ19

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 80	Sand____	Silt/Clay 20	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ____	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes holes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 100 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

The "stream" appears to have been dug, perhaps to expand the wetland near SBALØ20. It is higher in elevation than the associated wetland.

STREAM QUALITY (indicate) ☐ High ☒ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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Suite 300
Houston, Texas 77084-5140

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WATERBODY DATA SHEET

Waterbody Name: Fish Creek Waterbody ID No.: SBAL Ø2O

Centerline Re-Route Access Road Warehouse Site Other:

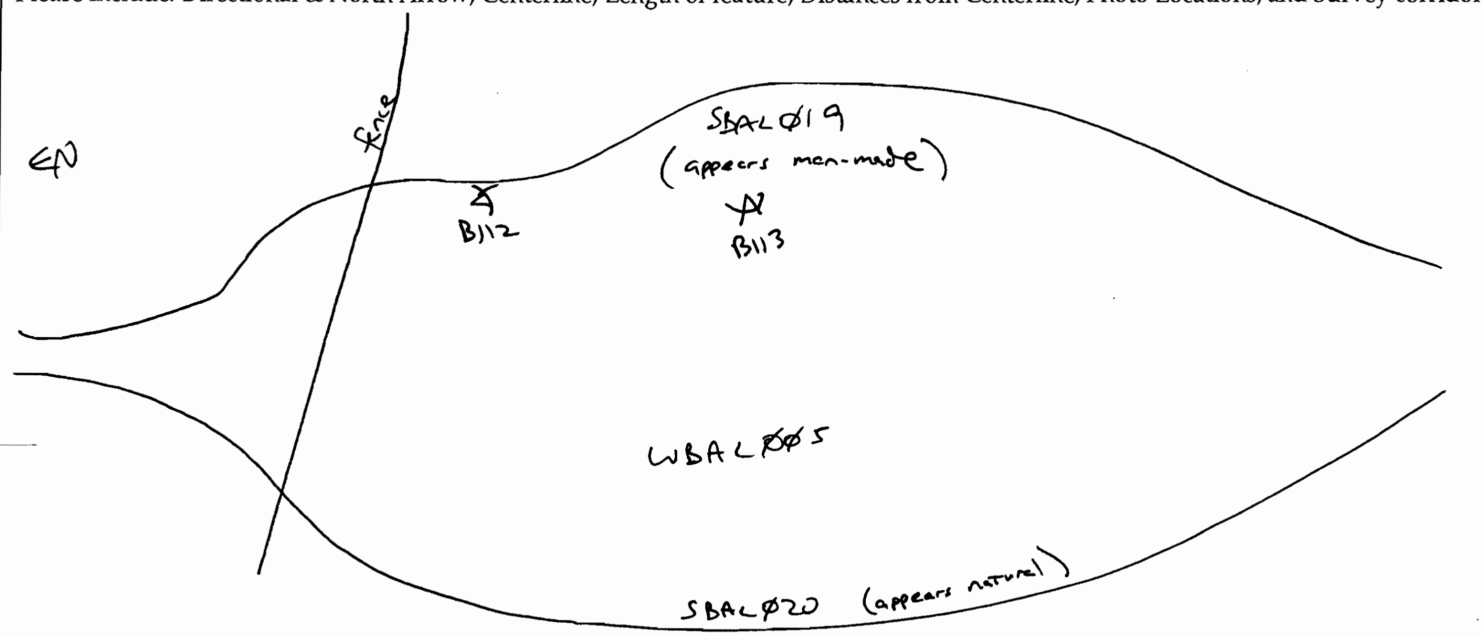
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co., Wyoming		Picture No.: B113

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ____________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate	Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)	Ephemeral (Flows only in response to rainfall)		Direction: S Months of estimated flow: 12	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+
Stream Width (ft.)	Top of Bank (at crossing location): 4				Water Surface (at crossing location): 3				

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM®

Waterbody ID No.: SBALØ2Ø

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel 75	Sand_____	Silt/Clay 25	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover _____	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 100 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone			☐ Evidence of non-buffered concentrated flows	
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone			☒ Manure in stream or on banks	
	☐ Waste discharge pipes present			☐ Other:________	

T/E SPECIES / SUITABLE HABITAT

Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Fish Creek Tributary   Waterbody ID No.: SBALØ21

Centerline   Re-Route   Access Road   Warehouse Site   Other:

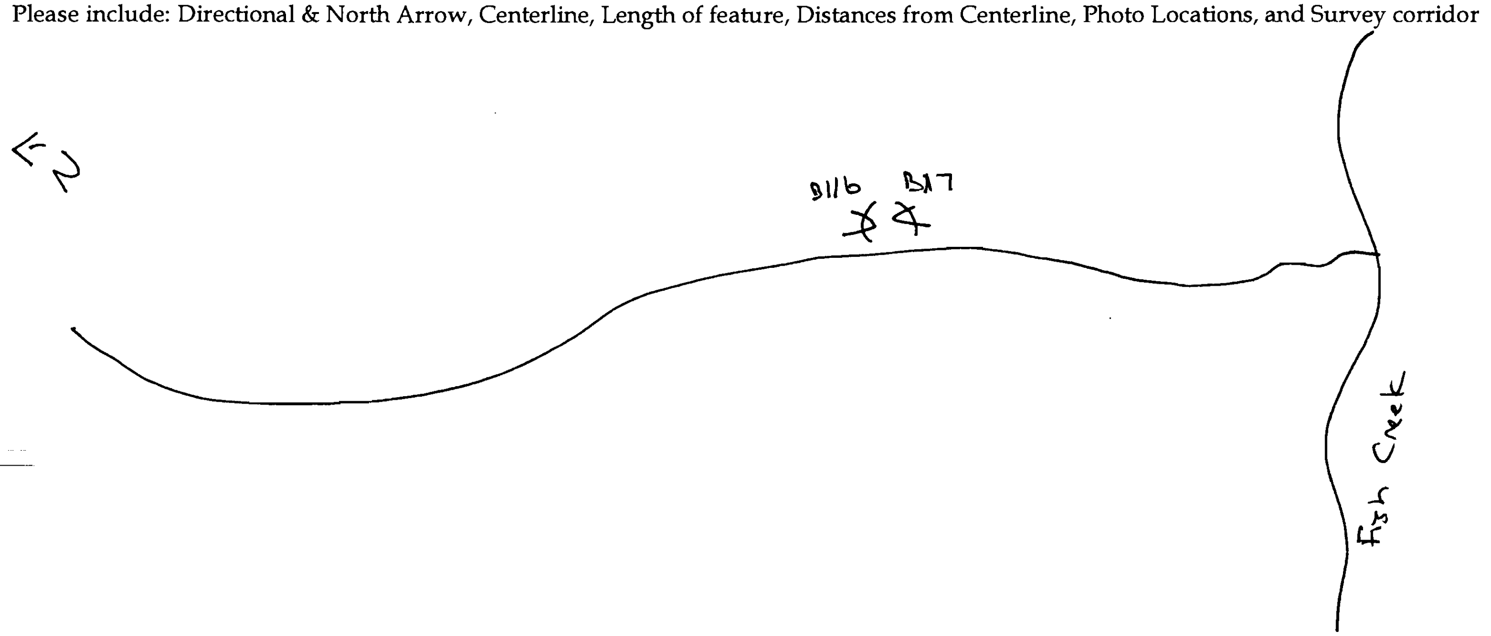
Associated Wetland No.:

Date: 8/27/09	**Client/Project Name & No.:** Hermosa 0105023	**Milepost:**
Investigators: Erin Johnson, Amanda Zuniga		**Quad Name:**
State/County/Municipality:: Albany Co. Wyoming		**Picture No.:** B116 + B117

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: S Months of estimated flow: 8	
OHWM Indicator	Clear natural line on bank		Shelving		Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 15				Water Surface (at crossing location): Ø			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAC Ø21

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 10	Sand_____	Silt/Clay 90	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 60	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:________________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

ERM.

WATERBODY DATA SHEET

aterbody Name: Fish Creek Tributery   Waterbody ID No.: SBALØ22

Centerline   Re-Route   Access Road   Warehouse Site   Other:

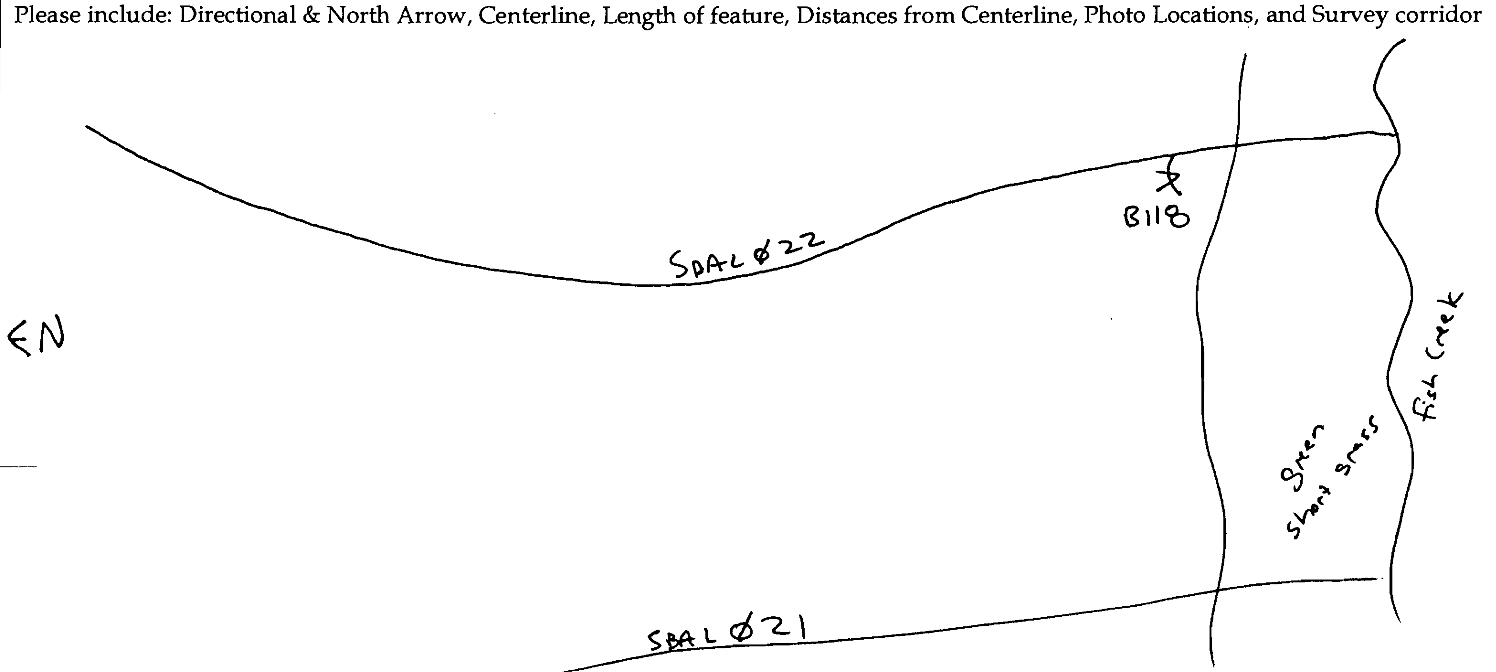
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co, Wyoming		Picture No.: B118

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ___________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: S Months of estimated flow: 3	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location): 10 - 15				Water Surface (at crossing location): Ø			

Bank Height (ft.) (looking downstream else give direction you are facing here:_______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:_______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM.

Waterbody ID No.: SBAL Ø22

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
NA	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel 40	Sand_____	Silt/Clay 60	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover _____	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None

Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: _________ (ft)
	Circle vegetative layers: trees shrubs herbs
	☐ Significant bare areas within riparian zone ☐ Evidence of non-buffered concentrated flows

Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	~~Channelization~~/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:__________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

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Houston, Texas 77084-5140

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WATERBODY DATA SHEET

Waterbody Name: Fish Creek Tributary Waterbody ID No.: S8AL ∅23

Centerline Re-Route Access Road Warehouse Site Other:

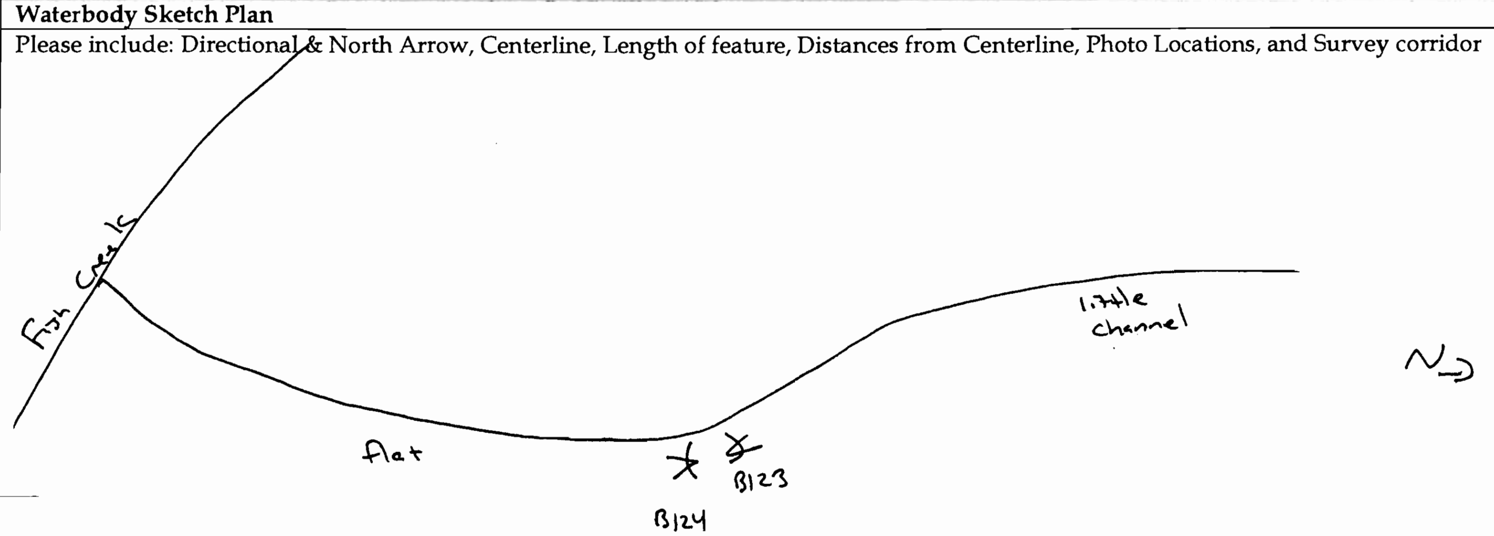
Associated Wetland No.:

Date: 8/27/09 — Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zwaigs	Quad Name:
State/County/Municipality:: Albany Co., Wyoming	Picture No.: B123 + B124

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ___________

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:	
Stream Flow	Fast		Moderate		Slow		Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/ Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)		Direction: SW Months of estimated flow: 2	
OHWM Indicator	Clear natural line on bank			Shelving	Wrested vegetation		Scour	Water Staining
Bent, matted or missing vegetation		Soil character changes		Abrupt plant community change			Wrack line	Litter and debris
Sinuosity	Straight		Meandering		**Subsurface Flow?**		Yes	No / Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60 / 60+
Stream Width (ft.)	Top of Bank (at crossing location):				Water Surface (at crossing location):			

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4 NW reach	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60 NW reach	60-80	80+

Southwest

ERM

Waterbody ID No.: SBAL∅23

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance NA	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock____	Gravel 80	Sand____	Silt/Clay 20	Organic____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover 10-50	In-stream submerged plants % Cover ____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other:			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 5 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☒ Livestock access to riparian zone		☒ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:____		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

STREAM QUALITY (indicate) ☒ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140

WATERBODY DATA SHEET

ERM.

aterbody Name: ______ Waterbody ID No.: SBAL024

Centerline Re-Route Access Road Warehouse Site Other:

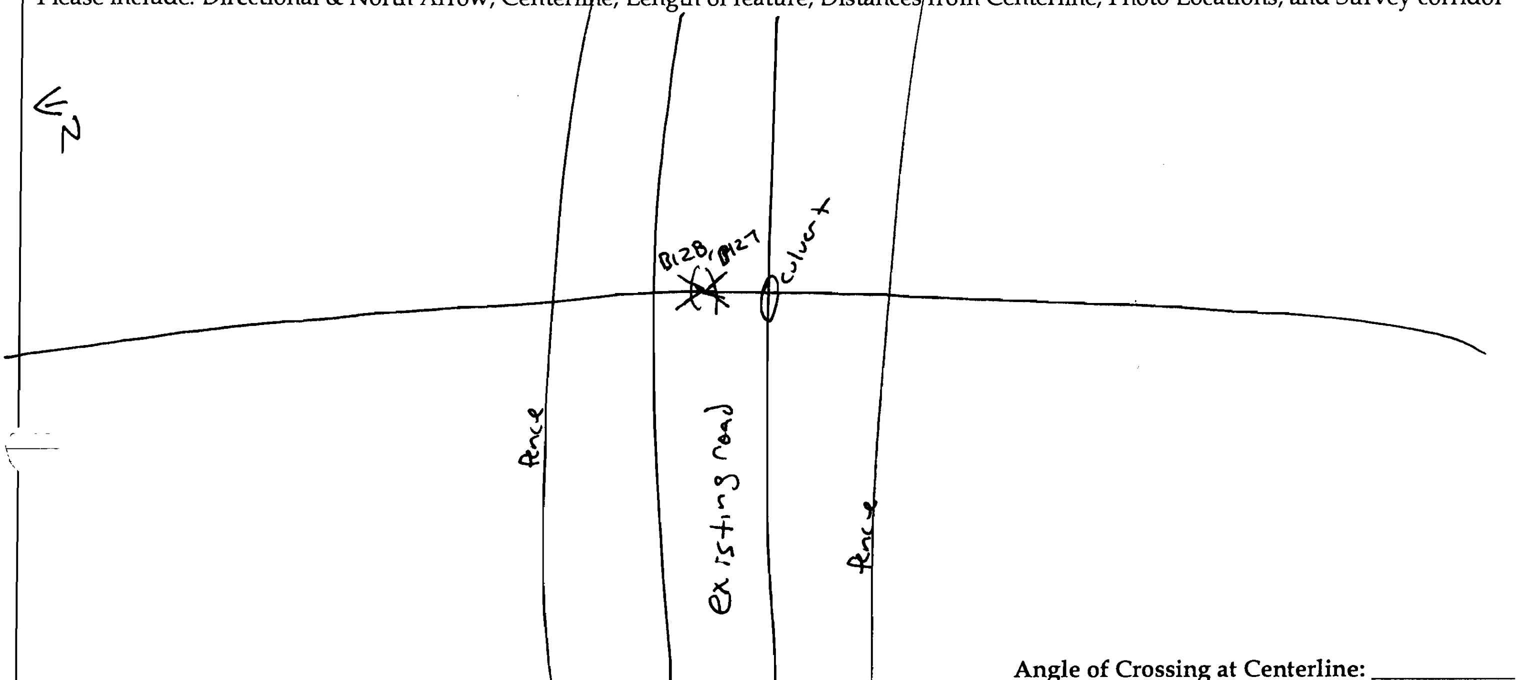
Associated Wetland No.:

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:
Investigators: Erin Johnson, Amanda Zuniga		Quad Name:
State/County/Municipality:: Albany Co, Wyoming		Picture No.: B127 - 128

PHYSICAL ATTRIBUTES

Waterbody Sketch Plan

Please include: Directional & North Arrow, Centerline, Length of feature, Distances from Centerline, Photo Locations, and Survey corridor



Angle of Crossing at Centerline: ______

Waterbody Type	Lake	Pond	Borrow Pit	River	Stream	Ag. Ditch	Other:
Stream Flow	Fast		Moderate		Slow	Very Slow	None
Flow type	Perennial (Flows > 3 months annually)		Intermittent/Seasonal (Flows <3 months annually)		Ephemeral (Flows only in response to rainfall)	Direction: N Months of estimated flow: 12	

OHWM Indicator	Clear natural line on bank	Shelving	Wrested vegetation	Scour	Water Staining
Bent, matted or missing vegetation	Soil character changes	Abrupt plant community change		Wrack line	Litter and debris

Sinuosity	Straight		Meandering		**Subsurface Flow?**	Yes	No	Unknown
Stream Depth (in.)	0-3	3-6	6-12	12-18	18-24	24-36	36-48	48-60	60+

Stream Width (ft.) Top of Bank (at crossing location): 2 Water Surface (at crossing location): 1

Bank Height (ft.) (looking downstream else give direction you are facing here:______)	Left	0-2	2-4	4-6	6-8	8+
	Right	0-2	2-4	4-6	6-8	8+
Bank Slope (°) (looking downstream else give direction you are facing here:______)	Left	0-20	20-40	40-60	60-80	80+
	Right	0-20	20-40	40-60	60-80	80+

ERM

Waterbody ID No.: SBAC Ø24

Date: 8/27/09	Client/Project Name & No.: Hermosa 0105023	Milepost:

QUALITATIVE ATTRIBUTES

Water Appearance	Clear	Slightly Turbid	Turbid	Very Turbid	Color:
	Floating algal mats	Obvious surface scum	Sheen on surface	Greenish color	Other:
Stream Substrate %	Bedrock_____	Gravel_______	Sand______	Silt/Clay 100	Organic_____
Aquatic Habitats	Sand Bar	Gravel Bar	Mud Bar	Gravel Riffles	Deep Pools
Undercut Banks	Overhanging trees/shrubs	In-stream emergent plants % Cover ______	In-stream submerged plants % Cover _____	Bank root systems	Fringing Wetlands
Aquatic Organisms Observed	Waterfowl	Fish (adult)	Fish (juvenile)	Frogs	Turtles
	Snakes	Other: Difficult to see due to plant growth			
	Invertebrates:	Intolerant	Facultative	Tolerant	None
Riparian Zone	Width of natural vegetation zone from edge of active channel out onto flood plain: 50 (ft)				
	Circle vegetative layers: trees shrubs herbs				
	☐ Significant bare areas within riparian zone		☐ Evidence of non-buffered concentrated flows		
Tributary is	Natural	Artificial (Man-Made)	Manipulated (Explain below)		Stable / Unstable
Channel Condition	Channelization/Braiding	Unnatural straightening	Downcutting	Dikes/Berms	Excessive bank erosion
Disturbances	☑ Livestock access to riparian zone		☐ Manure in stream or on banks		
	☐ Waste discharge pipes present		☐ Other:_______________		

T/E SPECIES / SUITABLE HABITAT Habitat ID No.:

Comments (e.g. Information useful for JD forms, construction constraints, erosion potential, existing disturbances, and meanders)

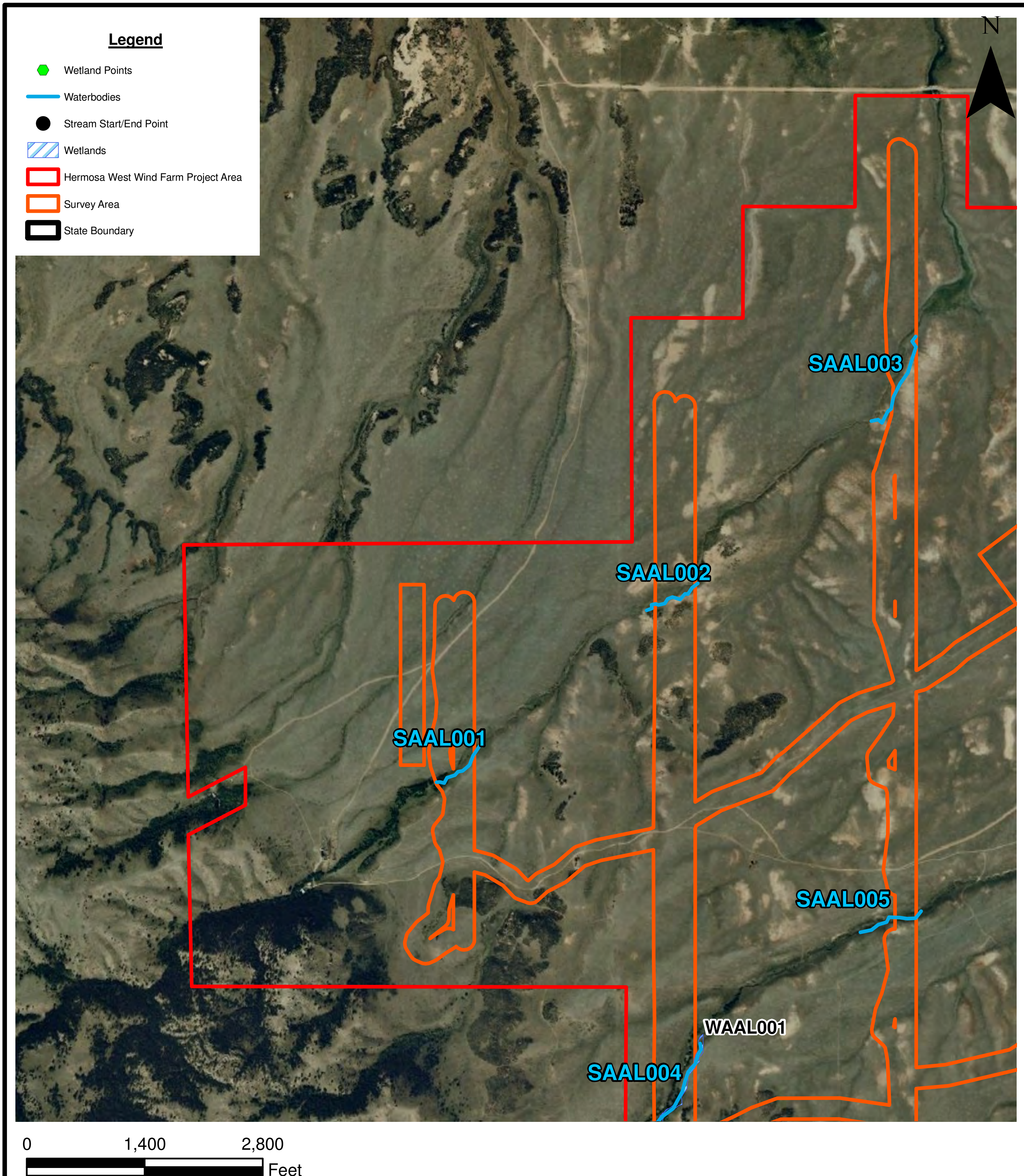
Culverted, thin stream with a lot of vegetation surrounding it

STREAM QUALITY (indicate) ☑ High ☐ Moderate ☐ Low

High Quality: Natural channel (no structures or dikes; no evidence of downcutting or excessive lateral cutting); evidence of past channel alteration with significant recovery; any dikes/levies are set back to provide access to adequate flood plain; natural vegetation extends at least one or two active channel widths on each side; banks stable and protected by roots that extend to the base-flow elevation; water clear to tea-colored; no barriers to fish movement (seasonal water withdrawals prevent movement); many fish cover types available; diverse and stable aquatic habitat; no disturbance by livestock or man; intolerant macroinvertebrates present.

Moderate Quality: Altered channel evidenced by rip rap and/or channelization; dikes/levees restrict flood plain width; natural vegetation extends 1/3-1/2 of the active channel width on each side; filtering function of riparian vegetation only moderately compromised; banks moderately unstable (outside bends actively eroding with few fallen trees); considerable water cloudiness, submerged objects covered with green film; moderate odor; minor barriers to fish movement; 4-3 fish cover types available; fair aquatic habitat; minimum disturbance by livestock or man; Facultative macroinvertebrates present.

Low Quality: Channel is actively downcutting or widening; rip rap and channelization excessive; flood plain restricted by dikes/levees; natural vegetation less than 1/3 of the active channel width on each side; lack of regeneration; filtering function severely compromised; Banks unstable (inside and outside bends actively eroding with numerous fallen trees); water very turbid to muddy; obvious pollutants (algal mats, surface scum, surface sheen); heavy odor; green color to water; severe barriers to fish movement; 2-0 fish cover types available; little to no aquatic habitat; severe disturbance by livestock or man; tolerant or no macroinvertebrates present.

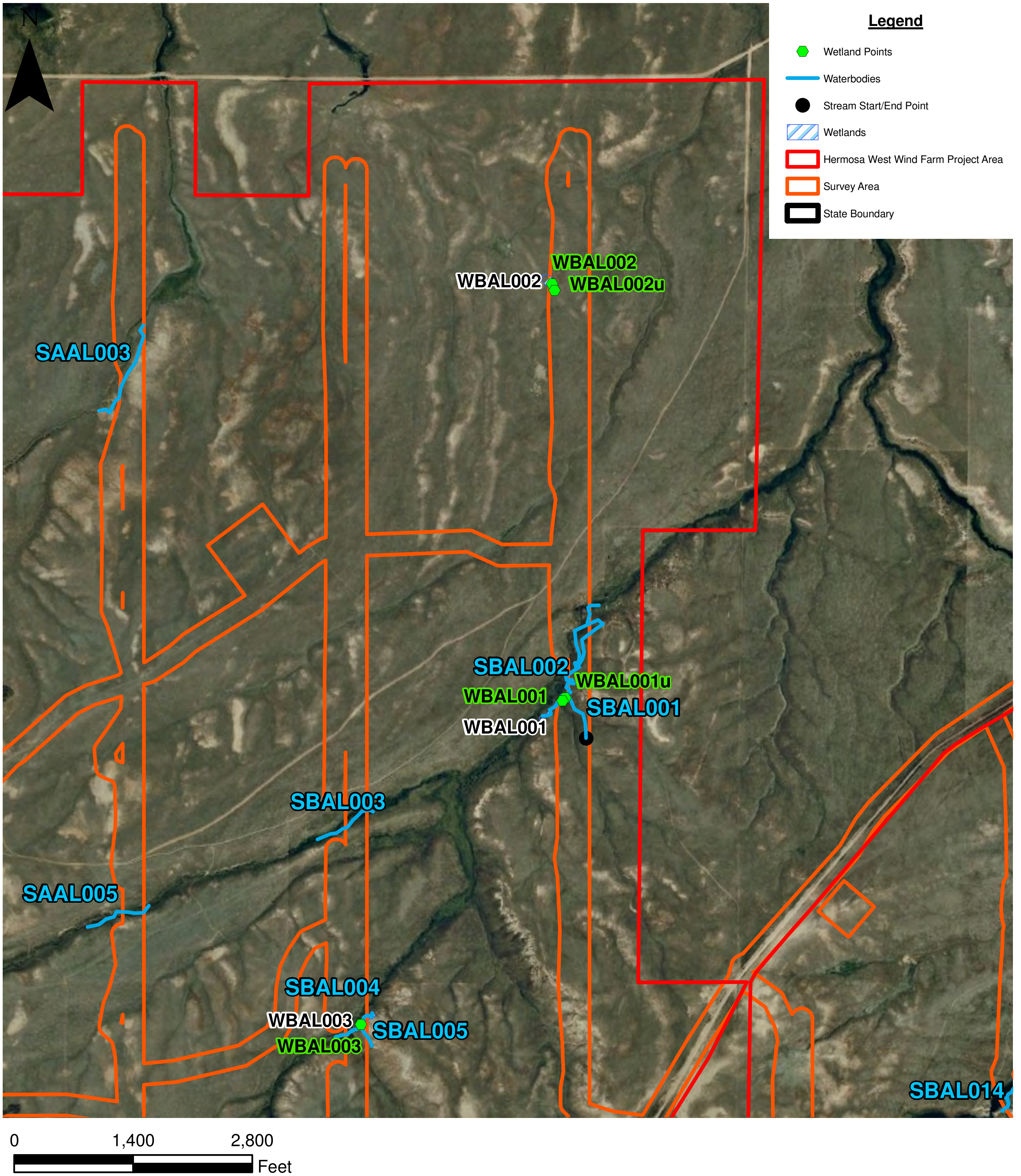


Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\aerial_wetlands.mxd				

FIGURE A-1a
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
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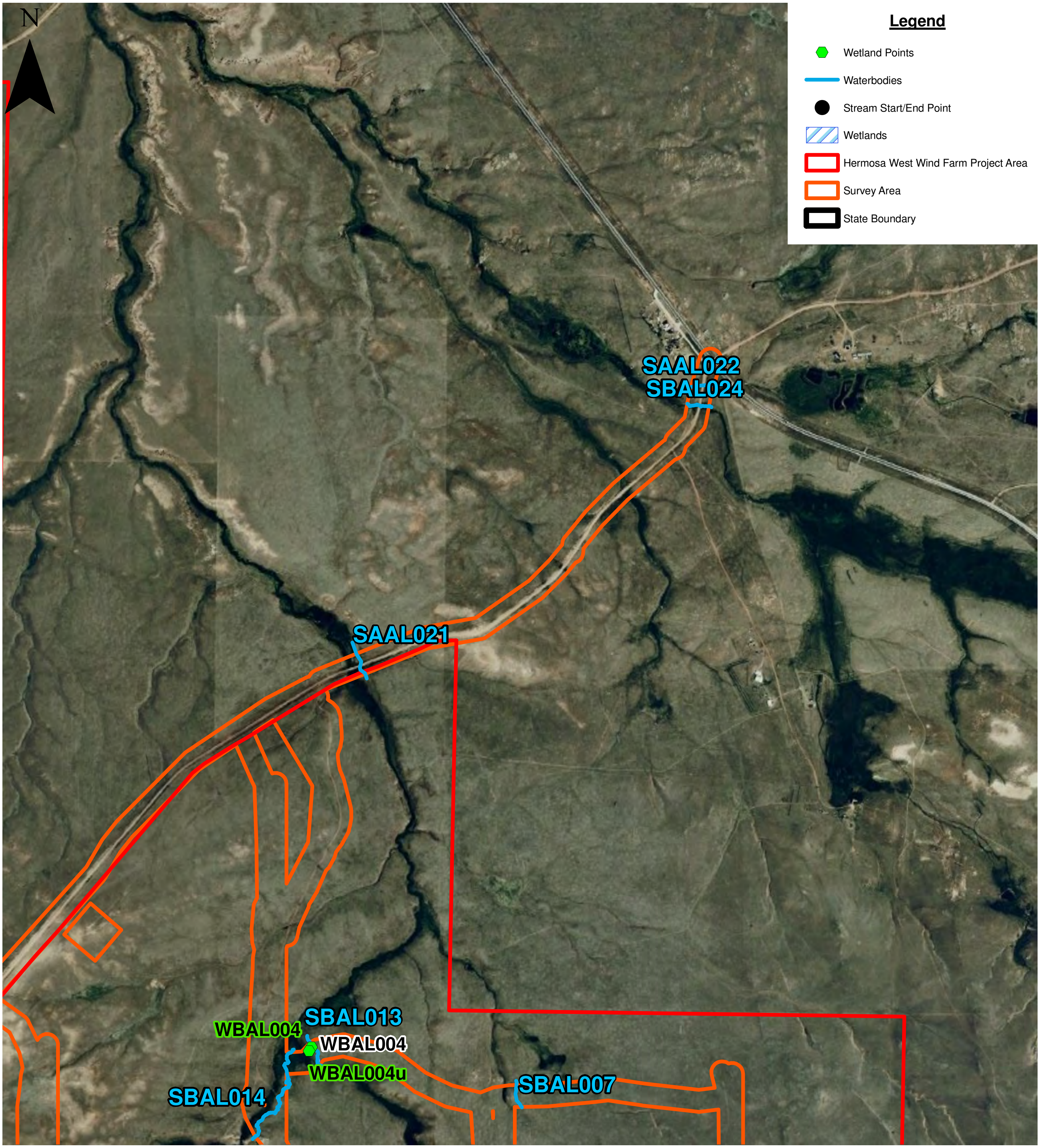
FIGURE A-1b
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



0 1,400 2,800 Feet

Environmental Resources Management

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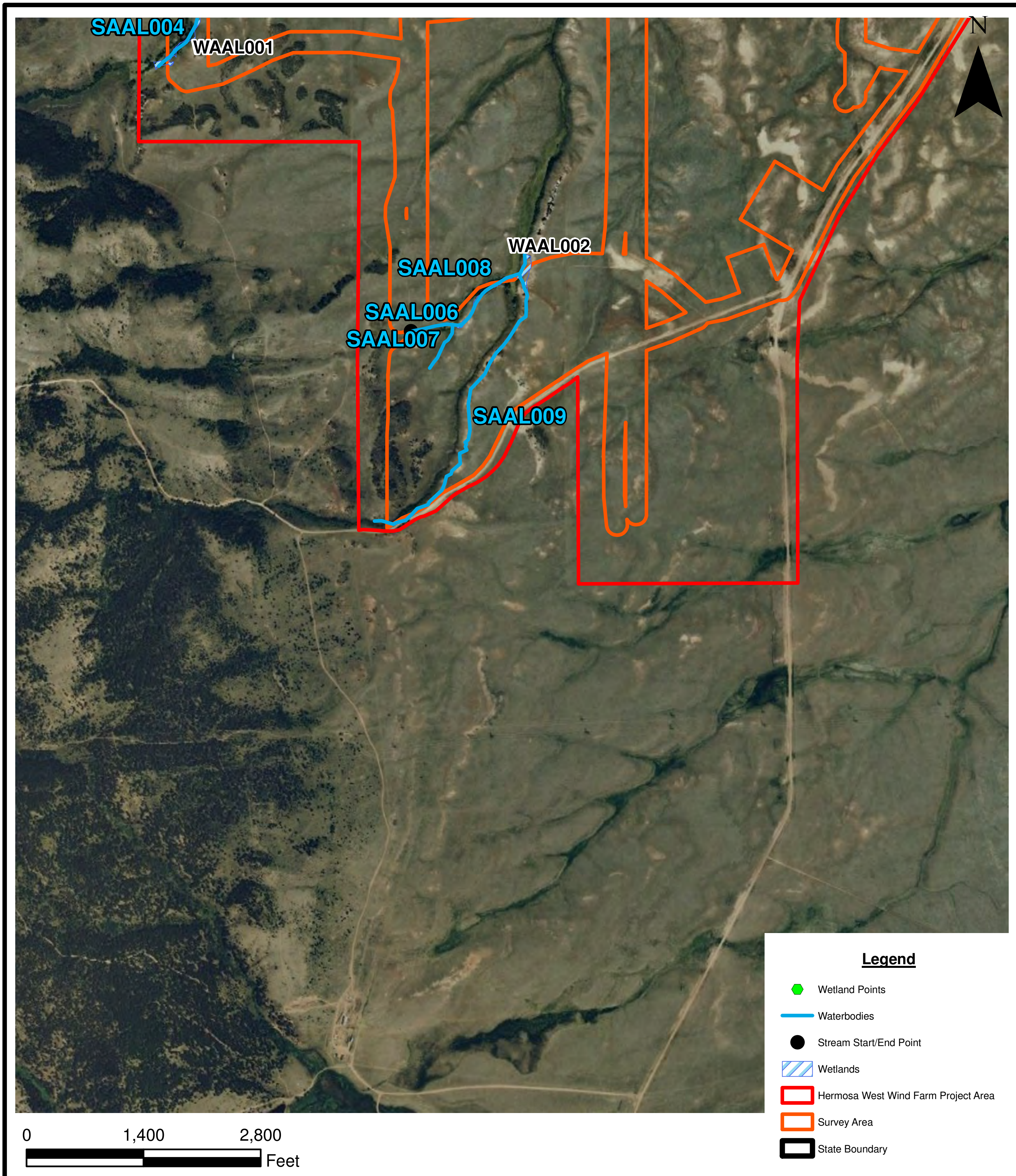
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\aerial_wetlands.mxd		

FIGURE A-1c
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

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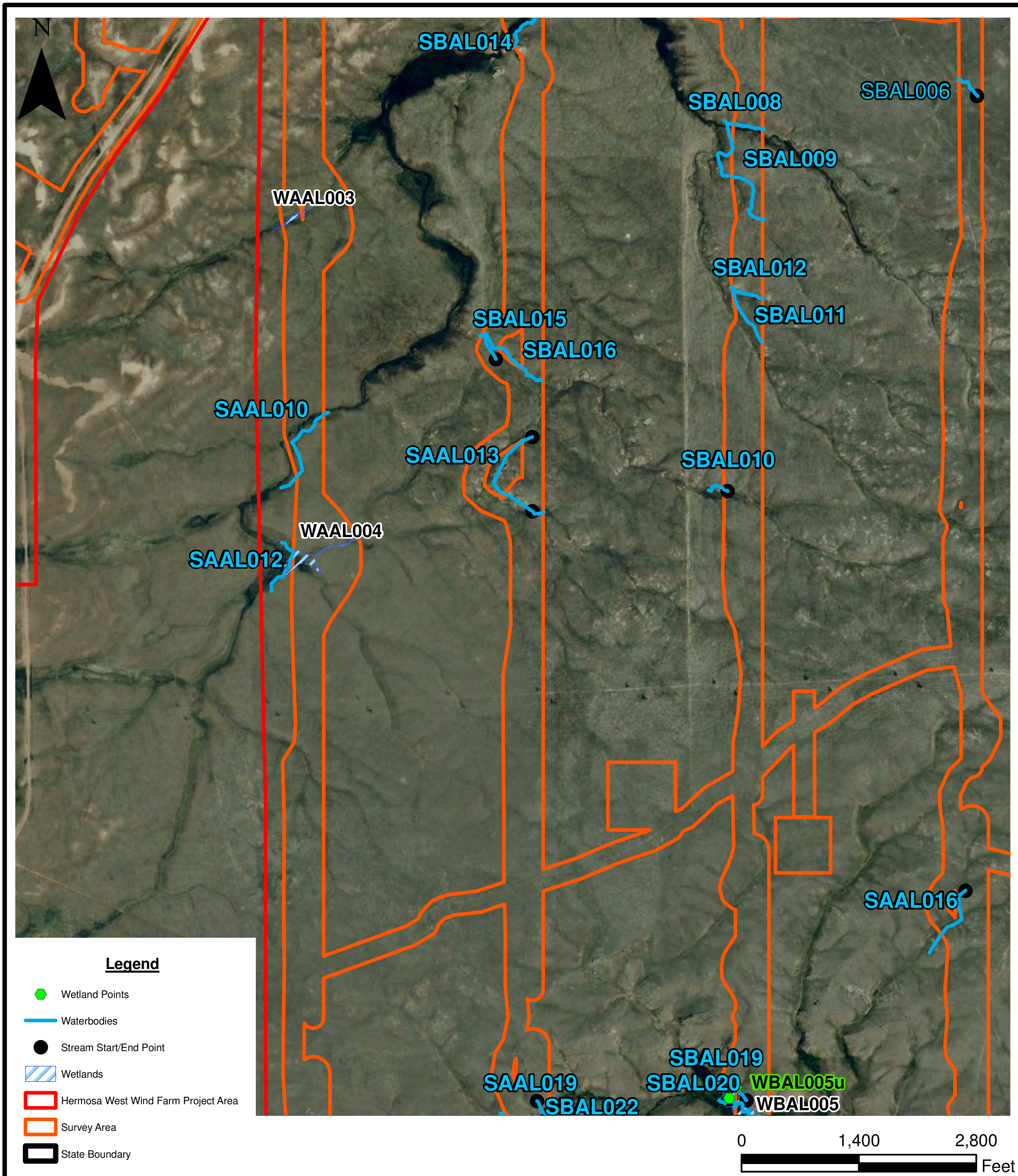
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\aerial_wetlands.mxd				

FIGURE A-1d
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

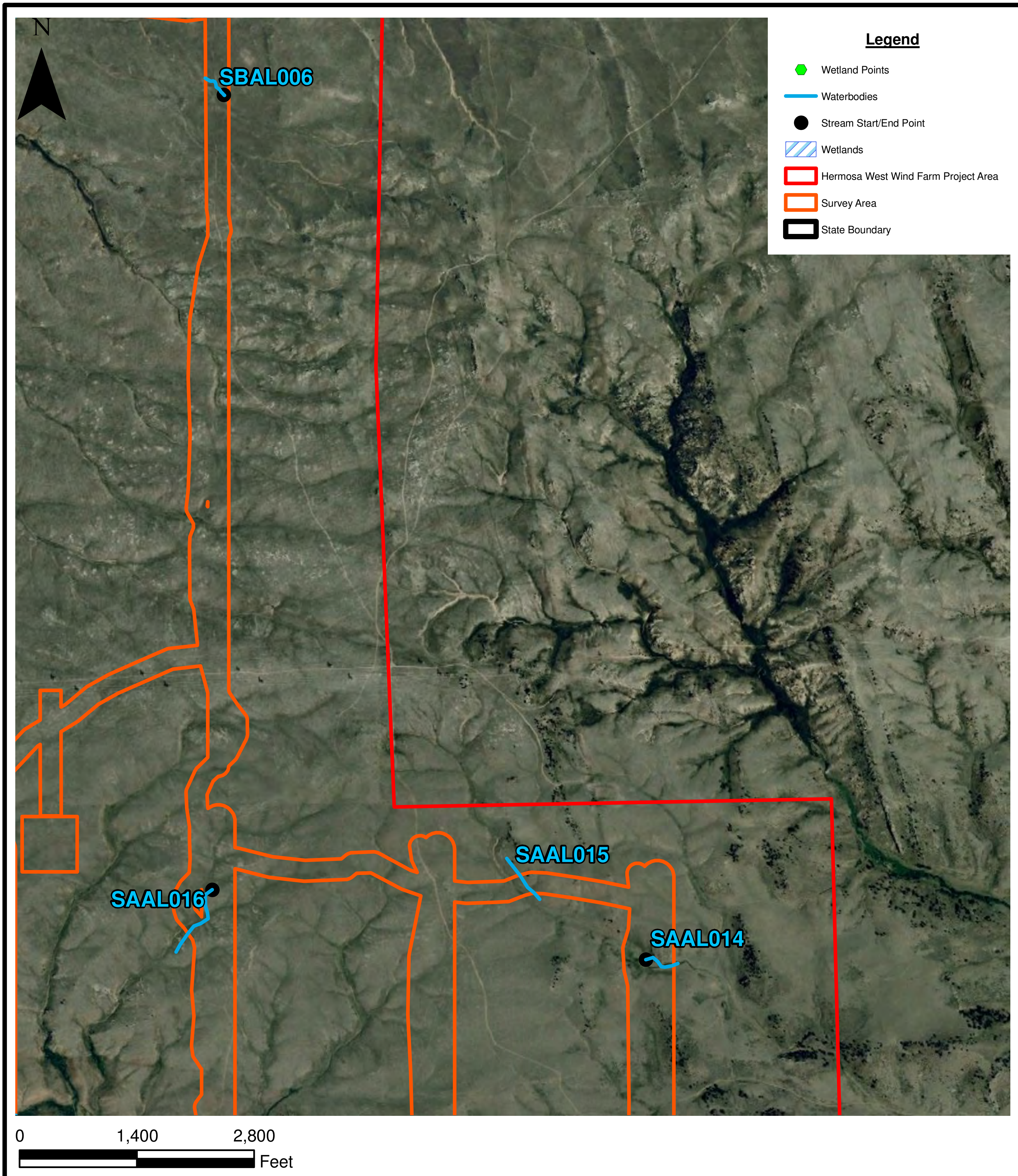
ERM



Environmental Resources Management					
DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\aerial_wetlands.mxd				

FIGURE A-1e
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
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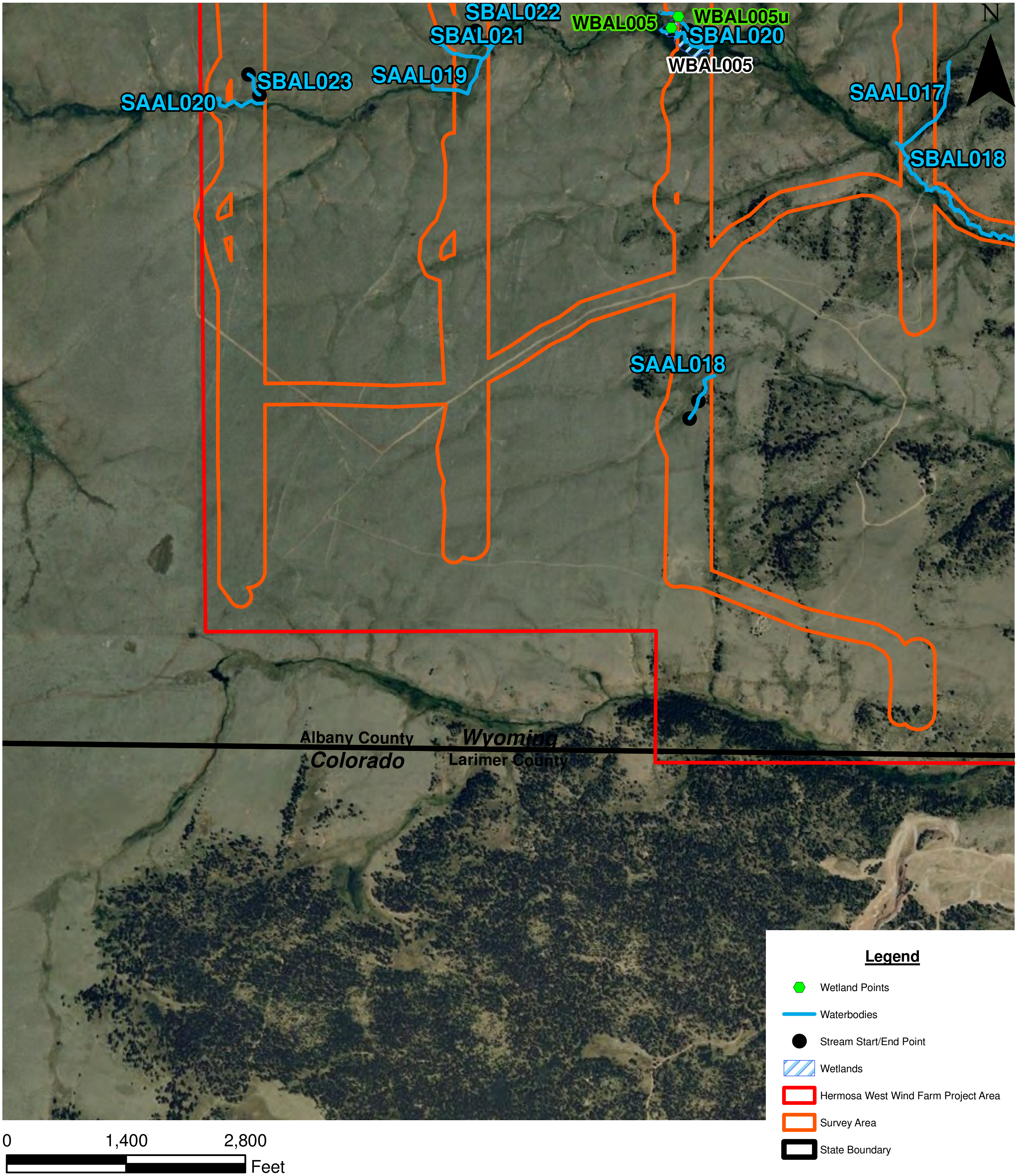
FIGURE A-1f
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
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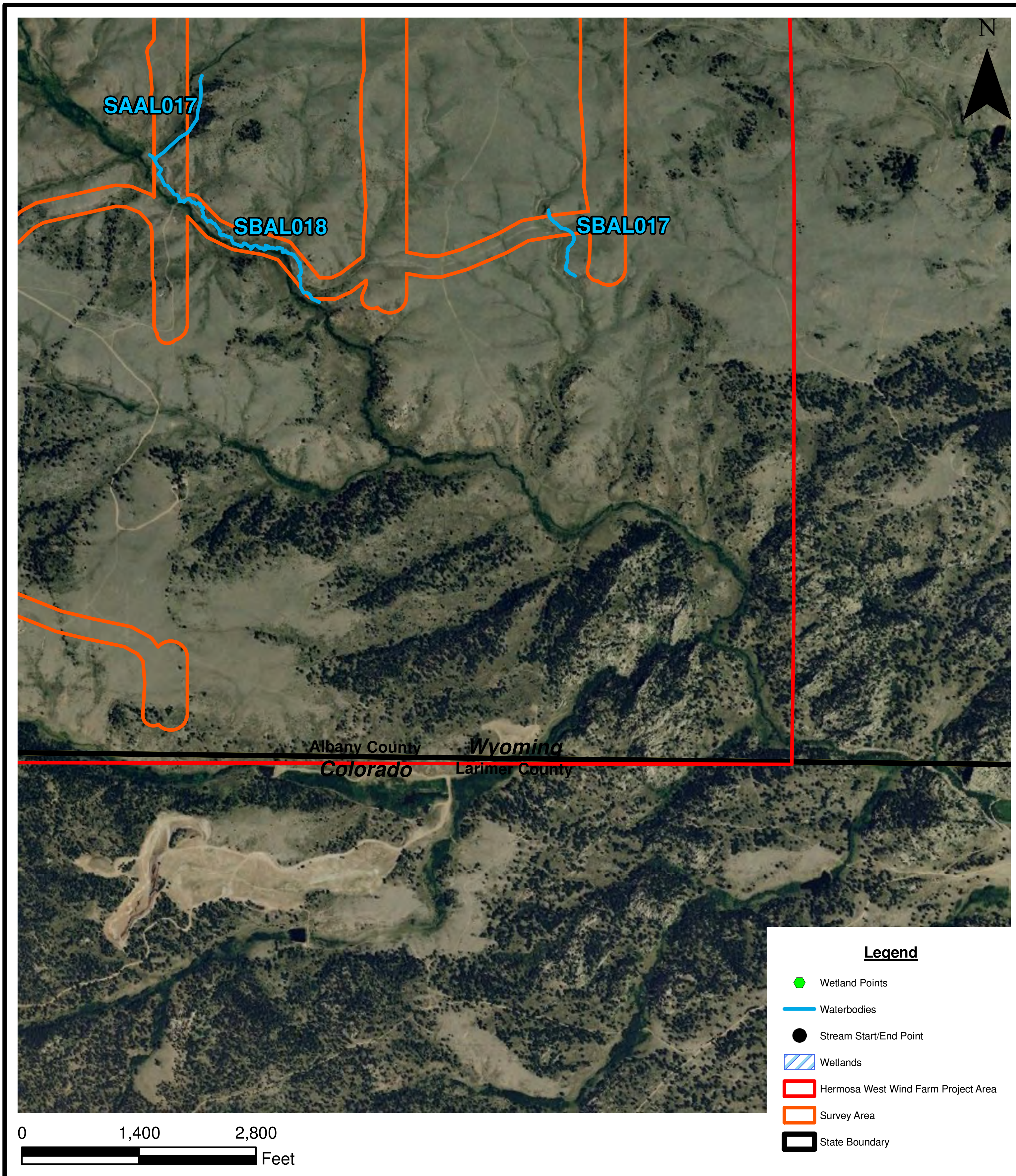
FIGURE A-1g
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\aerial_wetlands.mxd		

FIGURE A-1h
AERIAL MAP WITH CORPPLOTS
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

Description of Dominance Test

Appendix B

January 11, 2010
Project No. 0105023

Environmental Resources Management Southwest Inc.
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

Procedure

The procedure for using hydrophytic vegetation indicators is as follows:

1. Apply Indicator 1 (Dominance Test).

   a. If the plant community passes the dominance test, then the vegetation is hydrophytic and no further vegetation analysis is required.
   b. If the plant community fails the dominance test, and indicators of hydric soil and/or wetland hydrology are absent, then hydrophytic vegetation is absent unless the site meets requirements for a problematic wetland situation (see Chapter 5).
   c. If the plant community fails the dominance test, but indicators of hydric soil and wetland hydrology are both present, proceed to step 2.

2. Apply Indicator 2 (Prevalence Index). This step assumes that at least one indicator of hydric soil and one primary or two secondary indicators of wetland hydrology are present.

   a. If the plant community satisfies the prevalence index, then the vegetation is hydrophytic. No further vegetation analysis is required.
   b. If the plant community fails the prevalence index, then hydrophytic vegetation is absent unless indicators of hydric soil and wetland hydrology are present and the site meets the requirements for a problematic wetland situation (Chapter 5).

Indicator 1: Dominance test

Description: More than 50 percent of the dominant plant species across all strata are rated OBL, FACW, or FAC.

User Notes: Use the "50/20 rule" described below to select dominant species from each stratum of the community. Combine dominant species across strata and apply the dominance test to the combined list. Once a species is selected as a dominant, its cover value is not used in the dominance test; each dominant species is treated equally. Thus, a plant community with seven dominant species across all strata would need at least four dominant species that are OBL, FACW, or FAC to be considered hydrophytic by this indicator. Species that are dominant in two or more strata should be counted two or more times in the dominance test.

Procedure for Selecting Dominant Species by the 50/20 Rule: Dominant plant species are the most abundant species in the community; they contribute more to the character of the community than do the other non-dominant species present. The 50/20 rule is the recommended method for selecting dominant species from a plant community when quantitative data are available.

Dominant species are chosen independently from each stratum of the community. In general, dominants are the most abundant species that individually or collectively account for more than 50 percent of the total coverage of vegetation in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total. For the purposes of this regional supplement, absolute percent cover is the recommended abundance measure for plants in all vegetation strata. See Table 3 for an example application of the 50/20 rule in evaluating a plant community. Steps in selecting dominant species by the 50/20 rule are as follows:

1. Estimate the absolute percent cover of each species in the first stratum. Since the same data may be used later to calculate the prevalence index, the data should be recorded as absolute cover and not converted to relative cover.

2. Rank all species in the stratum from most to least abundant.

3. Calculate the total coverage of all species in the stratum (i.e., sum their individual percent cover values). Absolute cover estimates do not necessarily sum to 100 percent.

4. Select plant species from the ranked list, in decreasing order of coverage, until the cumulative coverage of selected species *exceeds* 50 percent of the total absolute coverage for the stratum. If two or more species are equal in coverage (i.e., they are tied in rank), they should all be selected. The selected plant species are all considered to be dominants. All dominants must be identified to species.

5. In addition, select any other species that, by itself, is at least 20 percent of the total absolute percent cover in the stratum. Any such species is also considered to be a dominant and must be accurately identified.

Table 3. Example of the selection of dominant species by the 50/20 rule and determination of hydrophytic vegetation by the dominance test.

Stratum	Species Name	Wetland Indicator Status[1]	Absolute Percent Cover	Dominant?
Herb	*Impatiens capensis*	FACW	30	Yes
	Boehmeria cylindrica	FACW	18	Yes
	Pilea pumila	FACW	12	No
	Athyrium filix-femina	FAC	3	No
	Symplocarpus foetidus	OBL	3	No
		Total cover	66	
		50/20 Thresholds: 50% of total cover =33.0% 20% of total cover =13.2%		
Shrub	*Ilex opaca*	FACU	18	Yes
	Viburnum dentatum	FAC	6	Yes
	Clethra alnifolia	FAC	3	No
	Vaccinium corymbosum	FACW	3	No
		Total cover	30	
		50/20 Thresholds: 50% of total cover =15.0% 20% of total cover = 6.0%		
Sapling	*Acer rubrum*	FAC	9	Yes
	Liquidambar styraciflua	FAC	9	Yes
	Fraxinus pennsylvanica	FACW	2	No
		Total cover	20	
		50/20 Thresholds: 50% of total cover =10.0% 20% of total cover = 4.0%		
Tree	*Acer rubrum*	FAC	18	Yes
	Liquidambar styraciflua	FAC	18	Yes
	Platanus occidentalis	FACW	12	Yes
	Fraxinus pennsylvanica	FACW	6	No
	Liriodendron tulipifera	FACU	3	No
	Nyssa sylvatica	FAC	3	No
		Total cover	60	
		50/20 Thresholds: 50% of total cover = 30% 20% of total cover = 12%		
Woody Vine	*Toxicodendron radicans*	FAC	5	Yes
	Lonicera japonica	FAC	4	Yes
	Parthenocissus quinquefolia	FACU	1	No
		Total cover	10	
		50/20 Thresholds: 50% of total cover = 5.0% 20% of total cover = 2.0%		
Hydrophytic Vegetation Determination	Total number of dominant species across all strata = 11. Percent of dominant species that are OBL, FACW, or FAC = 10/11 = 90.9%. Therefore, this community is hydrophytic by Indicator 1 (Dominance Test).			

[1] Indicator statuses according to the Region 1 (Northeast) plant list (Reed 1988).

6. Repeat steps 1-5 for any other stratum present. Combine the lists of dominant species across all strata. Note that a species may be dominant in more than one stratum (e.g., a woody species may be dominant in both the tree and sapling strata).

Indicator 2: Prevalence index

Description: The prevalence index is 3.0 or less.

User Notes: The prevalence index ranges from 1 to 5. A prevalence index of 3.0 or less indicates that hydrophytic vegetation is present. To calculate the prevalence index, at least 80 percent of the total vegetation cover on the plot (summed across all strata) must be of species that have been correctly identified and have assigned wetland indicator statuses (Reed 1988 or current list) or are upland (UPL) species.

Procedure for Calculating a Plot-Based Prevalence Index: The prevalence index is a weighted-average wetland indicator status of all plant species in the sampling plot, where each indicator status category is given a numeric code (OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5) and weighting is by abundance (absolute percent cover). It is a more comprehensive analysis of the hydrophytic status of the community than one based on just a few dominant species. It is particularly useful in (1) communities with only one or two dominants, (2) highly diverse communities where many species may be present at roughly equal coverage, and (3) cases where strata differ greatly in total plant cover (e.g., total herb cover is 80 percent but sapling cover is only 10 percent). The prevalence index is used in this supplement to determine whether hydrophytic vegetation is present on sites where indicators of hydric soil and wetland hydrology are present but the vegetation initially fails the dominance test.

The following procedure is used to calculate a plot-based prevalence index. The method was described by Wentworth et al. (1988) and modified by Wakeley and Lichvar (1997). It uses the same field data (i.e., percent cover estimates for each plant species) that were used to select dominant species by the 50/20 rule, with the added constraint that at least 80 percent of the total vegetation cover on the plot must be of species that have been correctly identified and have an assigned indicator status (including UPL). For any species that occurs in more than one stratum, cover estimates are summed across strata. Steps for determining the prevalence index are as follows:

1. Identify and estimate the absolute percent cover of each species in each stratum of the community. Sum the cover estimates for any species that is present in more than one stratum.

2. Organize all species (across all strata) into groups according to their wetland indicator status (i.e., OBL, FACW, FAC, FACU, or UPL) and sum their cover values within groups. Do not include species that were not identified.

3. Calculate the prevalence index using the following formula:

$$PI = \frac{A_{OBL} + 2A_{FACW} + 3A_{FAC} + 4A_{FACU} + 5A_{UPL}}{A_{OBL} + A_{FACW} + A_{FAC} + A_{FACU} + A_{UPL}}$$

where:

PI = Prevalence index
A_{OBL} = Summed percent cover values of obligate (OBL) plant species
A_{FACW} = Summed percent cover values of facultative wetland (FACW) plant species
A_{FAC} = Summed percent cover values of facultative (FAC) plant species
A_{FACU} = Summed percent cover values of facultative upland (FACU) plant species
A_{UPL} = Summed percent cover values of upland (UPL) plant species

See Table 4 for an example calculation of the prevalence index using the same data set as in Table 3. The following web link provides free public-domain software for simultaneous calculation of the 50/20 rule, dominance test, and prevalence index:
http://www.crrel.usace.army.mil/rsgisc/wetshed/wetdatashed.htm.

Table 4. Example of the Prevalence Index using the same data as in Table 3.

Indicator Status Group	Species Name	Absolute Percent Cover by Species	Total Cover by Group	Multiply by:[1]	Product
OBL species	*Symplocarpus foetidus*	3	3	1	3
FACW species	*Boehmeria cylindrica*	18			
	Fraxinus pennsylvanica[2]	8			
	Impatiens capensis	30			
	Pilea pumila	12			
	Platanus occidentalis	12			
	Vaccinium corymbosum	3	83	2	166
FAC species	*Acer rubrum*[2]	27			
	Athyrium filix-femina	3			
	Clethra alnifolia	3			
	Liquidambar styraciflua[2]	27			
	Lonicera japonica	4			
	Nyssa sylvatica	3			
	Toxicodendron radicans	5			
	Viburnum dentatum	6	78	3	234
FACU species	*Ilex opaca*	18			
	Liriodendron tulipifera	3			
	Parthenocissus quinquefolia	1	22	4	88
UPL species	None	0	0	5	0
Sum			186 (A)		491 (B)
Hydrophytic Vegetation Determination		Prevalence Index = B/A = 491/186 = 2.64 Therefore, this community is hydrophytic by Indicator 2 (Prevalence Index).			

[1] Where OBL = 1, FACW = 2, FAC = 3, FACU = 4, and UPL = 5.

[2] These species were each recorded in two or more strata (see Table 3), so the cover estimates were summed across strata.

Photographic Log
Appendix C

January 11, 2010
Project No. 0105023

Environmental Resources Management Southwest Inc.
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

Environmental
Resources
Management

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140
(281) 600-1000
(281) 600-1001 (fax)

Photographic Log

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A35

Feature:
WAAL001

Date:
08-25-2009

Comments:
Looking south, this photo depicts wetland WAAL001 associated with stream SAL004 (Forest Creek).

Photograph ID:
A36

Feature:
WAAL001

Date:
08-25-2009

Comments:
Looking north, this image shows another view of wetland WAAL001.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A37 **Feature:** WAAL001U **Date:** 08-25-2009 **Comments:** Looking west, this photograph shows the upland vegetation community adjacent to wetland WAAL001.	
Photograph ID: A54 **Feature:** WAAL002 **Date:** 08-26-2009 **Comments:** Looking south-southwest this image shows a view of wetland WAAL002 associated with the confluence of stream SAAL008 (Boulder Creek) and SAAL009.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A55 **Feature:** WAAL002 **Date:** 08-26-2009 **Comments:** Looking north-northeast this photograph shows another view of wetland WAAL002.	
Photograph ID: A56 **Feature:** WAAL002U **Date:** 08-26-2009 **Comments:** Looking south, this picture shows the upland plant community associated with wetland WAAL002.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A65 **Feature:** WAAL003 **Date:** 08-26-2009 **Comments:** Looking west, this image shows wetland WAAL003. This wetland is located in a low-lying area near an offsite wetland complex associated with a tributary to Willow Creek.	
Photograph ID: A66 **Feature:** WAAL003 **Date:** 08-26-2009 **Comments:** Looking east, this image shows another view of the hummocks within wetland WAAL003.	

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A67

Feature: WAAL003U

Date: 08-26-2009

Comments: Looking north, this photograph shows the upland community associated with wetland WAAL003.

Photograph ID: A74

Feature: WAAL004

Date: 08-26-2009

Comments: Looking east, this photograph shows wetland WAAL004, a large wetland associated with the confluence of SAAL011 and SAAL012, both unnamed tributaries of Willow Creek.

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A75 **Feature:** WAAL004 **Date:** 08-26-2009 **Comments:** Looking west, this image depicts another view of wetland WAAL004.	
Photograph ID: A76 **Feature:** WAAL004U **Date:** 08-26-2009 **Comments:** Looking north, this photo shows the upland plant community associated with wetland WAAL004.	

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B6

Feature: WBAL001

Date: 08-25-2009

Comments: Fringing wetland at junction of stream features SBAL001 and SBAL002. Photograph taken facing south.

Photograph ID: B7

Feature: WBAL001

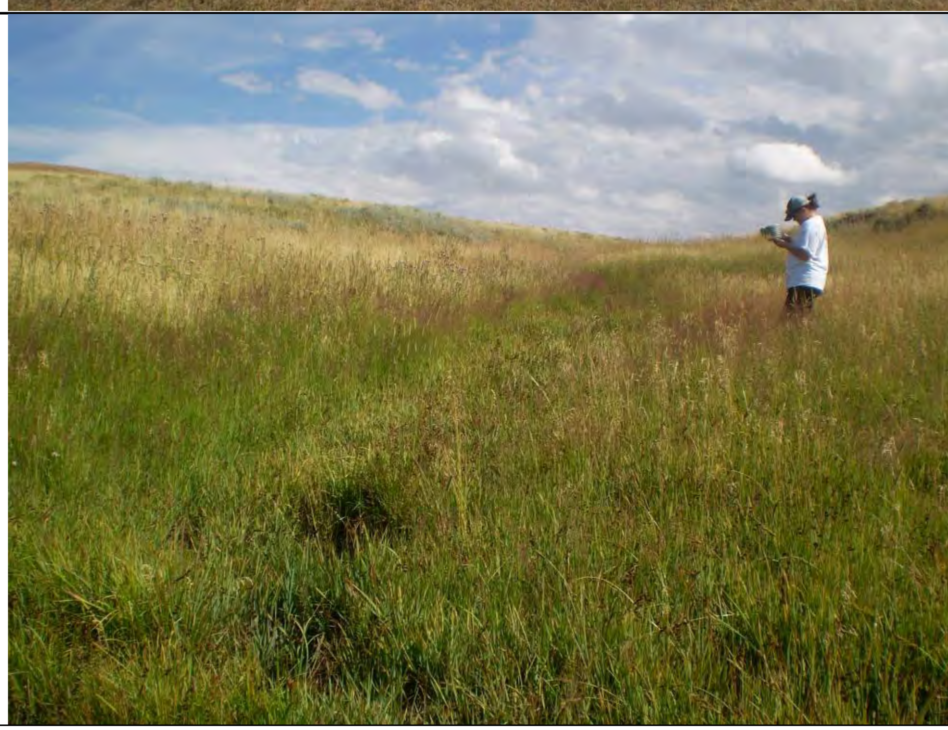
Date: 08-25-2009

Comments: Fringing wetland at junction of SBAL001 and SBAL002 facing north.

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B17 **Feature:** WBAL002 **Date:** 08-25-2009 **Comments:** Isolated wetland feature facing south.	
Photograph ID: B29 **Feature:** WBAL003 **Date:** 08-25-2009 **Comments:** SBAL004 facing south with fringing wetland WBAL003 at junction of SBAL004 and SBAL005.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B85

Feature: WBAL004

Date: 08-26-2009

Comments: Stream SBAL013 and wetland feature WBAL004 facing south.

Photograph ID: B86

Feature: WBAL004

Date: 08-26-2009

Comments: Stream SBAL013 and wetland feature WBAL004 facing north.

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B113	
Feature: WBAL005	
Date: 08-27-2009	
Comments: Photograph taken from SBAL019 looking towards wetland WBAL005 with stream SBAL020 following the line of shrubs in the distance.	
Photograph ID:	[INTENTIONALLY LEFT BLANK]
Feature:	
Date:	
Comments:	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A11

Feature: SAAL001

Date: 08-25-2009

Comments: Looking west, this image shows the aspen lined stream banks of SAAL001 (Government Creek).

Photograph ID: A12

Feature: SAAL001

Date: 08-25-2009

Comments: Looking east, this photo shows another view of the perennial streem SAAL001.

<table>
<tr><td>Client:</td><td>Shell Wind Energy</td><td>Project Number:</td><td>0105023</td></tr>
<tr><td>Project Name:</td><td>Hermosa West</td><td>Location:</td><td>Albany County, WY</td></tr>
<tr><td colspan="2">Photograph ID:
A21

Feature:
SAAL002

Date:
08-25-2009

Comments:
Looking west this image shows a view of the perennial stream SAAL002 (Government Creek).</td><td colspan="2"></td></tr>
<tr><td colspan="2">Photograph ID:
A22

Feature:
SAAL002

Date:
08-25-2009

Comments:
Looking east this image shows another view of this Waterbody.</td><td colspan="2"></td></tr>
</table>

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A25 **Feature:** SAAL003 **Date:** 08-25-2009 **Comments:** Looking southwest, this image shows stream SAAL003. While this is still Government Creek, this reach is considered an ephemeral creek.	
Photograph ID: A26 **Feature:** ESAAL003 **Date:** 08-25-2009 **Comments:** Looking northeast, this image shows the shelving of SAAO003.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A33	
Feature: SAAL004	
Date: 08-25-2009	
Comments: Looking west, this image shows the perennial creek SAAL004 (Forrest Creek). This Waterbody is associated with wetland WAAL001.	
Photograph ID: A34	
Feature: ESAAL004	
Date: 08-25-2009	
Comments: Looking east, this image provides another view of SAAL004 and wetland WAAL001.	

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A38	
Feature: SAAL005	
Date: 08-26-2009	
Comments: Looking west, this image shows the intermittent reach of Forrest Creek SAAL005.	
Photograph ID: A39	
Feature: SAAL005	
Date: 08-26-2009	
Comments: Looking east, this image shows the shelving associated with this intermittent waterbody.	

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A50 **Feature:** SAAL006 **Date:** 08-26-2009 **Comments:** Looking west, this photograph shows the ephemeral creek SAAL006, a tributary to Boulder Creek.	
Photograph ID: A51 **Feature:** SAAL006 **Date:** 08-26-2009 **Comments:** Looking east, this image shows another view of this ephemeral creek.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A52	
Feature: SAAL007	
Date: 08-26-2009	
Comments: Looking west, this image shows the ephemeral creek SAAL007. This Waterbody is a tertiary tributary to Boulder Creek.	
Photograph ID: A53	
Feature: SAAL007	
Date: 08-26-2009	
Comments: Looking east, this image shows Boulder Creek in the distance along the tree line.	

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A57

Feature: SAAL008

Date: 08-26-2009

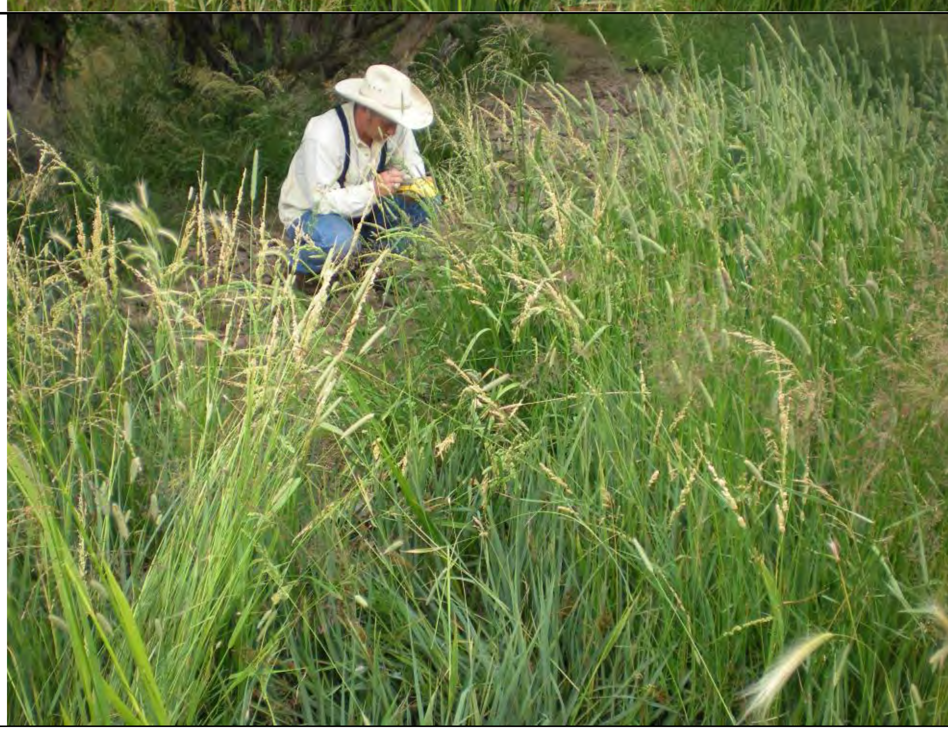
Comments: Looking west, this image shows the ephemeral creek SAAL008. This photograph also show the associated wetland, WAAL002.

Photograph ID: A58

Feature: SAAL008

Date: 08-26-2009

Comments: Looking east, this image provides another view of SAAL008 and the associated wetland WAAL002.



Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A59 **Feature:** SAAL009 **Date:** 08-26-2009 **Comments:** Looking north, this image shows the ephemeral stream SAAL009 and the associated wetland WAAL002.	
Photograph ID: A60 **Feature:** SAAL009 **Date:** 08-26-2009 **Comments:** Looking south this image provides another view of the ephemeral stream and the associated wetland.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A70 **Feature:** SAAL010 **Date:** 08-26-2009 **Comments:** Looking west, this image shows the perennial stream SAAL010, an unnamed tributary to Willow Creek.	
Photograph ID: A71 **Feature:** SAAL010 **Date:** 08-26-2009 **Comments:** Looking east this image provides another view of this stream.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A72 **Feature:** SAAL011 **Date:** 08-26-2009 **Comments:** Looking northeast this image shows the perennial stream SAAL011. This stream flows into wetland WAAL004 where it looses all channeling.	
Photograph ID: A73 **Feature:** SAAL011 **Date:** 08-26-2009 **Comments:** Looking southwest this image shows another view of SAAL011.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A77

Feature: SAAL012

Date: 08-26-2009

Comments: Looking northeast this image shows the perennial stream SAAL012. This image also provides a view of the wetland WAAL004.

Photograph ID: A78

Feature: SAAL012

Date: 08-26-2009

Comments: Looking southwest, this image shows another view of SAAL012 and the associated wetland WAAL004.

PHOTOGRAPHIC LOG

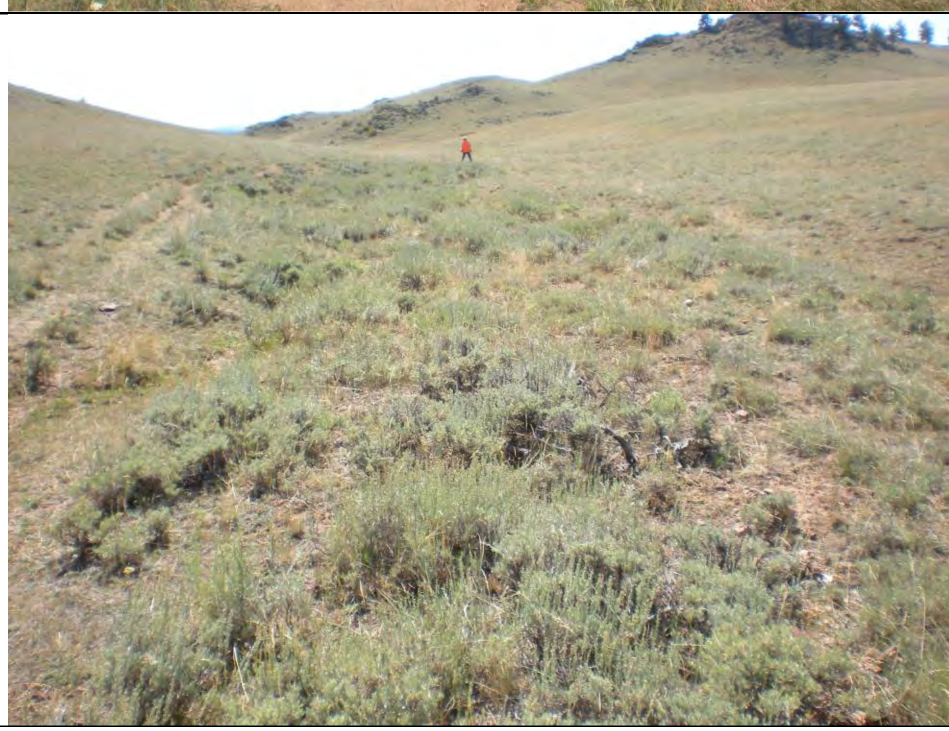
Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A87 **Feature:** SAAL013 **Date:** 08-26-2009 **Comments:** Looking west this image depicts the ephemeral stream SAAL013.	
Photograph ID: A88 **Feature:** SAAL013 **Date:** 08-26-2009 **Comments:** Looking east, this photograph provides another view of SAAL013.	

Photographic Log

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A93	
Feature: SAAL015	
Date: 08-27-2009	
Comments: Looking west this image shows the shelving associated with the ephemeral stream SAAL015.	
Photograph ID: A94	
Feature: SAAL014	
Date: 08-27-2009	
Comments: Looking east, this photo provides another view of SAAL015.	

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A95 **Feature:** SAAL014 **Date:** 08-27-2009 **Comments:** Looking northwest, this photo shows the perennial stream SAAL014.	
Photograph ID: A96 **Feature:** SAAL015 **Date:** 08-27-2009 **Comments:** Looking southeast this image shows another view of SAAL015.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A101 **Feature:** SAAL016 **Date:** 08-27-2009 **Comments:** Looking northeast this photograph shows the ephemeral stream SAAL016.	
Photograph ID: A102 **Feature:** SAAL016 **Date:** 08-27-2009 **Comments:** Looking southwest this image shows the shelving associated with SAAL016.	

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A103 **Feature:** SAAL017 **Date:** 08-27-2009 **Comments:** Looking east this image shows a view of the perennial stream SAAL017.	
Photograph ID: A104 **Feature:** SAAL017 **Date:** 08-27-2009 **Comments:** Looking west this image shows another view of the stream course.	

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A109 **Feature:** SAAL018 **Date:** 08-27-2009 **Comments:** Looking west this picture shows the ephemeral creek SAAL018.	
Photograph ID: A110 **Feature:** SAAL018 **Date:** 08-27-2009 **Comments:** Looking east this photograph provides another view of SAAL018.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A114 **Feature:** SAAL019 **Date:** 08-27-2009 **Comments:** Looking west this photo depicts the perennial stream SAAL019 (Fish Creek).	
Photograph ID: A115 **Feature:** SAAL019 **Date:** 08-27-2009 **Comments:** Looking east this photo provides another view of this perennial stream.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A120

Feature: SAAL020

Date: 08-27-2009

Comments: Looking west this picture shows the westernmost crossing of Fish Creek.

Photograph ID: A121

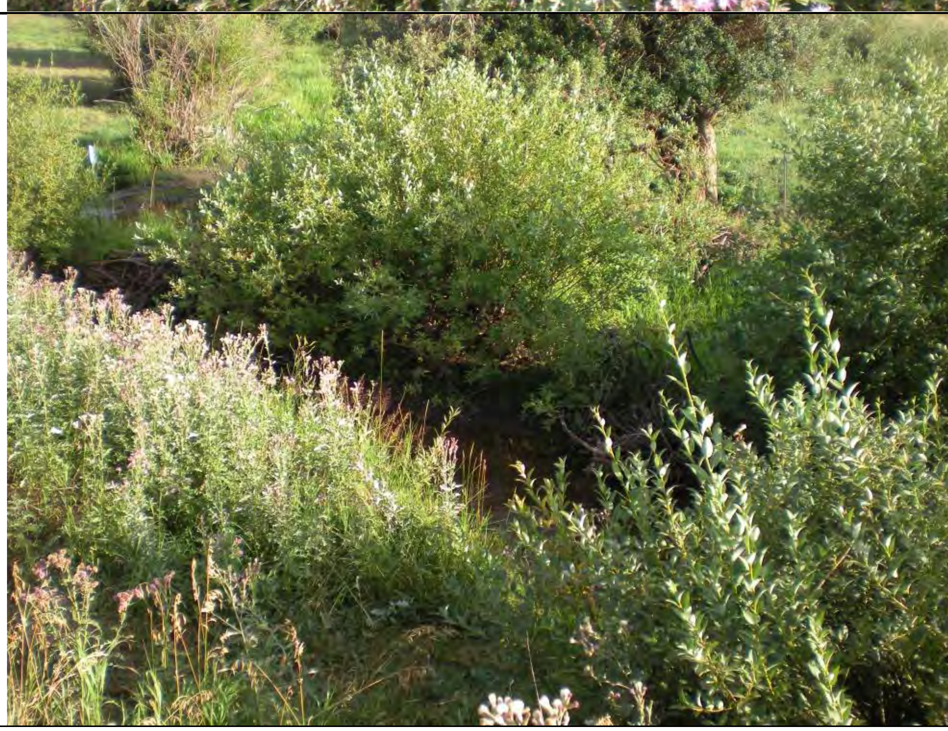
Feature: SAAL020

Date: 08-27-2009

Comments: Looking east this photo provides an additional view of Fish Creek.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A122 **Feature:** SAAL021 **Date:** 08-27-2009 **Comments:** Looking north this image shows the perennial creek SAAL021 along the entry road.	
Photograph ID: A123 **Feature:** SAAL021 **Date:** 08-27-2009 **Comments:** Looking south, this photograph shows another view of SAAL021 along the entry road.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A124 **Feature:** SAAL022 **Date:** 08-27-2009 **Comments:** Looking north along the entry road, this photograph shows the intermittent stream SAAL022.	
Photograph ID: A125 **Feature:** SAAL022 **Date:** 08-27-2009 **Comments:** Looking south along the entry road, this photograph shows another view of SAAL022	

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B5

Feature: SBAL001

Date: 08-25-2009

Comments: Stream feature facing south.

Photograph ID: B8

Feature: SBAL002

Date: 08-25-2009

Comments: Stream feature facing south.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B9 **Feature:** SBAL002 **Date:** 08-25-2009 **Comments:** Stream feature on the left side of the photograph, facing north into WBAL001.	
Photograph ID: B10 **Feature:** SBAL002 **Date:** 08-25-2009 **Comments:** Segment of stream feature SBAL002 to the north of previous photographs. Facing south from a berm.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B11 **Feature:** SBAL002 **Date:** 08-25-2009 **Comments:** Facing north from the berm.	
Photograph ID: B12 **Feature:** SBAL002 **Date:** 08-25-2009 **Comments:** Facing east from the berm.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B13	
Feature: SBAL002	
Date: 08-25-2009	
Comments: Same stream feature a little further north.	
Photograph ID: B14	
Feature: SBAL002	
Date: 08-25-2009	
Comments: Same general location as photograph B13 facing south.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B25 **Feature:** SBAL003 **Date:** 08-25-2009 **Comments:** Stream feature facing east.	
Photograph ID: B26 **Feature:** SBAL003 **Date:** 08-25-2009 **Comments:** Stream feature facing west.	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B31	
Feature: SBAL004	
Date: 08-25-2009	
Comments: SBAL005 facing west with fringing wetland WBAL003 at junction of SBAL005 and SBAL004.	
Photograph ID: B32	
Feature: SBAL004	
Date: 08-25-2009	
Comments: SBAL005 facing east with fringing wetland WBAL003 at junction of SBAL005 and SBAL004.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B29 **Feature:** SBAL005 **Date:** 08-25-2009 **Comments:** SBAL004 facing south with fringing wetland WBAL003 at junction of SBAL004 and SBAL005.	
Photograph ID: B30 **Feature:** Metal corral **Date:** 08-25-2009 **Comments:** Metal cistern with water flowing out of black pipe in center at junction of SBAL004 and SBAL005. (Located just to the left of photograph B29)	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B53 **Feature:** SBAL006 **Date:** 08-26-2009 **Comments:** Stream feature facing east.	
Photograph ID: B54 **Feature:** SBAL006 **Date:** 08-26-2009 **Comments:** Stream feature facing west.	

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B59 **Feature:** SBAL007 **Date:** 08-26-2009 **Comments:** Stream feature facing south.	
Photograph ID: B60 **Feature:** SBAL007 **Date:** 08-26-2009 **Comments:** Stream feature facing north.	

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B63 **Feature:** SBAL008 **Date:** 08-26-2009 **Comments:** Stream feature facing east.	
Photograph ID: B64 **Feature:** SBAL008 **Date:** 08-26-2009 **Comments:** Stream feature facing west.	

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B65 **Feature:** SBAL009 **Date:** 08-26-2009 **Comments:** Stream feature facing south.	
Photograph ID: B66 **Feature:** SBAL009 **Date:** 08-26-2009 **Comments:** Stream feature facing north.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B76 **Feature:** SBAL010 **Date:** 08-26-2009 **Comments:** Looking east, into corridor from the edge of stream feature SBAL010.	
Photograph ID: B77 **Feature:** SBAL010 **Date:** 08-26-2009 **Comments:** Looking west, out of the corridor into stream feature SBAL010.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B78

Feature:
SBAL011

Date:
08-26-2009

Comments:
Stream feature facing east.

Photograph ID:
B79

Feature:
SBAL011

Date:
08-26-2009

Comments:
Stream feature facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B80

Feature:
SBAL012

Date:
08-26-2009

Comments:
Stream feature facing east to the edge of the corridor.

Photograph ID:
B81

Feature:
SBAL012

Date:
08-26-2009

Comments:
Stream feature facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B82 **Feature:** SBAL012 **Date:** 08-26-2009 **Comments:** Facing south from the same stream feature as photographs B80 and B81.	
Photograph ID: **Feature:** **Date:** **Comments:**	[INTENTIONALLY LEFT BLANK]

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B85	
Feature: SBAL013	
Date: 08-26-2009	
Comments: Stream SBAL013 and wetland feature WBAL004 facing south.	
Photograph ID: B86	
Feature: SBAL013	
Date: 08-26-2009	
Comments: Stream SBAL013 and wetland feature WBAL004 facing north.	

PHOTOGRAPHIC LOG

<table>
<tr><td>Client:</td><td>Shell Wind Energy</td><td>Project Number:</td><td>0105023</td></tr>
<tr><td>Project Name:</td><td>Hermosa West</td><td>Location:</td><td>Albany County, WY</td></tr>
<tr><td>Photograph ID:
B91
Feature:
SBAL014
Date:
08-26-2009
Comments:
Stream feature facing east.</td><td colspan="3"></td></tr>
<tr><td>Photograph ID:
B92
Feature:
SBAL014
Date:
08-26-2009
Comments:
Stream feature facing west.</td><td colspan="3"></td></tr>
</table>

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B100

Feature:
SBAL015

Date:
08-26-2009

Comments:
Stream feature facing south.

Photograph ID:
B101

Feature:
SBAL016

Date:
08-26-2009

Comments:
Stream feature facing south.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B102

Feature:
SBAL015,
SBAL016

Date:
08-26-2009

Comments:
Junction of SBAL015 and SBAL016, facing north.

Photograph ID:

Feature:

Date:

Comments:

[INTENTIONALLY LEFT BLANK]

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B104

Feature: SBAL017

Date: 08-27-2009

Comments: Stream feature facing south from existing culverted road.

Photograph ID: B105

Feature: SBAL017

Date: 08-27-2009

Comments: Culverts under existing road for stream feature SBAL017, facing south.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B106

Feature: SBAL017

Date: 08-27-2009

Comments: Stream feature facing north while standing on existing road.

Photograph ID: B107

Feature: SBAL017

Date: 08-27-2009

Comments: Further north on stream feature SBAL017.

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B108

Feature:
SBAL018

Date:
08-27-2009

Comments:
Photograph taken just north of an existing access road and wood fence facing northwest towards the end of the corridor. An existing road parallels the stream along the north (unseen to the right).

Photograph ID:
B109

Feature:
SBAL018

Date:
08-27-2009

Comments:
Same position as previous photograph, facing east towards the access road and wooden fence.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B112

Feature:
SBAL019

Date:
08-27-2009

Comments:
Photograph taken facing southwest from a fence. Stream feature is channelized and appears to be man-made.

Photograph ID:
B113

Feature:
SBAL020

Date:
08-27-2009

Comments:
Photograph taken from SBAL019 looking towards wetland WBAL005 with stream SBAL020 following the line of shrubs in the distance.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B116 **Feature:** SBAL021 **Date:** 08-27-2009 **Comments:** Stream feature facing north. Tributary to Fish Creek	
Photograph ID: B117 **Feature:** SBAL021 **Date:** 08-27-2009 **Comments:** Stream feature facing south. Tributary to Fish Creek	

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B118	
Feature: SBAL022	
Date: 08-27-2009	
Comments: Stream feature facing north. Tributary to Fish Creek	
Photograph ID:	[INTENTIONALLY LEFT BLANK]
Feature:	
Date:	
Comments:	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B123	
Feature: SBAL023	
Date: 08-27-2009	
Comments: Stream feature facing northwest.	
Photograph ID: B124	
Feature: SBAL023	
Date: 08-27-2009	
Comments: Stream feature facing southwest.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B127 **Feature:** SBAL024 **Date:** 08-27-2009 **Comments:** Stream feature facing south from existing culverted road.	
Photograph ID: B128 **Feature:** SBAL024 **Date:** 08-27-2009 **Comments:** Stream feature facing north from existing culverted road.	

PHOTOGRAPHIC LOG

ERM

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B93

Feature:
Prairie Dog

Date:
08-26-2009

Comments:
Prairie dog town located on Wyoming State property.

Photograph ID:

Feature:

Date:

Comments:

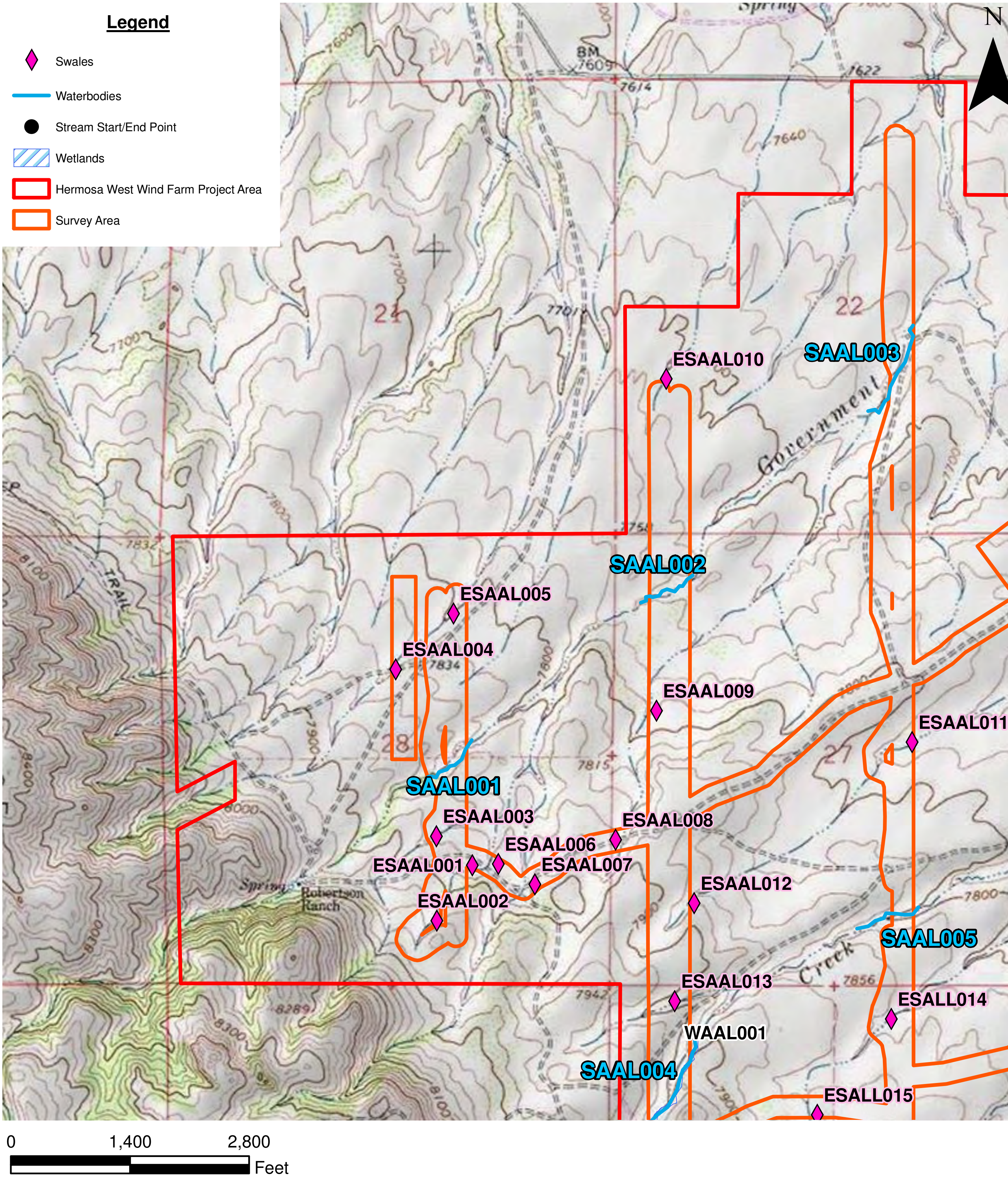
[INTENTIONALLY LEFT BLANK]

Identified Swales and Erosional Features

Appendix D

January 11, 2010
Project No. 0105023

Environmental Resources Management Southwest Inc.
15810 Park Ten Place, Suite 300
Houston, Texas 77084-5140
(281) 600-1000

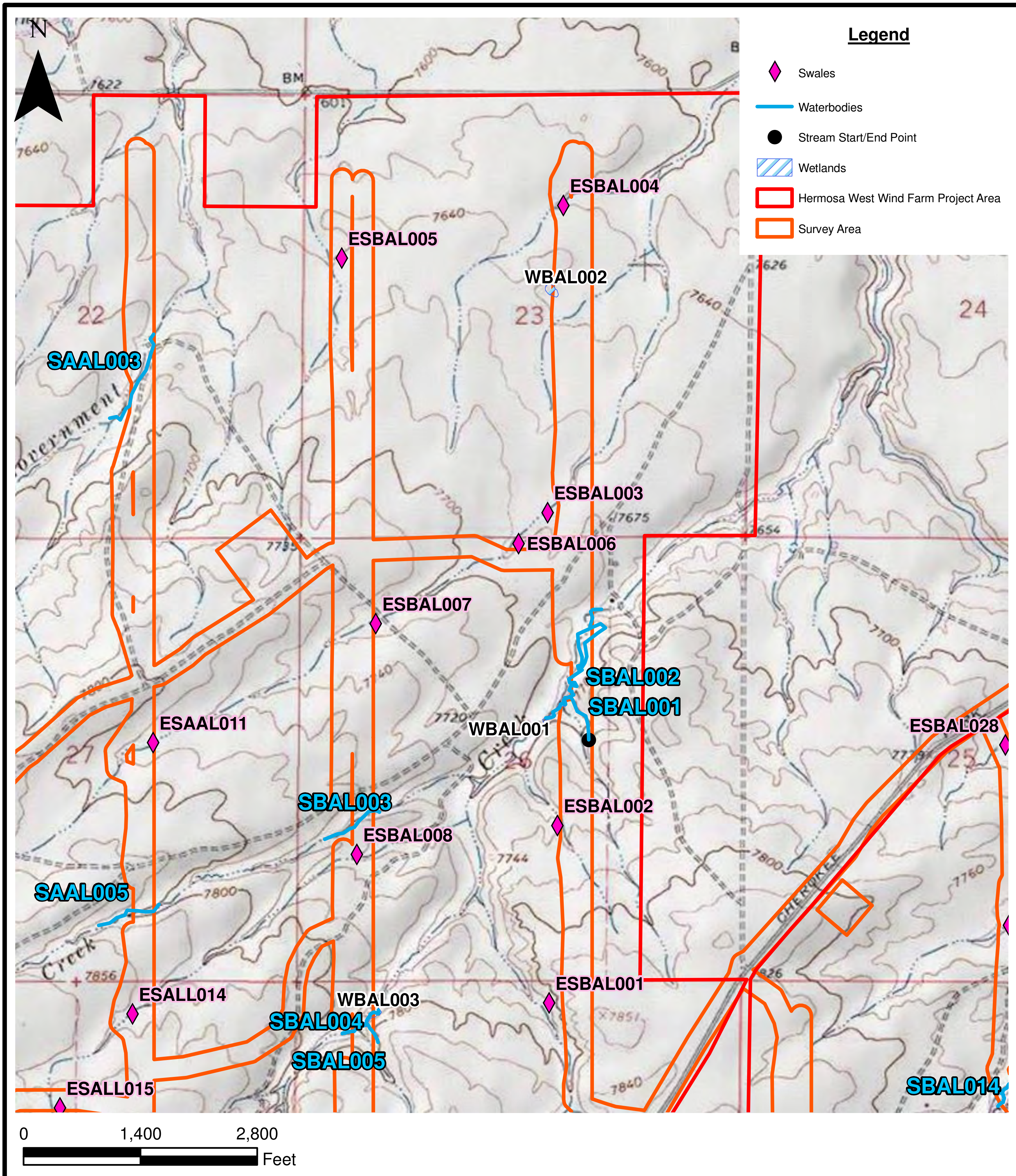


Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\topo_swales.mxd				

FIGURE D-1a
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

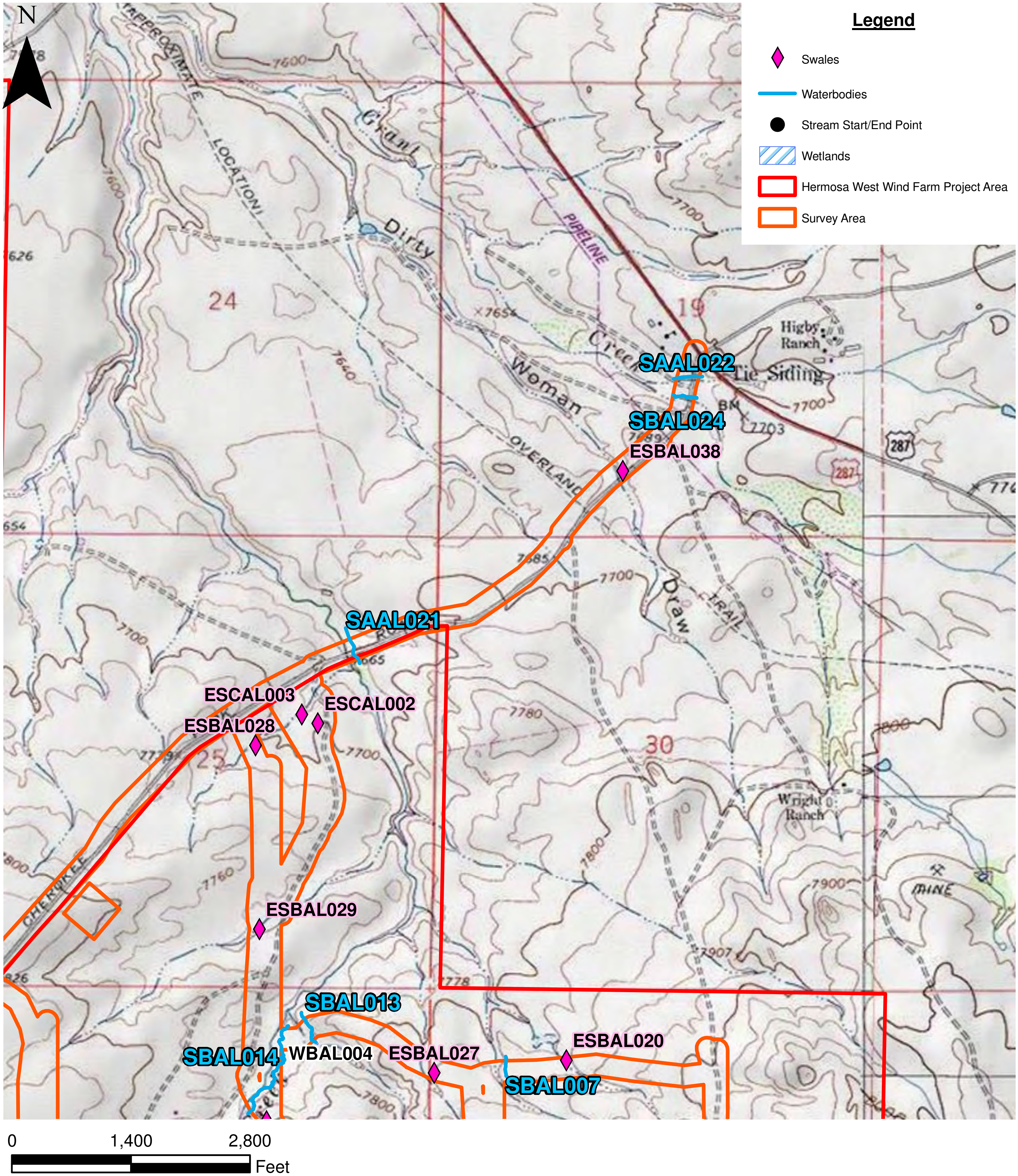


Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\topo_swales.mxd				

FIGURE D-1b
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

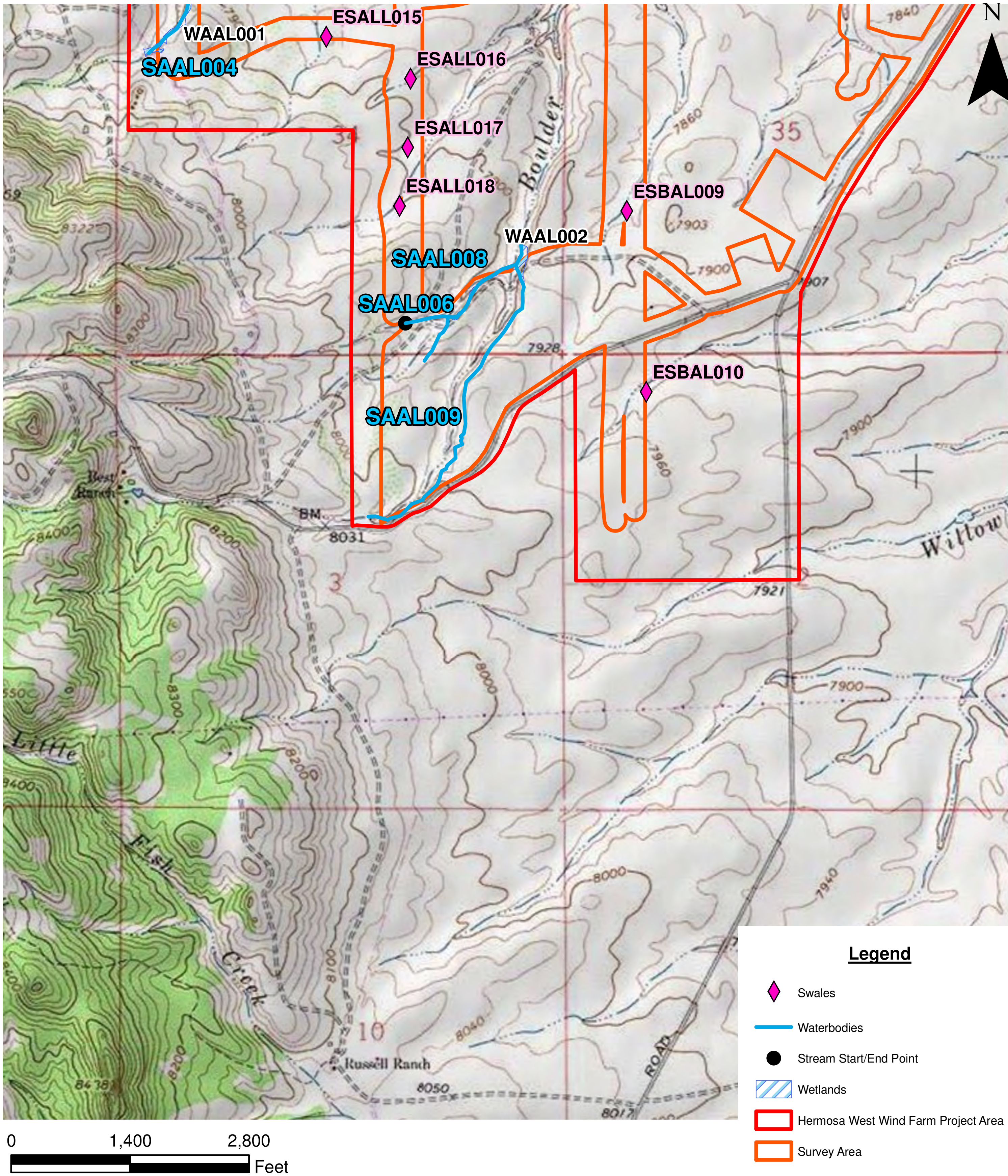


Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\topo_swales.mxd		

FIGURE D-1c
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

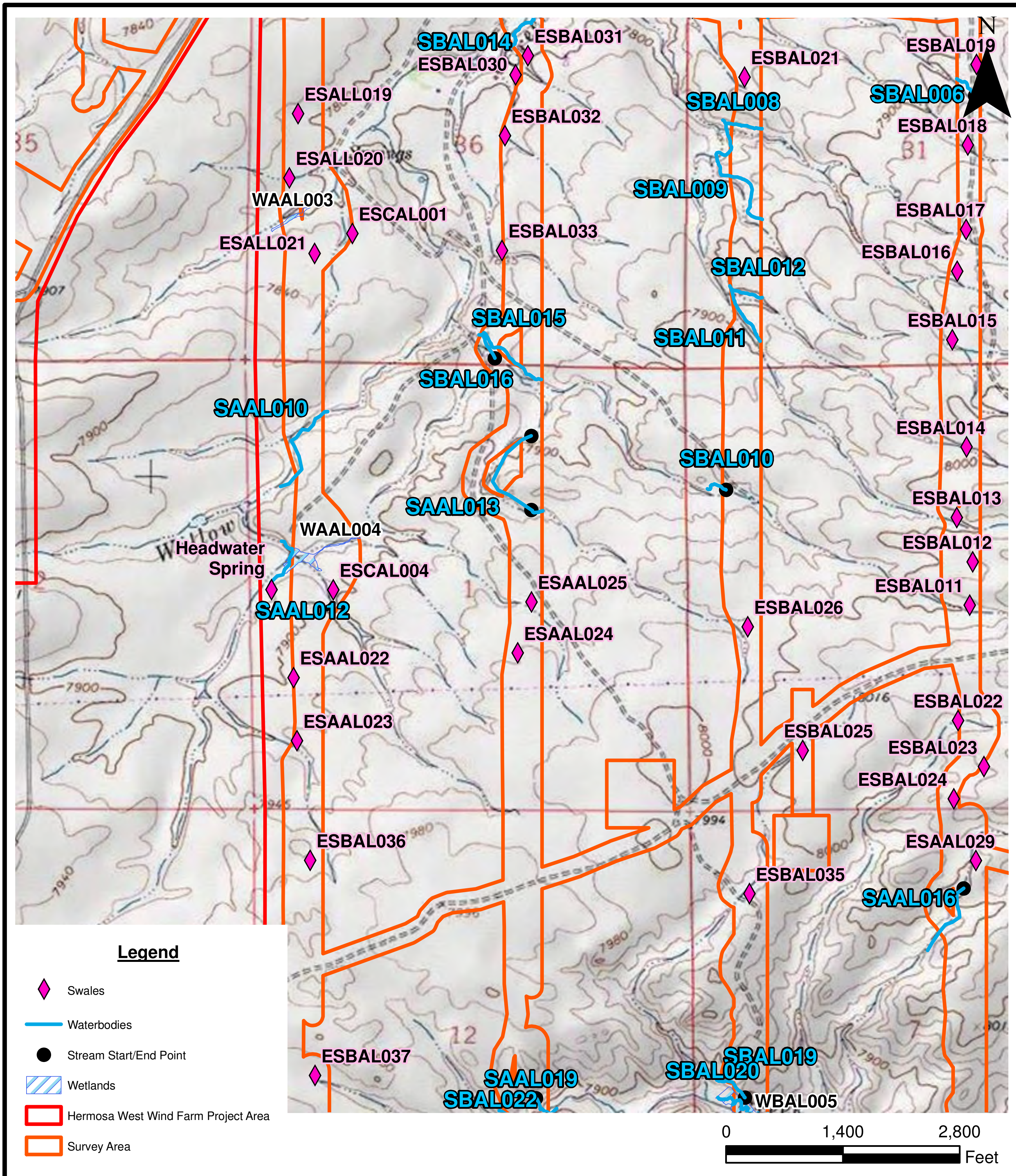


Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\topo_swales.mxd		

FIGURE D-1d
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

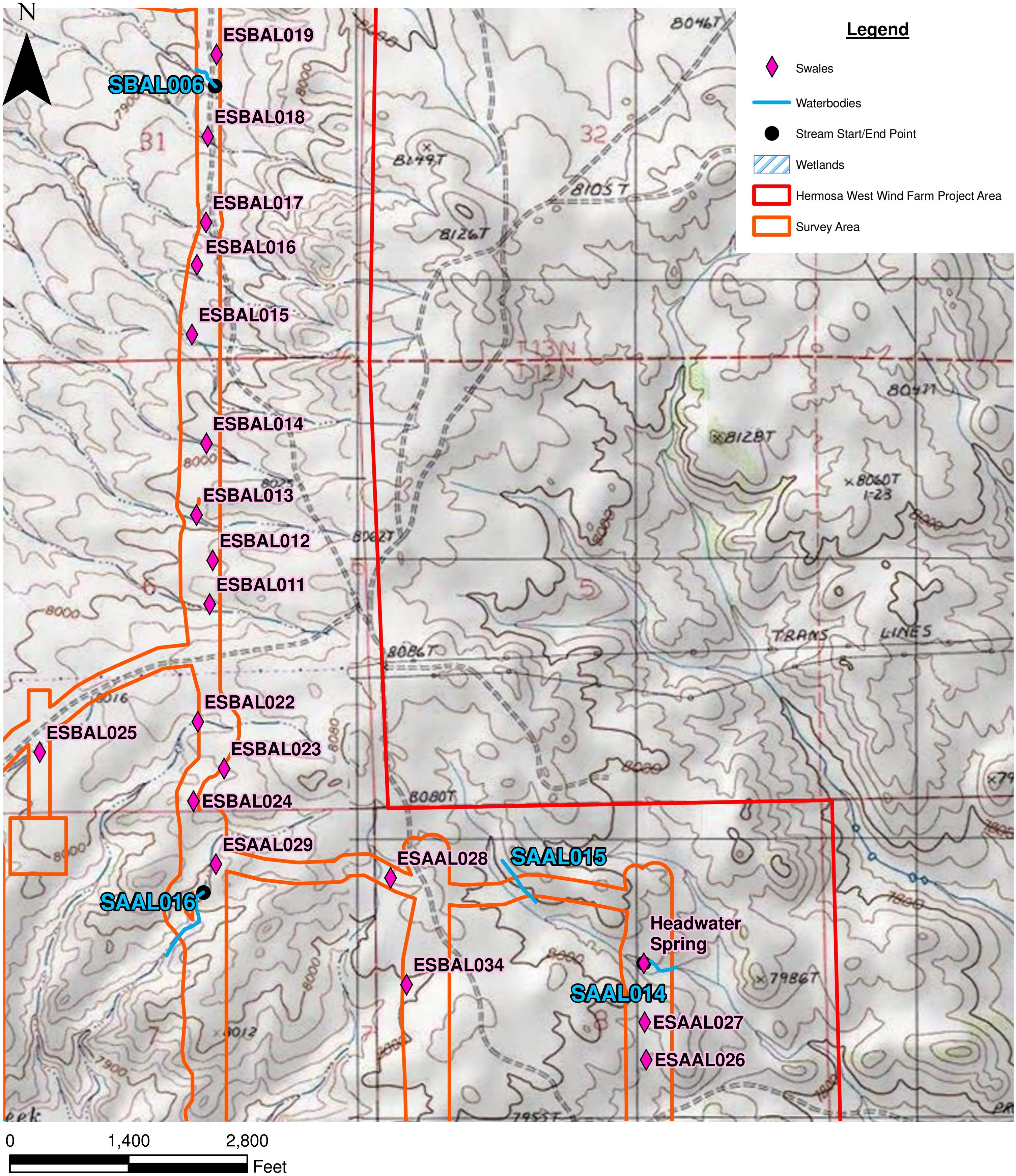


Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\topo_swales.mxd		

FIGURE D-1e
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

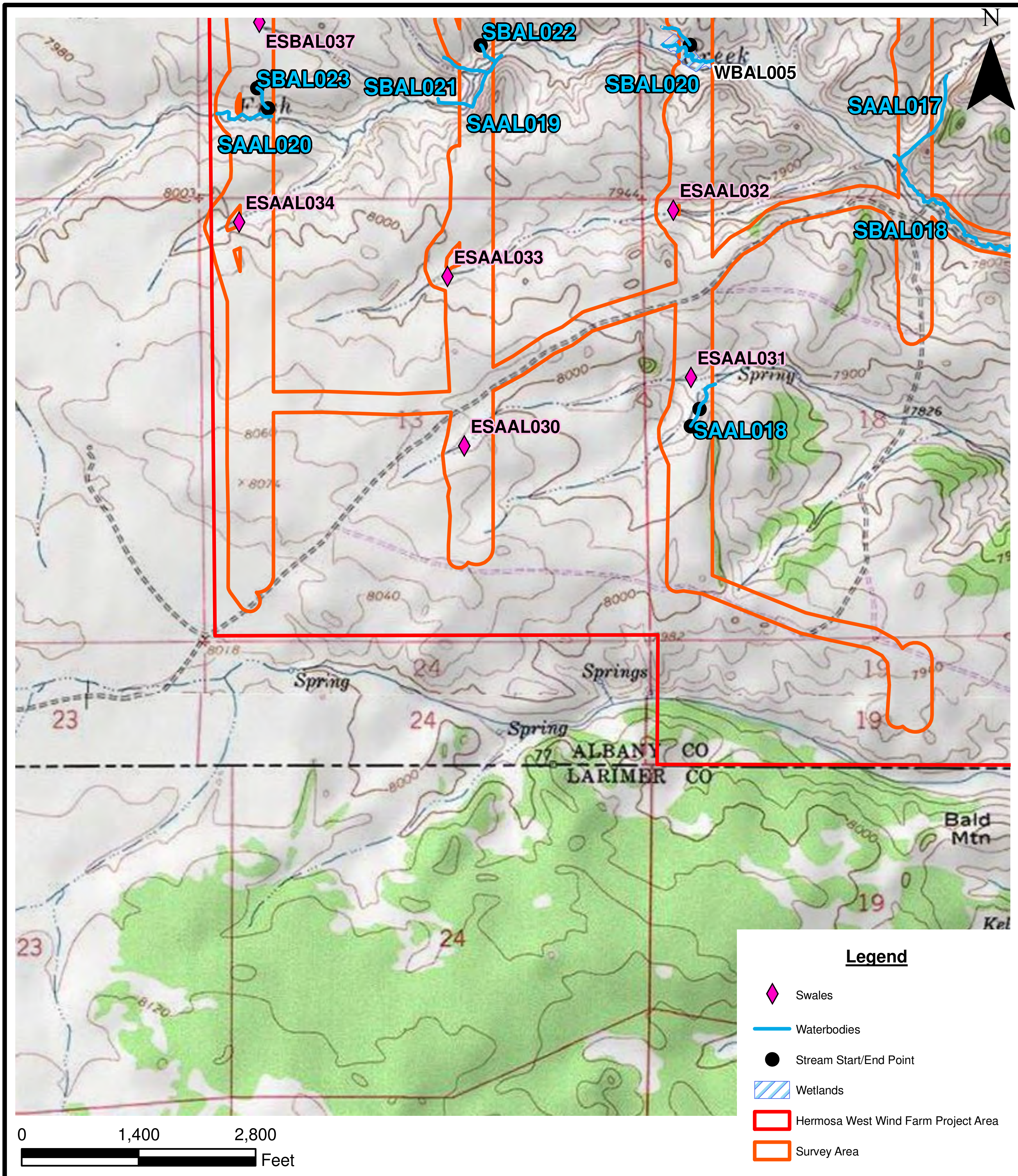


Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\topo_swales.mxd		

FIGURE D-1f
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

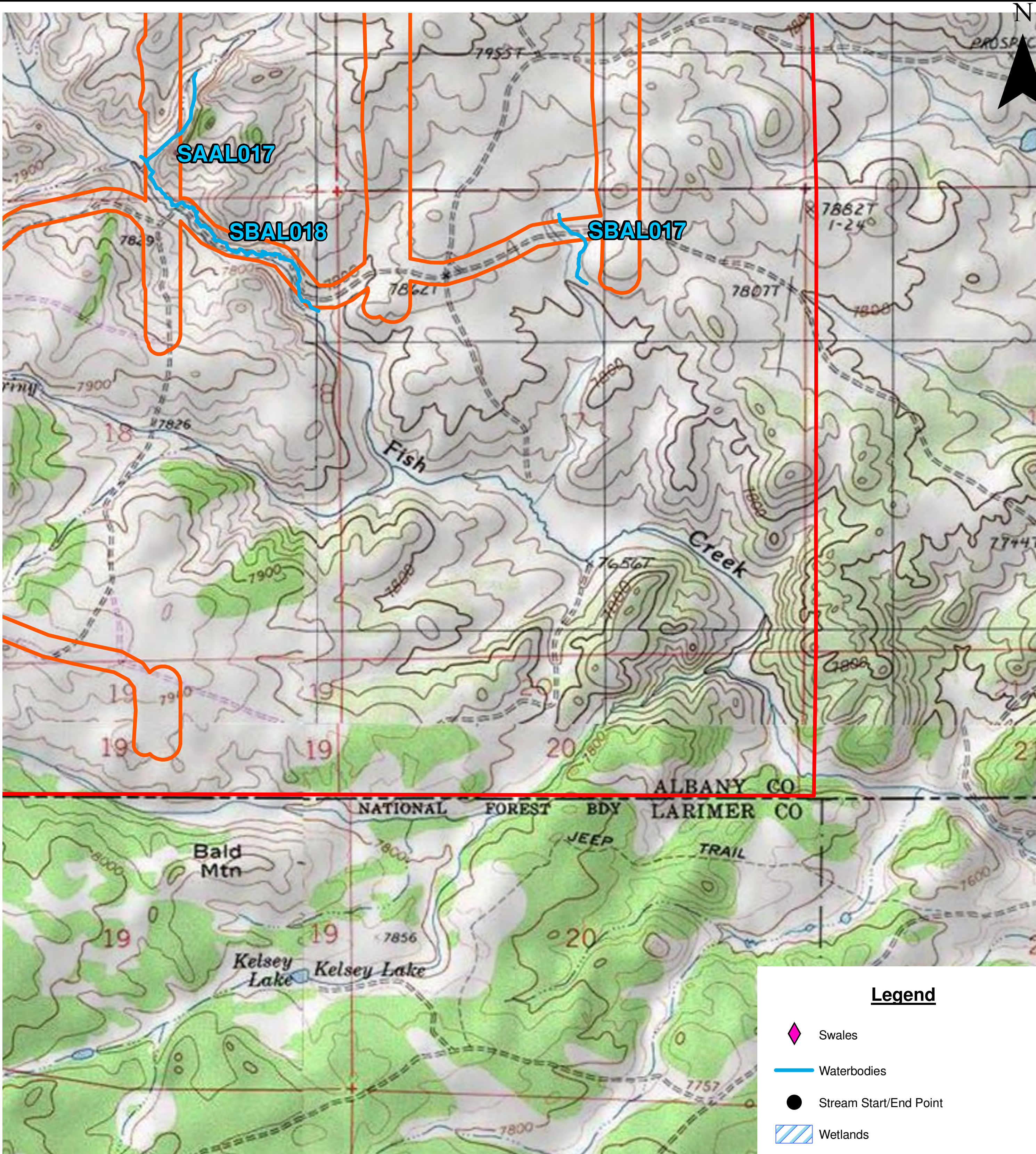


Environmental Resources Management

DESIGN: E Johnson	DRAWN: S King	CHKD.: A Smith
DATE: 11/12/2009	SCALE: AS SHOWN	REVISION: 0
File: I:\GIS\Shell\projects\topo_swales.mxd		

FIGURE D-1g
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM



Legend

- Swales
- Waterbodies
- Stream Start/End Point
- Wetlands
- Hermosa West Wind Farm Project Area
- Survey Area

0 1,400 2,800 Feet

Environmental Resources Management

DESIGN:	E Johnson	DRAWN:	S King	CHKD.:	A Smith
DATE:	11/12/2009	SCALE:	AS SHOWN	REVISION:	0
File:	I:\GIS\Shell\projects\topo_swales.mxd				

FIGURE D-1h
IDENTIFIED SWALES
Shell WindEnergy
Hermosa West Wind Farm Project
Albany County, Wyoming

ERM

Environmental
Resources
Management

15810 Park Ten Place
Suite 300
Houston, Texas 77084-5140
(281) 600-1000
(281) 600-1001 (fax)

ERM®

Photographic Log

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A1 **Feature:** ESAAL001 **Date:** 08-25-2009 **Comments:** Erosional swale (determined not to be a water body), facing northeast.	
Photograph ID: A2 **Feature:** ESAAL001 **Date:** 08-25-2009 **Comments:** Swale facing southwest.	

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A3

Feature: ESAAL002

Date: 08-25-2009

Comments: Swale facing northeast.

Photograph ID: A4

Feature: ESAAL002

Date: 08-25-2009

Comments: Swale facing southwest.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A5

Feature: ESAAL003

Date: 08-25-2009

Comments: Swale facing west.

Photograph ID: A6

Feature: ESAAL003

Date: 08-25-2009

Comments: Swale facing east.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A7

Feature:
ESAAL004

Date:
08-25-2009

Comments:
Swale facing northeast.

Photograph ID:
A8

Feature:
ESAAL004

Date:
08-25-2009

Comments:
Swale facing southwest.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A9 **Feature:** ESAAL005 **Date:** 08-25-2009 **Comments:** Swale facing east.	
Photograph ID: A10 **Feature:** ESAAL005 **Date:** 08-25-2009 **Comments:** Swale facing west.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A13	
Feature: ESAAL006	
Date: 08-25-2009	
Comments: Swale facing west.	
Photograph ID: A14	
Feature: ESAAL006	
Date: 08-25-2009	
Comments: Swale facing east.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A15

Feature:
ESAAL007

Date:
08-25-2009

Comments:
Swale facing southwest.

Photograph ID:
A16

Feature:
ESAAL007

Date:
08-25-2009

Comments:
Swale facing northeast.

PHOTOGRAPHIC LOG

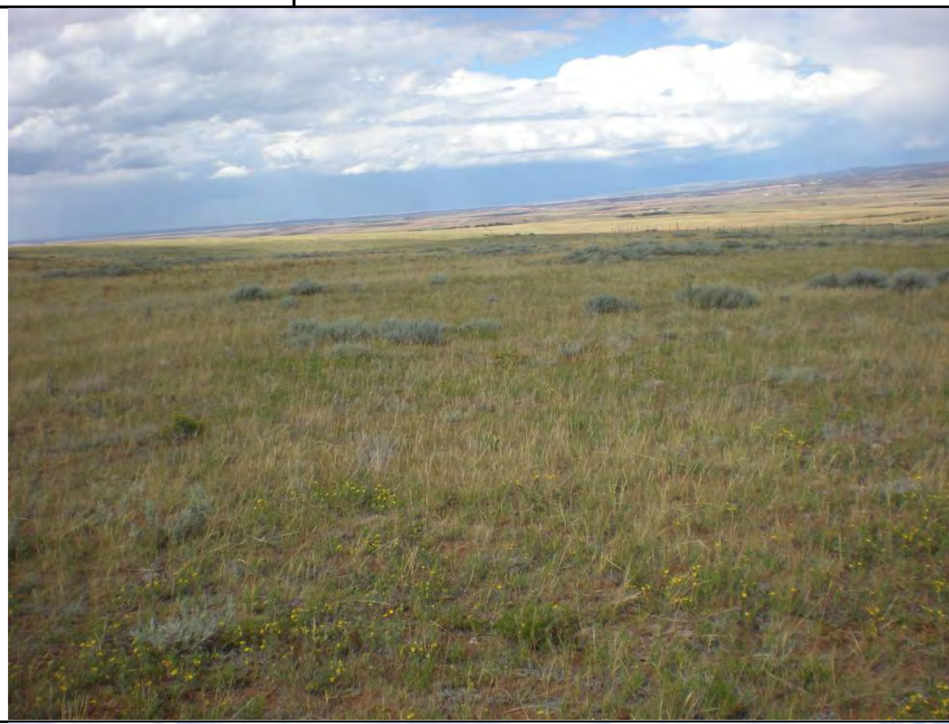
Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A17

Feature: ESAAL008

Date: 08-25-2009

Comments: Swale facing northeast.



Photograph ID: A18

Feature: ESAAL008

Date: 08-25-2009

Comments: Swale facing southwest.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A19

Feature:
ESAAL009

Date:
08-25-2009

Comments:
Swale facing west.

Photograph ID:
A20

Feature:
ESAAL009

Date:
08-25-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A23 **Feature:** ESAAL010 **Date:** 08-25-2009 **Comments:** Swale facing west.	
Photograph ID: A24 **Feature:** ESAAL010 **Date:** 08-25-2009 **Comments:** Swale facing east.	

Photographic Log

ERM

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A27

Feature:
ESAAL011

Date:
08-25-2009

Comments:
Swale facing west.

Photograph ID:
A28

Feature:
ESAAL011

Date:
08-25-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

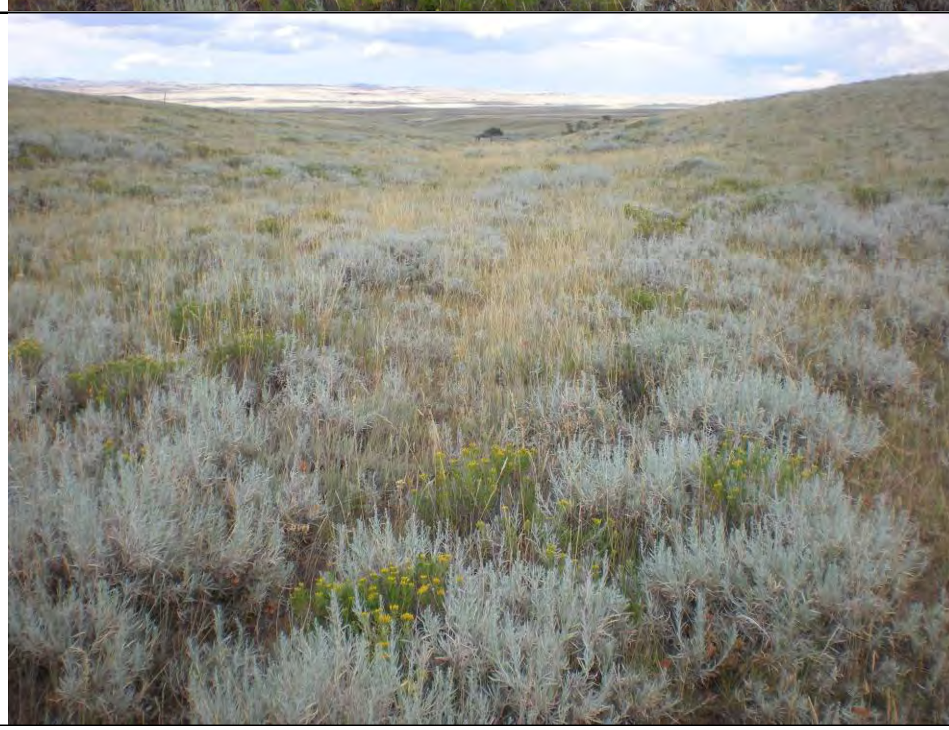
Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A29 **Feature:** ESAAL012 **Date:** 08-25-2009 **Comments:** Swale facing southwest.	
Photograph ID: A30 **Feature:** ESAAL012 **Date:** 08-25-2009 **Comments:** Swale facing northeast.	

ERM

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A31 **Feature:** ESAAL013 **Date:** 08-25-2009 **Comments:** Swale facing west.	
Photograph ID: A32 **Feature:** ESAAL013 **Date:** 08-25-2009 **Comments:** Swale facing east.	

PHOTOGRAPHIC LOG

ERM

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A40 **Feature:** ESAAL014 **Date:** 08-26-2009 **Comments:** Swale facing southwest.	
Photograph ID: A41 **Feature:** ESAAL014 **Date:** 08-26-2009 **Comments:** Swale facing northeast.	

PHOTOGRAPHIC LOG

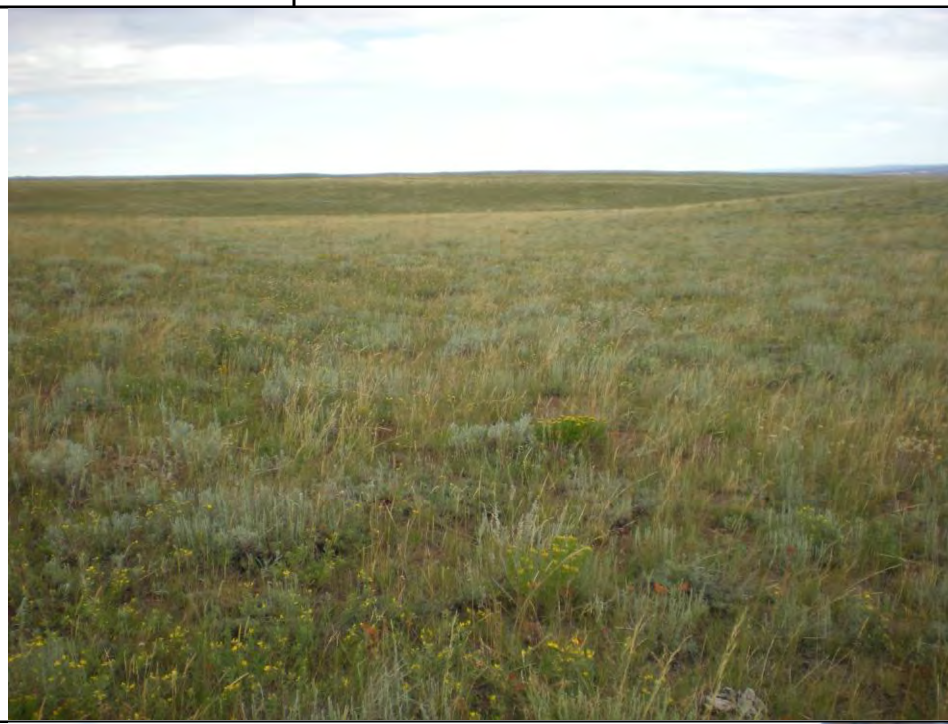
Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A42

Feature: ESAAL015

Date: 08-26-2009

Comments: Swale facing north.



Photograph ID: A43

Feature: ESAAL015

Date: 08-26-2009

Comments: Swale facing south.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A44

Feature:
ESAAL016

Date:
08-26-2009

Comments:
Swale facing west-southwest.

Photograph ID:
A45

Feature:
ESAAL016

Date:
08-26-2009

Comments:
Swale facing east-northeast.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A46

Feature:
ESAAL017

Date:
08-26-2009

Comments:
Swale facing west.

Photograph ID:
A47

Feature:
ESAAL017

Date:
08-26-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A48

Feature:
ESAAL018

Date:
08-26-2009

Comments:
Swale facing west.

Photograph ID:
A49

Feature:
ESAAL018

Date:
08-26-2009

Comments:
Swale facing east.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A61

Feature:
ESAAL019

Date:
08-26-2009

Comments:
Swale facing west-southwest.

Photograph ID:
A62

Feature:
ESAAL019

Date:
08-26-2009

Comments:
Swale facing east-northeast.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A63

Feature: ESAAL020

Date: 08-26-2009

Comments: Swale facing west.

Photograph ID: A64

Feature: ESAAL020

Date: 08-26-2009

Comments: Swale facing east.

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A68

Feature:
ESAAL021

Date:
08-26-2009

Comments:
Swale facing southwest.

Photograph ID:
A69

Feature:
ESAAL021

Date:
08-26-2009

Comments:
Swale facing north-northwest.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A79

Feature:
ESAAL022

Date:
08-26-2009

Comments:
Swale facing northwest.

Photograph ID:
A80

Feature:
ESAAL022

Date:
08-26-2009

Comments:
Swale facing southeast.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A81

Feature:
ESAAL023

Date:
08-26-2009

Comments:
Swale facing west.

Photograph ID:
A82

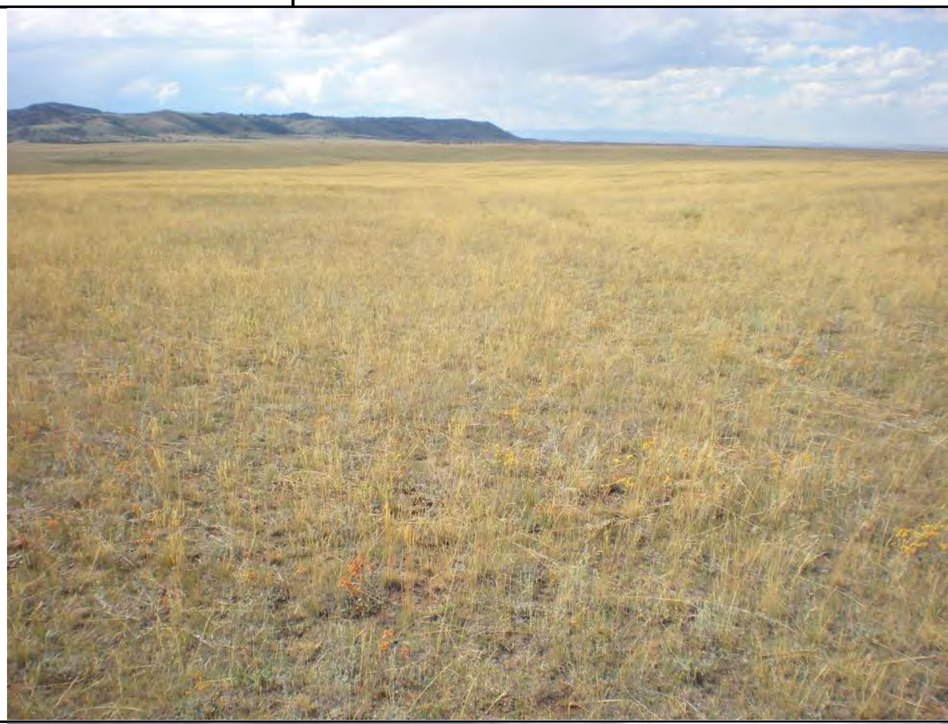
Feature:
ESAAL023

Date:
08-26-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A83	
Feature: ESAAL024	
Date: 08-26-2009	
Comments: Swale facing northeast.	
Photograph ID: A84	
Feature: ESAAL024	
Date: 08-26-2009	
Comments: Swale facing southwest.	

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A85

Feature:
ESAAL025

Date:
08-26-2009

Comments:
Swale facing west.

Photograph ID:
A86

Feature:
ESAAL025

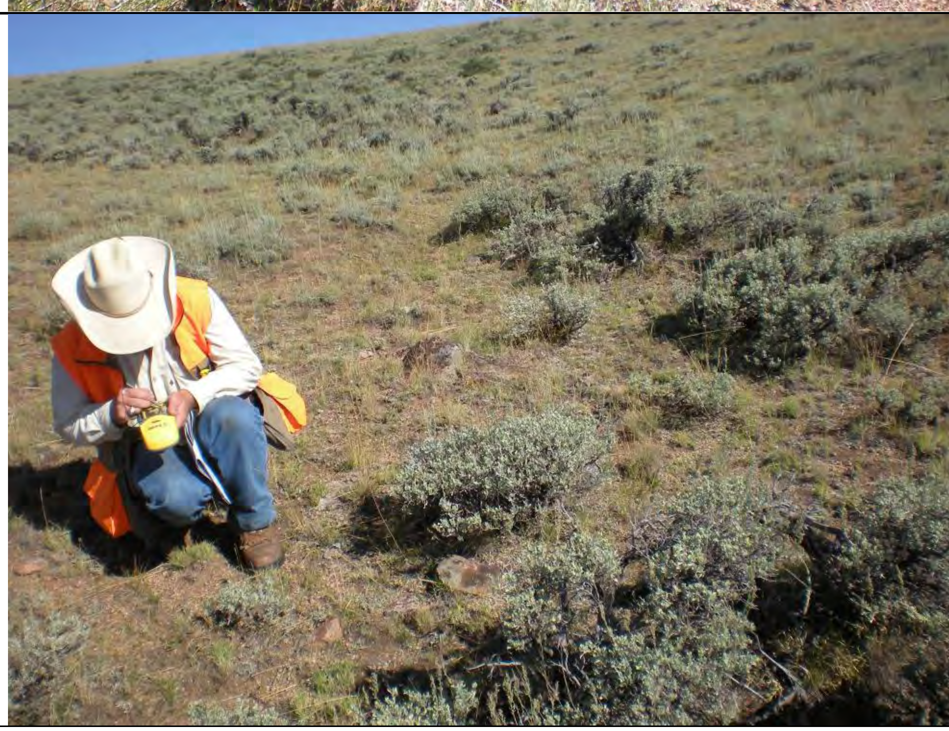
Date:
08-26-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A89 **Feature:** ESAAL026 **Date:** 08-27-2009 **Comments:** Swale facing southeast.	
Photograph ID: A90 **Feature:** ESAAL026 **Date:** 08-27-2009 **Comments:** Swale facing northwest.	

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A91

Feature: ESAAL027

Date: 08-27-2009

Comments: Swale facing west.

Photograph ID: A92

Feature: ESAAL027

Date: 08-27-2009

Comments: Swale facing east.

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A97

Feature:
ESAAL028

Date:
08-27-2009

Comments:
Swale facing north-northeast.

Photograph ID:
A98

Feature:
ESAAL028

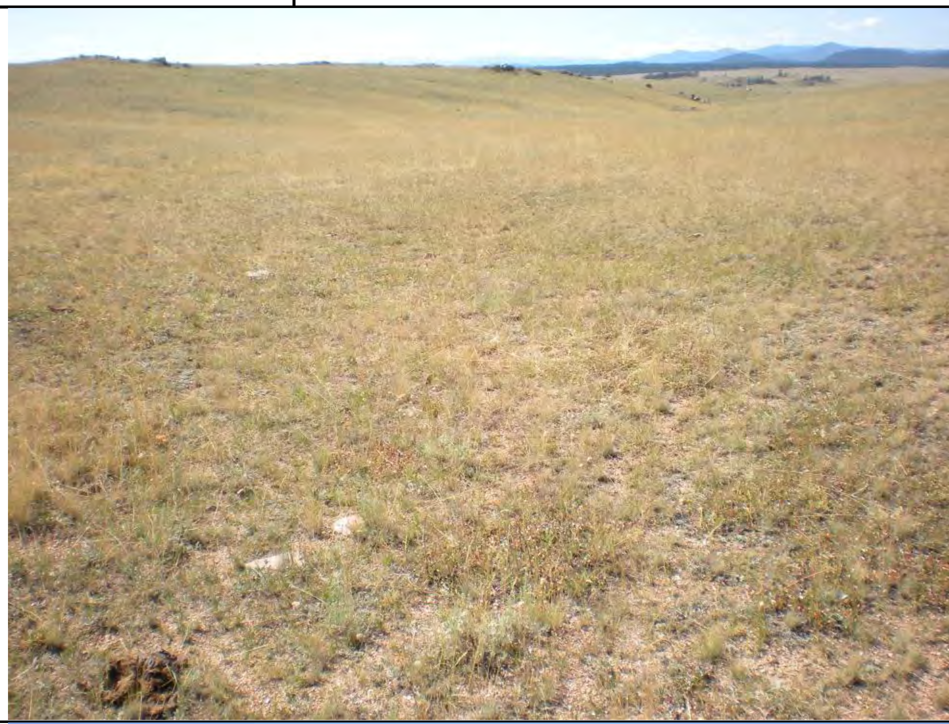
Date:
08-27-2009

Comments:
Swale facing south-southwest.

PHOTOGRAPHIC LOG

ERM®

Client: Shell Wind Energy		Project Number: 0105023	
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A99 **Feature:** ESAAL029 **Date:** 08-27-2009 **Comments:** Swale facing west.	
Photograph ID: A100 **Feature:** ESAAL029 **Date:** 08-27-2009 **Comments:** Swale facing east.	

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A105

Feature: ESAAL030

Date: 08-27-2009

Comments: Swale facing west.

Photograph ID: A106

Feature: ESAAL030

Date: 08-27-2009

Comments: Swale facing east.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: A107

Feature: ESAAL031

Date: 08-27-2009

Comments: Swale facing west.

Photograph ID: A108

Feature: ESAAL031

Date: 08-27-2009

Comments: Swale facing east.

PHOTOGRAPHIC LOG

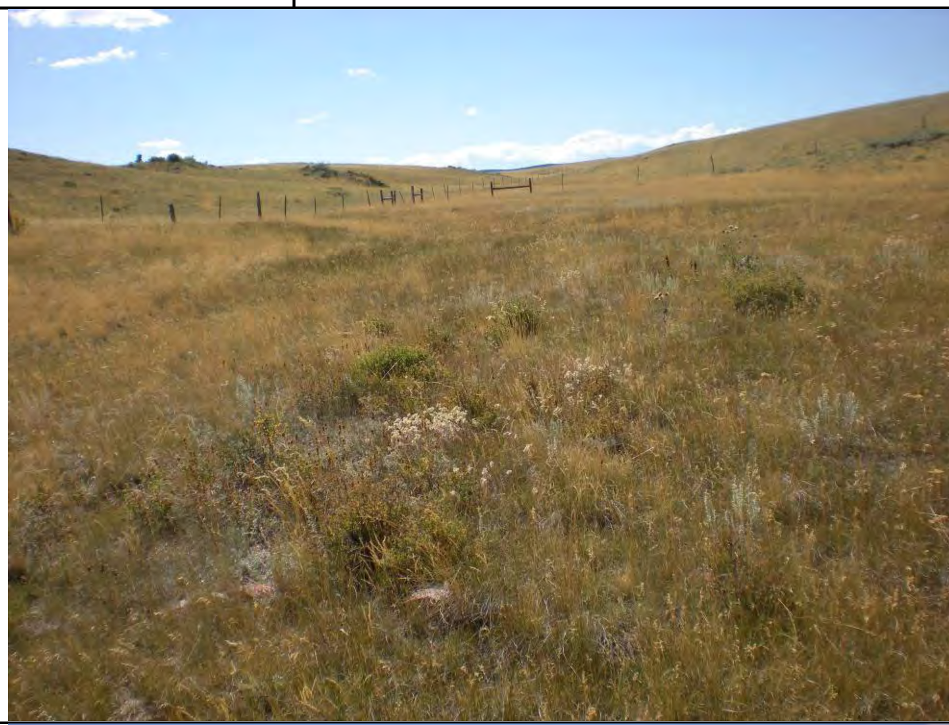
Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
A112

Feature:
ESAAL032

Date:
08-27-2009

Comments:
Swale facing west.



Photograph ID:
A113

Feature:
ESAAL032

Date:
08-27-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
A116

Feature:
ESAAL033

Date:
08-27-2009

Comments:
Swale facing west.

Photograph ID:
A117

Feature:
ESAAL033

Date:
08-27-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: A118

Feature: ESAAL034

Date: 08-27-2009

Comments: Swale facing east.

Photograph ID: A119

Feature: ESAAL034

Date: 08-27-2009

Comments: Swale facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B1

Feature:
ESBAL001

Date:
08-25-2009

Comments:
Erosional swale (determined not to be a water body) located west of survey corridor. Facing south.

Photograph ID:
B2

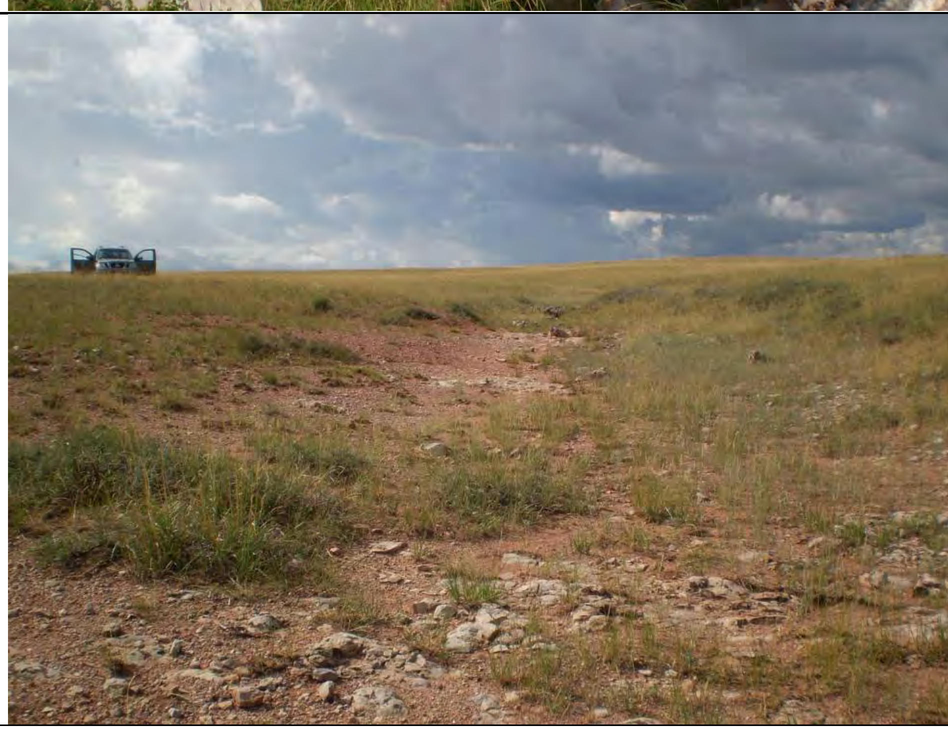
Feature:
ESBAL001

Date:
08-25-2009

Comments:
Erosional swale facing north.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B3 **Feature:** ESBAL002 **Date:** 08-25-2009 **Comments:** Erosional swale facing north.	
Photograph ID: B4 **Feature:** ESBAL002 **Date:** 08-25-2009 **Comments:** Erosional swale facing south.	

Photographic Log

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B15

Feature:
ESBAL003

Date:
08-25-2009

Comments:
Swale facing east.

Photograph ID:
B16

Feature:
ESBAL003

Date:
08-25-2009

Comments:
Swale facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B18

Feature:
ESBAL004

Date:
08-25-2009

Comments:
Swale facing east.

Photograph ID:
B19

Feature:
ESBAL004

Date:
08-25-2009

Comments:
Swale facing west

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B20	
Feature: ESBAL005	
Date: 08-25-2009	
Comments: Swale facing north.	

Photograph ID: B21	
Feature: ESBAL005	
Date: 08-25-2009	
Comments: Swale facing south.	

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B22

Feature:
ESBAL006

Date:
08-25-2009

Comments:
Swale facing west.

Photograph ID:
B23

Feature:
ESBAL006

Date:
08-25-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

ERM

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B24 **Feature:** ESBAL007 **Date:** 08-25-2009 **Comments:** Swale facing east	
Photograph ID: **Feature:** **Date:** **Comments:**	[INTENTIONALLY LEFT BLANK]

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B27

Feature:
ESBAL008

Date:
08-25-2009

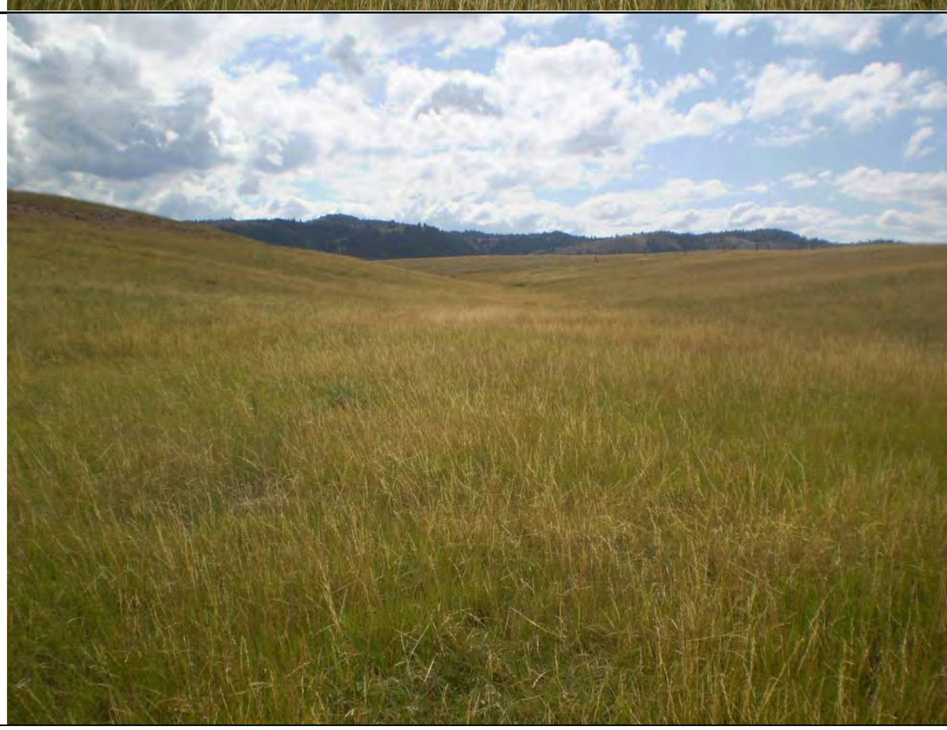
Comments:
Swale facing east.

Photograph ID:
B28

Feature:
ESBAL008

Date:
08-25-2009

Comments:
Swale facing west



Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B33	
Feature: ESBAL009	
Date: 08-25-2009	
Comments: Swale facing east	
Photograph ID: B34	
Feature: ESBAL009	
Date: 08-25-2009	
Comments: Swale facing west	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B35 **Feature:** ESBAL010 **Date:** 08-25-2009 **Comments:** Swale facing west.	
Photograph ID: B36 **Feature:** ESBAL010 **Date:** 08-25-2009 **Comments:** Swale facing east.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B37

Feature:
ESBAL011

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B38

Feature:
ESBAL011

Date:
08-26-2009

Comments:
Swale facing west.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B39

Feature:
ESBAL012

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B40

Feature:
ESBAL012

Date:
08-26-2009

Comments:
Swale facing west.

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B41

Feature:
ESBAL013

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B42

Feature:
ESBAL013

Date:
08-26-2009

Comments:
Swale facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B43

Feature:
ESBAL014

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B44

Feature:
ESBAL014

Date:
08-26-2009

Comments:
Swale facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B45

Feature:
ESBAL015

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B46

Feature:
ESBAL015

Date:
08-26-2009

Comments:
Swale facing west.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B47

Feature: ESBAL016

Date: 08-26-2009

Comments: Swale facing east.

Photograph ID: B48

Feature: ESBAL016

Date: 08-26-2009

Comments: Swale facing west.

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B49 **Feature:** ESBAL017 **Date:** 08-26-2009 **Comments:** Swale facing east.	
Photograph ID: B50 **Feature:** ESBAL017 **Date:** 08-26-2009 **Comments:** Swale facing west.	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B51

Feature: ESBAL018

Date: 08-26-2009

Comments: Swale facing east.

Photograph ID: B52

Feature: ESBAL018

Date: 08-26-2009

Comments: Swale facing west.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B55

Feature:
ESBAL019

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B56

Feature:
ESBAL019

Date:
08-26-2009

Comments:
Swale facing northwest.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B57

Feature:
ESBAL020

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B58

Feature:
ESBAL020

Date:
08-26-2009

Comments:
Swale facing west with cattle in background.

PHOTOGRAPHIC LOG

ERM

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B61

Feature:
ESBAL021

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:
B62

Feature:
ESBAL021

Date:
08-26-2009

Comments:
Swale facing northwest.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B67

Feature:
ESBAL022

Date:
08-26-2009

Comments:
Swale facing east.

Photograph ID:

Feature:

Date:

Comments:

[INTENTIONALLY LEFT BLANK]

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B68

Feature: ESBAL023

Date: 08-26-2009

Comments: Swale facing east.

Photograph ID: B69

Feature: ESBAL023

Date: 08-26-2009

Comments: Swale facing west.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B70

Feature:
ESBAL024

Date:
08-26-2009

Comments:
Swale facing north.

Photograph ID:
B71

Feature:
ESBAL024

Date:
08-26-2009

Comments:
Swale facing south.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B72 **Feature:** ESBAL025 **Date:** 08-26-2009 **Comments:** Swale facing east.	
Photograph ID: B73 **Feature:** ESBAL025 **Date:** 08-26-2009 **Comments:** Swale facing west.	

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B74

Feature:
ESBAL026

Date:
08-26-2009

Comments:
Swale facing south.

Photograph ID:
B75

Feature:
ESBAL026

Date:
08-26-2009

Comments:
Swale facing northwest.

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B83

Feature: ESBAL027

Date: 08-26-2009

Comments: Swale facing southeast.

Photograph ID: B84

Feature: ESBAL027

Date: 08-26-2009

Comments: Swale facing northwest.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B87 **Feature:** ESBAL028 **Date:** 08-26-2009 **Comments:** Swale facing west.	
Photograph ID: B88 **Feature:** ESBAL028 **Date:** 08-26-2009 **Comments:** Erosional feature facing east, out of the corridor.	

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B89

Feature:
ESBAL029

Date:
08-26-2009

Comments:
Swale facing west.

Photograph ID:
B90

Feature:
ESBAL029

Date:
08-26-2009

Comments:
Swale facing east.

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B94	
Feature: ESBAL030	
Date: 08-26-2009	
Comments: Swale facing south.	
Photograph ID:	[INTENTIONALLY LEFT BLANK]
Feature:	
Date:	
Comments:	

PHOTOGRAPHIC LOG

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B95

Feature:
ESBAL031

Date:
08-26-2009

Comments:
Erosional feature facing south.

Photograph ID:
B96

Feature:
ESBAL031

Date:
08-26-2009

Comments:
Erosional feature facing north.

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B97

Feature:
ESBAL032

Date:
08-26-2009

Comments:
Swale facing north.

Photograph ID:
B98

Feature:
ESBAL032

Date:
08-26-2009

Comments:
Swale facing south.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	Project Number:	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B99

Feature:
ESBAL033

Date:
08-26-2009

Comments:
Swale facing south, looking into the corridor from the edge.

Photograph ID:
B103

Feature:
ESBAL034

Date:
08-27-2009

Comments:
Swale facing north into the corridor from the edge.

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID: B114 **Feature:** ESBAL035 **Date:** 08-27-2009 **Comments:** Swale facing east.	
Photograph ID: B115 **Feature:** ESBAL035 **Date:** 08-27-2009 **Comments:** Swale facing west.	

PHOTOGRAPHIC LOG

ERM®

Client:	Shell Wind Energy	Project Number:	0105023
Project Name:	Hermosa West	Location:	Albany County, WY

Photograph ID:
B119

Feature:
ESBAL036

Date:
08-27-2009

Comments:
Swale facing north.

Photograph ID:
B120

Feature:
ESBAL036

Date:
08-27-2009

Comments:
Swale facing south.

PHOTOGRAPHIC LOG

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID: B121 **Feature:** ESBAL037 **Date:** 08-27-2009 **Comments:** Swale facing east.	
Photograph ID: B122 **Feature:** ESBAL037 **Date:** 08-27-2009 **Comments:** Swale facing west.	

PHOTOGRAPHIC LOG

ERM®

Client:	**Shell Wind Energy**	**Project Number:**	**0105023**
Project Name:	Hermosa West	**Location:**	Albany County, WY

Photograph ID:
B125

Feature:
ESBAL038

Date:
08-27-2009

Comments:
Swale facing south.

Photograph ID:
B126

Feature:
ESBAL038

Date:
08-27-2009

Comments:
Swale facing north.

APPENDIX E

WILDLIFE BASELINE STUDIES

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WILDLIFE BASELINE STUDIES, FINAL REPORT, APRIL 2010 – APRIL 2011

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Wildlife Baseline Studies for the Hermosa West Wind Resource Area Albany County, Wyoming

Final Report
April 2010 – April 2011

Prepared for:

Shell Wind Energy, Inc.

910 Louisiana Street
Houston, Texas

Prepared by:

Kenton Taylor, Donald Solick and Kimberly Bay

Western EcoSystems Technology, Inc.
2003 Central Avenue
Cheyenne, Wyoming

August 18, 2011

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

EXECUTIVE SUMMARY

Shell Wind Energy, Inc. has proposed a wind-energy facility in Albany County, Wyoming, referred to as the Hermosa West Wind Resource Area. Shell Wind Energy contracted Western EcoSystems Technology, Inc. to conduct surveys and monitor wildlife resources in the Hermosa West Wind Resource Area to estimate the impacts of facility construction and operations on wildlife. The following document contains results for a raptor habitat mapping effort and a mountain plover habitat assessment, fixed-point bird use surveys, raptor nest surveys, raptor (particularly golden eagle and ferruginous hawk) observations, acoustic bat surveys, and incidental wildlife observations.

The principal objectives of the baseline wildlife studies were to: 1) provide site-specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed wind-energy facility, 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats, and 3) recommend further studies or potential mitigation measures, if warranted.

The proposed wind-energy facility is dominated by grasslands. Vegetation/habitat mapping determined that approximately 87.6% of the Hermosa West Wind Resource Area contains grasslands, while the remaining areas are comprised of coniferous forest, riparian, mountain mahogany, shrub steppe, and riparian/willow. Potential raptor habitat types mapped within the Hermosa Wind Resource Area during 2010 included: two white-tailed prairie dog colonies, Richardson's ground squirrel concentrations, rock outcrops, small tree groups (<20 trees), and large tree groups (>20 trees). While the potential for mountain plover use of the Hermosa West Wind Resource Area cannot be ruled out, the suitability of the habitat within the site is considered low with small isolated patches of potentially suitable habitat. Mountain plovers have not been targeted with specific surveys but, no mountain plovers have been observed during baseline work conducted at the Hermosa West Wind Resource Area.

The objective of the fixed-point bird use surveys was to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly diurnal raptors. Fixed-point surveys were conducted from April 29, 2009 through April 11, 2011, at six points established throughout the Hermosa West Wind Resource Area. This report focuses on the second year of surveys conducted from April 20, 2010 – April 11, 2011. A total of 194 20-minute (min) fixed-point surveys were completed and 42 bird species were identified. Diurnal raptor use was highest during the summer (1.38 birds/plot/20-min survey) and lowest during the winter (0.69). The most common raptors observed in the study area were red tailed hawks, ferruginous hawks, and golden eagles. The raptor species with the highest exposure indices were red tailed hawk and golden eagle (0.09 and 0.08, respectively).

Annual mean diurnal raptor use (number of raptors divided by the number of 800-m plots and the total number of surveys) at the Hermosa West Wind Resource Area was compared with 40 other wind energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these wind energy facilities ranged from 0.10 to 3.18 raptors/plot/20-min survey. Mean diurnal raptor use at the Hermosa West Wind Resource Area during the second year of surveys (1.02 raptors/plot/20-min survey) ranked sixth compared to the 40 other wind energy facilities. Mean diurnal raptor use at the Hermosa West Wind Resource Area during the first year of surveys (0.75 raptors/plot/20-min survey) ranked 11th compared to the 40 other facilities, and the combined results for the two years of baseline studies (0.88 raptors/plot/20-min survey) ranked eighth out of the 40 other comparable studies at modern wind energy facilities.

Within the Rocky Mountain Region, the mean annual raptor use estimates for the Foote Creek Rim Facility in Wyoming was 0.55 raptors/plot/20-min survey. Raptor fatality rates at Foote Creek Rim averaged 0.04/MW/year. To date, no other raptor use estimates coupled with fatality estimates are publicly available for the Rocky Mountain Region. Within the Pacific Northwest Region, raptor use estimates at 11 modern facilities coupled with fatality estimates ranged from 0.21 to 0.75 raptors/plot/20-min survey. Raptor fatality estimates were available for the same 11 facilities, and estimates ranged from zero to 0.21/MW/year and averaged 0.08/MW/year. Assuming a correlation between use and fatality rates exists, rates at the Hermosa West Wind Resource Area would be expected to be at the upper end of the fatality rates reported for the Rocky Mountain and Pacific Northwest Regions but, would be lower than the fatality rates observed at sites in California. The raptor species with the highest exposure indices were red-tailed hawk and golden eagle, which were influenced by the relatively high use estimates by these species and the proportion of initial flight heights recorded within the rotor swept height. Impacts to raptor species can be minimized by placing spatial buffers around nest sites during siting of the wind-energy facility and avoiding known foraging areas (e.g. the two small white-tailed prairie dog colonies). Given the data collected during baseline wildlife surveys and the potential for impact to raptor species, Shell Wind Energy, Inc. has implemented a third year of focused raptor observations and plans to utilize the information collected from the three years of raptor surveys in designing the project layout with the intent of minimizing potential impacts to raptors.

Four active raptor nests (0.09 active nests/mi^2; 0.04 active nests/km^2), ten inactive raptor nests (0.22 inactive nests/mi^2; 0.09 inactive nests/km^2), and 3 raptor nests of undetermined status were identified within the Hermosa West Wind Resource Area and surrounding one mile buffer in 2010. Species on active nests included: Swainson's hawk (one nest), prairie falcon (*one nest*), unidentified buteo (one nest), and common raven (one nest). The one active golden eagle nest from 2009 was inactive in 2010. One additional inactive nest is considered a possible golden eagle nest due to the size of the nest, but no golden eagles were observed in the vicinity of the nest in either 2009 or 2010. The nests of undetermined status had adult Swainson's hawks in the vicinity of the nests, but status of the nests was undetermined during the survey effort. Access issues limited the survey coverage outside of leased lands within the study area, and it is possible that additional nests exist within the one-mile buffer surrounding leased lands.

The objective of the raptor observations was to better understand the spatial extent and use of a portion of the Hermosa West Wind Resource Area by raptors (especially golden eagles and ferruginous hawks). Two hour observations were conducted from a vantage point allowing maximum visibility between a golden eagle nest identified in 2009 and proposed turbine corridors. Observations were initiated on May 25, 2010 and occurred following the same schedule proposed for avian use surveys in the remainder of the spring/summer 2010. A total of 28 two hour observation periods were conducted from May 25, 2010 to April 11, 2011. Golden eagles were observed during 12 of the 28 observation periods and 21 golden eagle flight paths were mapped during surveys. Ferruginous hawks were observed during 10 of the 28 observation periods and 14 ferruginous hawk flight paths were mapped during surveys.

Golden eagles are protected by the Migratory Bird Treaty Act (MBTA 1918) and the BGEPA (1940). The USFWS has recently expressed elevated concern over impacts to golden eagles from wind energy projects. Mean golden eagle use at the Hermosa West Wind Resource Area ranks 7th out of ten other publicly available golden eagle use estimates reported at other Wind Resource Areas in Wyoming. Shell WindEnergy has requested that WEST implement additional raptor observations during 2011-2012 to help better understand use of the Hermosa West Wind Resource Area by raptors (particularly golden eagles) and to collect information on golden eagle use that can be incorporated into planning/facility siting with the intent of reducing potential risk to golden eagles. The results of the raptor observations can be used to inform project siting and may help to minimize potential impacts to golden eagles. The utility of these surveys in minimizing impacts to raptors will be better understood as similar methods are implemented at more projects in Wyoming and across the Western U.S. WEST recommends that Shell Wind Energy continue to coordinate with the U.S. Fish and Wildlife Service regarding potential impacts to golden eagles from the proposed project.

The objective of the bat acoustic surveys was to estimate the seasonal and spatial patterns of activity of the Hermosa West Wind Resource Area by bats. Bats were surveyed using Anabat™ SD1/SD2 bat detectors. Bat detectors are a recommended method to index and compare habitat use by bats. The use of bat detectors for calculating an index to bat impacts is a primary bat risk assessment tool for baseline wind development surveys. Bat activity was surveyed using three detectors from April 26 to October 31, 2010. Two detectors were placed near a met tower sampled in 2009. At this station, a ground detector was paired with a detector raised on the met tower to compare bat activity at different heights (ground versus raised) and monitor bat activity in the rotor-swept zone. The additional detector was rotated through five ground stations in areas proposed for turbine placement. The five ground stations were placed systematically with a random starting location. One additional location (a historic mine shaft) was sampled in late July/early August and again in late October.

The proposed wind-energy facility is not located near any large, known bat colonies likely to attract large numbers of bats. The one historic mine location within the Hermosa West Wind Resource Area, was sampled in 2010 and the bat activity rate in the vicinity of the mine was within the range of activity rates at other sampling stations. In addition, both hoary bats and eastern red bats were recorded in the vicinity of the mine. Hoary bats and eastern red bats would not be expected to be using the historic mine location for roosting. These findings suggest that the historic mine shaft at Hermosa West Wind Resource Area does not appear to be an important bat roosting area.

Based on similar activity levels, the proximity of the Hermosa West Wind Resource Area to the Foote Creek Rim Facility, and the presence of similar habitats among the two areas, similar rates of bat mortality could be expected at the Hermosa West Wind Resource Area. Bat activity at the Hermosa West Wind Resource Area was similar to bat activity levels recorded at several other wind resource areas in Wyoming. To date, however, the only bat mortality data for Wyoming are from the Foote Creek Rim wind-energy facility. As more research is conducted at facilities in the Wyoming, more information regarding the potential direct impacts of Wyoming wind-energy facilities to bats will be obtained.

The objective of incidental wildlife observations was to record wildlife seen outside of the standardized surveys. Six bird species were recorded as incidental observations. Observations included golden eagle. common raven, northern harrier, ferruginous hawk, prairie falcon, and bald eagle. Five mammal species were recorded incidentally including 273 pronghorn in 17 groups, 220 elk in two groups, 4 mule deer, three coyotes, and one badger. According to the Wyoming Game and Fish Department, the Hermosa West Wind Resource Area is not in an area designated as crucial winter range, parturition, or migration route for either species. The Hermosa West Wind Resource Area is not in a designated core greater sage-grouse area and no greater sage-grouse were observed within the Hermosa West Wind Resource Area.

The list of sensitive species identified during the second year of surveys is similar to the list of sensitive species from the first year of baseline surveys. All sensitive species identified during the second year were recorded the first year however; three avian species (Sandhill crane, grasshopper sparrow, and chestnut-collared longspur; all Wyoming Native Status Species) were not recorded during the second year of surveys. Some small-scale displacement of grassland passerines is possible in close proximity to turbines. Timing construction outside of the nesting season or clearing construction areas of vegetation prior to the nesting season will help to minimize impacts to grassland-nesting passerines.

STUDY PARTICIPANTS

Western EcoSystems Technology

Kenton Taylor	Project Manager
Kimberly Bay	Data Analyst and Report Manager
Christina Roderick	Statistician
JR Boehrs	GIS Technician
Kyle Nehring	Report Compiler
Donald Solick	Bat Biologist
Heather Darrow	Technical Editor
Kyle Nehring	Field Technician

REPORT REFERENCE

Taylor K. and K. Bay. 2011. Wildlife Baseline Studies for the Hermosa West Wind Resource Area, Albany County, Wyoming. Final Report: April 20, 2010 – April 11, 2011. Prepared for Shell Wind Energy, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming

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INTRODUCTION

Shell WindEnergy, Inc. (SWE) has proposed a wind-energy facility in Albany County, Wyoming (Figure 1). Shell contracted Western EcoSystems Technology, Inc. (WEST) to conduct surveys and monitor wildlife resources in the Hermosa West Wind Resource Area (HWWRA) to estimate the impacts of wind-energy facility construction and operations on wildlife.

The principal objectives of the study were to: 1) provide site-specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed HWWRA; 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats; and 3) recommend further studies or potential mitigation measures, if warranted. The protocols for the baseline studies are similar to those used at other wind-energy facilities across the nation and follow the guidance of the National Wind Coordinating Collaborative (Anderson et al. 1999). The protocols have been developed based on WEST's experience studying wildlife at proposed wind-energy facilities throughout the United States and were designed to help predict potential impacts to bird (particularly raptors and waterfowl) and bat species.

Baseline surveys were conducted from April 29, 2009, through April 11, 2011, at the HWWRA, with this report covering second year results from surveys conducted from April 20, 2010 to April 11, 2011. Second year surveys consisted of a raptor habitat mapping effort and a mountain plover habitat (*Charadrius montanus*) assessment, fixed-point bird use surveys, raptor nest surveys, raptor (particularly golden eagle [*Aquila chrysaetos*] and ferruginous hawk [*Buteo regalis*]) observations, acoustic bat surveys, and incidental wildlife observations. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities. The ability to estimate potential bird mortality at the proposed HWWRA is greatly enhanced by operational monitoring data collected at existing facilities. For several wind-energy facilities, standardized data on fixed-point bird surveys were collected in association with standardized post-construction (operational) monitoring, allowing comparisons of bird use with bird mortality. Where possible, comparisons were made among regional and local studies.

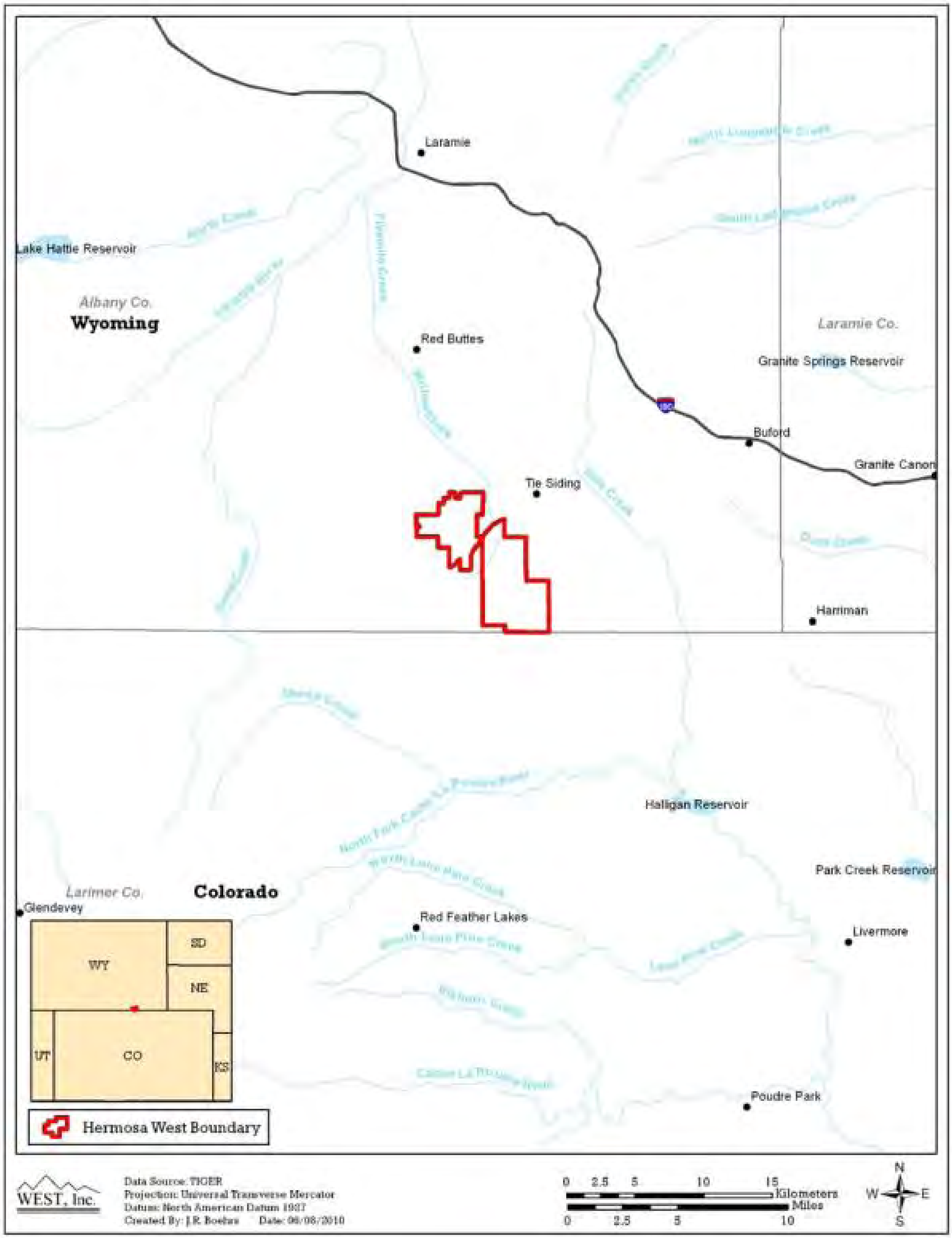


Figure 1. Location of the Hermosa West Wind Resource Area.

STUDY AREA

The HWWRA, approximately 11,118 acres (17.4 square miles [mi^2]) in size, is located in southeastern Wyoming (Figure 1). The proposed HWWRA contains a variety of topographic features from generally flat/rolling areas to large drainage features and prominent ridges (Figure 2). Based on a vegetation and habitat mapping effort conducted within the HWWRA, grassland is the dominant landcover type (87.6%), followed by coniferous forest (6.0%), riparian (3.6%), and mountain mahogany (*Cercocarpus* spp., 1.2%; Table 1). Shrub steppe and riparian/willow (*Salix* spp.) each cover one percent of the HWWRA or less (Table 1; Figure 3). The HWWRA is a mixture of private and state lands, with the dominant land use being rangeland for grazing livestock.

The number and size of wind turbines that will be installed within the HWWRA is currently unknown. A rotor-swept height (RSH) for potential collision with a turbine blade of 115 to 427 foot (ft; 35 to 130 meters [m]) above ground level (AGL) was used for the purposes of the analyses.

Table 1. Mapped vegetation and habitat types, coverage, and percent composition (%) within the Hermosa West Wind Resource Area.

Habitat	Acres	% Composition
Grassland	9,735.14	87.6
Coniferous Forest	661.33	6.0
Riparian	397.70	3.6
Mountain Mahogany	131.30	1.2
Shrub Steppe	106.46	1.0
Riparian/Willow	86.01	0.8
Total	**11,117.94**	**100**

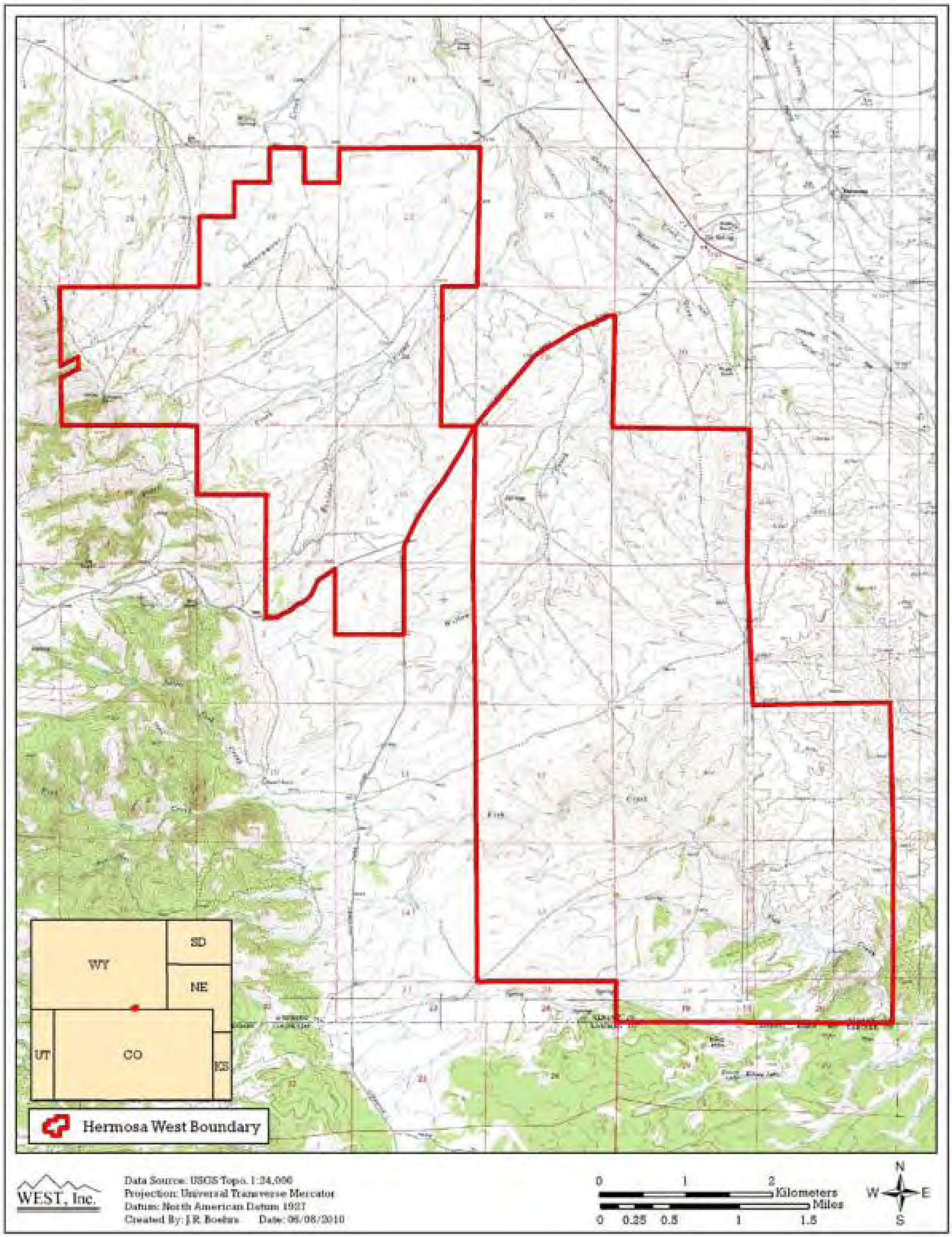


Figure 2. Overview of the Hermosa West Wind Resource Area.

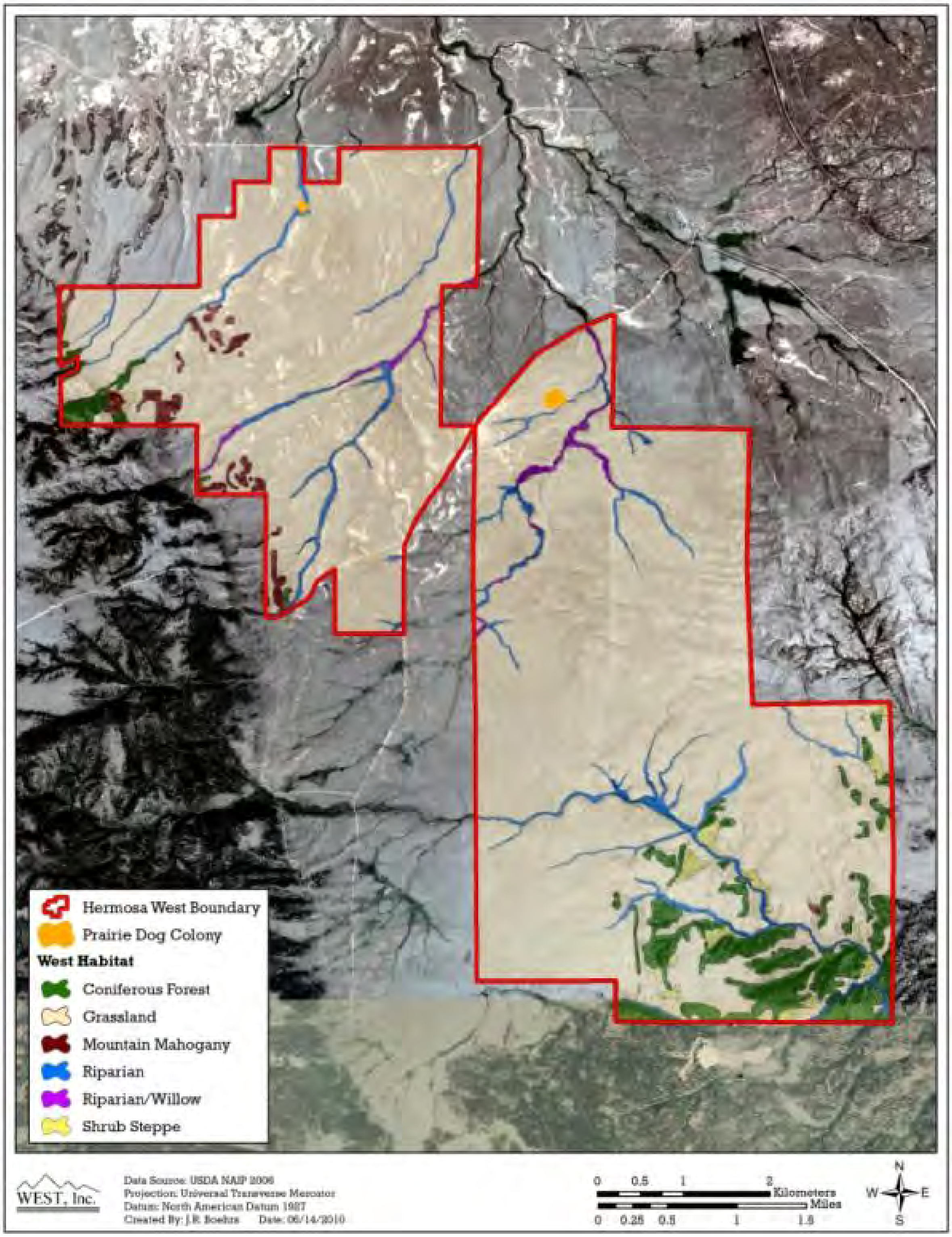


Figure 3. Mapped vegetation and habitat types within the Hermosa West Wind Resource Area.

METHODS

Raptor Habitat Mapping and Mountain Plover Habitat Assessment

Vegetation/habitat types in the HWWRA were mapped using the latest available aerial imagery and ground-truthing in 2009 (Taylor and Bay 2010). Vegetation/habitat types (e.g., grassland, rocky/forested, mountain mahogany) were described and mapped with the goal of identifying important habitat areas for sensitive species. This habitat information was digitized into a geographic information system (GIS) format and may be used to guide sensitive species surveys, if warranted.

The 2009 vegetation mapping effort was updated based on potentially suitable raptor habitat (e.g., rock outcrops, ridgelines, white-tailed prairie dog [*Cynomys leucurus*] colonies) in 2010. In addition, the suitability of the HWWRA as mountain plover habitat was documented in 2010. The 2010 vegetation/habitat mapping efforts were conducted by driving and pedestrian surveys that occurred throughout the HWWRA. Surveyors mapped potential raptor habitat on aerial imagery. Representative photographs of the vegetative cover were taken in the areas containing the greatest potential to be considered suitable mountain plover habitat. Potential raptor habitat information was digitized into a GIS format.

Fixed-Point Bird Use Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal and spatial use of the HWWRA by birds, particularly raptors. Fixed-point bird surveys (variable circular plots) were conducted using methods described by Reynolds et al. (Reynolds et al. 1980).

Survey Plots

Six points were selected to survey representative habitats and topography of the HWWRA while also providing relatively even coverage of the study area (Figure 4). Each survey plot was a 2,625-ft (800-m) radius circle centered on the point.

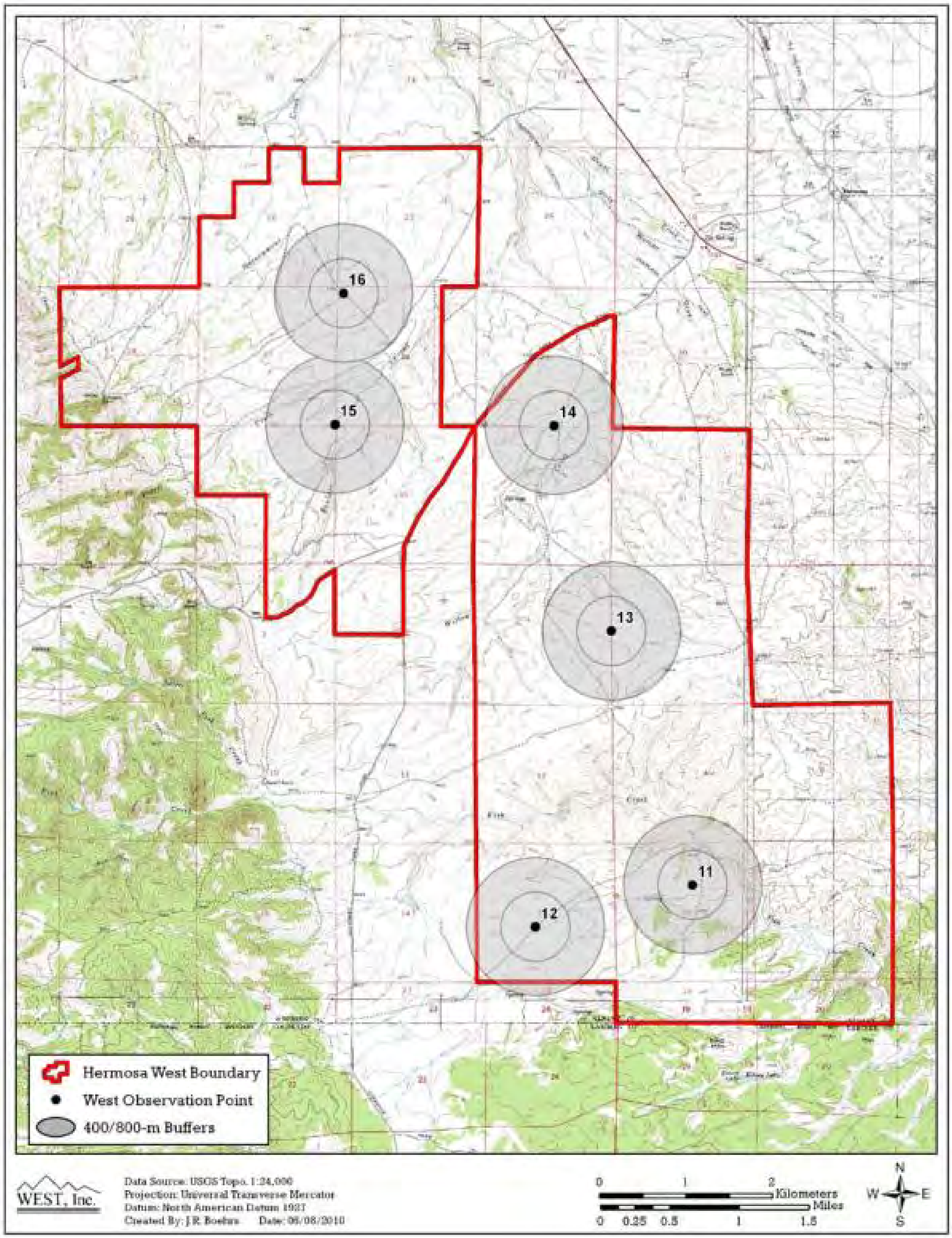


Figure 4. Fixed-point bird use points at the Hermosa West Wind Resource Area.

Survey Methods

All birds observed during each 20-minute (min) fixed-point bird use survey were recorded by unique observation numbers. Point counts were conducted for 20-min to be consistent with methodologies employed at other wind energy facilities. Observations of large birds beyond the 800-m radius were recorded, but were not included in the statistical analyses; for small birds, observations beyond the 100-m (328-ft) radius were excluded. Large birds included waterbirds, waterfowl, rails and coots, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, and large corvids (e.g., ravens, magpies, and crows), goatsuckers, kingfisher, and large woodpeckers (e.g., flickers). Passerines (excluding large corvids, cuckoo, and woodpeckers), swifts/hummingbirds, some woodpeckers, and most cuckoos were considered small birds.

The date, start and end time of the survey period, and weather information (e.g., temperature, wind speed, wind direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. The behavior of each bird observed and the vegetation type in which or over which the bird occurred were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest five-m (16-ft) interval. Other information recorded about the observation included whether or not the observation was auditory only and the 10-min interval of the 20-min survey in which it was first observed.

Locations of raptors, other large birds, and species of concern seen during fixed-point bird use surveys were recorded on field maps by unique observation number. Flight paths and perched locations were digitized using ArcGIS 10.0. Comments were recorded in the comments section of the data sheet.

Observation Schedule

Sampling intensity was designed to document bird use and behavior by habitat and season within the HWWRA. Surveys were conducted weekly during spring (March 16 to May 31) and fall (September 1 to November 15), and were conducted twice per month during summer (June 1 to August 31) and winter (November 16 to March 15). Surveys were carried out during daylight hours, and survey periods varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed about the same number of times. However, the schedule varied in response to adverse weather conditions (e.g., fog, rain, heavy snow), which caused delays and/or missed surveys.

Incidental wildlife observations provide records of wildlife seen outside of the standardized surveys. All raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species) and habitat were recorded. The location of sensitive species was recorded by Universal Transverse Mercator (UTM) coordinates using a hand-held Global Positioning System (GPS) unit.

Raptor Nest Surveys

The objectives of the raptor nest surveys were to: 1) identify the species and nest densities occurring within the HWWRA; and 2) record raptor nest locations to aid in project planning to avoid/minimize potential impacts to nesting raptors. Suitable raptor nesting habitat is present at the HWWRA in the form of coniferous trees, rock outcrops, and scattered deciduous trees. Ground based surveys for raptor nests were conducted within the HWWRA and a 1-mile (1,600 m) buffer surrounding the HWWRA in 2009. Survey coverage within the 1-mile (1,600 m) buffer was restricted to areas of public access and/or viewing from the lease boundary. The survey effort focused on species that build large nest structures, such as red-tailed hawk (*Buteo jamaicensis*). Other species that nest on the ground, or in cavities, were recorded if observed, but were not the focus of surveys. To the greatest extent possible, care was taken to minimize disturbance to raptors at nest sites during surveys. In addition to searching for new or previously unidentified raptor nests, raptor nests identified in 2009 were revisited in the spring of 2010 to determine status.

Several items were recorded for each nest site, including nest status (active or inactive), the number of adults and young present, species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), nest location (global positioning system [GPS] coordinates) and nest substrate.

Raptor Observations

The objective of the raptor observations was to better understand the spatial extent and use of a portion of the Hermosa West Wind Resource Area by raptors (especially golden eagles and ferruginous hawks). Two hour observations were conducted from a vantage point allowing maximum visibility between a golden eagle nest identified in 2009 and proposed turbine corridors. Observations were initiated on May 25, 2010 and occurred following the same schedule proposed for avian use surveys in the remainder of the spring/summer 2010. To the extent practicable, each observation period was conducted during a different time of day from the previous week to vary the time of day during which observations were conducted and distribute observations over all daylight periods throughout the year. Observers recorded detailed notes describing the activities of eagles and ferruginous hawks including mapping perch locations and flight paths on USGS 1:24,000 scale topographic maps.

Acoustic Bat Surveys

The objective of the bat acoustic surveys was to estimate the seasonal and spatial patterns of activity of the HWWRA by bats. Bats were surveyed using Anabat™ SD1/SD2 bat detectors (Titley Scientific™, Australia). Bat detectors are a recommended method to index and compare habitat use by bats. The use of bat detectors for calculating an index to bat impacts is a primary bat risk assessment tool for baseline wind development surveys (Arnett 2007, Kunz et al. 2007a). Bat activity was surveyed using three detectors from April 26 to October 31, 2010.

Two detectors were placed near a met tower sampled in 2009 (Figure 5; Taylor et al. 2010c). At this station, a ground detector was paired with a detector raised on the met tower to compare bat activity at different heights (ground versus raised) and monitor bat activity in the rotor-swept zone. The additional detector was rotated through five ground stations in areas proposed for turbine placement. The five ground stations were placed systematically with a random starting location. Anabat detectors were tilted toward the sky to maximize the height at which bat calls were detected. One additional location (a historic mine shaft; labeled station 19t) was sampled in late July/early August and again in late October.

Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are translated into frequencies audible to humans by dividing the frequencies by a predetermined ratio. A division ratio of 16 was used for the study. Bat echolocation detectors also detect other ultrasonic sounds, such as those sounds made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. Calls were recorded to a compact flash memory card with large storage capacity. The detection range of Anabat detectors depends on a number of factors (e.g., echolocation call characteristics, microphone sensitivity, habitat, the orientation of the bat, atmospheric conditions; Limpens and McCracken 2004), but is generally less than 30 m (98 ft) due to atmospheric absorption on echolocation pulses (Fenton 1991). To ensure similar detection ranges among detectors, microphone sensitivities were calibrated using a BatChirp (Tony Messina, Las Vegas, NV) ultrasonic emitter as described in Larson and Hayes (2000). All units were programmed to turn on each night approximately 30 minutes (min) before sunset and turn off approximately 30 min after sunrise.

To minimize the potential for water damage due to rain, Anabat detectors were placed inside plastic weather-tight containers that had a hole cut in the side through which the microphone extended. The microphones were encased in poly-vinyl chloride (PVC) tubing that curved skyward at 45 degrees outside the container, and holes were drilled in the PVC tubing. Detectors protected in this manner have been found to detect similar numbers and quality of bat calls as detectors exposed to the environment, and record twice as many species as detectors protected with Bat-Hat weatherproof housing (Britzke et al. 2010). Containers were raised approximately 1 m (3.3 ft) off the ground to minimize echo interference and lift the unit above vegetation. Raised Anabat microphones were elevated 45 m (148 ft) on meteorological towers using a pulley system. Microphones were encased in a Bat-Hat weatherproof housing (EME Systems, Berkeley, California), and attached to a coaxial cable that transmitted ultrasonic sounds to an Anabat unit at the base of the tower. Since a recent study has found that detectors protected using Bat-Hats may detect lower activity and species richness than are present at a site (Britzke et al. 2010), the Bat-Hat weatherproof housing was modified by replacing the Plexiglas reflector plate with a 45-degree angle PVC elbow, for better comparability with data collected by detectors on the ground. The 2011 acoustic sampling study utilized the same acoustic sampling techniques and equipment that was used in the 2010 acoustic studies at the HWWRA.

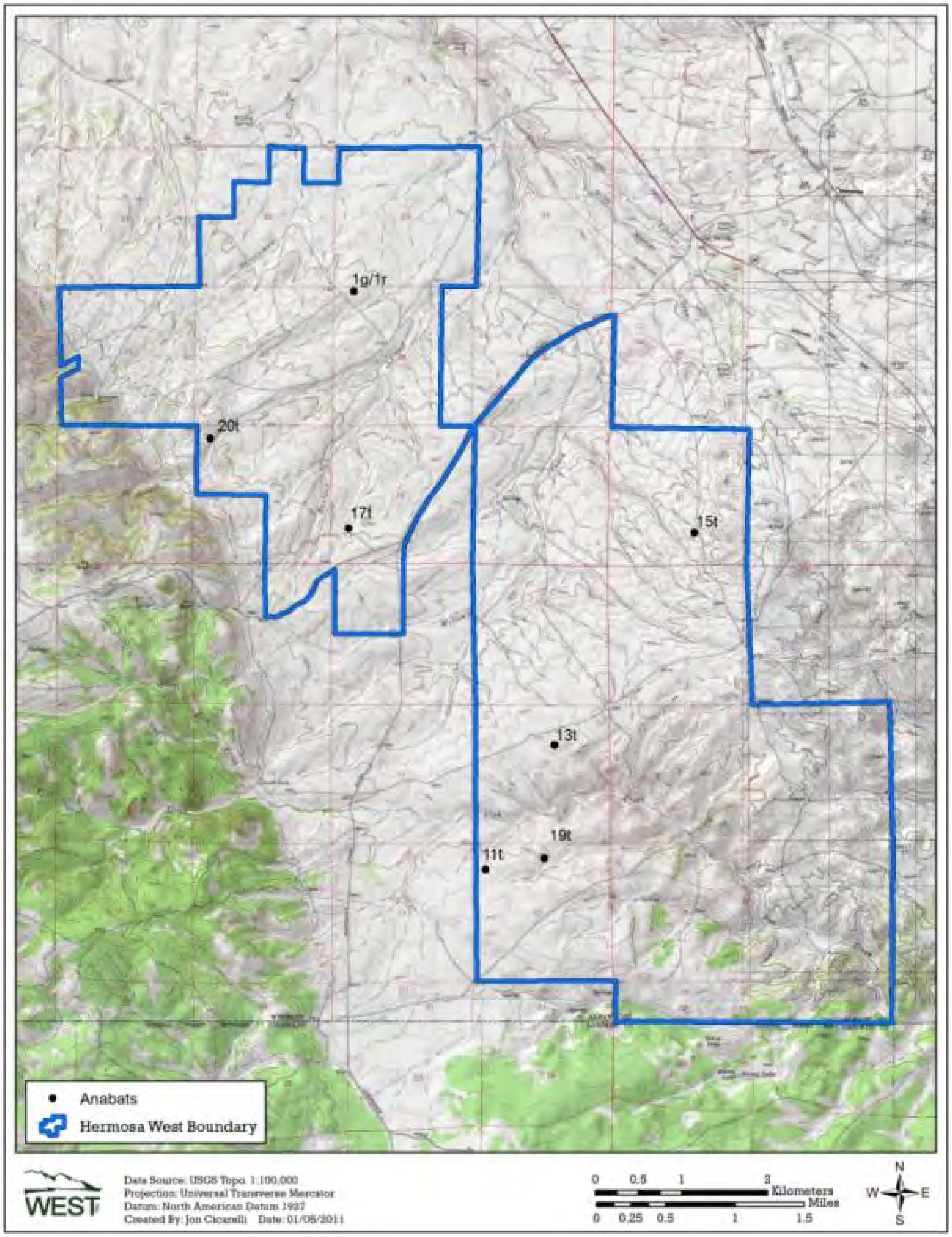


Figure 5. Study area map and Anabat sampling stations at the Hermosa West Wind Resource Area.

Incidental Wildlife Observations

The objective of incidental wildlife observations was to record wildlife seen outside of the standardized surveys. All raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), and habitat were recorded. The locations of sensitive species were recorded by collecting GPS coordinates using a hand-held unit.

Statistical Analysis

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes were made in all affected steps.

Data Compilation and Storage

A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks (if provided), and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season and included all observations of birds detected, regardless of their distance from the observer. Species richness was calculated as the mean number of species observed per plot per survey (i.e., number of species/plot/20-min survey). Species diversity and richness were compared among seasons for fixed-point bird use surveys.

Bird Use, Percent Composition, and Frequency of Occurrence

For the standardized fixed-point bird use estimates, only observations of large birds detected within the 800-m (2,625-ft) radius plot were used in the analysis. For small birds only observations within a 100-m (328-ft) radius were used. Estimates of mean bird use (i.e., number of birds/plot/20-min survey) were used to compare differences between bird types, seasons, survey points, and other wind energy facilities. Mean use is calculated by determining the number of birds seen within each 800-m plot (or 100-m plot for small birds) for each given visit and then averaging by the number of plots surveyed during that visit. A second averaging occurs across the number of visits during the season and entire study period. A visit is defined as the required length of time to survey all of the plots once within the study area.

Percent composition was calculated as the proportion of the overall mean use for a particular bird type or species, and the frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Frequency of occurrence and percent composition provide relative measures of species use of the proposed wind resource area. For example, a particular species might have high use estimates for the study area based on just a few observations of large groups; however, the frequency of occurrence would indicate that the species only occurred during a few of the surveys, therefore the species would be less likely to be affected by the wind energy facility or the transmission corridor.

<u>Bird Flight Height and Behavior</u>

To calculate potential risk to bird species, the first flight height recorded was used to estimate the percentages of birds flying within the likely rotor-swept heights (RSH) for collision with turbine blades of 35 to 130 m (115 to 427 ft) above ground level (AGL), which is the blade height of typical turbines likely to be used at the HWWRA.

<u>Bird Exposure Index</u>

The bird exposure index is used as a relative measure of how often birds fly at heights similar to blades of modern wind turbines. A relative index of bird exposure (R) was calculated for bird species observed during the fixed-point bird use surveys using the following formula:

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (large bird observations within 800 m [2,625 ft] of the observer or 100 m [328 ft] for small birds) averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals the proportion of all initial flight height observations of species *i* within the likely RSH.

<u>Spatial Use</u>

Large bird flight paths were qualitatively compared to study area characteristics (e.g., topographic features). The objective of mapping observed large bird locations and flight paths was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the study area. This information can be useful in turbine layout design or adjustments of individual turbines for micro-siting.

Bat Acoustic Surveys

Bat activity was measured by counting number of bat passes (Hayes 1997). A pass was defined as a continuous series of two or more call notes produced by an individual bat with no pauses between call notes of more than one second (White and Gehrt 2001, Gannon et al. 2003). The number of bat passes was determined by downloading the data files to a computer and tallying the number of echolocation passes recorded. Total number of passes was corrected for effort by dividing by the number of detector-nights. A detector-night is defined as one detector collecting data for one night. In this report, the terms bat pass and bat call are used interchangeably.

The study was divided into three seasonal survey periods: Spring (April 26 – May 31), Summer (June 1 – July 14) and Fall (July 15 – October 31). In this report, the activity rate recorded at the fixed ground detector during the Fall serves as a standard for comparison with activity data from other wind energy facilities, and is used to assess the potential for bat mortality at the HWWRA. Peak bat activity was estimated by taking the maximum average activity rate for any seven day period, not restricted to a particular starting date. The week (or weeks, in case of a tie) with the highest sum indicate the period of highest sustained bat activity.

For each survey location, bat passes were sorted into four groups based on their minimum frequency that correspond roughly to species groups of interest. For example, most species of *Myotis* bats echolocate at frequencies greater than 40 kilohertz (kHz), whereas species such as the eastern red bat (*Lasiurus borealis*) typically have echolocation calls that fall between 30 and 40 kHz. Species such as big brown (*Eptesicus fuscus*), silver-haired (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*), have echolocation that fall between 15 kHz and 30 kHz. Therefore, bat passes were classified as high-frequency (HF; greater than 40 kHz), mid-frequency (MF; 30 - 40 kHz), and low-frequency (LF; 15 - 30 kHz). To establish which species may have produced passes in each category, a list of species expected to occur in the study area was compiled from range maps (Table 2; Harvey et al. 1999, Bat Conservation International [BCI] website 2011). Data determined to be noise (produced by a source other than a bat) or call notes that did not meet the pre-specified criteria to be termed a pass were removed from the analysis.

Table 2. Bat species determined from range-maps (BCI website 2011; Harvey et al. 1999) as likely to occur within the Hermosa West Wind Resource Area, sorted by call frequency.

Common Name	Scientific Name
High-frequency (> 40 kHz)	
western small-footed bat[3]	*Myotis ciliolabrum*
long-legged bat[1]	*Myotis volans*
Mid-frequency (30-40 kHz)	
eastern red bat[1,2,3]	*Lasiurus borealis*
western long-eared bat	*Myotis evotis*
little brown bat[2]	*Myotis lucifugus*
Low-frequency (< 30 kHz)	
pallid bat[3]	*Antrozous pallidus*
Townsend's big-eared bat	*Corynorhinus townsendii*
big brown bat[2]	*Eptesicus fuscus*
silver-haired bat[1,2]	*Lasionycteris noctivagans*
hoary bat[1,2]	*Lasiurus cinereus*
fringed bat	*Myotis thysanodes*

[1]long-distance migrant;
[2]species known to have been killed at wind energy facilities;
[3]species occurrence based upon a single source

Within these categories, an attempt was made to identify passes made by two *Lasiurus* species: hoary and eastern red bats. Passes that had a distinct U-shape and that exhibited variability in the minimum frequency across the call sequence were identified as belonging to the *Lasiurus* genus (C. Corben, pers comm.). Hoary and eastern red bats were distinguished based on minimum frequency; hoary bats typically produce calls with minimum frequencies between 18 and 24 kHz, whereas eastern red bats typically emit calls with minimum frequencies between 30 and 43 kHz (J. Szewczak, pers comm.). Only sequences containing three or more calls were used for species identification. Given the high intraspecific variability of bat calls and the number of call files that were too fragmented for proper identification, it is likely that more hoary and eastern red bat calls were recorded than were positively identified.

Bat activity for this report was defined as the number of bat passes per detector-night, and was used as an index for potential bat risk in the HWWRA. Because individuals cannot be differentiated by their calls, bat pass data represent relative levels of bat activity rather than the total numbers of individuals present. To assess potential for bat mortality, the mean number of bat passes per detector-night (averaged across ground-based monitoring stations) was compared to existing data from wind energy facilities where both bat activity and mortality levels have been measured.

RESULTS

Second year baseline surveys were completed at the HWWRA from April 20, 2010, through April 11, 2011. Forty-two bird species and five mammal species were identified during the second year of baseline surveys completed at the HWWRA.

Raptor Habitat Mapping and Mountain Plover Habitat Assessment

Results of the potential raptor habitat mapping effort conducted in 2010 within the HWWRA are depicted in Figure 6. Potential raptor habitat types within the HWWRA included: two white-tailed prairie dog colonies, Richardson's ground squirrel (*Spermophilus richardsonii*) concentrations, rock outcrops, small tree groups (<20 trees), and large tree groups (>20 trees). The locations of photographs taken to assess the suitability of the HWWRA as potential mountain plover habitat and to depict vegetation cover representative of the HWWRA are presented in Figure 7. Representative photographs are provided in Appendix A.

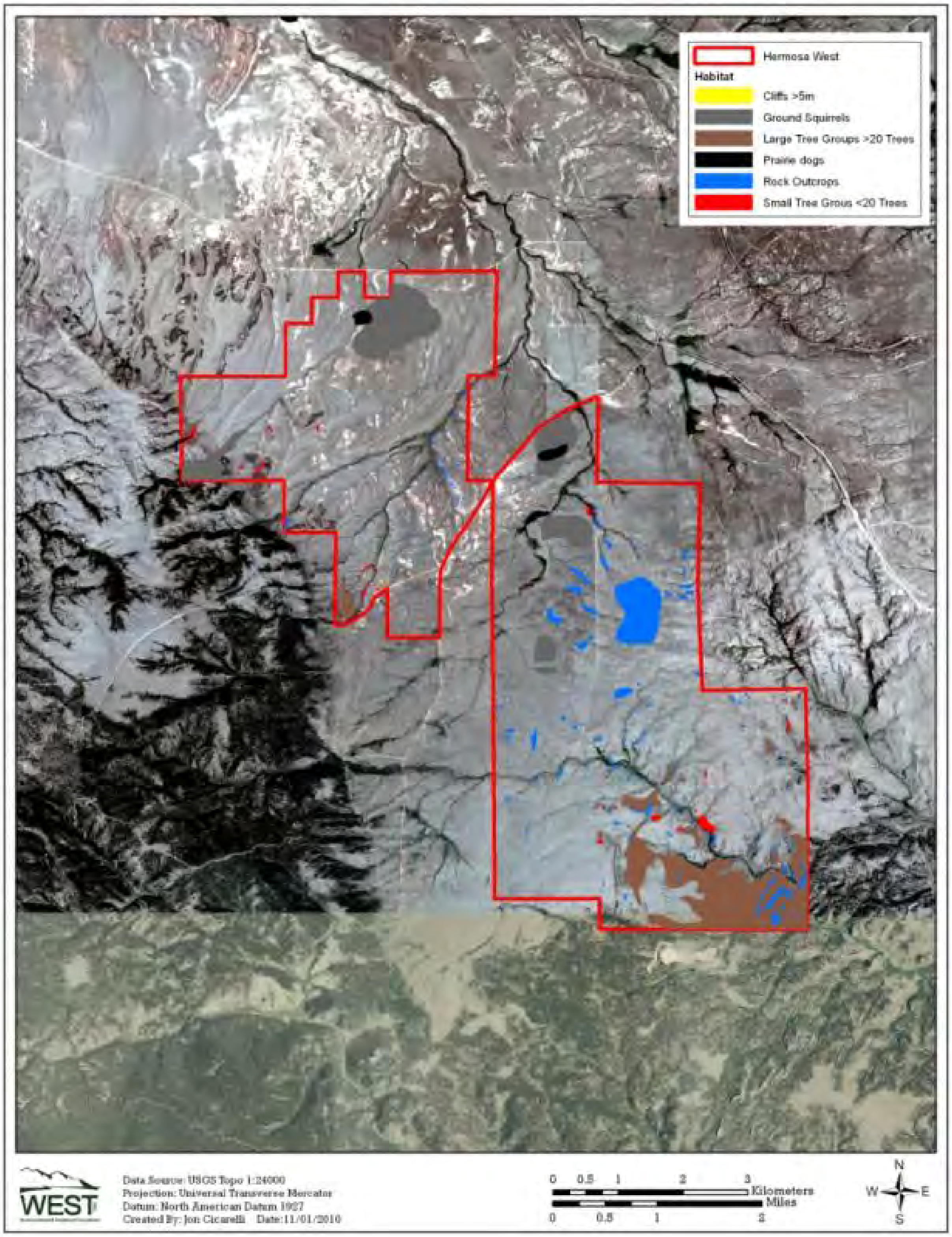


Figure 6. Results of the potential raptor habitat mapping effort conducted at the Hermosa West Wind Resource Area.

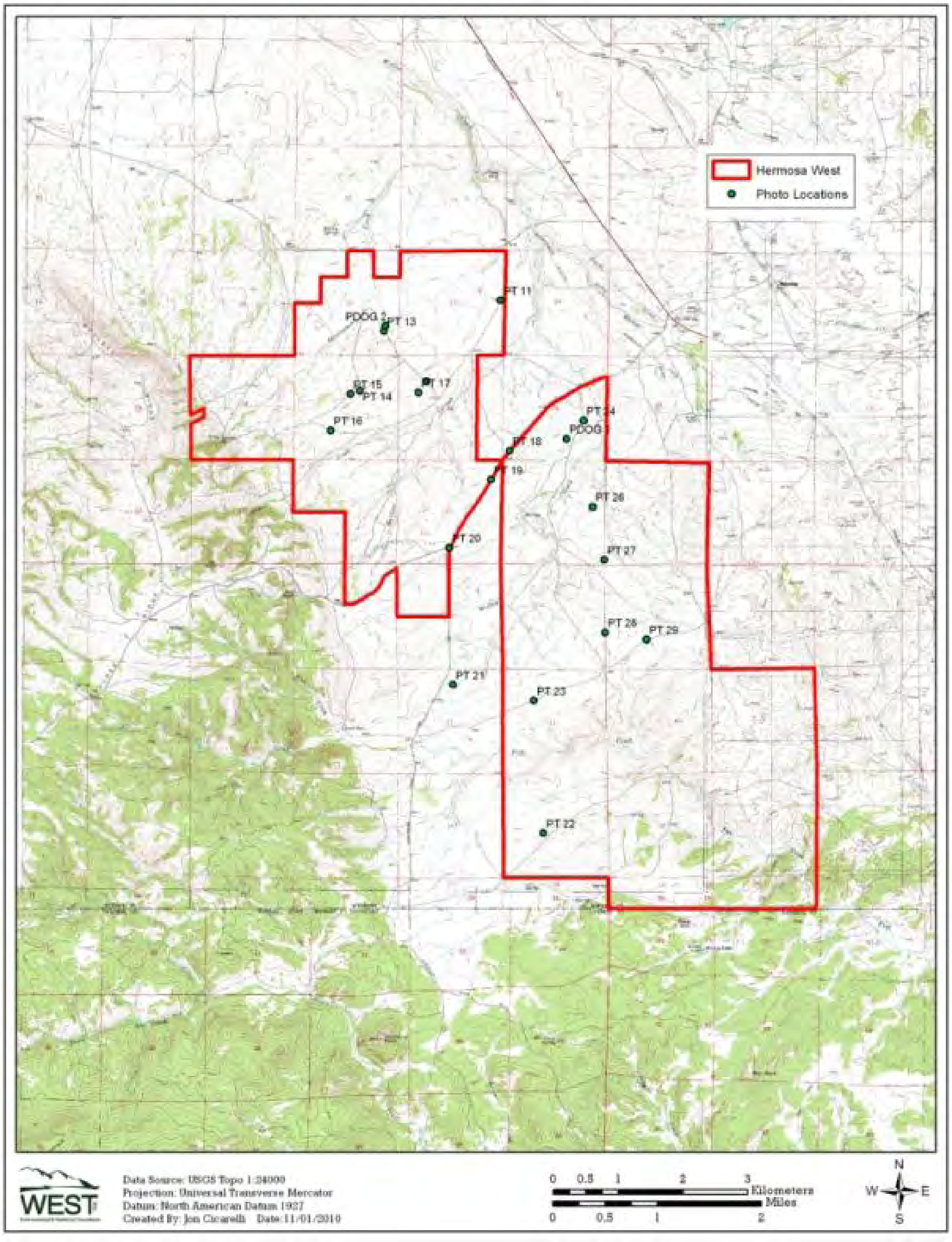


Figure 7. Photograph locations used to depict vegetation cover and suitability of the Hermosa West Wind Resource area as potential mountain plover habitat.

Fixed-Point Bird Use Surveys

A total of 194 20-min fixed-point bird use surveys were conducted during 33 visits to the HWWRA (Table 3). Two different viewsheds were utilized when calculating the different statistics (species richness, use, percent composition, percent frequency, and exposure index): 800 m for large bird observations and 100 m for small bird observations. For the purposes of this report, small birds were determined to be passerines (excluding large corvids), hummingbirds, and woodpeckers.

Bird Diversity and Species Richness

Forty-two unique species were observed over the course of all fixed-point bird use surveys (Table 3). A mean of 1.07 large bird species/800-m plot/20-min survey and 1.37 small bird species/100-m plot/20-min survey was recorded. Bird diversity (the number of unique species) was higher in the spring (31 species), followed by fall (26), summer (25), and winter (16). Large bird species richness (mean number of species per plot per survey) was highest in the summer and fall (both 1.26 species/plot/survey), followed by the spring (1.20), and winter (0.71). Small bird species richness was higher in the summer (1.90 species/plot/survey) compared to the fall (1.65), spring (1.55), and winter (0.67; Table 3).

Table 3. Summary of species richness (species/plot[a]/20-min survey), and sample size by season and overall during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness	
				Large Birds	Small Birds
Spring	10	56	31	1.20	1.55
Summer	7	42	25	1.26	1.90
Fall	9	54	26	1.26	1.65
Winter	7	42	16	0.71	0.67
Overall	**33**	**194**	**42**	**1.07**	**1.37**

[a] 800-m radius for large birds and 100-m radius for small birds.

A total of 1,434 individual birds were observed within 697 separate groups (defined as one or more individual) during the fixed-point surveys (Appendix B). Regardless of bird size, four species (9.5% of all species) composed 63.5% of all observations: horned lark (*Eremophila alpestris*), McCown's longspur (*Calcarius mccownii*), mountain bluebird (*Sialia curucroides*), and vesper sparrow (*Pooecetes gramineus*). Individually, all other species comprised less than 5% of the observations. The most abundant large bird species observed was American crow (*Corvus brachyrhynchos*), with 65 individuals observed in 21 groups. A total of 214 individual raptors were recorded within the HWWRA, representing 10 species (Table 4).

Bird Use, Percent Composition, and Frequency of Occurrence

Mean bird use, percent composition, and frequency of occurrence were calculated by season for all bird types (Table 4) and species (Appendix C). The highest overall large bird use occurred in the summer (2.63 birds/800-m plot/20-min survey), followed by spring (1.76), fall (1.50), and winter (1.14). Small bird use was highest in the spring (8.13 birds/100-m plot/20-min survey), followed by the summer (5.10), fall (4.38), and winter (3.64; Table 4).

Waterbirds
Waterbirds were only observed in the summer, with a use of 0.08 birds/plot/20-min survey (Table 4). American white pelican (*Pelecanus erythrorhynchos*) was the only waterbird species observed within the HWWRA (Appendix B). American white pelicans comprised 3.2% of the overall large bird use and were observed in less than 2% of surveys in the summer season (Table 4).

Waterfowl
Canada goose (*Branta Canadensis*) was the only waterfowls species observed (Appendix B). Canada geese were only observed in the summer (one group of five individuals), accounting for less than 2% of the overall large bird use and were observed in less than 2% of the surveys in the summer season (Table 4).

Gulls/Terns
One group of thirty unidentified terns were the only shorebirds observed within the HWWRA (Appendix B). This group was observed in the summer and accounted for 19% of the large bird use in the summer, while only being observed in less than 2% of the surveys (Table 4).

Diurnal Raptors
Diurnal raptor use was highest in the summer (1.38 birds/plot/20-min survey), followed by fall (1.14), spring (1.00) and winter (0.69; Table 4). Use in the summer was influence by red-tailed hawk (*Buteo jamaicensis*) and northern harrier (0.35 birds/plot/20-min survey and 0.32, respectively; Appendix C). Ferruginous hawk (*Buteo regalis*) had the highest use in the fall (0.29). Ferruginous hawk (0.28) and golden eagle (0.22) made up a large portion of spring raptor use.and rough-legged hawk (*Buteo lagopus*) had the highest use of any other raptor in the winter (0.43; Appendix C). Diurnal raptors comprised over 50.0% of the overall large bird use in all four seasons, comprising as high as 76.2% of observations in the fall season. In addition, diurnal raptors were observed during 50.0% or more of surveys over all four seasons (Table 4).

Vultures
Turkey vulture (*Cathartes aura*) was the only vulture species observed, and use by turkey vulture was relatively even in spring and fall (0.15 and 0.14 birds/plot/20-min survey, respectively) with lower use in the summer (0.05) and no observations in the winter (Table 4; Appendix C). Turkey vulture comprised 8.4% and 9.5% of overall large bird use in spring and fall, respectively, while only comprising 1.9% of large bird use in the summer. Turkey vultures were observed during 11.1% of surveys in the spring and 11.9% in the fall compared to 5.0% in the spring (Table 3).

Large Corvids

Use by large corvids was higher in spring (0.61 birds/800-m plot/20-min survey) and summer (0.58) compared to the winter (0.45) and fall (0.21; Table 3). Out of large corvids, American crow had the highest use during all four seasons. Percent composition of large corvid use ranged from 39.6% of all large bird use in the winter to 14.3% of large bird use in the fall. Large corvids were observed in 21.7% of surveys in the summer and 16.7% of surveys in the spring and winter, compared to 9.5% of surveys in the fall (Table 4).

Passerines

A 100-m viewshed was used for small birds, therefore descriptive statistics for small bird types are not directly comparable to large bird types. Passerine use was highest in the spring (8.13 birds/plot/20-min survey), compared to the summer (5.10), fall (4.38), and winter (3.64; Table 4). Horned lark had the highest use by any one passerine species across all seasons (fall 3.96, winter 2.74, spring 2.32, and summer 1.93 birds/plot/20-min survey; Appendix C).Passerines were observed 85.0% or more of surveys in the spring, summer, and fall compared to 52.4% of surveys in the winter (Table 4).

Woodpeckers

Northern flicker was the only woodpecker observed in the HWWRA. Northern flickers were only observed in the summer, comprising only 0.3% of small bird use and were only seen in 1.7% of surveys in the summer (Table 4).

Table 4. Mean bird use (number of birds/plot[a]/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Hermosa West Wind Resource Area; April 20, 2010 – April 11, 2011.

	Mean Use				% Composition				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	0	0.08	0	0	0	3.2	0	0	0	1.7	0	0
Waterfowl	0	0.03	0	0	0	1.3	0	0	0	1.7	0	0
Gulls/Terns	0	0.50	0	0	0	19.0	0	0	0	1.7	0	0
Diurnal Raptors	1.00	1.38	1.14	0.69	56.8	52.5	76.2	60.4	59.3	55.0	61.9	50.0
Accipiters	*0*	*0.03*	*0*	*0.02*	*0*	*1.3*	*0*	*2.1*	*0*	*3.3*	*0*	*2.4*
Buteos	*0.56*	*0.63*	*0.69*	*0.55*	*31.6*	*24.1*	*46.0*	*47.9*	*44.4*	*38.3*	*42.9*	*38.1*
Northern Harrier	*0.09*	*0.32*	*0*	*0*	*5.3*	*12.0*	*0*	*0*	*9.3*	*5.0*	*0*	*0*
Eagles	*0.22*	*0.20*	*0.21*	*0.02*	*12.6*	*7.6*	*14.3*	*2.1*	*20.4*	*13.3*	*21.4*	*2.4*
Falcons	*0.13*	*0.20*	*0.24*	*0.10*	*7.4*	*7.6*	*15.9*	*8.3*	*11.1*	*13.3*	*23.8*	*9.5*
Vultures	0.15	0.05	0.14	0	8.4	1.9	9.5	0	11.1	5.0	11.9	0
Large Corvids	0.61	0.58	0.21	0.45	34.7	22.2	14.3	39.6	16.7	21.7	9.5	16.7
Large Bird Overall	**1.76**	**2.63**	**1.50**	**1.14**	**100**	**100**	**100**	**100**				
Passerines	8.13	5.08	4.38	3.64	100	99.7	100	100	87.0	85.0	88.1	52.4
Woodpeckers	0	0.02	0	0	0	0.3	0	0	0	1.7	0	0
Small Bird Overall	**8.13**	**5.10**	**4.38**	**3.64**	**100**	**100**	**100**	**100**				

[a.] 800-meter (m) radius plot for large birds and 100-m for small birds.

Bird Flight Height and Behavior

Flight height characteristics were estimated for both bird types and species (Table 5; Table 6; Appendix D). During fixed-point bird use surveys, 235 groups (defined as one or more individual), totaling 339 individuals, of large birds were observed flying within the 800-m plot. Overall, 37.8% of flying large birds were initially recorded within the RSH, 60.8% were below the RSH, and 1.5% were flying above the RSH for collision with turbine blades of 35 to 130 m (115 – 427 ft) AGL. More than half (54.0%) of flying raptors were initially observed below the RSH, 43.4% were within the RSH, and only 2.6% were above the RSH. Of flying raptors, 62.5% of northern harriers, 56.2% of eagles. 46.9% of buteo observations, 9.1% of falcons, and zero accipiters were recorded flying within the RSH during initial observations. Waterbirds, waterfowl, and gulls/terns had the highest percentage of flying birds within the RSH (100.0%) although these observations are based on single groups and few individuals. Approximately forty seven percent of vultures were initially recorded within the RSH. The majority of flying large corvids (99.0%) were initially observed below the RSH. All passerines and woodpeckers initially observed flying within the 100-m plot were observed below the RSH (Table 5).

Of all large bird species, five species (red-tailed hawk, golden eagle [*Aquila chrysaetos*], ferruginous hawk, prairie falcon [*Falco mexicanus*] and Swainson's hawk) had at least 20 groups observed flying (Table 6). All observed flying raptor species, except for ferruginous hawk (18.8% within RSH) and prairie falcon (13% within RSH), were observed flying within the RSH during at least 50% of initial observations (Table 6). American white pelican, Canada goose, and unidentified gull were always seen flying within the RSH during initial observations; however, these were only based on one observation. No passerines or small bird species were observed flying within the RSH (Table 6).

Table 5. Flight height characteristics by bird type[a] and raptor subtype during fixed-point bird use surveys at the Hermosa West Wind Resource Area from April 20, 2010 – April 11, 2011.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories 0 - 35 m	35 - 130 m[b]	> 130 m
Waterbirds	1	5	90.00	100	0	100	0
Waterfowl	1	2	90.00	100	0	100	0
Gulls/Terns	1	30	40.00	100	0	100	0
Diurnal Raptors	176	189	37.19	88.3	54.0	43.4	2.6
Accipiters	*2*	*2*	*15.00*	*66.7*	*100*	*0*	*0*
Buteos	*98*	*98*	*34.74*	*81.7*	*53.1*	*46.9*	*0*
Northern Harrier	*11*	*24*	*23.91*	*100*	*37.5*	*62.5*	*0*
Eagles	*32*	*32*	*73.06*	*94.1*	*28.1*	*56.2*	*15.6*
Falcons	*33*	*33*	*15.45*	*100*	*90.9*	*9.1*	*0*
Vultures	17	17	36.71	100	52.9	47.1	0
Large Corvids	39	96	6.74	100	99.0	1.0	0
Large Birds Overall	**235**	**339**	**32.57**	**93.1**	**60.8**	**37.8**	**1.5**
Passerines	393	983	1.82	92.0	100	0	0
Woodpeckers	1	1	2.00	100	100	0	0
Small Birds Overall	**394**	**984**	**1.82**	**92.0**	**100**	**0**	**0**

a. 800-meter (m) radius plot for large birds and 100-m for small birds.
b. The likely "rotor-swept height" for potential collision with a turbine blade, or 35 to 130 m (115 to 427 ft) above ground level.

Table 6. Relative exposure index and flight characteristics for bird species[a] during fixed-point bird use surveys at the Hermosa West Wind Resource Area from April 20, 2010 – April 11, 2011.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[b] based on Initial obs	Exposure Index	% Within RSH at Anytime
Large Bird Species[c]						
unidentified gull	1	0.11	100	100	0.11	100
red-tailed hawk	34	0.17	87.2	61.8	0.09	79.4
golden eagle	32	0.15	94.1	56.2	0.08	68.8
Swainson's hawk	20	0.10	95.2	65.0	0.06	65.0
northern harrier	11	0.09	100	62.5	0.05	66.7
rough-legged hawk	12	0.16	54.5	50.0	0.04	58.3
turkey vulture	17	0.08	100	47.1	0.04	58.8
ferruginous hawk	32	0.18	84.2	18.8	0.03	40.6
American white pelican	1	0.02	100	100	0.02	100
prairie falcon	23	0.11	100	13.0	0.01	26.1
Canada goose	1	<0.01	100	100	<0.01	100
common raven	10	0.04	100	9.1	<0.01	18.2

a Only include species with actual exposure index values.
b. RSH: the likely rotor-swept heights for potential collision with a turbine blade, or 35 to 130 m (115 to 427 ft) above ground level.
c. 800-meter (m) radius plot for large birds and 100-m for small birds.

Bird Exposure Index

A relative exposure index was calculated for each bird species based on initial flight height observations and relative abundance (defined as the use estimate). Those species that had exposure to the turbine RSH are listed in Table 6, and a complete list of all species is presented in Appendix D. The exposure index does not account for other possible collision risk factors such as foraging or courtship behavior. Unidentified terns had a higher exposure index than other large bird species (0.11) however this is based on one group of 30 terns. Red-tailed hawk had the second highest exposure index (0.09), followed by golden eagle (0.08) Swainson's hawk (0.06), northern harrier (0.05), rough-legged hawk (0.04), turkey vulture (0.04), ferruginous hawk (0.03), and American white pelican (0.02). All other species had an exposure index of 0.01 or less. Based on observations within 100 m, no small bird species were observed flying within the RSH; therefore, all small bird species had an exposure index of zero (Table 6).

Spatial Use

For all large bird species combined, use was highest at point 14 (4.09 birds/20-min survey; Figure 8; Appendix E). Bird use at other points ranged from 1.00 to 1.75 birds/20-min survey. Mean use at point 14 was influenced by large corvid use (1.62 birds/20-min survey) as well as gull/tern use (0.94) and buteo use (0.91). Waterbirds were only observed at point 12 (0.16 birds/20-min survey) and waterfowl were only observed at point 11 (0.06 birds/20-min survey). Gulls/terns were only observed at point 14 (0.94 birds/20-min survey). Raptor use was highest at point 14 (1.34 birds/20-min survey), and ranged from 0.50 at point 12 to 1.25 at point 13. Accipiter use was only observed at point 11 (0.09 birds/20-min survey); while buteo use was observed at all points, with the lowest use at point 12 (0.19 birds/20-min survey) and the highest use at point 14 (0.91). Northern harriers were observed at all points with the highest use recorded at point 11 (0.5 birds/20-min survey). Eagle use was highest at points 16 and 15 (0.33 and 0.21 birds/20-min survey, respectively), and ranged from 0.06 to 0.19 at other points. Use by falcons was highest at points 14 and 13 (0.28 and 0.25 birds/20-min survey, respectively) and ranged from 0.06 to 0.16 at other points. Vulture use was highest at point 14 (0.19 birds/20-min survey), and ranged from 0.03 to 0.09 at the remaining points. Large corvid use was highest at point 14 (1.62 birds/20-min survey), and ranged from 0.18 to 0.38 birds/20-min survey at other points. Passerine use (within 100 m) was highest at point 12 (10.47 birds/20-min survey), and ranged from 3.56 to 5.91 birds/20-min survey at other points. Woodpeckers were only observed at point 13 (0.03 birds/20-min survey; Appedix E).

Flight paths for raptors and vultures were digitized and mapped (Appendix F). Mapped flight paths suggest that the northern portion of the HWWRA had increased ferruginous hawk and Swainson's hawk flights. Prairie falcon flight paths were more numerous in the vicinity of point 11 than at other points in the HWWRA. Points 13 and 16 had a higher number of mapped golden eagle flight paths compared to other points. Turkey vulture flight paths were more numerous in the vicinity of point 12.

Sensitive Species Observations

A total of seven sensitive species were recorded during fixed-point bird use surveys within the HWWRA (Table 7). Six bird species with native species status (NSS) rankings one through four in the state of Wyoming were observed in the HWWRA during fixed-point bird use surveys. Of these species, two were raptors: ferruginous hawk (38 observations), and Swainson's hawk (21 observations). In addition, 34 golden eagle observations were recorded during fixed point surveys. Golden eagles are not listed as a Wyoming species of special concern, but both golden and bald eagles are protected under the Federal Bald and Golden Eagle Act (BGEPA 1940). McCown's longspur (*Calcarius mccownii*) was the most common high ranking NSS species recorded during fixed-point bird surveys, with 185 observations in 92 groups. Fifteen Brewer's sparrows (*Spizella breweri*) were observed in 11 groups, four lark buntings (*Calamospiza melanocorys*) were observed in two groups, and five American white pelicans in one group observed within the HWWRA (Table 7).

Table 7. Summary of sensitive species observed at the Hermosa West Wind Resource Area during fixed-point bird use surveys (FP) and as incidental wildlife observations (Inc.) from April 20, 2010 – April 11, 2011.

Species	Scientific Name	Status	FP # of grps	FP # of obs	Inc. # of grps	Inc. # of obs	Total # of grps	Total # of obs
McCown's longspur	*Calcarius mccownii*	NSS4	92	185	0	0	92	185
ferruginous hawk	*Buteo regalis*	NSS3	38	38	1	1	39	39
Golden eagle	*Aquila chrysaetos*	EA	34	34	4	5	38	39
Swainson's hawk	*Buteo swainsoni*	NSS4	21	21	0	0	21	21
Brewer's sparrow	*Spizella breweri*	NSS4	11	15	0	0	11	15
American white pelican	*Pelecanus erythrorhynchos*	NSS3	1	5	0	0	1	5
lark bunting	*Calamospiza melanocorys*	NSS4	2	4	0	0	2	4
bald eagle	*Haliaeetus leucocephalus*	EA; FSOC; NSS2;	0	0	1	1	1	1
Total	**8 Species**		**199**	**302**	**6**	**7**	**205**	**309**

NSS1 - Populations greatly restricted or declining, extirpation possible OR ongoing significant loss of habitat.

NSS2 - Populations declining, extirpation possible; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; ongoing significant loss of habitat.

NSS3 - Populations greatly restricted or declining, extirpation possible; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR species widely distributed; population status or trends unknown but suspected to be stable; on-going significant loss of habitat.

NSS4 - Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance OR populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat.

NSS Definitions from WGFD (2005) and Wyoming's Natural Diversity Database (WYNDD 2009).

EA – Federal Bald and Golden Eagle Protection Act (BGEPA 1940).

Raptor Nest Surveys

Four active raptor nests (0.09 active nests/mi^2; 0.04 active nests/km^2), ten inactive raptor nests (0.22 inactive nests/mi^2; 0.09 inactive nests/km^2), and 3 raptor nests of undetermined status were identified within the HWWRA and surrounding one mile buffer in 2010 (Table 8; Figure 8). Total raptor nest density within the HWWRA and surrounding one mile buffer in 2010 was 0.38 total nests/mi^2 (0.15 total nests/km^2). Species on active nests included: Swainson's hawk (one nest), prairie falcon (*Falco mexicanus; one nest*), unidentified buteo (one nest), and common raven (*Corvus corax*; one nest). Two of the raptor nests identified in 2010 were new or previously unidentified nests. Two inactive raptor nest identified during the 2009 nest survey effort were not identified during the 2010 effort. The one active golden eagle nest from 2009 was inactive in 2010 (Table 8; Figure 8; Taylor and Bay 2010). One additional inactive nest is considered a possible golden eagle nest due to the size of the nest, but no golden eagles were observed in the vicinity of the nest in either 2009 or 2010. The nests of undetermined status had adult Swainson's hawks in the vicinity of the nests, but status of the nests was undetermined during the survey effort. Access constraints limited the ability to adequately view all areas within the surrounding one mile buffer during the 2010 raptor nest survey effort and it is possible that additional nests may exist within the one-mile buffer.

Table 8. Nesting raptor species and nest density for the Hermosa Wind Resource Area and surrounding one mile buffer in 2010.[1]

Species	# of nests within the WWRA and surrounding 1-mile buffer	Density (mi^2) within the WWRA and surrounding 1-mile buffer
Swainson's hawk	1	0.02
Prairie Falcon	1	0.02
unidentified buteo	1	0.02
common raven[2]	1	0.02
undetermined status[3]	3	0.07
inactive[4]	10	0.22
Overall	**17**	**0.38**

[1]Two inactive nests identified in 2009 (Taylor and Bay 2010) were not identified during the 2010 raptor nest surveys.
[2]Although common raven is not considered a raptor, this nest could be occupied by a raptor species in the future.
[3]All three of the undetermined nests had adult Swainson's hawks in the vicinity but, nest status was not confirmed.
[4]One of the inactive nests in 2010 was an active golden eagle nest in 2009 (Taylor and Bay 2010b). Additionally, one inactive nest is a possible golden eagle nest due to its size; however no golden eagles were observed in the vicinity of the nest in 2009 or 2010.

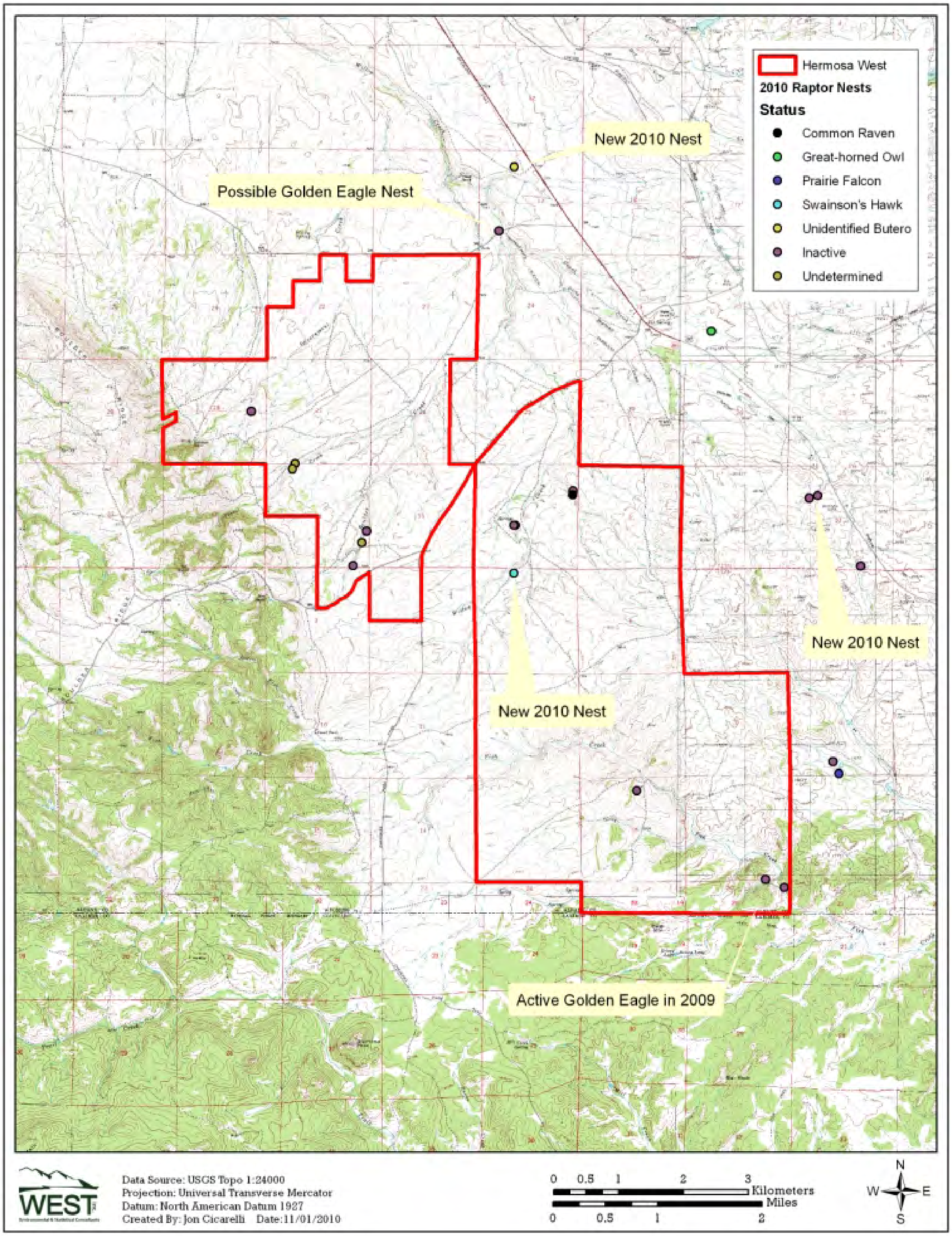


Figure 8. Locations of raptor nests identified during the 2010 raptor nest search within the Hermosa West Wind Resource Area and surrounding 1-mile buffer.

Raptor Observations

A total of 28 two hour observation periods were conducted from May 25, 2010 to April 11, 2011. Golden eagles were observed during 12 of the 28 observation periods and 21 golden eagle flight paths were mapped during surveys. Ferruginous hawks were observed during 10 of the 28 observation periods and 14 ferruginous hawk flight paths were mapped during surveys. A 100 X 100 meter grid was created to cover the viewshed of the observation station and each 100 X 100 meter cell was weighted based on the length of mapped flight paths located within each cell (Figures 9 and 10). Cells with a value greater than zero from the 100X100 m flight path grid were overlayed against a topographic map and the potential raptor habitat mapping effort (Figures 9 and 10).

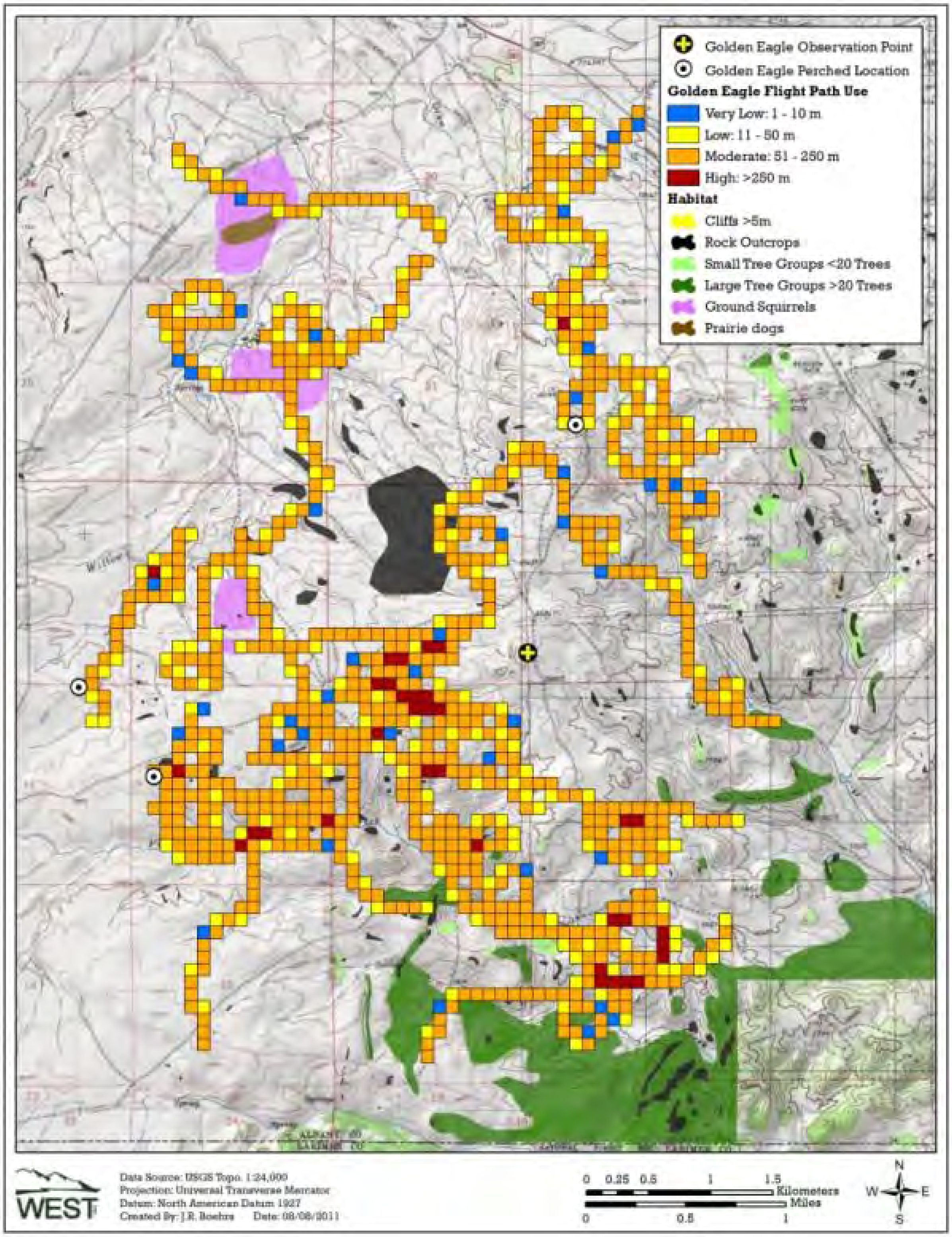


Figure 9. The 100 X 100 grid depicting golden eagle flight paths mapped against golden eagle perch locations, raptor habitat mapping, and topography from the raptor observations conducted at the Hermosa West Wind Resource Area.

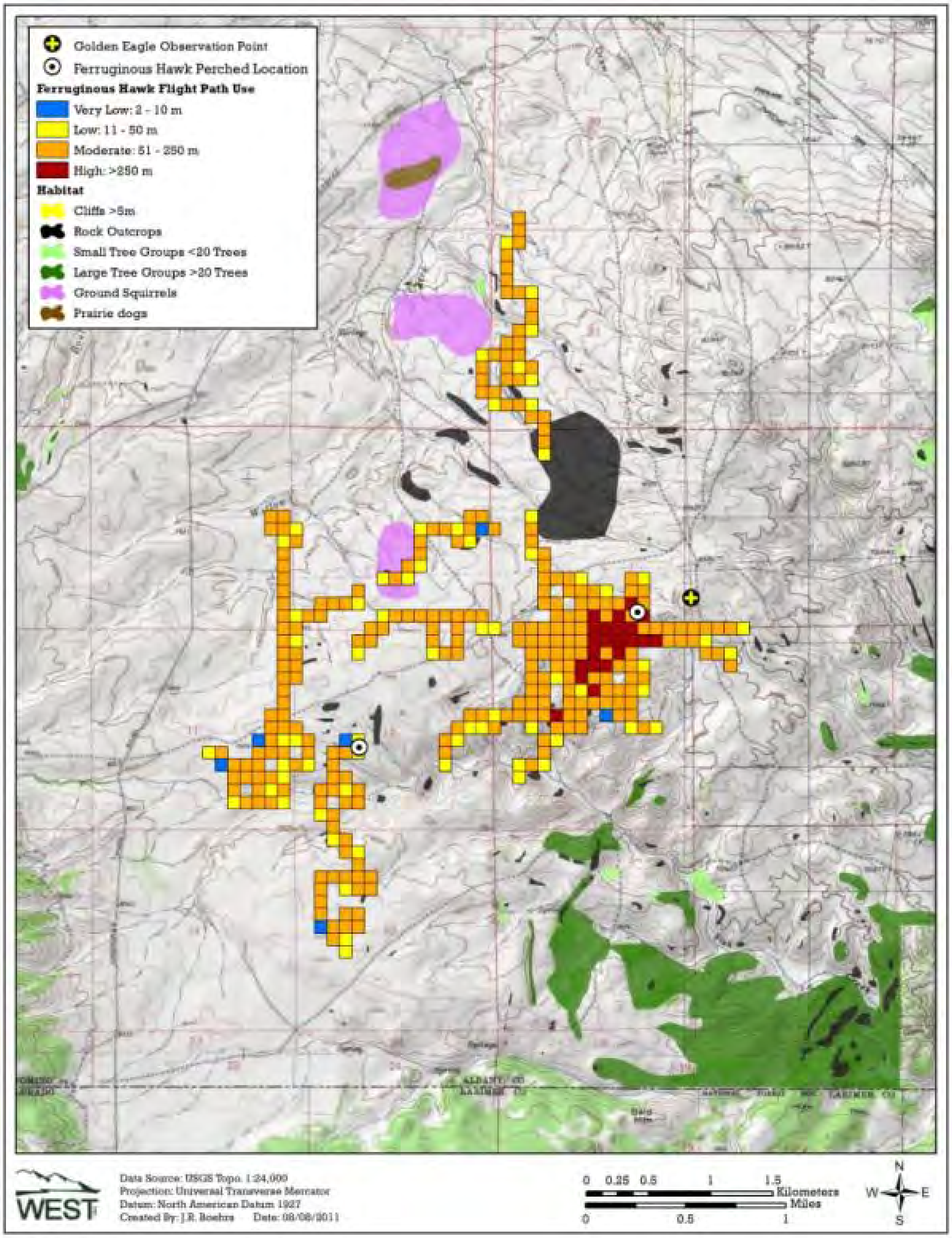


Figure 10. The 100 X 100 grid depicting ferruginous hawk flight paths mapped against ferruginous hawk perch locations, raptor habitat mapping, and topography from the raptor observations conducted at the Hermosa West Wind Resource Area.

Acoustic Surveys for Bats

Bat activity was monitored at seven sampling locations (excluding station at the historic mine shaft location [HE19t] on a total of 189 nights during the period April 26 to October 31, 2010. Results of the historic mine shaft location [HE19t] are presented separately since the mine shaft is not within proposed turbine corridors. Anabat units were operable for 81.4% of the sampling period (Figure 11). Equipment failures compromised data collection for raised Anabat unit HE1r between June 29 and August 2, and then again on October 3 until October 31. Levels of wind and insect noise were relatively low throughout the study period (i.e., < 1500 noise files per detector-night; Figure 12). Anabat units recorded 1,065 bat passes on 407 detector-nights (Table 9). Averaging bat passes per detector-night across all stations, a mean (± standard error) of 3.24 ± 0.40 bat passes per detector-night was recorded. The pass rate for the fixed ground station was (mean ± SE) 2.66 ± 0.29 bat passes per detector-night, while the average bat activity for all ground stations was 3.60 ± 0.51 bat passes per detector-night, and for the fixed raised station was 1.04 ± 0.30 bat passes per detector-night (Table 9).

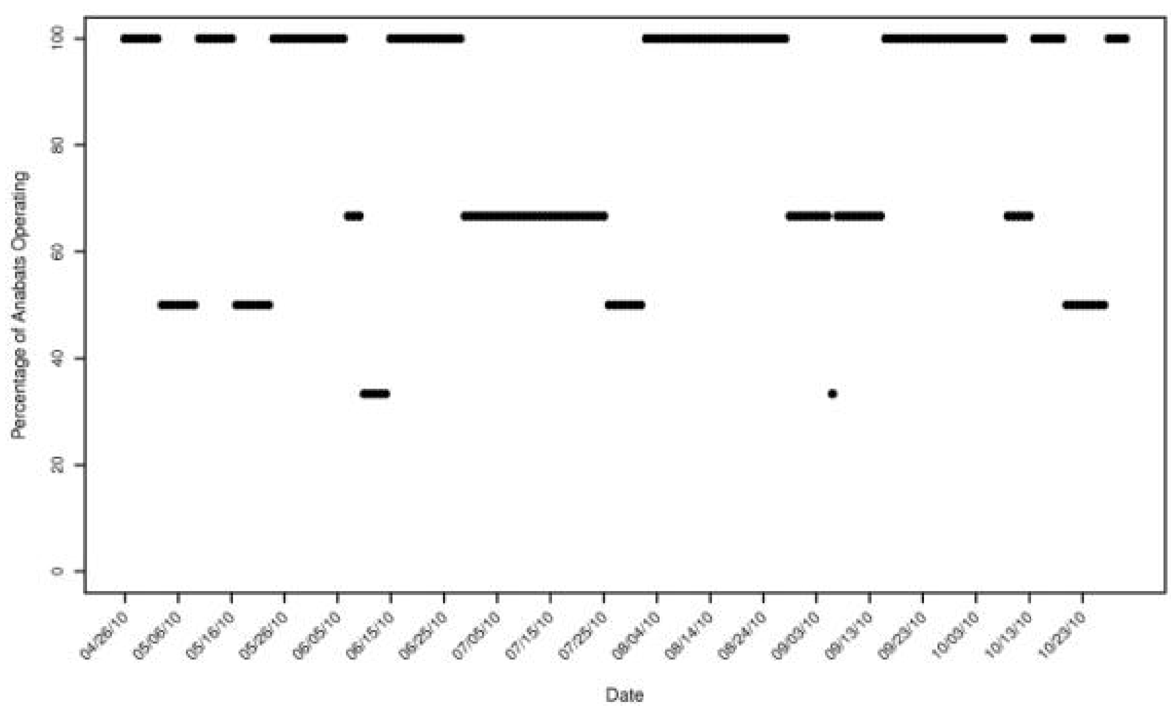


Figure 11. Percentage of Anabat detectors (n = 3) at the Hermosa West Wind Resource Area operating during each night of the study period April 26 – October 31, 2010.

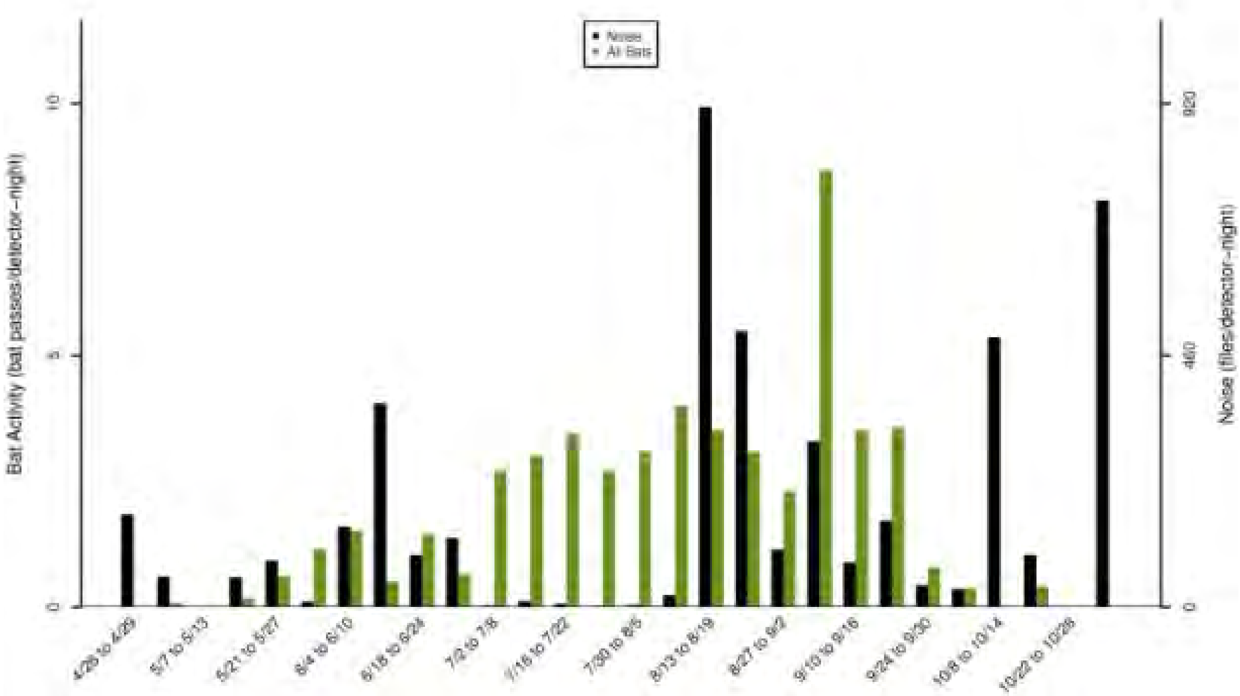


Figure 12. Bat activity and noise files detected per detector-night at the Hermosa West Wind Resource Area for the study period April 26 – October 28, 2010, presented by week. Noise files are indicated on the second axis.

Table 9. Results of acoustic bat surveys conducted at the Hermosa West Wind Resource Area, April 26 - October 31, 2010, separated by call frequency: high frequency (HF), mid frequency (MF), and low frequency (LF).

Anabat Station	Type	Location	# of HF Bat Passes	# of MF Bat Passes	# of LF Bat Passes	# of Hoary Bat Passes*	# of Eastern Red Bat Passes**	Total Bat Passes	Detector-Nights	Bat Passes/ Night***
HE1g	Fixed	ground	152	62	268	23	0	482	181	2.66±0.29
HE1r	Fixed	raised	3	12	87	15	0	102	98	1.04±0.30
HE11t	Temporary	ground	13	3	34	1	0	50	12	4.17±0.83
HE13t	Temporary	ground	25	12	61	4	0	98	31	3.16±0.56
HE15t	Temporary	ground	11	6	38	1	0	55	30	1.83±0.55
HE17t	Temporary	ground	23	10	21	3	0	54	26	2.08±0.62
HE20t	Temporary	ground	105	42	77	7	2	224	29	7.72±2.43
Total Ground			**329**	**135**	**499**	**39**	**2**	**963**	**309**	**3.60±0.51**
Total Raised			**3**	**12**	**87**	**15**	**0**	**102**	**98**	**1.04± 0.30**
Grand Total			**332**	**147**	**586**	**54**	**2**	**1065**	**407**	**3.24±0.40**

*Passes by hoary bats included in low-frequency (LF) numbers;
**Passes by eastern red bats are included in mid-frequency (MF) numbers;
***± bootstrapped standard error.

Spatial Variation

Bat activity varied among the six ground stations in the HWWRA (Table 9; Figure 13), ranging between 1.83 and 7.72 bat passes per detector-night among ground stations, and bat activity was 1.04 bat passes per detector-night at the raised station. Overall, use was lowest at the fixed raised station HE1r and temporary ground station HE15t (1.04 and 1.83 bat passes per detector-night) and highest at temporary ground stations HE20t and HE11t (7.72 and 4.17; Table 9).

Comparing paired stations on just the nights that both ground and raised detectors were operating; bat use activity was greater at the ground station (HE1g) than at raised station (HE1r) (Figure 14).

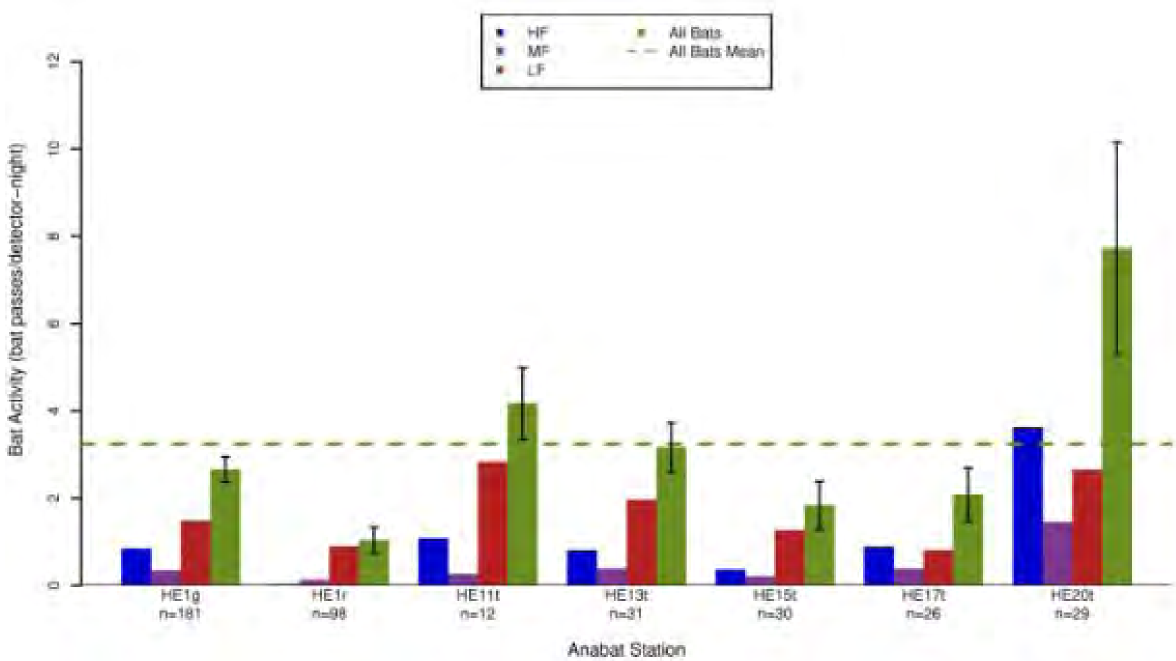


Figure 13. Number of bat passes per detector-night by Anabat station at the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

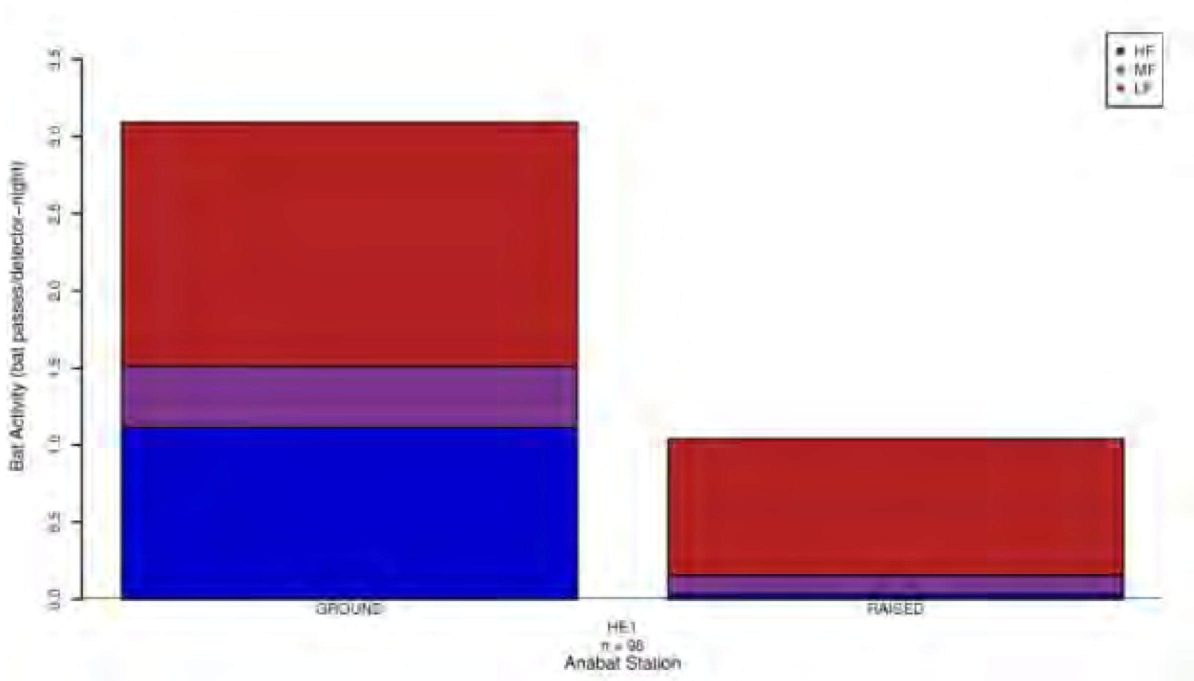


Figure 14. Number of high-frequency (HF), mid-frequency (MF), and low-frequency (LF) bat passes per detector-night recorded at paired ground and raised Anabat unit stations at the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010.

Temporal Variation

Bat activity at fixed stations was generally low from the start of the study period on April 26 until July 2 when activity increased through September 23, with the week of September 1 - 7 doubling that of any other week's activity (16.9%; Table 10, Figure 15). The highest number of bat passes per detector-night of HF bats were recorded during the week of August 4 – August 10; the highest number of bat passes per detector-night of MF bat passes were recorded during the week of September 1 – September 7; and the highest number of bat passes per detector-night of LF bat passes were recorded during the week of September 1 – September 7 (Table 10; Figure 15). Activity declined through the end of September, and very few bats were detected in October.

The study was divided into three seasonal survey periods: Spring 2010 (April 26 – May 31, 2010), Summer 2010 (June 1 – July 14, 2010), and Fall 2010 (July 15 – October 31, 2010). Bat activity varied among seasons (Table 11; Figure 16). Overall bat activity was highest during Fall 2010, averaging 2.72 bat passes per detector-night. Bat activity was relatively low during Spring 2010 (0.32 bat passes per detector-night) and intermediate use was recorded during Summer 2010 (1.16 bat passes per detector-night; Table 11 and Figure 16).

Table 10. Periods of peak activity for high-frequency (HF), mid-frequency (MF), low-frequency (LF), Hoary bats (LACI) and all bats at the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010. Peak activity was not calculated for eastern red due to low activity rates (< 1.0 bat passes per detector-night).

Species Group	Start Date of Peak Activity	Number of Nights	Bat Passes per Detector-Night
HF	Aug 4	7	3.21
MF	Sept 1	7	1.43
LF	Sept 1	7	14.5
LACI	Sept 1	7	1.36
All Bats	Sept 1	7	16.5

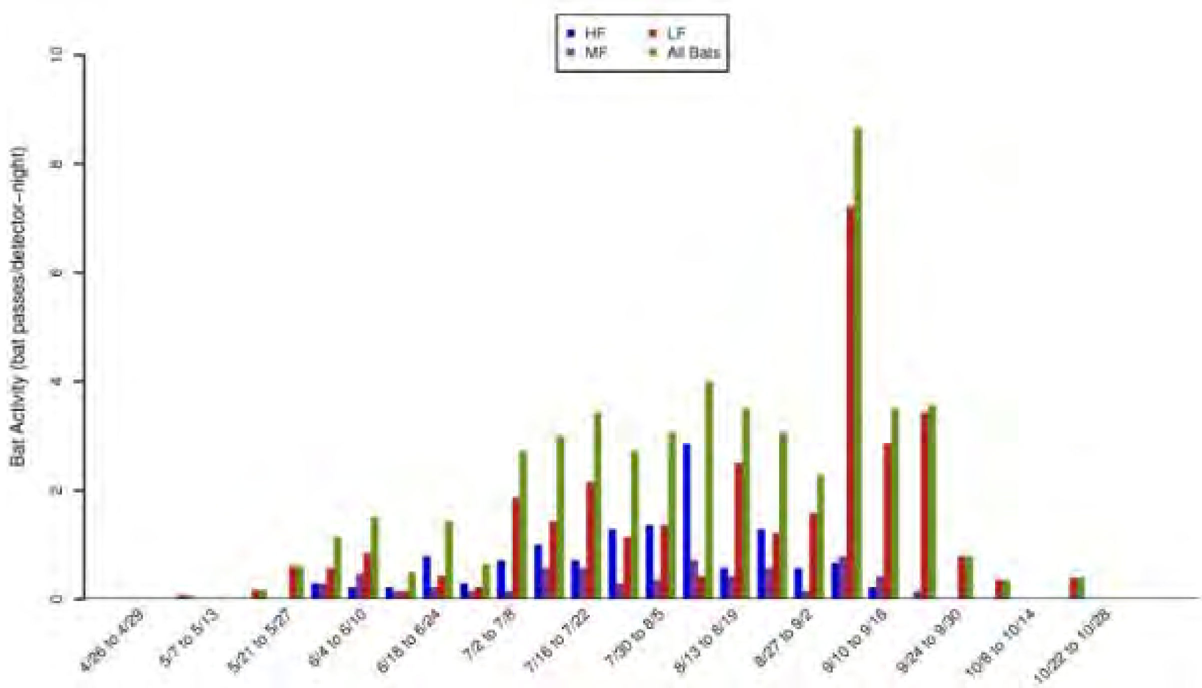


Figure 15. Weekly patterns of bat activity within the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010.

Table 11. Bat activity (number of bat passes/detector-night) by pass type (high-frequency [HF], mid-frequency [MF], low-frequency [LF], and all bats [AB]), during each season surveyed in 2010 at the Hermosa West Wind Resource Area.

Station	Pass type	Spring Apr 26 – May 31, 2010	Summer June 1 – July 14, 2010	Fall July 15 – Oct 31, 2010
HE1g	LF	0.25	0.89	2.18
HE1g	MF	0.03	0.36	0.45
HE1g	HF	0	0.73	1.19
HE1g	AB	0.28	1.98	3.81
HE1r	LF	0.27	0.22	1.43
HE1r	MF	0	0.13	0.17
HE1r	HF	0.09	0	0.02
HE1r	AB	0.36	0.35	1.62
Overall	**LF**	0.26±0.13	0.55±0.13	1.81±0.39
Overall	**MF**	0.01±0.01	0.25±0.08	0.31±0.05
Overall	**HF**	0.05±0.03	0.36±0.08	0.60±0.12
Overall	**AB**	0.32±0.14	1.16±0.21	2.72±0.41

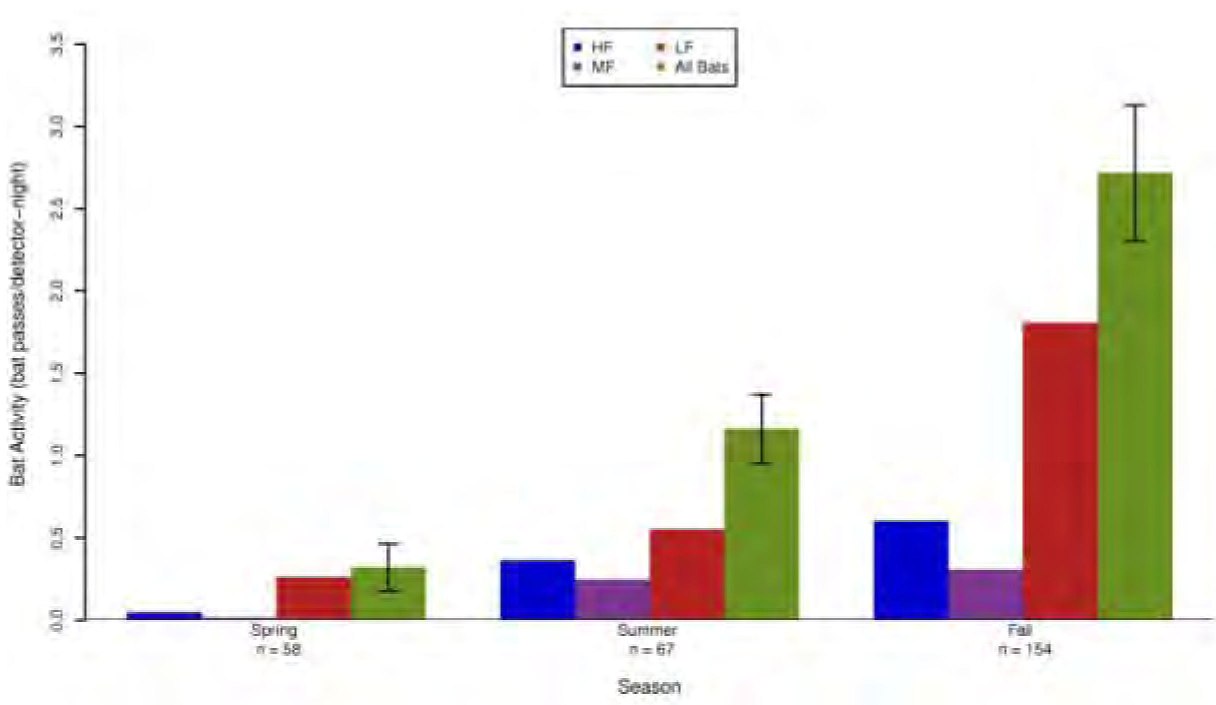


Figure 16. Seasonal bat activity within the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010. The bootstrapped standard errors are represented on the 'All Bats' columns.

Temporal patterns of bat activity between ground and raised stations were similar (Figure 17), and followed the overall trend. However, raised stations recorded more bat passes than ground stations in early September, while ground stations recorded more activity through the remainder of the study period.

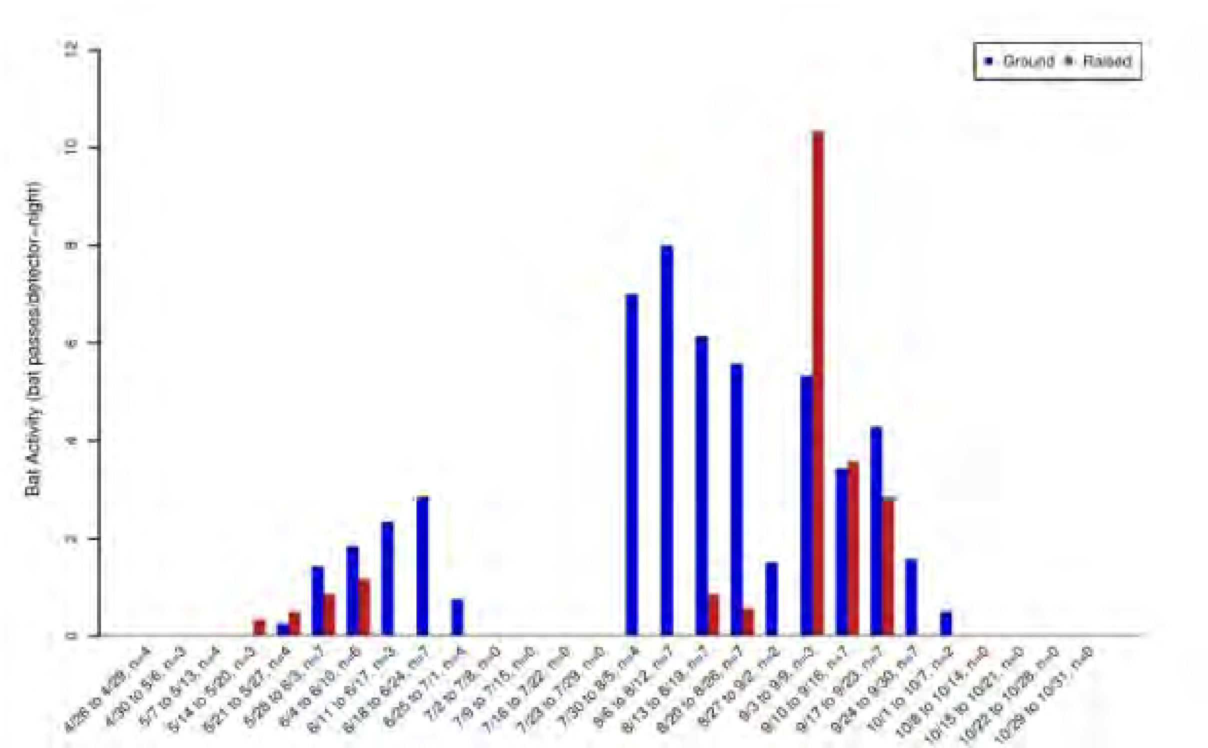


Figure 17. Weekly patterns of bat activity at ground and raised stations within the HWWRA during the study period April 26 – October 31, 2010.

Species Composition

Overall, passes by low-frequency bats (LF; 55% of all passes) outnumbered passes by high-frequency bats (HF; 31%) and mid-frequency bats (MF; 14%; Table 9), and this pattern was consistent among ground stations (Table 9). Among raised stations, LF bats comprised about 85% of passes (Table 9; Figure 14). Patterns of activity were generally similar among all three species groups during the study period (Figure 15), with all bat species being most active during the fall (Table 11). HF bats were most active between August 4 and August 10 (21.9% of HF passes; Table 10), with no HF passes recorded before May 27 or after September 17 (Figure 15). MF species were most active between September 1 and September 7 (12.3% of MF passes; Table 10), with no MF passes recorded before May 27 or past September 24. Activity by LF bats was relatively high through September 23, with most activity between September 1 and September 7 (Table 10).

Hoary bats comprised 5.1% of total passes detected within the study area, and 9.2% of all low frequency passes (Table 9). Twenty-eight percent of hoary bat passes were detected at raised stations (Table 9; Figure 18). Hoary bats were detected at all Anabat stations (Figure 18), with most activity recorded at the fixed ground station HE1g (42.6% of 54 hoary bat passes). Among fixed stations, weekly hoary bat activity was highest between September 1 and September 7 (Table 10). No hoary bats were recorded after September 23. Temporal activity for hoary bats matched the general temporal trends seen for all bats recorded within the project area.

For all stations, passes attributable to eastern red bats accounted for 0.2% of all passes, and 1.4% of all MF passes (Table 9). A total of two eastern red bats were recorded during the survey period, all were detected at temporary ground station HE20t, (100%, Figure 18).

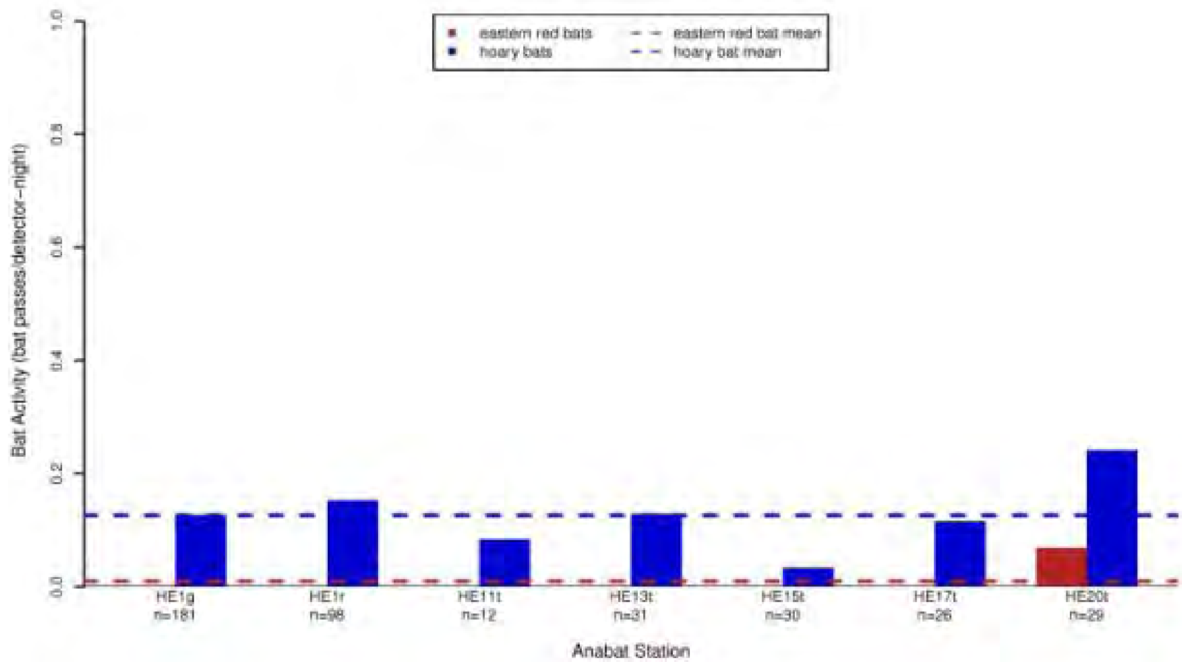


Figure 18. Bat activity by hoary bats and eastern red bats by Anabat Station at the Hermosa West Wind Resource Area for the study period April 26 – October 31, 2010.

Historic Mine Shaft Location

Activity at the historic mine location (HE19t) was within the range of bat passes rates recorded at other ground stations (5.14 bat passes per detector-night). All bat passes were recorded during the first sampling period from July 26 to August 10, 2010. No bat passes were detected during the second sampling period from Octover 19 to October 31, 2010. Both hoary bats and eastern red-bats were recorded at station HE19t in 2010.

Incidental Observations

Six bird species were recorded as incidental observations, representing thirteen individuals. Observations included golden eagle (five observations). common raven (*Corvus* corax; three observations), northen harrier (two observations), ferruginous hawk (one observation), prairie falcon (one observation), and bald eagle (one observation; Table 12).Five mammal species were recorded incidentally including 273 pronghorn (*Antilocapra Americana*) in 17 groups, 220 elk (*Cervus elaphus*) in two groups, 4 mule deer (*Odocoileus hemionus*), three coyotes (*Canis latrans*), and one badger (Taxidea taxus; Table 12).

One state listed NSS species was recorded incidentally (one ferruginous hawk). In addition, five golden eagles in four groups and one bald eagle were recorded incidentally within the HWWRA. Both golden and bald eagles are protected under the Federal Bald and Golden Eagle Act (BGEPA 1940).

Table 12. Incidental wildlife observed while conducting all surveys at the Hermosa West Wind Resource Area from April 20, 2010 – April 11, 2011.

Species	Scientific Name	# grps	# obs
golden eagle	*Aquila chrysaetos*	4	5
common raven	*Corvus corax*	1	3
northern harrier	*Circus cyaneus*	1	2
ferruginous hawk	*Buteo regalis*	1	1
prairie falcon	*Falco mexicanus*	1	1
bald eagle	*Haliaeetus leucocephalus*	1	1
Bird Subtotal	**6 Species**	**9**	**13**
pronghorn	*Antilocapra americana*	17	273
elk	*Cervus elaphus*	2	220
mule deer	*Odocoileus hemionus*	1	4
coyote	*Canis latrans*	3	3
North American badger	*Taxidea taxus*	1	1
Mammal Subtotal	**5 Species**	**24**	**501**

DISCUSSION AND IMPACT ASSESSMENT

Potential Bird Impacts

Impacts to wildlife resources from wind energy facilities can be direct or indirect. Direct impacts are considered to be the potential for fatalities from construction and operation of the proposed wind energy facility or actual loss of habitat. Indirect impacts include the potential to displace, either temporarily or permanently, wildlife during construction of or during the operational period of a wind energy facility.

Direct Effects

The most probable direct impact to birds from wind energy facilities is mortality or injury due to collisions with turbines or guy wires of meteorological (met) towers. SWE has installed bird diverters on met towers to help minimize collision risk to birds from guy wires. Collisions may occur with resident birds foraging and flying within the study area or with migrant birds seasonally moving through the HWWRA. Facility construction could affect birds through loss of habitat, or potential fatalities from construction equipment. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment. Potential mortality from construction equipment is expected to be very low, as equipment used in wind energy facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The risk of direct mortality to birds from construction is most likely potential destruction of a nest for ground- and shrub-nesting species during initial site clearing.

At 18 modern facilities in the Rocky Mountain and Pacific Northwest Regions where raptor fatality estimates are available, raptor fatality rates have ranged from zero to 0.21/MW/year, and averaged 0.07/MW/year (Appendix G). Three modern facilities within the Rocky Mountain Region have raptor fatality estimates ranging from zero to 0.11/MW/year and averaging 0.07/MW/year (Table 13; Appendix G). The Foote Creek Rim facility in Carbon County, Wyoming had multiple years of post-construction fatality monitoring across the project's multiple phases (Table 13). The Foote Creek Rim facility is the closest facility to the HWWRA with publicly available post-construction monitoring results, located approximately 60 miles (96.6 km) northwest of the HWWRA. Three comparable raptor fatality estimates are available for the Foote Creek Rim facility and estimates ranged from zero to 0.08/MW/year and averaged 0.04/MW/year (Table 13).

Table 13. Wind energy facilities in Rocky Mountains with fatality data for raptors.

Wind Energy Facility	Raptor Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
Hermosa West	**1.02**			
		Rocky Mountains		
Summerview, Alb. (2005/2006)		0.11	39	70.2
Judith Gap, MT		0.09	90	135
Foote Creek Rim, WY (Phase I; 1999)		0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)		0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		0	69	41.4

A=number of raptors/plot/20min survey
B=number of fatalities/MW/year
Data from the following sources:

Facility	Use Estimate	Fatality Estimate
Summerview, Alb. (06)		Brown and Hamilton 2006
Judith Gap, MT		TRC 2008
Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003c
Foote Creek Rim, WY (Phase I; 00)		Young et al. 2003c
Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003c

Using mortality data from a 10-year period from wind-energy facilities throughout the entire U.S., the average number of bird collision fatalities is 3.1/MW/year, or 2.3/turbine/year (NWCC 2004). Twenty-two comparable mortality estimates for all bird species combined are publicly available for 18 modern wind energy facilities in the Rocky Mountain and Pacific Northwest Regions (Table 14; Appendix G). Overall bird fatality rates have ranged from 0.16 – 6.66/MW/year, and averaged 2.25/MW/year. Five overall bird fatality estimates from the three modern Rocky Mountain facilities ranged from 1.06 to 3.40/MW/year and averaged 2.36/MW/year (Table 14). At the Foote Creek Rim facility, overall bird fatality estimates ranged from 1.93 to 3.40/MW/year and averaged 2.58/MW/year.

Table 14. Wind energy facilities in Rock Mountains with fatality data for all bird species.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Rocky Mountains			
Foote Creek Rim, WY (Phase I; 1999)	3.40	69	41.4
Judith Gap, MT	3.01	90	135
Foote Creek Rim, WY (Phase I; 2000)	2.42	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)	1.93	69	41.4
Summerview, Alb. (2005/2006)	1.06	39	70.2

A=number of bird fatalities/MW/year
Data from the following sources:

Facility	Fatality Estimate
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003c
Judith Gap, MT	TRC 2008
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003c
Foote Creek Rim, WY (Phase I; 01/02)	Young et al. 2003c
Summerview, Alb. (2005/2006)	Brown and Hamilton 2006

Not all studies with publically-available fatality data have data on specific species or mortality estimates for avian subtypes. One study looked at 12 fatality studies, primarily in the Pacific Northwest, and found that diurnal raptor fatalities comprised just 2% of the wind-energy facility-related fatalities. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising 82% of the 225 fatalities documented (Erickson et al. 2002b). Another study, focusing on the Western United States, reported that raptors comprised 19.4% of all bird mortality at newer wind-energy facilities; passerines were the most common species recorded as fatalities, and comprised 59.3% of all avian fatalities. Upland game birds, shorebirds, waterbirds, and waterfowl were also found as fatalities, but were much less common (Johnson and Stephens 2010 (in press)).

Although collision mortality is well documented at most wind-energy facilities, population level effects have not been detected, although few studies have addressed this issue. According to The Wildlife Society (TWS 2007), available data from wind-energy facilities suggest that fatalities of passerines from turbine strikes generally are not significant at the population level, although exceptions to this could occur if facilities are sited in areas where rare species are concentrated. Johnson and Erickson (2010) examined the potential for population level impacts caused by avian collision mortality associated with 6,700 MW of existing and proposed wind-energy development in the Columbia Plateau Ecoregion of eastern Oregon and Washington.

The number and species composition of bird collision fatalities was estimated based on results of 11 existing mortality studies in the Ecoregion. Estimated breeding population sizes were available for most birds in the Ecoregion based on Breeding Bird Survey (BBS) data. Predicted mortality rates for avian groups as well as species of concern were compared to published annual mortality rates. Because the additional wind-energy associated mortality was found to comprise only a small fraction of existing mortality rates, it was concluded that population level impacts would not be expected for the Ecoregion as a whole, but that local impacts to some species could occur. In the only study to quantitatively assess potential population level impacts, Hunt (2002) conducted a 4-year radio telemetry study of golden eagles at the Altamont Pass Wind Resource Area (APWRA) in California and found that the resident golden eagle population appeared to be self sustaining despite sustaining high levels of fatalities, but the effect of these fatalities on eagle populations wintering within and adjacent to the APWRA was unknown. Additional research conducted in 2005 by Hunt and Hunt (2006) found that all 58 territories occupied by golden eagle pairs in the APWRA in 2000 remained active in 2005.

Diurnal Raptor Use and Exposure Risk

Annual mean diurnal raptor use (number of raptors divided by the number of 800-m plots and the total number of surveys) at the HWWRA was compared with 40 other wind energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these wind energy facilities ranged from 0.10 to 3.18 raptors/plot/20-min survey (Figure 19). Mean diurnal raptor use at the HWWRA in 2010-2011 (1.02 raptors/plot/20-min survey) ranked sixth compared to the 40 other wind energy facilities (Figure 19). Mean diurnal raptor use at the HWWRA in 2009-2010 (0.75 raptors/plot/20-min survey) ranked 11th compared to the 40 other facilities, and the combined results 2009-2011 (0.88 raptors/plot/20-min survey) ranked eighth out of the 40 other comparable studies at modern wind energy facilities (Figure 19).

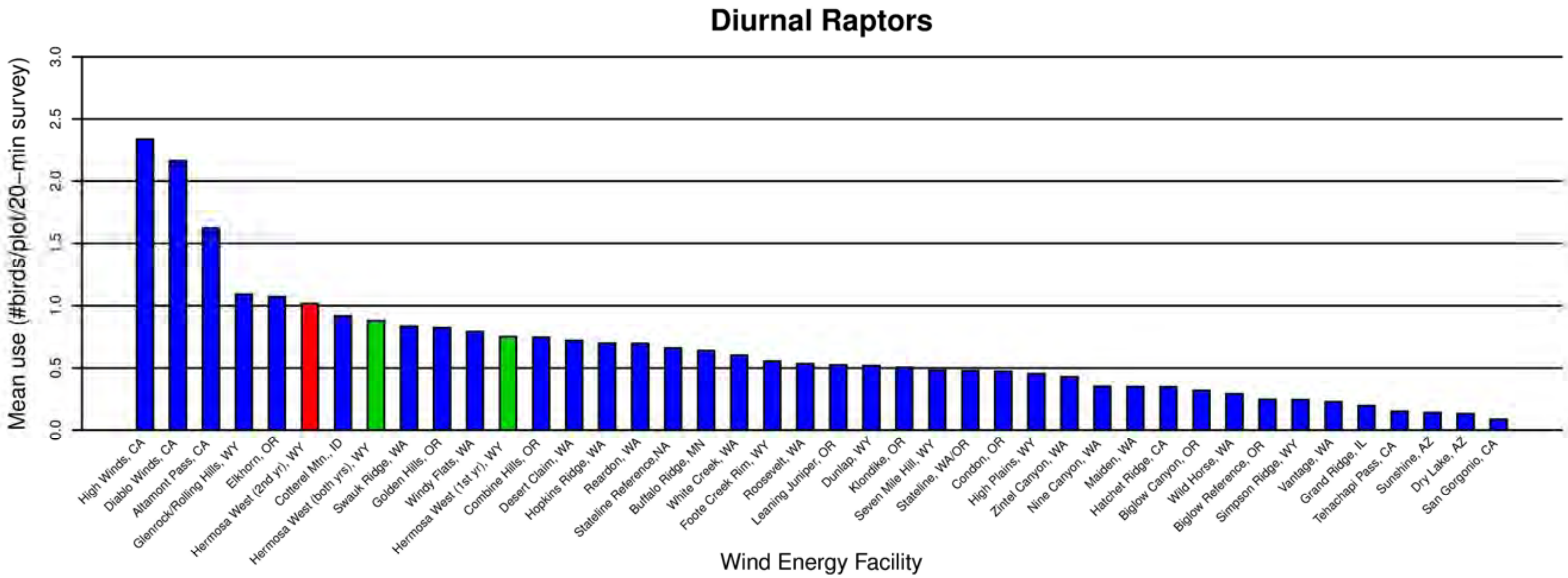


Figure 19. Comparison of annual diurnal raptor use between the Hermosa West Wind Resource Area and other US wind energy facilities.

Data from the following sources:

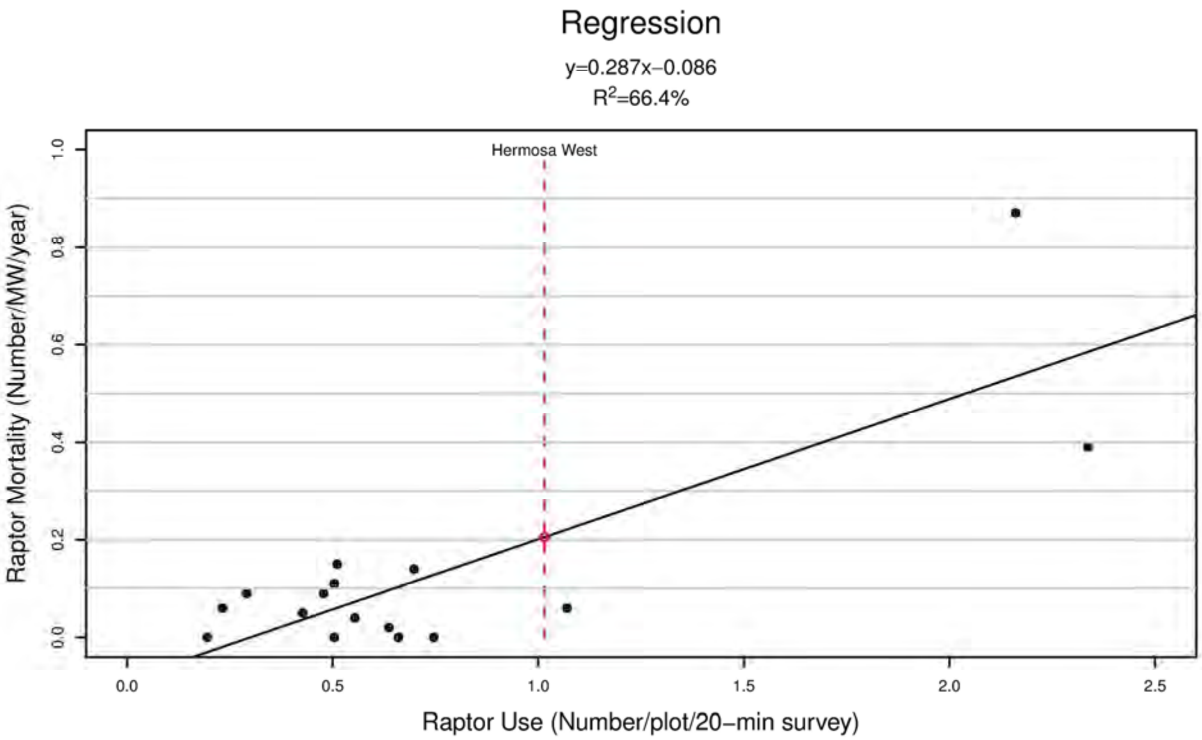
Study and Location	Reference	Study and Location	Reference	Study and Location	Reference
Hermosa West, Wyoming	This study.				
High Winds, CA	Kerlinger et al. 2005	White Creek, WA	NWC and WEST 2005	Wild Horse, WA	Erickson et al. 2003d
Diablo Winds, CA	WEST 2006	Foote Creek Rim, WY	Erickson et al. 2002b	Biglow Reference, OR	WEST 2005d
Altamont Pass, CA	Erickson et al. 2002b	Roosevelt, WA	NWC and WEST 2004	Simpson Ridge, WY	Johnson et al. 2000b
Glenrock/Rolling Hills, WY	Johnson et al. 2008a	Leaning Juniper, OR	Kronner et al. 2005	Invenergy_Vantage, WA	WEST 2007
Elkhorn, OR	WEST 2005a	Dunlap, WY	Johnson et al. 2009a	Grand Ridge, IL	Derby et al. 2009
Cotterel Mtn., ID	BLM 2006	Klondike, OR	Johnson et al. 2002a	Tehachapi Pass, CA	Erickson et al. 2002b
Swauk Ridge, WA	Erickson et al. 2003a	Seven Mile Hill, WY	Johnson et al. 2008b	Sunshine, AZ	WEST and the CPRS 2006
Golden Hills, OR	Jeffrey et al. 2008	Stateline, WA/OR	Erickson et al. 2002b	Dry Lake, AZ	Young et al. 2007c
Windy Flats, WA	Johnson et al. 2007	Condon, OR	Erickson et al. 2002b	San Gorgonio, CA	Erickson et al. 2002b
Combine Hills, OR	Young et al. 2003d	High Plains, WY	Johnson et al. 2009b		
Desert Claim, WA	Young et al. 2003b	Zintel Canyon, WA	Erickson et al. 2002a		
Hopkin's Ridge, WA	Young et al. 2003a	Nine Canyon, WA	Erickson et al. 2001b		
Reardon, WA	WEST 2005b	Maiden, WA	Erickson et al. 2002b		
Stateline Reference	URS et al. 2001	Hatchet Ridge, CA	Young et al. 2007b		
Buffalo Ridge, MN	Erickson et al. 2002b	Biglow Canyon, OR	WEST 2005d		

Within the Rocky Mountain Region, the mean annual raptor use estimates for the Foote Creek Rim Facility in Wyoming was 0.55 raptors/plot/20-min survey (Erickson et al. 2002b). Raptor fatality rates at Foote Creek Rim averaged 0.04/MW/year. To date, no other raptor use estimates coupled with fatality estimates are publicly available for the Rocky Mountain Region. Within the Pacific Northwest Region, raptor use estimates at 11 modern facilities coupled with fatality estimates ranged from 0.21 to 0.75 raptors/plot/20-min survey (Table 13). Raptor fatality estimates were available for the same 11 facilities, and estimates ranged from zero to 0.21/MW/year and averaged 0.08/MW/year. Assuming a correlation between use and fatality rates exists, rates at the HWWRA would be expected to be at the upper end of the fatality rates reported for the Rocky Mountain and Pacific Northwest Regions but, would be lower than the fatality rates observed at sites in California (Appendix G). Given the data collected during baseline wildlife surveys and the potential for impact to raptor species, Shell Wind Energy, Inc. has implemented a third year of focused raptor observations and plans to utilize the information collected from the three years of raptor surveys in designing the project layout with the intent of minimizing potential impacts to raptors.

Although raptors occur in most areas with the potential for wind energy development, individual species appear to differ from one another in their susceptibility to collision (NRC 2007). Results from Altamont Pass in California suggest that mortality for some species is not necessarily related to abundance (Orloff and Flannery 1992). American kestrels, red-tailed hawks, and golden eagles were found dead more often than predicted based on abundance. For example, American kestrel use at the High Winds wind energy facility in California was nearly seven times higher than that recorded at the Altamont facility (Kerlinger 2005), however, fatality rates at the Altamont facility were nearly seven times higher than at the High Winds facility (Kerlinger et al. 2006, Altamont Pass Avian Monitoring Team 2008). In contrast, few northern harrier fatalities have been reported at existing wind energy facilities, despite the fact they are commonly observed during fixed-point bird counts at these facilities (Erickson et al. 2001a;Whitfield and Madders 2006). Because northern harriers often forage close to the ground, risk of collision with turbine blades is generally considered low for this species. It is likely that many factors, in addition to abundance, are important in predicting raptor mortality. Two small white-tailed prairie dog colonies were identified within the HWWRA. Siting wind turbines outside of white-tailed prairie dog colonies may minimize impacts to foraging raptors.

Exposure indices analysis may also provide insight into which species might be the most likely turbine casualties; however, the index only considers relative probability of exposure based on abundance, proportion of observations flying, and proportion of flight height of each species within the RSH for turbines likely to be used at the wind energy facility. This analysis is based on observations of birds during the surveys and does not take into consideration behavior (e.g., foraging, courtship), habitat selection, the ability to detect and avoid turbines, and other factors that may vary among species and influence the likelihood for turbine collision. For these reasons, the exposure index is only a relative index among species observed during the surveys and within the study area. Actual risk for some species may be lower or higher than indicated by these data. At the HWWRA, the raptor species with the highest exposure indices were red-tailed hawk and golden eagle, which were influenced by the relatively high use estimates by these species and the proportion of initial flight heights recorded within the RSH. Swainson's hawk and northern harrier had a lower exposure index largely due to lower use estimates. Rough-legged hawk and ferruginous hawk had lower exposure indices due largely to a lower proportion of initial flight heights observed within the RSH. Prairie falcon exposure index was lower, primarily due to the lower use estimates and a relatively low proportion of flight heights observed in the RSH. The results from the 2009-2010 baseline studies suggested that the same two raptor species (red-tailed hawks and golden eagles) had the highest exposure index.

A regression analysis of raptor use and mortality for 16 new-generation wind energy facilities, where similar methods were used to estimate raptor use showed a significant (R^2 = 65.9%) correlation between raptor use and raptor collision mortality (Figure 20). Using this regression to predict raptor collision mortality at the HWWRA yields a 90% prediction interval of zero to 0.45 fatalities/MW/year, which encompasses the 90% prediction interval of zero to 0.39 fatalities/MW/year from the 2009-2010 baseline studies. The regression includes the two California facilities which had substantially higher use and fatality estimates than other Pacific Northwest and Rocky Mountain facilities. As more data on raptor use and fatalities at wind energy facilities in the Rocky Mountain region become publicly available, the predictive ability of this tool will be better understood. Given the available data, the regression equation provides further support to suggest that raptor fatalities at the HWWRA will be at the upper end of the range of fatalities observed at existing facilities in the Pacific Northwest and Rocky Mountain Region but, lower than fatality rates observed at facilities in California.



Overall Diurnal Raptor Use 1.02
Predicted Fatality Rate 0.21 fatalities/MW/year
90.0% Prediction Interval (0, 0.45 fatalities/MW/year)

Figure 20. Regression analysis comparing raptor use estimations versus estimated raptor mortality.

Data from the following sources:

Study and Location	Raptor Use (birds/plot /20-min survey)	Reference	Raptor Mortality (fatalities/MW/yr)	Reference
Diablo Winds, CA	2.161	WEST 2006	0.87	WEST 2008
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Bighorn, WA	0.51	Johnson and Erickson 2004	0.15	Kronner et al. 2008
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Stateline, WA/OR	0.48	Erickson et al. 2004	0.09	Erickson et al. 2002b
Wild Horse, WA	0.29	Erickson et al. 2003d	0.09	Erickson et al. 2008
Wessington Springs, SD	0.23	Derby et al. 2008	0.06	Derby et al. 2010g
Elkhorn Valley, OR	1.1	WEST 2005c	0.06	Jeffrey et al. 2009b
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b
Foote Creek Rim, WY	0.55	Johnson et al. 2000b	0.04	Young et al. 2003c
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003d	0.00	Young et al. 2006
Klondike, OR	0.50	Johnson et al. 2002a	0.00	Johnson et al. 2003
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2000
Grand Ridge, IL	0.20	Derby et al. 2009	0	Derby et al. 2010h

Golden eagles are protected by the Migratory Bird Treaty Act (MBTA 1918) and the BGEPA (1940). The USFWS has recently expressed elevated concern over impacts to golden eagles from wind energy projects. The mean golden eagle use at the HWWRA during the second year of baseline surveys was estimated at 0.15 golden eagles/plot/20-min survey (mean golden eagle use during the first year of surveys was estimated at 0.14; Taylor and Bay 2010b). Mean golden eagle use estimates from several wind resource areas in Wyoming are presented in Table 15. Mean golden eagle use estimates at wind resource areas in Wyoming ranged from 0.05 golden eagles/plot/20-min survey to 0.49 golden eagles/plot/20-min survey and averaged 0.25 golden eagles/plot/20-min survey.

Table 15. Mean raptor use estimates and mean golden eagle use for several Wyoming Wind Resource Areas.

Project Name	Average Overall Use	Average[1] Golden Eagle Use	Reference
Hermosa West	1.02	0.15	This study
Foote Creek Rim[2]	0.55	0.27	Erickson et al. 2002b
Morton Pass[2]	0.27	0.12	Johnson et al. 2000b
Simpson Ridge[2]	0.24	0.10	Johnson et al. 2000b
Glenrock/Rolling Hills	1.09	0.49	Johnson et al. 2000b
Dunlap	0.52	0.28	Johnson et al. 2009a
Seven Mile Hill	0.48	0.26	Johnson et al. 2008b
High Plains	0.45	0.05	Johnson et al. 2009b
Campbell Hill	0.75	0.38	Taylor et al. 2010b

[1]Non-weighted average of seasonal use estimates
[2]Adjusted from 40-minute surveys

SWE has requested that WEST implement additional raptor observations to help better understand use of the HWWRA by raptors (particularly golden eagles and ferruginous hawks) and to collect information on golden eagle use that can be incorporated into planning/facility siting with the intent of reducing potential risk to golden eagles. The one raptor observation location surveyed during the second year of baseline surveys was selected to maximize visibility of the area within the HWWRA near the active golden eagle nest identified in 2009 as well as to maximize visibility of the area associated with avian use station 13 (the avian use station with the highest golden eagle use estimate from the first year of baseline surveys; Taylor and Bay 2010). Qualitatively, the results collected to date for the raptor observations don't appear to be associated with the potential raptor habitat mapping efforts, but do appear to relate to areas of more abrupt topography (Figure 10). The results of the raptor observations also suggest a higher number of golden eagle flight paths in the vicinity of the southern portion of avian use station 13, which supports the mapped flight path data collected from avian use surveys. The highest golden eagle use stations from the second year of surveys were stations 16 and 15, followed by station 13. An additional raptor observation station has been implemented in the vicinity of points 15 and 16 for ongoing raptor observations in 2011-2012. The results of the raptor observations can be used to inform project siting and may help to minimize potential impacts to golden eagles. The utility of these surveys in minimizing impacts to raptors will be better understood as similar methods are implemented at more projects in Wyoming and across the Western U.S.

Non-Raptor Use and Exposure Risk

Passerines (primarily perching birds) have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001a, 2002b; Johnson and Stephens 2010 (in press)). Both migrant and resident passerine fatalities have been observed. Given that passerines made up a large proportion of the birds observed during the baseline study, passerines would be expected to make up the largest proportion of fatalities at the HWWRA. Based on observations within 100 m, exposure indices indicate that there is very little exposure risk to passerines due to all passerines (excluding large corvids) flying below the RSH. Horned lark is the most likely passerine to be exposed to collision from wind turbines at the HWWRA, based upon abundance. Other passerine species likely at risk based on abundance would include Mccown's longspur, mountain bluebird (*Sialia currucoides*), and vesper sparrow (*Pooecetes gramineus*; Appendix D).

Wind energy facilities with year-round use by water-dependent species have shown the highest mortality, although the levels of waterfowl, waterbird, and shorebird mortality appear insignificant compared to the use of the facilities by these bird groups. Of 1,033 bird carcasses collected at US wind energy facilities, waterbirds comprised about 2%, waterfowl comprised about 3%, and shorebirds comprised less than 1% (Erickson et al. 2002b). Only two Canada geese (*Branta canadensis*) fatalities were documented at the Klondike, Oregon wind energy facility, (Johnson et al. 2003) even though 43 groups totaling 4,845 individual Canada geese were observed during pre-construction surveys (Johnson et al. 2002a). The Top of Iowa wind energy facility is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use, including migrant and resident waterfowl. During a recent study, approximately one million goose-use days and 120,000 duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during concurrent and standardized wind energy facility fatality studies (Jain 2005). Similar findings were observed at the Buffalo Ridge wind energy facility in southwestern Minnesota, which is located in an area with relatively high waterfowl and waterbird use and some shorebird use. Snow geese (*Chen caerulescens*), Canada geese, and mallards (*Anas platyrhynchos*) were the most common waterfowl observed. Three of the 55 fatalities observed during the fatality monitoring studies were waterfowl (two mallards and one blue-winged teal [*Anas discors*]); two American coots (*Fulica americana*), one grebe, and one shorebird fatality were also found (Johnson et al. 2002b).

Unidentified gulls had the highest exposure index of any species during the 2010-2011 baseline studies at the HWWRA due to one group of 30 unidentified gulls initially observed within the RSH. Other waterfowl, waterbird, or shorebird species with exposure indices greater than zero during the 2010-2011 baseline studies included American white pelican (due to 1 group of 5 individuals initially observed within the RSH) and Canada goose (1 group of 2 individuals initially observed within the RSH). Although sandhill cranes had the highest exposure index of any species at the HWWRA during the 2009-2010 baseline studies (due to 2 groups totaling 36 individuals initially observed within the RSH), no sandhill crane observations were recorded during the 2010-2011 baseline studies. Based on available evidence, waterfowl do not seem especially vulnerable to turbine collisions and significant impacts are not likely.

Indirect Effects

The presence of wind turbines may alter the landscape so that wildlife use patterns are affected, displacing wildlife away from the project facilities and suitable habitat. The greatest concern with displacement impacts for wind energy facilities in the US has been where these facilities have been constructed in grassland or other native habitats (Leddy et al. 1999; Mabey and Paul 2007). Although Crockford (1992) suggests that disturbance appears to impact feeding, resting, and migrating birds (rather than breeding birds), results from studies at the Stateline wind energy facility in Washington and Oregon (Erickson et al. 2004) and the Buffalo Ridge wind energy facility in Minnesota (Johnson et al. 2000a) suggest that breeding birds are also affected by wind energy facility operations.

Raptor Displacement

There were four active raptor nests identified in 2010 resulting in an active raptor nest density within the HWWRA and surrounding one-mile buffer of 0.09 active nests/mi^2 (0.04 active nests/km^2). The total number of nests identified in 2010 (17 nests) did not change from the 2009 nest search effort even though two previously inactive nests were not identified in 2010. This is because two new or previously unidentified nests were documented in 2010. Six active raptor nests were identified in 2009 resulting in an active raptor nest density of 0.13 active nests/mi^2 (0.05 active nests/km^2). Three of the nests in 2010 were of undetermined status and could have possibly been active Swainson's hawk nests. No active golden eagle or red-tailed hawk nests were identified during the 2010 nest survey efforts.

Access issues limited the survey coverage outside of leased lands within the study area, and it is possible that additional nests exist within the one-mile buffer surrounding leased lands. The active raptor nest density identified in both 2009 and 2010 was below average compared to 10 other wind resource areas evaluated in the western United States, where active raptor nest density ranged from 0.03 to 0.30 nests/mi^2 (0.01 to 0.12 nests/km^2) and averaged 0.15 nests/mi^2 (0.06 nests/km^2;Erickson et al. 2002b). Raptors nesting closer to turbines are more likely to be impacted by disturbance due to construction or operation of the facility. The potential for collision with turbines for raptors nesting close to turbines may be increased by adults foraging in the vicinity of active nests as well as fledglings learning to fly in the vicinity of active nests however this is not well understood. Currently, data on nests very close to turbines (e.g., within a half-mile [0.8 km]) are currently inadequate to determine the level of these impacts.

Birds displaced from wind energy facilities might move to lower quality habitat with fewer disturbances, with an overall effect of reducing breeding success. Most studies on raptor displacement at wind energy facilities, however, indicate effects to be negligible (Howell and Noone 1992; Johnson et al. 2000a, 2003;Whitfield and Madders 2006). Notable exceptions include a study in Scotland that described territorial golden eagles avoiding the entire wind energy facility area, except when intercepting non-territorial birds (Walker et al. 2005). A study at the Buffalo Ridge wind energy facility in Minnesota found evidence of northern harriers avoiding turbines on both a small scale (less than 100 m from turbines) and a larger scale in the year following construction (Johnson et al. 2000a). Two years following construction, however, no large-scale displacement of northern harriers was detected.

The only published report of avoidance of wind turbines by nesting raptors occurred at the Buffalo Ridge facility in Minnesota, where raptor nest density on 101 mi^2 (262 km^2) of land surrounding the wind energy facility was 5.94 nests/39 mi^2 (101 km^2), yet no nests were present in the 12 mi^2 (31 km^2) facility itself, even though habitat was similar (Usgaard et al. 1997). However, this analysis assumes that raptor nests are uniformly distributed across the landscape (an unlikely event), and only two nests would be expected for an area 12 mi^2 in size if the nests were distributed uniformly. Based on extensive monitoring using helicopter flights and ground observations, raptors continued to nest at a wind energy facility in eastern Washington at approximately the same levels after construction, and several nests were located within a half-mile of turbines (Erickson et al. 2004). At the Foote Creek Rim wind energy facility in southern Wyoming, one pair of red-tailed hawks nested within 0.3 miles (0.5 km) of the turbine strings, and seven red-tailed hawk nests, one great horned owl (*Bubo virginianus*) nest, and one golden eagle nest located within one mile of the wind energy facility successfully fledged young (Johnson et al. 2000b). The golden eagle pair successfully nested a half-mile from the facility for three different years after it became operational. In Oregon, a Swainson's hawk (*Buteo swainsoni*) also nested within a quarter-mile (0.4 km) of a turbine string at the Klondike I wind energy facility after the facility was operational (Johnson et al. 2003). These observations suggest that there will be limited nesting displacement of raptors at the HWWRA, although the creation of a buffer (following recommendations provided by the WGFD in a letter dated June 22, 2009) surrounding known nests when siting turbines will further reduce any potential disturbance/displacement impact to nesting raptors by reducing human activities in close proximity to raptor nests.

Displacement of Non-Raptor Bird Species

Studies concerning displacement of non-raptor species have concentrated on grassland passerines and waterfowl/waterbirds (Winkelman 1990, Larsen and Madsen 2000, Mabey and Paul 2007). Wind energy facility construction appears to cause small-scale local displacement of grassland passerines. Construction also reduces habitat effectiveness because of the presence of access roads and large gravel pads surrounding turbines (Leddy 1996, Johnson et al. 2000a). Leddy et al. (1999) surveyed bird densities in Conservation Reserve Program (CRP) grasslands at the Buffalo Ridge wind energy facility in Minnesota, and found mean densities of 10 grassland bird species were four times higher at areas located 180 m (591 ft) from turbines than they were at grasslands nearer turbines. Johnson et al. (2000a) found reduced use of habitat by seven of 22 grassland-breeding birds following construction of the Buffalo Ridge wind energy facility. Results from the Stateline wind energy facility in Oregon and Washington (Erickson et al. 2004) and the Combine Hills wind energy facility in Oregon (Young et al. 2005) suggest a relatively small impact of wind energy facilities on grassland-nesting passerines. Transect surveys conducted prior to and after construction of the wind energy facilities found that grassland passerine use was significantly reduced within approximately 50 m (164 ft) of turbine strings, but areas further away from turbine strings did not have reduced bird use. There is the potential for small-scale displacement of grassland passerines at the HWWRA.

The results of studies to determine the displacement effects of wind energy facilities on waterfowl and shorebirds appear to be mixed. At the Buffalo Ridge wind-energy facility in Minnesota, the abundance of several bird types (including shorebirds and waterfowl) were found to be significantly lower at survey plots with turbines than at reference plots without turbines (Johnson et al 2000a). The report concluded that the area of reduced use was limited primarily to those areas within 100 m of the turbines. Disturbance tends to be greatest for migrating birds while feeding and resting (Crockford 1992; NRC 2007). Waterfowl, waterbird and shorebird observations at the HWWRA during the 2010-2011 baseline studies included one group of two Canada geese, one group of five American white pelicans, and one group of 20 unidentified gulls. Waterfowl and waterbird observations in 2009-2010 included two groups of 36 sandhill cranes, one group of 16 unidentified terns, one group of two American white pelicans, and one group of two mallards. No shorebirds were observed within the HWWRA during the 2009-2010 baseline studies. The amount of waterfowl, waterbird, and shorebird (excluding grassland/upland shorebirds) use within the HWWRA is very limited, suggesting that any displacement impacts to waterfowl, waterbirds, and shorebirds would be unlikely to impact their populations.

The results of the mountain plover habitat suitability assessment suggest that some areas within the HWWRA could be considered suitable mountain plover habitat. The areas of potentially suitable habitat are relatively small and isolated within the HWWRA. In addition, there are very few prairie dogs present within the HWWRA (only two small towns have been identified) reducing the habitat suitability for mountain plovers. While the potential for mountain plover use of the HWWRA cannot be ruled out, the suitability of the habitat within the site is considered low with small isolated patches of potentially suitable habitat. While mountain plovers have not been targeting with specific surveys, no mountain plovers have been observed during baseline work conducted for two consecutive years at the HWWRA and any potential displacement impacts are unlikely.

Much debate has occurred recently regarding the potential impacts of wind energy facilities on prairie grouse, including greater sage-grouse (*Centrocercus urophasianus*). While the potential exists for wind turbines to displace prairie grouse from occupied habitat, well-designed studies examining the potential impacts of wind turbines on prairie grouse are currently lacking. The greater sage-grouse has recently been designated as a candidate species for listing under the Endangered Species Act (ESA 1973) by the USFWS. Greater sage-grouse conservation in Wyoming is currently managed by the WGFD in cooperation with regional greater sage-grouse working groups in an attempt to increase grouse population levels and avoid federal listing under the ESA. The State of Wyoming has designated core sage-grouse areas within Wyoming, and the current position of the State is that no wind-energy development shall occur within core sage-grouse areas in Wyoming until it can be demonstrated that wind-energy development can occur with no impact to sage-grouse in core areas. The HWWRA is not within a designated core sage-grouse area, and no greater sage-grouse were observed within the HWWRA.

Potential Bat Impacts

Assessing the potential impacts of wind energy development to bats at the HWWRA is complicated because the proximate and ultimate causes of bat fatalities at turbines are poorly understood (Kunz et al. 2007b; Baerwald et al. 2008; Cryan and Barclay 2009; Long et al. 2010a, 2010b), and because monitoring elusive, night-flying animals is inherently difficult (O'Shea et al. 2003). In addition, although installed capacity for wind has increased rapidly in recent years, release of study results from these existing wind energy facilities has lagged the influx of newly proposed facilities (Kunz et al. 2007b). To date, monitoring studies of wind energy facilities suggest that:

1) bat mortality shows a potential relationship with bat activity (Appendix G; Kunz et al. 2007b);

2) the majority of fatalities occur during the post-breeding or fall migration season (roughly August and September; Johnson 2005, Arnett et al. 2008);

3) migratory tree-roosting species (eastern red, hoary, and silver-haired bats) comprise almost 75% of reported bat fatalities (Arnett et al. 2008), and;

4) the highest reported fatalities occur at wind energy facilities located along forested ridge tops in the eastern and northeastern US. However, some facilities in agricultural regions report relatively high fatalities as well (Appendix G).

Based on these patterns, current guidance to estimate potential mortality levels at a proposed wind energy facilities involves evaluation of the on-site bat acoustic data in terms of activity levels, seasonal variation, and species composition (Kunz et al. 2007b), as well as comparison to regional fatality patterns.

Overall Bat Activity

To date, few studies of wind energy facilities have recorded both bat passes per night and bat fatality rates (Appendix G). The addition of data sets from projects such as Hermosa will contribute to our understanding of the relationship between bat activity near wind turbines and bat fatalities. To our knowledge, the Anabat detections per night data for the studies in Appendix G were collected from ground locations that were selected to sample areas representative of proposed turbine locations. Thus, this report relies on the mean bat activity for the one fixed ground-based detector during the fall migration period (July 15 to October 31) to assess potential risk of bat fatality at the HWWRA relative to other publicly available studies with similar data.

Bat activity recorded by the fixed ground detector during the fall season within the HWWRA (3.81 ± 0.28 bat passes per detector-night) was similar to that observed at HWWRA in 2009 and at the Foote Creek Rim Facility in Wyoming, where recorded bat mortality was low, and was much lower than activity recorded at sites in West Virginia, Iowa, and Tennessee, where bat mortality rates were high (Appendix G). Thus, assuming a relationship between pre-construction bat activity and post-construction fatalities, bat fatality rates at the HWWRA would be expected to be similar to the low rates reported at Foote Creek Rim, Wyoming (1.05 fatalities/MW/study; Appendix G).

Spatial Variation

The proposed wind-energy facility is not located near any large, known bat colonies likely to attract large numbers of bats. The one historic mine location within the HWWRA, was sampled in 2010 and the bat activity rate in the vicinity of the mine was within the range of activity rates at other sampling stations. In addition, both hoary and eastern red bats were recorded in the vicinity of the mine. Hoary and eastern red bats would not be expected to be using the historic mine location for roosting. These findings suggest that the historic mine shaft at HWWRA does not appear to be an important bat roosting area.

In general, bat activity was greater at temporary stations than at fixed stations, possibly due to differences in habitat. All of the stations were located in grassland habitat (temporary stations were located in areas proposed for turbine placement and were placed systematically with a random starting location) however; some of the temporary stations were located in areas with rock outcrops, or small drainage/riparian features in the general vicinity which may have influenced bat activity rates. For example, station HE20t (which had the highest activity rate of all stations in 2010; 7.72 bat passes/detector night) had a small drainage/riparian area located in the general vicinity. Also the station with the second highest activity rate (station HE11t; 4.17 bat passes/detector night) had rock outcrops located in the general vicinity of the sampling station. Acoustic bat sampling in 2009 provided similar results in that activity rates were higher for temporary stations and the stations with the highest activity rates relative to other stations were stations located in riparian habitats.

The paired station (HE1) ground detector recorded over twice as much activity as the raised detector, suggesting that a higher number of bats fly at a lower range of altitudes within the HWWRA and generally lower bat activity at heights near the bottom of the rotor swept heights. Interestingly, this result differed from the acoustic sampling in 2009 when the ground and raised detectors recorded similar rates of bat activity.

Temporal Variation

Bat activity was relatively low until mid-July when it increased with recorded activity being relatively high during early August and September. Bat activity in July likely corresponds with the reproductive season, when pups are being weaned and foraging rates are high. Activity between August and September is likely a combination of continued foraging activity by resident bats, as well as movement of migrating bats through the area. After September, activity was very low, indicating that most bats had left the area for winter hibernacula or warmer climates. Although the 2009 study was only conducted from mid-July through October, similar peaks in bat activity rates were observed between the two years.

The fall migration period (late July to late September) represents the period between dissolution of maternity colonies and onset of the swarming and hibernation seasons. During this time bats begin moving toward wintering areas, and many species of bats initiate reproductive behaviors (Cryan 2008). This period of increased landscape-scale movement and reproductive behavior is often associated with increased levels of bat fatalities at operating wind energy facilities (Arnett et al. 2008) Many fatality studies of bats at wind energy facilities in the US have shown a corresponding peak in mortality in August and September and generally lower mortality earlier in the summer (Johnson 2005, Arnett et al. 2008), though relatively few studies have monitored for fatalities during spring and early summer (Kunz et al. 2007b). While the survey effort varies among the different studies, the studies that combine Anabat surveys and fatality surveys show a general association between the timing of increased bat call rates and timing of mortality, with both call rates and fatalities peaking during the fall. Based on the available data, it is expected that bat fatalities at the HWWRA will be highest between August and early September.

Species Composition

Of the 11 species of bat likely to occur in the HWWRA, five are known fatalities at wind energy facilities (Table 2). Acoustic bat surveys were able to classify bat calls to frequency groups that roughly correspond to groups of relative risk. Approximately 55% of passes in 2010 and approximately 48% of passes in 2009 were by LF bats, suggesting higher relative abundance of species such as big brown, hoary and silver-haired bats. At raised stations, LF passes outnumbered HF passes, which most likely reflects different foraging behaviors among species. Generally, LF species tend to forage in less cluttered conditions (e.g., at greater heights) than HF species due to their wing morphology and echolocation call structure (Norberg and Rayner 1987).

During both sampling years, high-frequency species were most abundant from early-July to late-August, whereas LF species were more common in September. This change in species composition probably reflects movements of HF species out of the area, traveling to winter hibernacula once young are weaned and able to fly. The greater proportion of LF species in September may indicate movement of these species through the area at this time.

During 2010 sampling, hoary bats made up 9.2% of all LF passes, and were most active in early August, suggesting fall migration through the area. In 2009, hoary bats composed 8.1% of all passes and were most active from mid-July to late September suggesting hoary bats are likely to reside in the HWWRA during the summer (in addition to fall migration of hoary bats through the HWWRA). To date, some LF species, (e.g., hoary, Mexican free-tailed bats and silver-haired bats) have been found as fatalities in higher proportions than other LF species (e.g., Arnett et al. 2008). 13.8 percent of passes were classified as MF passes and 0.2% were eastern red bats in 2010 compared to 15.9% of passes classified as MF passes and 2.0% of passes classified as eastern red bats in 2009. In some regions, eastern red bats comprise the majority of bat fatalities found during searches (e.g., Arnett et al. 2008).

Regional Bat Fatality Studies

Publicly available bat fatality rate estimates corrected for searcher efficiency and carcass removal rates are available for 15 wind-energy facilities located throughout the Rocky Mountains and western North America, where annual bat fatality rates have ranged from 0.07 fatalities/MW/year at a wind-energy facility in California to 14.62 fatalities/MW/year at a facility in Alberta, and averaged 3.30 fatalities/MW/year (Appendix G).

Bat activity from the fixed ground based detector during the fall season at the HWWRA (3.81± 0.28 bat passes/detector-night) was similar to the mean of 2.2 bat passes/detector-night recorded at the Foote Creek Rim wind-energy facility in 2000. The Foote Creek Rim facility is located approximately 60 miles (96.6 km) northwest of the HWWRA. Actual bat mortality at the Foote Creek Rim facility in 2000 (the only year for which bat activity estimates are available) was estimated at 1.05 bat fatalities/MW/year (Gruver 2002). The rate of 1.05 bat fatalities/MW/year measured at Foote Creek Rim is low compared to most other operational wind-energy facilities (Johnson 2005, Arnett et al. 2008; Gruver 2002). Based on similar activity levels, the proximity of the HWWRA to the Foote Creek Rim Facility, and the presence of similar habitats among the two areas, similar rates of bat mortality could be expected at the HWWRA. Bat activity at the HWWRA was similar to bat activity levels recorded at several other wind resource areas in Wyoming, where they have ranged from 0.29 to 3.76 bat passes/detector night (Table 16). To date, however, the only bat mortality data for Wyoming are from the Foote Creek Rim wind-energy facility. As more research is conducted at facilities in the Wyoming, more information regarding the potential direct impacts of Wyoming wind-energy facilities to bats will be obtained.

Table 16. Bat activity indices for several wind resource areas in Wyoming.

Wind Resource Area	Location	Bat passes/ Detector night	Reference
Glenrock/Rolling Hills	Converse County	0.29	Johnson et al. 2008a
Campbell Hill	Converse County	2.03	Taylor et al. 2008
Seven Mile Hill	Carbon County	2.90	Johnson et al. 2008b; Johnson et al. 2000b
Dunlap Ranch	Carbon County	1.67	Johnson et al. 2009a
Simpson Ridge	Carbon County	1.79	Johnson et al. 2009c
High Plains	Carbon/Albany Counties	3.76	Johnson et al. 2009b
Foote Creek Rim	Carbon County	2.20	Gruver 2002
Hermosa West	Albany County	2.22	This study
Mean		**2.11**	

Big Game

Two-hundred and twenty elk in two groups, 273 pronghorn antelope in 17 groups, and four mule deer in one group were observed while conducting the second year of baseline surveys within the HWWRA. Both elk (295 individuals in 4 groups) and pronghorn (85 individuals in 11 groups) were observed during the first year of baseline surveys as well. According to the Wyoming Game and Fish Department (WGFD), the HWWRA is not in an area designated as crucial winter range, parturition, or migration route for any big-game species. The impacts to big game, including elk, pronghorn antelope and mule deer, from wind-energy facilities are not well known. At the Foote Creek Rim facility in Carbon County, Wyoming, pronghorn antelope observed during raptor use surveys were recorded year round (Johnson et al. 2000b). The mean number of pronghorn antelope observed at the six fixed-point bird use points was 1.07 animals/survey prior to construction of the wind-energy facility and 1.59 and 1.14 animals/survey the two years immediately following construction, indicating no reduction in use of the immediate area. A study of interactions of elk with operating wind-energy facilities was recently conducted in Oklahoma, and the study found no evidence that operating wind turbines have a measurable impact on elk use of the surrounding area (Walter et al. 2004). However, more research is needed to understand the impacts of wind-energy facilities on big game, including elk, pronghorn antelope, and mule deer.

Sensitive Species

All sensitive species observed at the HWWRA during the second year of baseline surveys are summarized in Table 7 No federally-listed threatened or endangered species were observed within the HWWRA. During the second year of surveys, seven bird species with native NSS rankings one through four in the state of Wyoming were observed in the HWWRA during the surveys. Of these species, three were raptors: bald eagle (one observation), ferruginous hawk (38 observations), and Swainson’s hawk (21 observations). Thirty-nine golden eagles were also observed within the HWWRA. Golden eagles are not listed in Wyoming, but both bald and golden eagles are legally protected under the BGEPA (1940), while the others are further protected under the MBTA (1918). Impacts to raptor species can be minimized by placing spatial buffers around known nest sites and avoiding known foraging areas (e.g., the two white-tailed prairie dog colonies identified) while siting the wind-energy facility. One Wyoming sensitive waterfowl species, American white pelican (one group of five observations), was observed within the HWWRA. The three remaining Wyoming sensitive species were passerines: McCown’s longspur (185 observations), Brewer’s sparrow (15 observations), and lark bunting (four observations).

The list of sensitive species identified during the second year of surveys is similar to the list of sensitive species from the first year of baseline surveys (Taylor and Bay 2010a). All sensitive species identified during the second year were recorded the first year however; three avian species (Sandhill crane, grasshopper sparrow, and chestnut-collared longspur; all NSS species) were not recorded during the second year of surveys. Some small-scale displacement of grassland passerines is possible in close proximity to turbines. Timing construction outside of the nesting season or clearing construction areas of vegetation prior to the nesting season will help to minimize impacts to grassland-nesting passerines.

CONCLUSIONS AND RECOMMENDATIONS

Based on data collected during this study, raptor and all bird use of the HWWRA is within the range of raptor and all bird use reported at wind resource areas evaluated throughout the US using similar methods. Based on the results of the studies to date, bird mortality at the HWWRA would likely be similar to bird mortality documented at other wind-energy facilities located in the Rocky Mountain Region where bird collision mortality has been relatively low.

Based on research conducted at wind-energy facilities throughout the Rocky Mountain and Pacific Northwest Regions, raptor use at the HWWRA is at the upper end of raptor use reported from other wind-energy facilities in the Rocky Mountain and Pacific Northwest regions. Raptor fatality rates at the HWWRA would be expected to be at the upper end of the fatality rates reported for the Rocky Mountain and Pacific Northwest Regions but, would be lower than the fatality rates observed at sites in California. Impacts to raptor species can be minimized by placing spatial buffers around nest sites during siting of the wind-energy facility and avoiding the two small white-tailed prairie dog colonies identified. Given the data collected during baseline wildlife surveys and the potential for impact to raptor species, Shell Wind Energy, Inc. has implemented a third year of focused raptor observations and plans to utilize the information collected from the three years of raptor surveys in designing the project layout with the intent of minimizing potential impacts to raptors.

To date, no relationships have been observed between overall use by other bird types, and fatality rates of those bird groups at wind-energy facilities. However, the flight characteristics and foraging habits of some species may result in increased exposure for these species at the HWWRA. To date, overall fatality rates for birds at wind-energy facilities have been relatively low and consistent in the Rocky Mountain and Pacific Northwest Regions. As more research is conducted at facilities in the Rocky Mountain Region, more information regarding the potential direct impacts of wind-energy facilities to bird species will be obtained.

Golden eagles are protected by the Migratory Bird Treaty Act (MBTA 1918) and the BGEPA (1940). The USFWS has recently expressed elevated concern over impacts to golden eagles from wind energy projects. Mean golden eagle use at the HWWRA ranks 7th out of ten other publicly available golden eagle use estimates reported at other Wind Resource Areas in Wyoming. SWE has requested that WEST implement additional raptor observations during 2011-2012 to help better understand use of the HWWRA by raptors (particularly golden eagles) and to collect information on golden eagle use that can be incorporated into planning/facility siting with the intent of reducing potential risk to golden eagles. The results of the raptor observations can be used to inform project siting and may help to minimize potential impacts to golden eagles. The utility of these surveys in minimizing impacts to raptors will be better understood as similar methods are implemented at more projects in Wyoming and across the Western U.S.

Waterfowl, waterbird and shorebird observations at the HWWRA during the 2010-2011 baseline studies included one group of two Canada geese, one group of five American white pelicans, and one group of 20 unidentified gulls. Waterfowl and waterbird observations in 2009-2010 included two groups of 36 sandhill cranes, one group of 16 unidentified terns, one group of two American white pelicans, and one group of two mallards. No shorebirds were observed within the HWWRA during the 2009-2010 baseline studies. The amount of waterfowl, waterbird, and shorebird (excluding grassland/upland shorebirds) use within the HWWRA is limited, suggesting that any displacement impacts to waterfowl, waterbirds, and shorebirds would be unlikely to impact their populations.

Based on similar activity levels, the proximity of the HWWRA to the Foote Creek Rim Facility, and the presence of similar habitats among the two areas, similar rates of bat mortality could be expected at the HWWRA. Bat activity at the HWWRA was similar to bat activity levels recorded at several other wind resource areas in Wyoming. To date, however, the only bat mortality data for Wyoming are from the Foote Creek Rim wind-energy facility. As more research is conducted at facilities in the Wyoming, more information regarding the potential direct impacts of Wyoming wind-energy facilities to bats will be obtained.

The proposed wind-energy facility is dominated by grasslands, comprising approximately 88% of the HWWRA. Some small-scale displacement of grassland passerines (including Wyoming NSS species) is possible in close proximity to turbines at the HWWRA. Timing construction outside of the nesting season or clearing construction areas of vegetation prior to the nesting season will help to minimize impacts to grassland-nesting passerines.

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Appendix A: Representative photographs of potentially suitable Mountain Plover Habitat within the Hermosa West Wind Resource Area


Looking north at Prairie Dog Town 1

Looking south from Prairie Dog Town 2


Rocky/bare ground in the vicinity of Prairie Dog Town 2

Looking north from Point 11

Looking east from Point 12

Looking west from Point 13


Looking east from Point 13


Looking north from Point 13


Looking south from Point 13

Looking southwest from Point 14


Looking north from Point 15


Looking northwest from Point 15


Looking west from Point 16

Looking southeast from Point 17

Looking northeast from Point 18

Looking southeast from Point 19


Looking southeast from Point 20


Looking north from Point 21

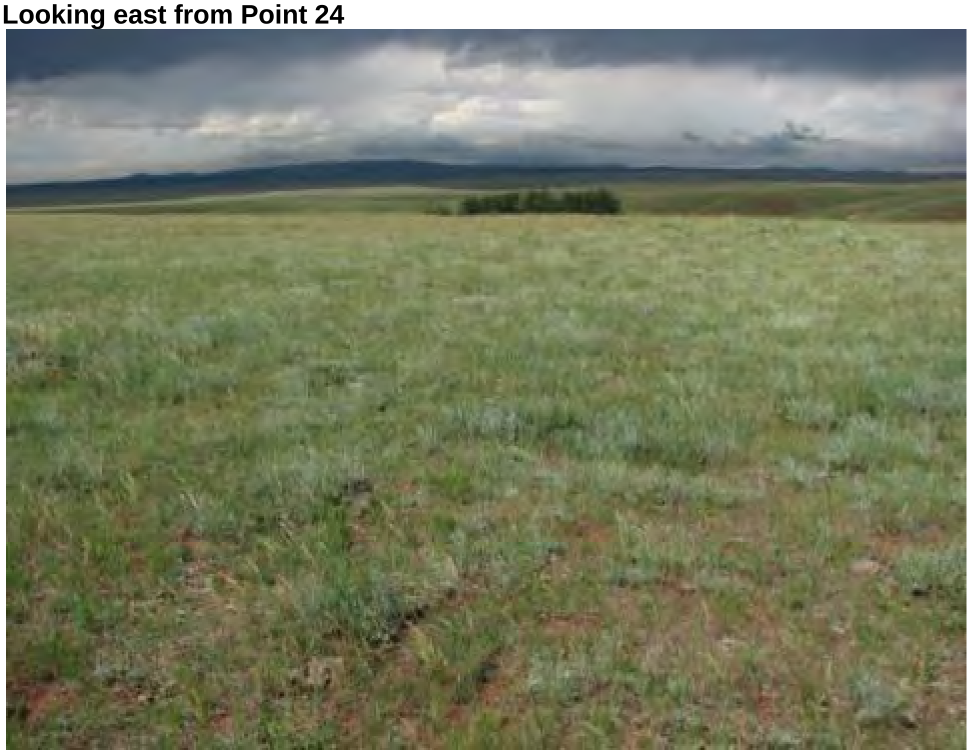

Looking south from Point 21

Looking north from Point 22


Looking west from Point 22


Looking south from Point 23


Looking east from Point 24


Looking north from Point 26


Looking east from Point 27

Looking east from Point 28


Looking west from Point 28

Looking south from Point 29


Looking west from Point 29

Appendix B: All Bird Types and Species Observed at the Hermosa West Wind Resource Area during Fixed-Point Bird Use Surveys, April 20, 2010 to April 11, 2011

Appendix B. Summary of individuals and group observations by species and bird group for fixed-point use surveys at the Hermosa West Wind Resource Area[a], April 20, 2010- April 11, 2011.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**1**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**5**
American white pelican	*Pelecanus erythrorhynchos*	1	5	0	0	0	0	0	0	1	5
Waterfowl		**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**2**
Canada goose	*Branta canadensis*	1	2	0	0	0	0	0	0	1	2
Gulls/Terns		**1**	**30**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**30**
unidentified gull		1	30	0	0	0	0	0	0	1	30
Diurnal Raptors		**70**	**83**	**48**	**48**	**54**	**54**	**23**	**29**	**195**	**214**
Accipiters		*2*	*2*	*0*	*0*	*0*	*0*	*1*	*1*	*3*	*3*
sharp-shinned hawk	*Accipiter striatus*	2	2	0	0	0	0	1	1	3	3
Buteos		*38*	*38*	*29*	*29*	*30*	*30*	*17*	*23*	*114*	*120*
ferruginous hawk	*Buteo regalis*	8	8	12	12	15	15	3	3	38	38
red-tailed hawk	*Buteo jamaicensis*	21	21	8	8	8	8	2	2	39	39
rough-legged hawk	*Buteo lagopus*	0	0	0	0	4	4	12	18	16	22
Swainson's hawk	*Buteo swainsoni*	9	9	9	9	3	3	0	0	21	21
Northern Harrier		*6*	*19*	*0*	*0*	*5*	*5*	*0*	*0*	*11*	*24*
northern harrier	*Circus cyaneus*	6	19	0	0	5	5	0	0	11	24
Eagles		*12*	*12*	*9*	*9*	*12*	*12*	*1*	*1*	*34*	*34*
golden eagle	*Aquila chrysaetos*	12	12	9	9	12	12	1	1	34	34
Falcons		*12*	*12*	*10*	*10*	*7*	*7*	*4*	*4*	*33*	*33*
American kestrel	*Falco sparverius*	5	5	3	3	1	1	1	1	10	10
prairie falcon	*Falco mexicanus*	7	7	7	7	6	6	3	3	23	23
Vultures		**3**	**3**	**6**	**6**	**8**	**8**	**0**	**0**	**17**	**17**
turkey vulture	*Cathartes aura*	3	3	6	6	8	8	0	0	17	17
Large Corvids		**15**	**35**	**4**	**9**	**12**	**33**	**8**	**19**	**39**	**96**
American crow	*Corvus brachyrhynchos*	4	15	2	6	10	30	5	14	21	65
black-billed magpie	*Pica pica*	3	11	2	3	1	2	2	4	8	20
common raven	*Corvus corax*	8	9	0	0	1	1	1	1	10	11
Passerines		**146**	**293**	**129**	**184**	**134**	**439**	**33**	**153**	**442**	**1,069**
American pipit	*Anthus rubescens*	4	8	0	0	0	0	0	0	4	8
American robin	*Turdus migratorius*	1	1	1	1	0	0	0	0	2	2

Appendix B. Summary of individuals and group observations by species and bird group for fixed-point use surveys at the Hermosa West Wind Resource Area[a], April 20, 2010- April 11, 2011.

		Spring		Summer		Fall		Winter		Total	
Type / Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
American tree sparrow	*Spizella arborea*	0	0	0	0	1	3	0	0	1	3
black-capped chickadee	*Poecile atricapilla*	0	0	0	0	0	0	2	6	2	6
Brewer's sparrow	*Spizella breweri*	4	4	6	8	1	3	0	0	11	15
brown-headed cowbird	*Molothrus ater*	0	0	1	1	0	0	0	0	1	1
Cassin's sparrow	*Aimophila cassinii*	0	0	1	1	1	1	0	0	2	2
chipping sparrow	*Spizella passerina*	1	4	0	0	1	2	0	0	2	6
Clark's nutcracker	*Nucifraga columbiana*	0	0	1	1	1	1	3	6	5	8
cliff swallow	*Petrochelidon pyrrhonota*	4	6	0	0	0	0	0	0	4	6
dark-eyed junco	*Junco hyemalis*	0	0	0	0	3	6	2	5	5	11
green-tailed towhee	*Pipilo chlorurus*	1	1	0	0	0	0	0	0	1	1
horned lark	*Eremophila alpestris*	71	133	48	81	66	214	20	115	205	543
Lapland longspur	*Calcarius lapponicus*	0	0	1	1	15	40	4	15	20	56
lark bunting	*Calamospiza melanocorys*	0	0	2	4	0	0	0	0	2	4
lark sparrow	*Chondestes grammacus*	1	2	1	1	0	0	0	0	2	3
loggerhead shrike	*Lanius ludovicianus*	2	2	1	1	3	3	0	0	6	6
McCown's longspur	*Calcarius mccownii*	35	93	46	59	11	33	0	0	92	185
mountain bluebird	*Sialia currucoides*	11	28	5	6	12	58	0	0	28	92
rock wren	*Salpinctes obsoletus*	0	0	1	1	0	0	0	0	1	1
snow bunting	*Plectrophenax nivalis*	0	0	0	0	0	0	2	6	2	6
vesper sparrow	*Pooecetes gramineus*	4	4	10	14	17	73	0	0	31	91
western kingbird	*Tyrannus verticalis*	3	3	1	1	0	0	0	0	4	4
western meadowlark	*Sturnella neglecta*	3	3	3	3	1	1	0	0	7	7
white-breasted nuthatch	*Sitta carolinensis*	1	1	0	0	1	1	0	0	2	2
Woodpeckers		**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
northern flicker	*Colaptes auratus*	1	1	0	0	0	0	0	0	1	1
Overall		**238**	**452**	**187**	**247**	**208**	**534**	**64**	**201**	**697**	**1,434**

[a] Regardless of distance from observer.

Appendix C: Mean Use, Percent Composition, and Frequency of Occurrence for Large Birds and Small Birds Observed During Fixed-Point Bird Use Surveys at the Hermosa West Wind Resource Area, April 20, 2010 to April 11, 2011

Appendix C. Mean bird use (number of birds/plot[a]/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011.

	Mean Use				% Composition				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0**	**0.08**	**0**	**0**	**0**	**3.2**	**0**	**0**	**0**	**1.7**	**0**	**0**
American white pelican	0	0.08	0	0	0	3.2	0	0	0	1.7	0	0
Waterfowl	**0**	**0.03**	**0**	**0**	**0**	**1.3**	**0**	**0**	**0**	**1.7**	**0**	**0**
Canada goose	0	0.03	0	0	0	1.3	0	0	0	1.7	0	0
Gulls/Terns	**0**	**0.50**	**0**	**0**	**0**	**19**	**0**	**0**	**0**	**1.7**	**0**	**0**
unidentified gull	0	0.50	0	0	0	19	0	0	0	1.7	0	0
Diurnal Raptors	**1.00**	**1.38**	**1.14**	**0.69**	**56.8**	**52.5**	**76.2**	**60.4**	**59.3**	**55**	**61.9**	**50**
Accipiters	*0*	*0.03*	*0*	*0.02*	*0*	*1.3*	*0*	*2.1*	*0*	*3.3*	*0*	*2.4*
sharp-shinned hawk	0	0.03	0	0.02	0	1.3	0	2.1	0	3.3	0	2.4
Buteos	*0.56*	*0.63*	*0.69*	*0.55*	*31.6*	*24.1*	*46.0*	*47.9*	*44.4*	*38.3*	*42.9*	*38.1*
ferruginous hawk	0.28	0.13	0.29	0.07	15.8	5.1	19.0	6.2	24.1	13.3	23.8	7.1
red-tailed hawk	0.15	0.35	0.19	0.05	8.4	13.3	12.7	4.2	14.8	25.0	19.0	4.8
rough-legged hawk	0.07	0	0	0.43	4.2	0	0	37.5	7.4	0	0	28.6
Swainson's hawk	0.06	0.15	0.21	0	3.2	5.7	14.3	0	5.6	8.3	16.7	0
Northern Harrier	*0.09*	*0.32*	*0*	*0*	*5.3*	*12.0*	*0*	*0*	*9.3*	*5.0*	*0*	*0*
northern harrier	0.09	0.32	0	0	5.3	12.0	0	0	9.3	5.0	0	0
Eagles	*0.22*	*0.20*	*0.21*	*0.02*	*12.6*	*7.6*	*14.3*	*2.1*	*20.4*	*13.3*	*21.4*	*2.4*
golden eagle	0.22	0.20	0.21	0.02	12.6	7.6	14.3	2.1	20.4	13.3	21.4	2.4
Falcons	*0.13*	*0.20*	*0.24*	*0.10*	*7.4*	*7.6*	*15.9*	*8.3*	*11.1*	*13.3*	*23.8*	*9.5*
American kestrel	0.02	0.08	0.07	0.02	1.1	3.2	4.8	2.1	1.9	6.7	7.1	2.4
prairie falcon	0.11	0.12	0.17	0.07	6.3	4.4	11.1	6.2	11.1	11.7	16.7	7.1
Vultures	**0.15**	**0.05**	**0.14**	**0**	**8.4**	**1.9**	**9.5**	**0**	**11.1**	**5.0**	**11.9**	**0**
turkey vulture	0.15	0.05	0.14	0	8.4	1.9	9.5	0	11.1	5.0	11.9	0
Large Corvids	**0.61**	**0.58**	**0.21**	**0.45**	**34.7**	**22.2**	**14.3**	**39.6**	**16.7**	**21.7**	**9.5**	**16.7**
American crow	0.56	0.25	0.14	0.33	31.6	9.5	9.5	29.2	16.7	5.0	4.8	9.5
black-billed magpie	0.04	0.18	0.07	0.10	2.1	7	4.8	8.3	1.9	5.0	4.8	4.8
common raven	0.02	0.15	0	0.02	1.1	5.7	0	2.1	1.9	13.3	0	2.4
Overall	**1.76**	**2.63**	**1.5**	**1.14**	**100**	**100**	**100**	**100**				

[a] 800-meter (m) radius plot for large birds and 100-m for small birds.

Appendix C. Mean bird use (number of birds/plot[a]/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each bird type and species by season during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011.

	Mean Use				% Composition				% Frequency			
Type / Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**8.13**	**5.08**	**4.38**	**3.64**	**100**	**99.7**	**100**	**100**	**87.0**	**85.0**	**88.1**	**52.4**
American pipit	0	0.13	0	0	0	2.6	0	0	0	5.0	0	0
American robin	0	0.02	0.02	0	0	0.3	0.5	0	0	1.7	2.4	0
American tree sparrow	0.06	0	0	0	0.7	0	0	0	1.9	0	0	0
black-capped chickadee	0	0	0	0.14	0	0	0	3.9	0	0	0	4.8
Brewer's sparrow	0.06	0.07	0.19	0	0.7	1.3	4.3	0	1.9	3.3	11.9	0
brown-headed cowbird	0	0	0.02	0	0	0	0.5	0	0	0	2.4	0
Cassin's sparrow	0.02	0	0.02	0	0.2	0	0.5	0	1.9	0	2.4	0
chipping sparrow	0.04	0.07	0	0	0.5	1.3	0	0	1.9	1.7	0	0
Clark's nutcracker	0.02	0	0.02	0.14	0.2	0	0.5	3.9	1.9	0	2.4	7.1
cliff swallow	0	0.10	0	0	0	2	0	0	0	3.3	0	0
dark-eyed junco	0.11	0	0	0.12	1.4	0	0	3.3	3.7	0	0	4.8
green-tailed towhee	0	0.02	0	0	0	0.3	0	0	0	1.7	0	0
horned lark	3.96	2.32	1.93	2.74	48.7	45.4	44.0	75.2	70.4	66.7	66.7	38.1
Lapland longspur	0.74	0	0.02	0.36	9.1	0	0.5	9.8	18.5	0	2.4	7.1
lark bunting	0	0	0.10	0	0	0	2.2	0	0	0	2.4	0
lark sparrow	0	0.03	0.02	0	0	0.7	0.5	0	0	1.7	2.4	0
loggerhead shrike	0.06	0.03	0.02	0	0.7	0.7	0.5	0	5.6	3.3	2.4	0
McCown's longspur	0.61	1.65	1.40	0	7.5	32.4	32.1	0	14.8	35	52.4	0
mountain bluebird	1.07	0.47	0.14	0	13.2	9.2	3.3	0	16.7	13.3	11.9	0
rock wren	0	0	0.02	0	0	0	0.5	0	0	0	2.4	0
snow bunting	0	0	0	0.14	0	0	0	3.9	0	0	0	4.8
vesper sparrow	1.35	0.07	0.33	0	16.6	1.3	7.6	0	22.2	5.0	16.7	0
western kingbird	0	0.05	0.02	0	0	1.0	0.5	0	0	5.0	2.4	0
western meadowlark	0.02	0.05	0.07	0	0.2	1.0	1.6	0	1.9	5.0	7.1	0
white-breasted nuthatch	0.02	0.02	0	0	0.2	0.3	0	0	1.9	1.7	0	0
Woodpeckers	**0**	**0.02**	**0**	**0**	**0**	**0.3**	**0**	**0**	**0**	**1.7**	**0**	**0**
northern flicker	0	0.02	0	0	0	0.3	0	0	0	1.7	0	0
Overall	**8.13**	**5.1**	**4.38**	**3.64**	**100**	**100**	**100**	**100**				

[a.] 800-meter (m) radius plot for large birds and 100-m for small birds.

Appendix D: Species Exposure Indices for Large Birds and Small Birds at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011

Appendix D. Relative exposure index and flight characteristics by large bird species during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH based on initial obs	Exposure Index	% Within RSH at anytime
unidentified gull	1	0.11	100	100	0.11	100
red-tailed hawk	34	0.17	87.2	61.8	0.09	79.4
golden eagle	32	0.15	94.1	56.2	0.08	68.8
Swainson's hawk	20	0.10	95.2	65	0.06	65
northern harrier	11	0.09	100	62.5	0.05	66.7
rough-legged hawk	12	0.16	54.5	50.0	0.04	58.3
turkey vulture	17	0.08	100	47.1	0.04	58.8
ferruginous hawk	32	0.18	84.2	18.8	0.03	40.6
American white pelican	1	0.02	100	100	0.02	100
prairie falcon	23	0.11	100	13	0.01	26.1
Canada goose	1	<0.01	100	100	<0.01	100
common raven	10	0.04	100	9.1	<0.01	18.2
American crow	21	0.31	100	0	0	0
black-billed magpie	8	0.10	100	0	0	0
American kestrel	10	0.05	100	0	0	0
sharp-shinned hawk	2	0.01	66.7	0	0	0

RSH: The likely “rotor swept heights” for potential collision with a turbine blade, or 114-427 ft (35-130 m) above ground level (AGL).

Appendix D. Relative exposure index and flight characteristics for small birds during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 20, 2010 – April 11, 2011.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH based on initial obs	Exposure Index	% Within RSH at anytime
horned lark	175	2.70	89.9	0	0	0
McCown's longspur	87	0.83	96.2	0	0	0
vesper sparrow	30	0.38	98.9	0	0	0
mountain bluebird	23	0.36	85.9	0	0	0
Lapland longspur	18	0.28	96.4	0	0	0
Brewer's sparrow	10	0.07	93.3	0	0	0
dark-eyed junco	5	0.06	100	0	0	0
Clark's nutcracker	5	0.06	100	0	0	0
snow bunting	2	0.05	100	0	0	0
black-capped chickadee	2	0.05	100	0	0	0
western meadowlark	6	0.03	85.7	0	0	0
American pipit	4	0.03	100	0	0	0
loggerhead shrike	5	0.02	83.3	0	0	0
lark bunting	1	0.02	75.0	0	0	0
chipping sparrow	2	0.02	100	0	0	0
cliff swallow	4	0.02	100	0	0	0
western kingbird	4	0.02	100	0	0	0
lark sparrow	2	0.01	100	0	0	0
American tree sparrow	0	0.01	0	0	0	0
Cassin's sparrow	2	<0.01	100	0	0	0
American robin	2	<0.01	100	0	0	0
white-breasted nuthatch	2	<0.01	100	0	0	0
rock wren	1	<0.01	100	0	0	0
brown-headed cowbird	1	<0.01	100	0	0	0
northern flicker	1	<0.01	100	0	0	0
green-tailed towhee	0	<0.01	0	0	0	0

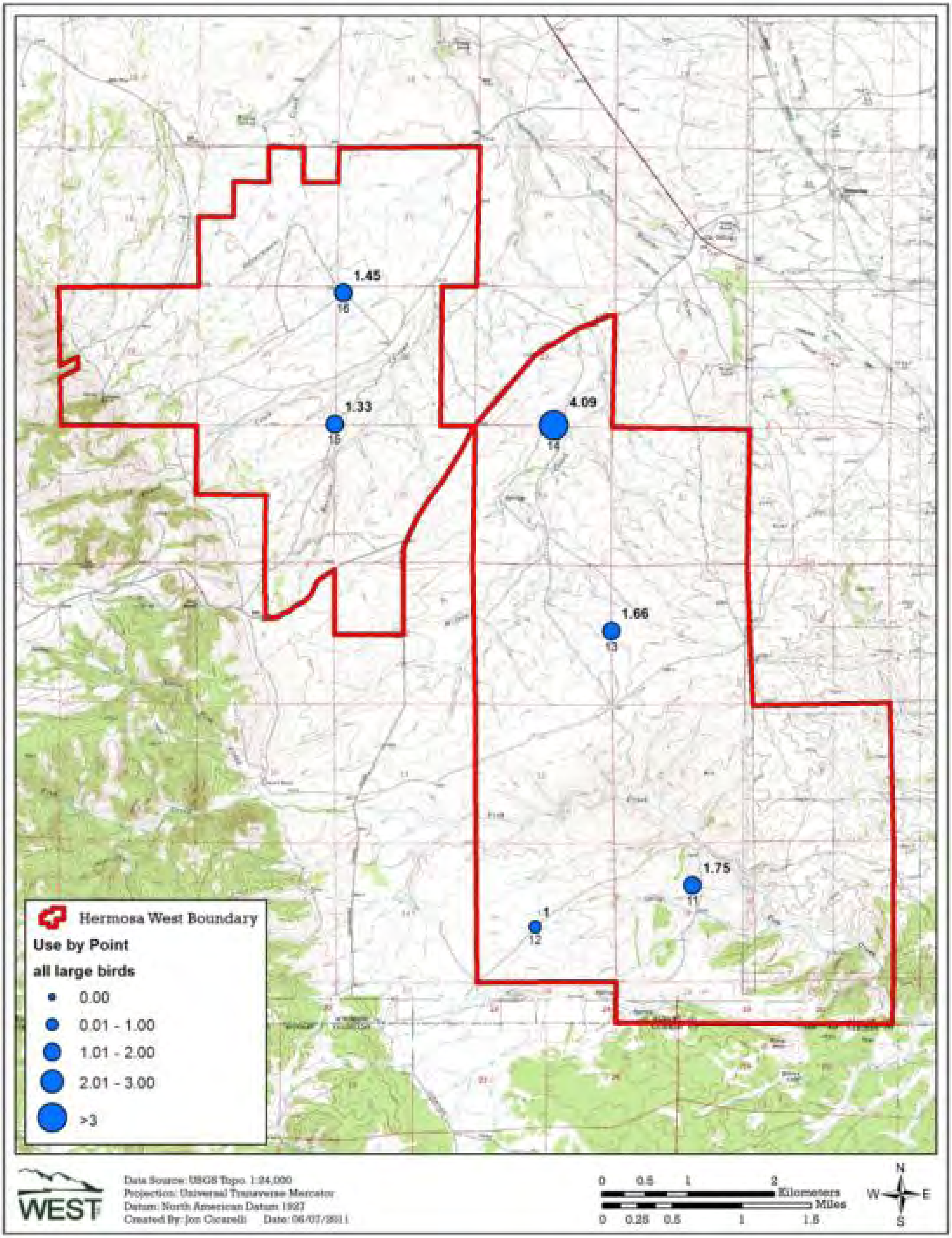
RSH: The likely “rotor swept heights” for potential collision with a turbine blade, or 114-427 ft (35-130 m) above ground level (AGL).

Appendix E: Mean Use by Point for All Birds, Major Bird Types, and Raptor Subtypes at Hermosa West Wind Resource Area April 20, 2010 to April 11, 2011

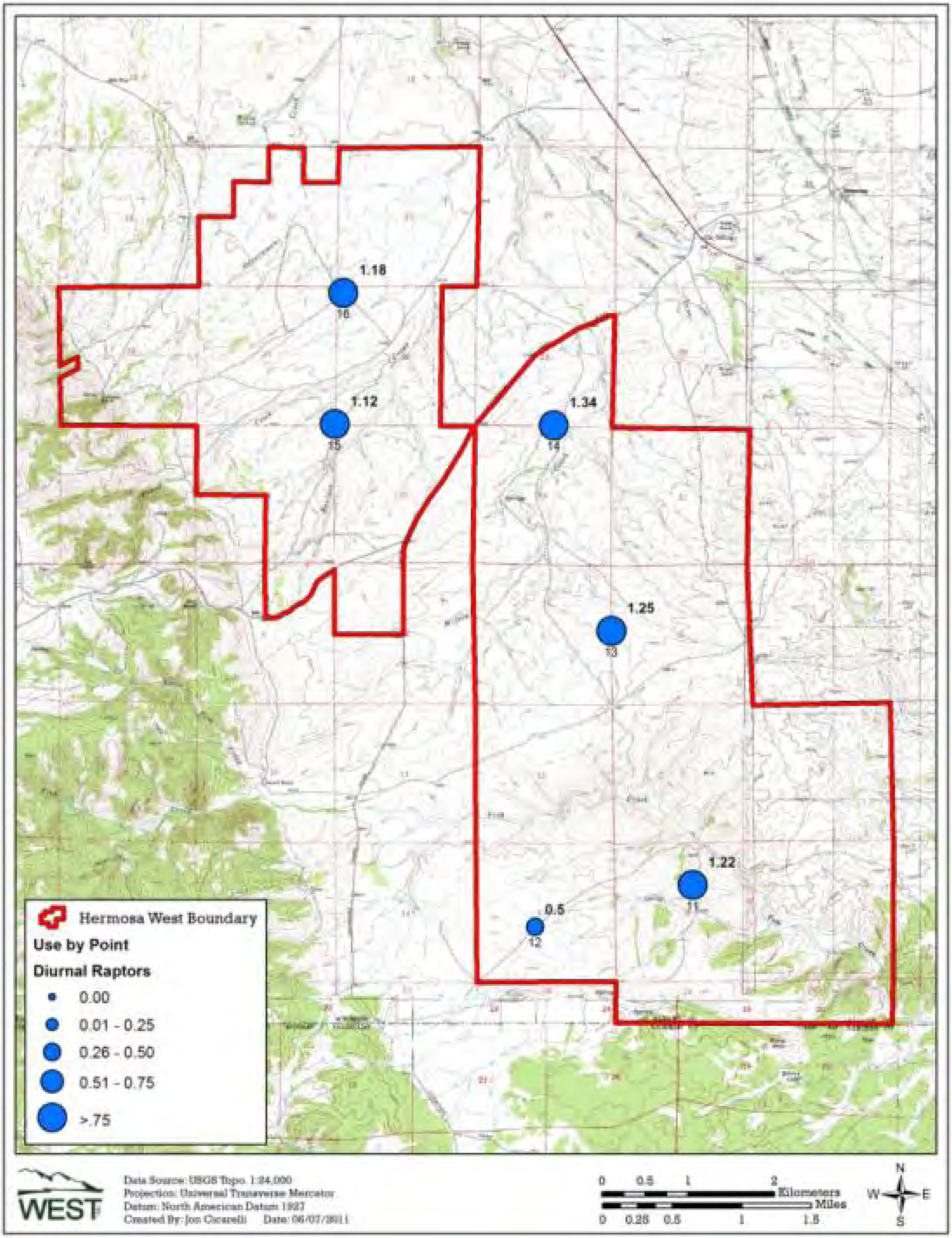
Appendix E. Mean use (number of birds/20-minute survey) by point for all birds[a], major bird types, and raptor subtypes observed at the Hermosa West Wind Resource Area during fixed-point bird use surveys between April 20, 2010 – April 11, 2011.

	Survey Point					
Bird Type	**H11**	**H12**	**H13**	**H14**	**H15**	**H16**
Waterbirds	0	0.16	0	0	0	0
Waterfowl	0.06	0	0	0	0	0
Gulls/Terns	0	0	0	0.94	0	0
Diurnal Raptors	1.22	0.50	1.25	1.34	1.12	1.18
Accipiters	*0.09*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.34*	*0.19*	*0.78*	*0.91*	*0.82*	*0.67*
Northern Harrier	*0.50*	*0.09*	*0.03*	*0.03*	*0.03*	*0.06*
Eagles	*0.12*	*0.06*	*0.19*	*0.12*	*0.21*	*0.33*
Falcons	*0.16*	*0.16*	*0.25*	*0.28*	*0.06*	*0.12*
Vultures	0.09	0.09	0.06	0.19	0.03	0.06
Large Corvids	0.38	0.25	0.34	1.62	0.18	0.21
Large Birds Overall	**1.75**	**1.00**	**1.66**	**4.09**	**1.33**	**1.45**
Passerines	4.47	10.47	3.56	4.38	5.91	4.3
Woodpeckers	0	0	0.03	0	0	0
Small Birds Overall	**4.47**	**10.47**	**3.59**	**4.38**	**5.91**	**4.3**

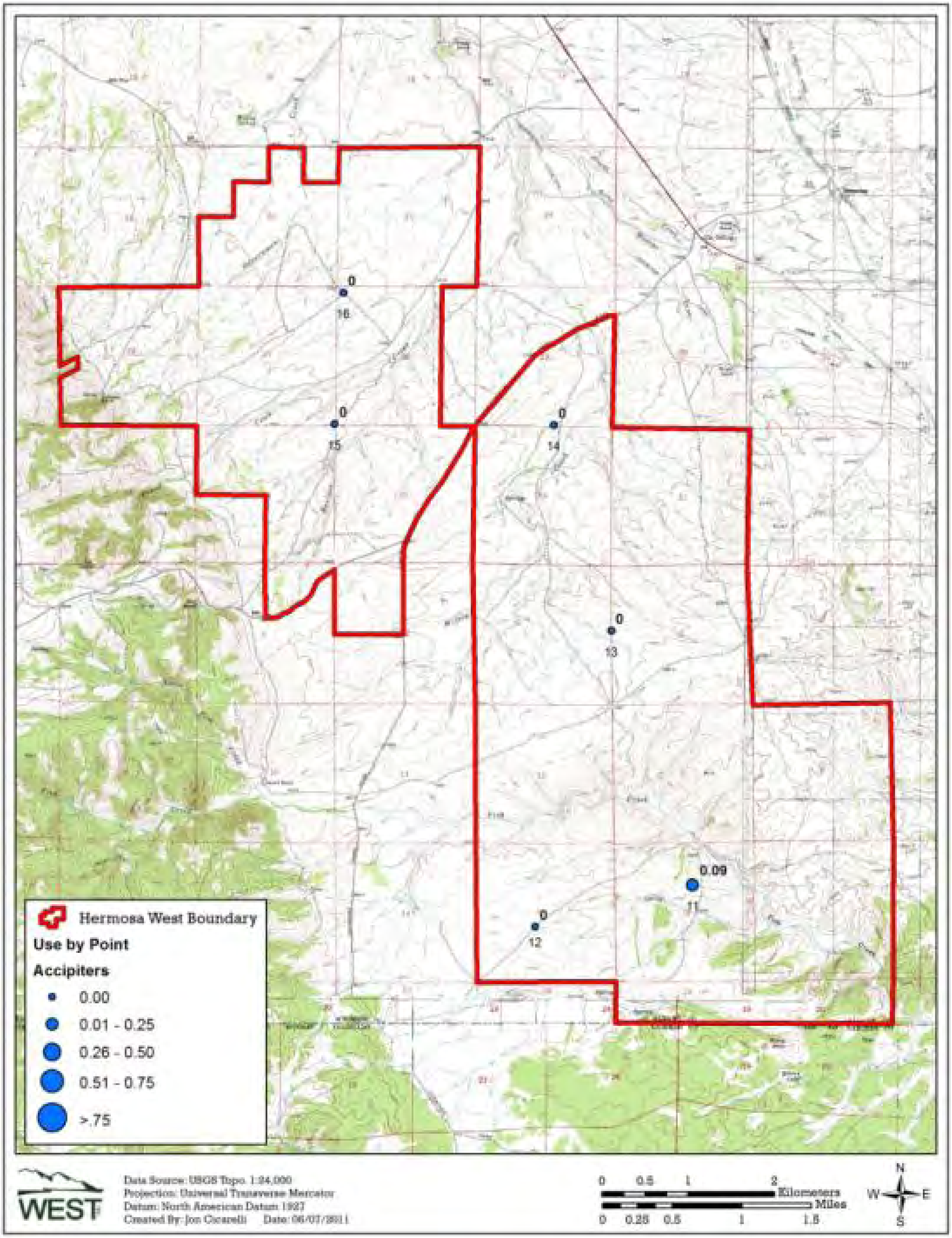
[a.] 800-meter (m) radius plot for large birds, 100-m for small birds.



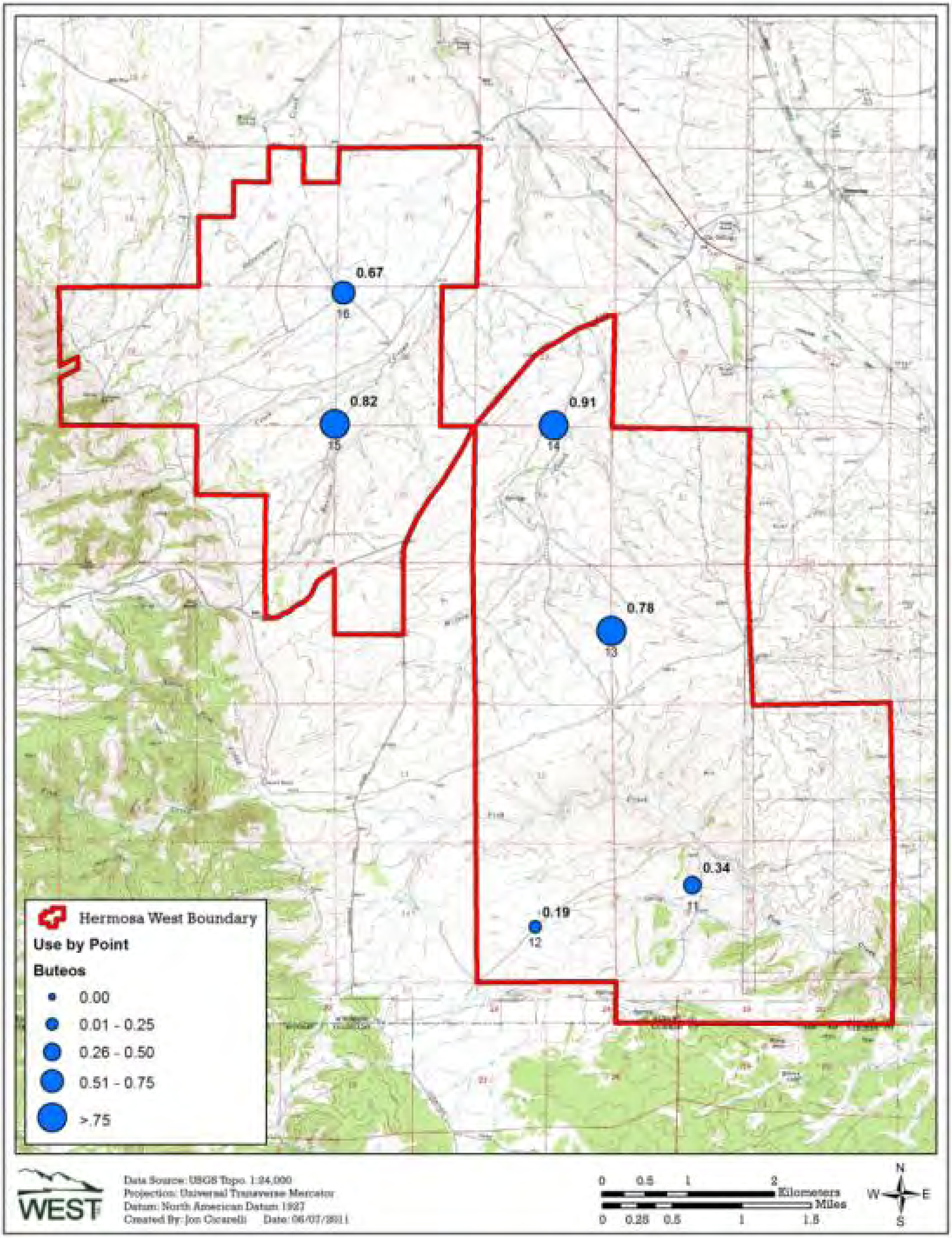
Appendix E. Bubble plot of large bird use by at observation points within the Hermosa West Wind Resource Area.



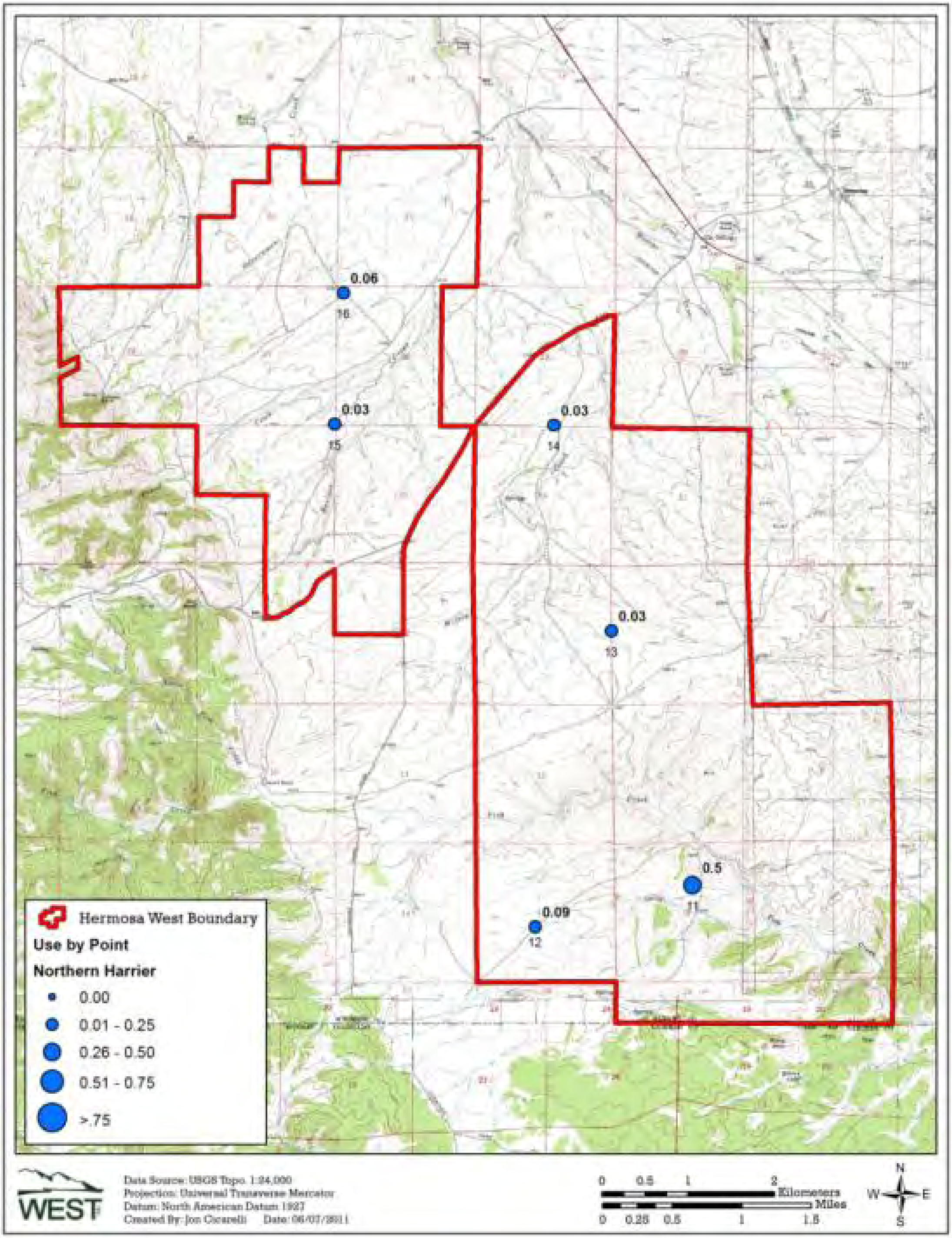
Appendix E. Bubble plot of use by diurnal raptors at observation points within the Hermosa West Wind Resource Area.



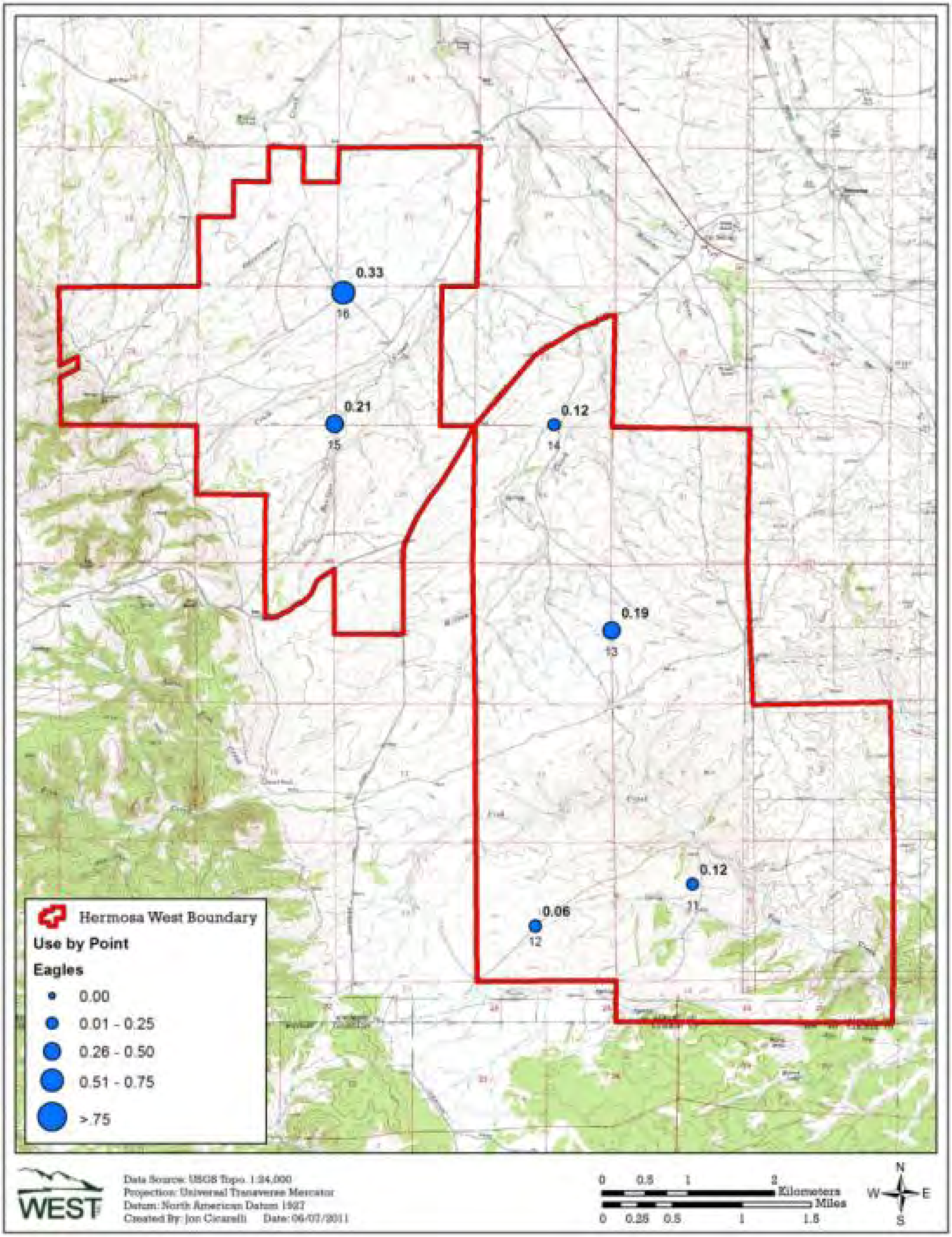
Appendix E. Bubble plot of use by accipiters at observation points within the Hermosa West Wind Resource Area.



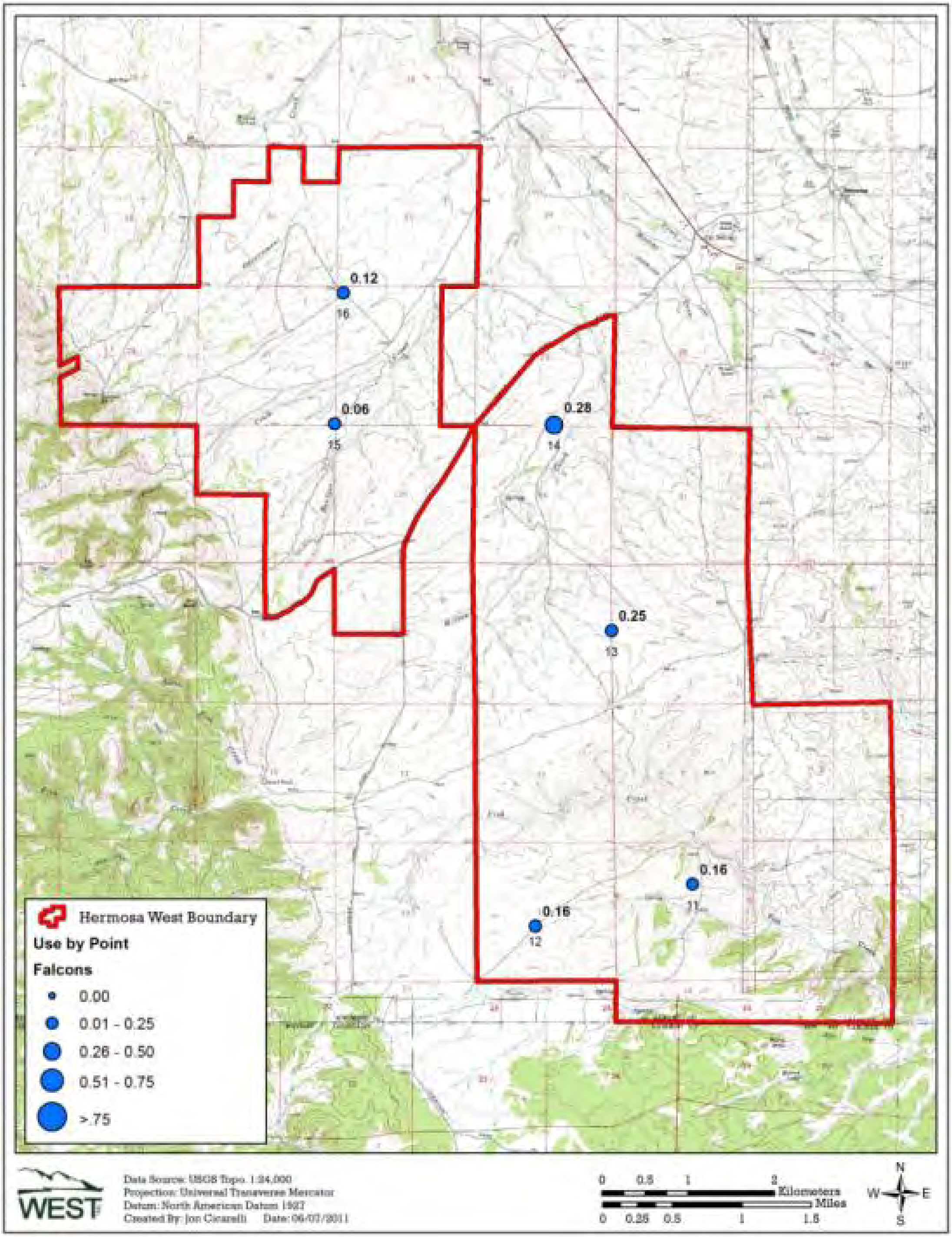
Appendix E. Bubble plot of use by buteos at observation points within the Hermosa West Wind Resource Area.



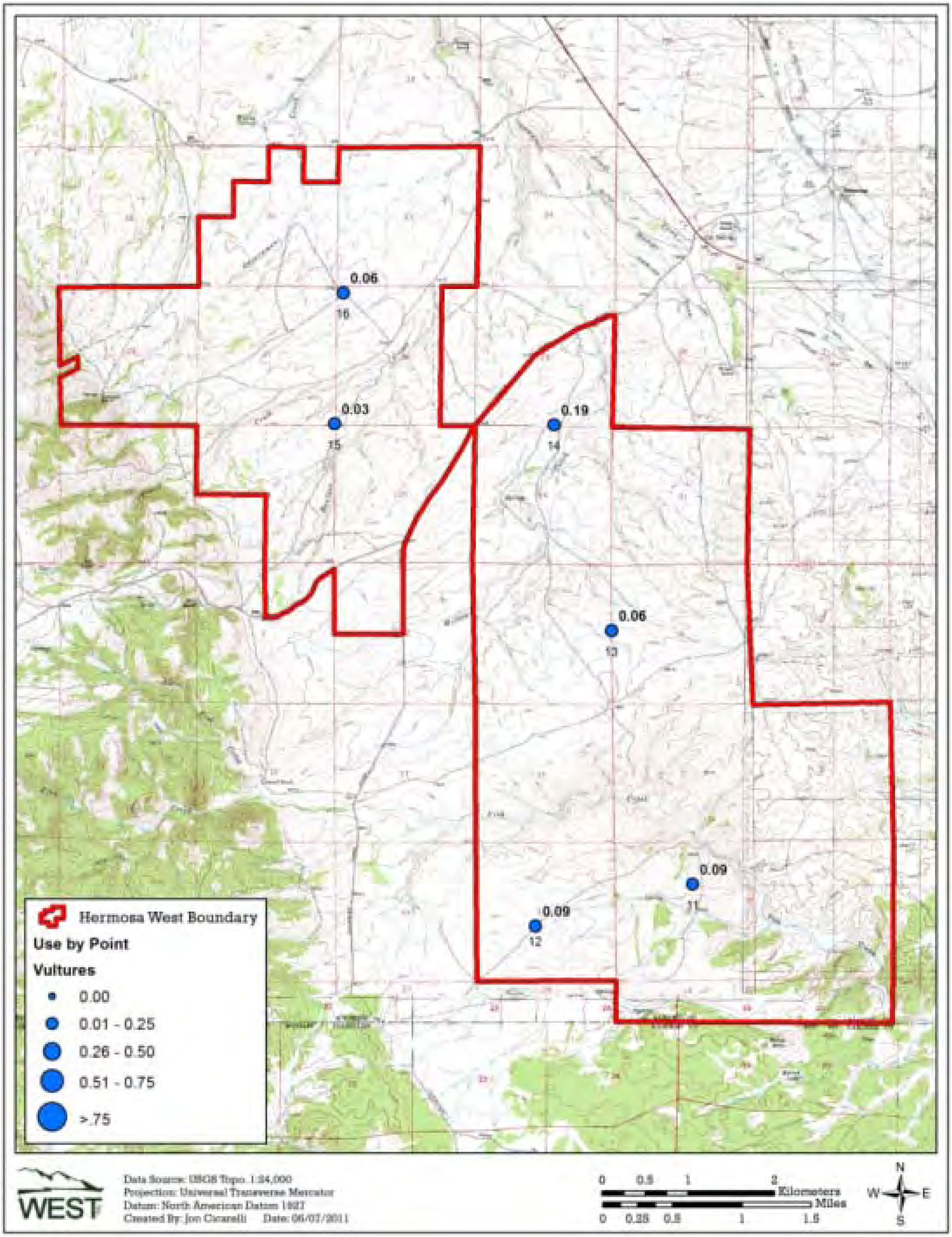
Appendix E. Bubble plot of use by northern harriers at observation points within the Hermosa West Wind Resource Area.



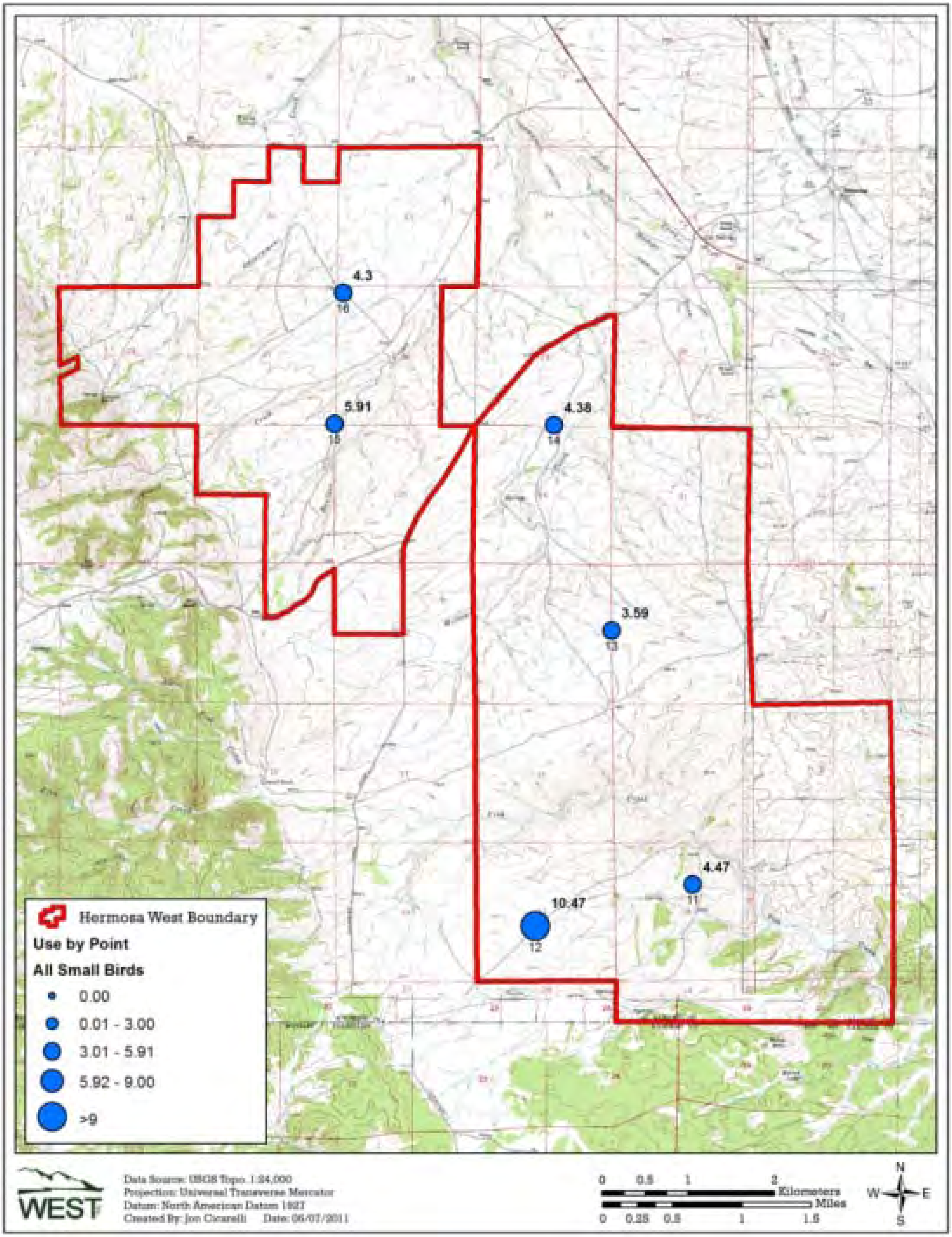
Appendix E. Bubble plot of use by eagles at observation points within the Hermosa West Wind Resource Area.



Appendix E. Bubble plot of use by falcons at observation points within the Hermosa West Wind Resource Area.

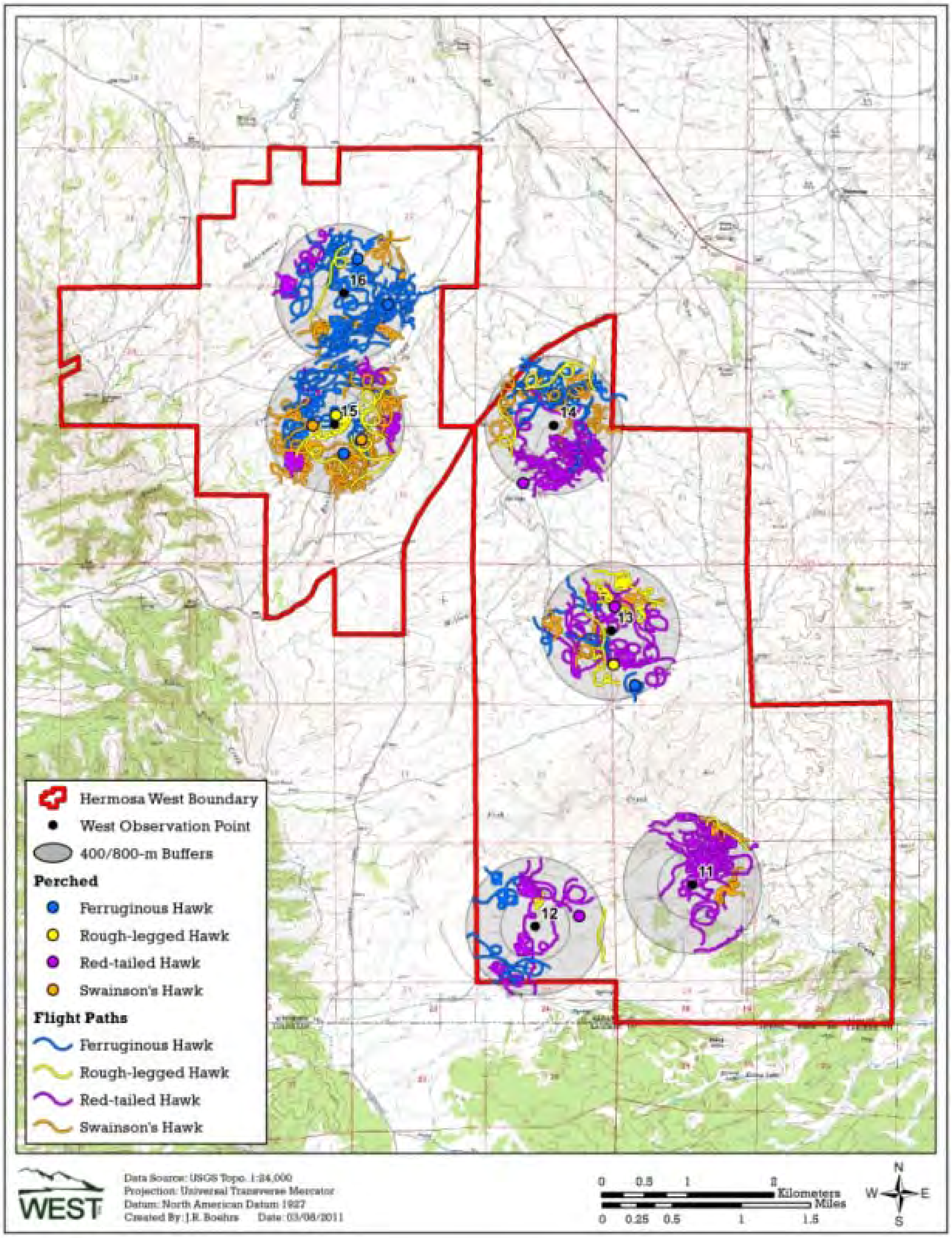


Appendix E. Bubble plot of use by turkey vultures at observation points within the Hermosa West Wind Resource Area.

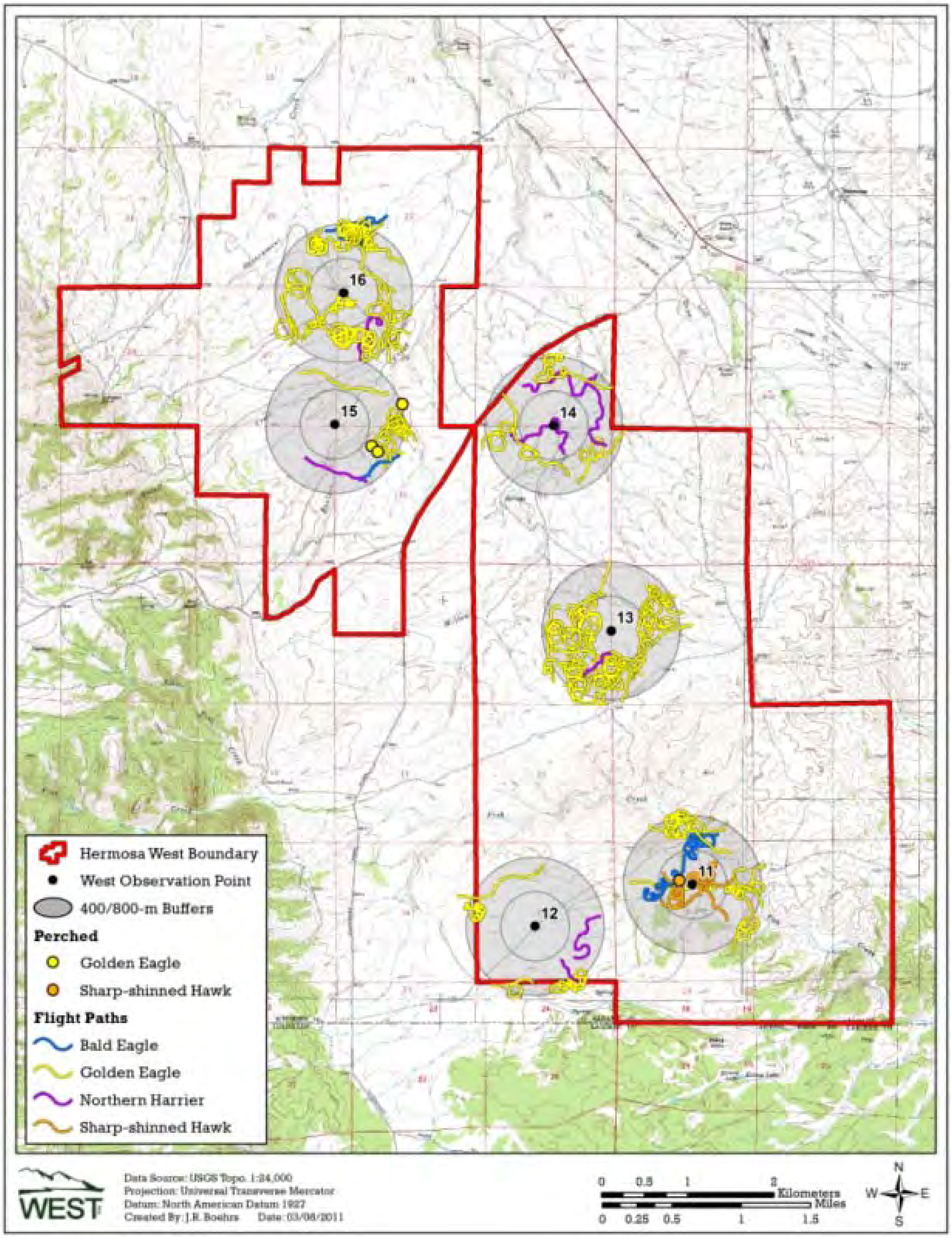


Appendix E. Bubble plot of use by small birds at observation points within the Hermosa West Wind Resource Area.

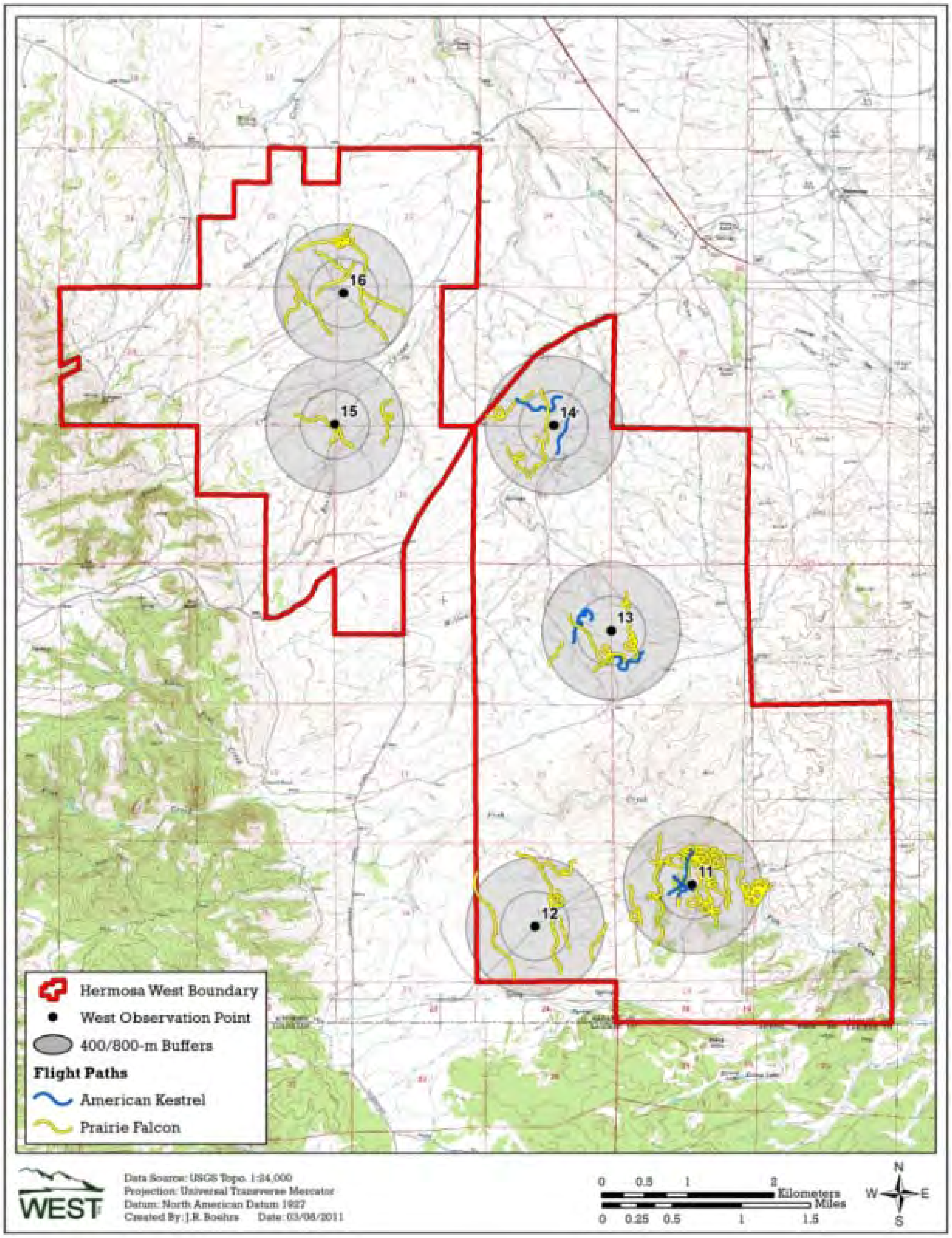
Appendix F: Mapped flight paths for raptors and vultures within the Hermosa West Wind Resource Area



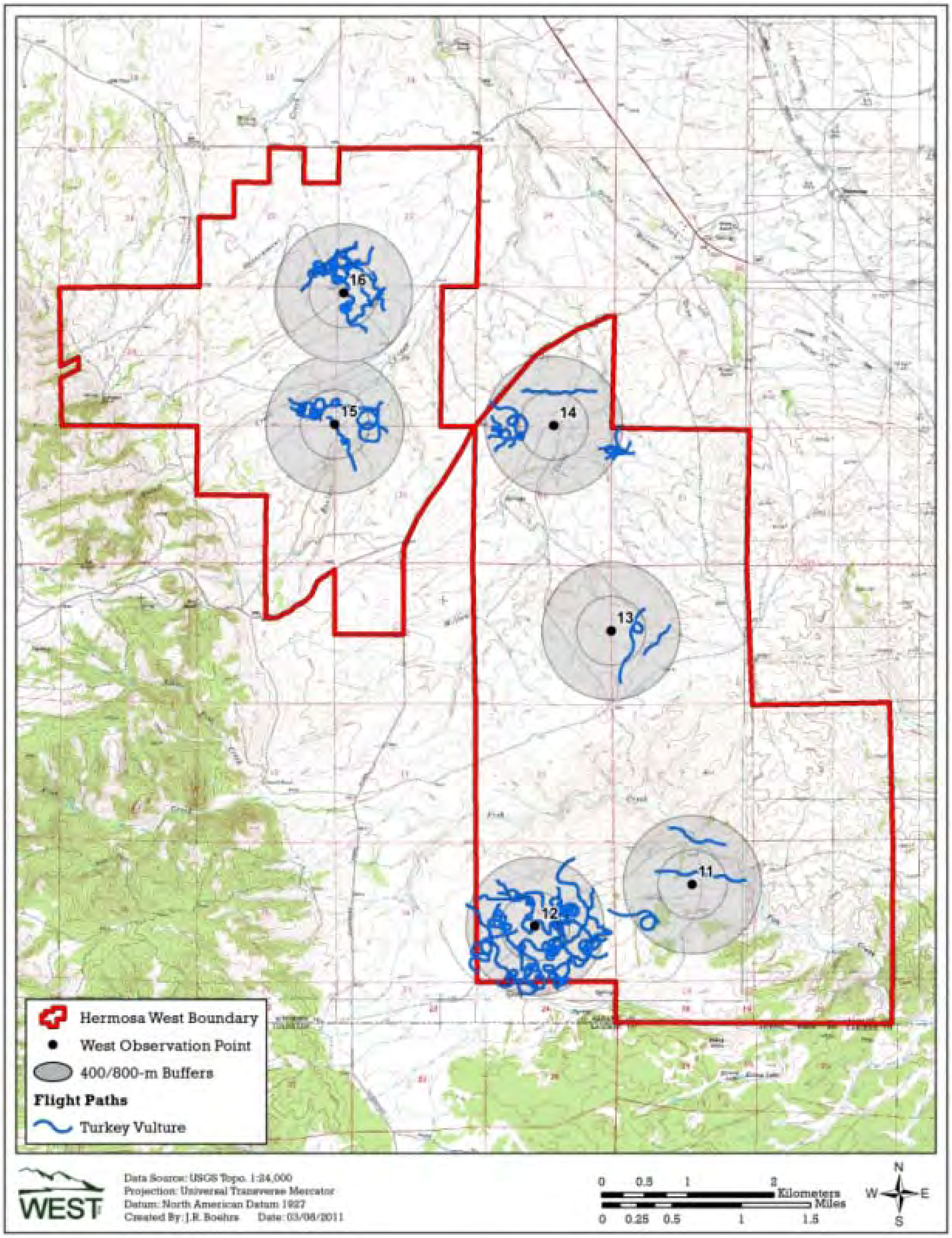
Appendix F. Flight paths for buteos within the Hermosa West Wind Resource Area.



Appendix F. Flight paths for accipiters and eagles within the Hermosa West Wind Resource Area.



Appendix F. Flight paths for falcons within the Hermosa West Wind Resource Area.



Appendix F. Flight paths for turkey vultures within the Hermosa West Wind Resource Area.

Appendix G: North American Fatality Summary Table

Appendix G. Wind energy facilities in North America with fatality data for all bird species, grouped by geographic region.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Rocky Mountains			
Foote Creek Rim, WY (Phase I; 1999)	3.40	69	41.4
Judith Gap, MT	3.01	90	135
Foote Creek Rim, WY (Phase I; 2000)	2.42	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)	1.93	69	41.4
Summerview, Alb. (2006)	1.06	39	70.2
Midwest			
Wessington Springs, SD	8.25	34	51
Blue Sky Green Field, WI	7.17	88	145
Cedar Ridge, WI	6.55	41	68
Buffalo Ridge, MN (Phase III; 1999)	5.93	138	103.5
Moraine II, MN	5.59	33	49.5
Buffalo Ridge I, SD	5.06	24	50.4
Winnebago, IA	3.88	10	20
Buffalo Ridge, MN (Phase II; 1999)	3.57	143	107.25
Ripley, Ont.	3.09	38	76
Buffalo Ridge, MN (Phase II; 1998)	2.46	143	107.25
Buffalo Ridge, MN (Phase I; 1996)	2.19	73	25
Kewaunee County, WI	1.98	31	20
Buffalo Ridge, MN (Phase I; 1998)	1.67	73	25
NPPD Ainsworth, NE	1.63	36	59.4
Elm Creek, MN	1.55	67	100
Buffalo Ridge, MN (Phase I; 1997)	1.33	73	25
Crescent Ridge, IL	0.87	33	49.5
Buffalo Ridge, MN (Phase I; 1999)	0.76	73	25
Top of Iowa, IA (2004)	0.73	89	80
Grand Ridge, IL	0.48	66	99
Top of Iowa, IA (2003)	0.42	89	80
Southern Plains			
Buffalo Gap, TX	1.32	67	134
Oklahoma Wind Energy Center, OK	0.08	68	102
California			
Dillon, CA	4.71	45	45
Diablo Winds, CA	4.29	31	20
High Winds, CA (2004)	1.62	90	162
High Winds, CA (2005)	1.10	90	162
SMUD Solano, CA	0.99		15

Appendix G. Wind energy facilities in North America with fatality data for all bird species, grouped by geographic region.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Pacific Northwest			
Biglow Canyon, OR (Phase II; 2009/2010)	7.72	65	150
Leaning Juniper, OR	6.66	67	100.5
Tuolumne (Windy Point I), WA	3.20	62	136.6
Stateline, OR/WA (2002)	3.17	454	263
Klondike II, OR	3.10	50	75
Klondike III, OR	3.02	122	375
Hopkins Ridge, WA (2008)	2.99	83	150
Nine Canyon, WA	2.76	37	48
Stateline, OR/WA (2003)	2.68	454	263
Combine Hills, OR	2.56	41	41
Big Horn, WA	2.54	133	199.5
Biglow Canyon, OR (Phase I; 2009)	2.47	76	125.4
Hay Canyon, OR	2.21	48	100.8
Pebble Springs, OR	1.93	47	98.7
Biglow Canyon, OR (Phase I; 2008)	1.76	76	125.4
Wild Horse, WA	1.55	127	229
Stateline II, OR/WA (2006)	1.23	454	263
Hopkins Ridge, WA (2006)	1.23	83	150
Vansycle, OR	0.95	38	24.9
Klondike, OR	0.95	16	24
Elkhorn, OR	0.64	61	101
Marengo I, WA	0.27	78	140.4
Marengo II, WA	0.16	39	70.2
Southeast			
Buffalo Mountain, TN (2000-2003)	13.93	3	1.98
Buffalo Mountain, TN (2005)	1.10	18	28.98
Northeast			
Maple Ridge, NY (2006)	5.81	120	198
Mount Storm, WV (2009)	5.73	82	164
Noble Ellenburg, NY (2009)	3.79	54	80
Maple Ridge, NY (2007)	3.44	195	321.75
Lempster, NH (2009)	3.38	12	24
Casselman, PA (Spring & Fall 2008)	3.13	23	34.5
Wolfe Island, Ont. (Report 2; July - December 2009)	3.04	86	197.8
Mountaineer, WV	3.00	44	66
Noble Bliss, NY (2008)	2.86	67	100
Noble Bliss, NY (2009)	2.81	67	100
Stetson Mountain, ME	2.68	38	57
Lempster, NH (2010)	2.64	12	24
Noble Clinton, NY (2008)	2.17	67	100
Maple Ridge, NY (2008)	2.07	195	321.75
Mount Storm, WV (2008)	1.91	82	164
Cohocton/Dutch Hill, NY	1.88	50	125
Mars Hill, ME (2008)	1.76	28	42
Mars Hill, ME (2007)	1.67	28	42
Munnsville, NY	1.48	23	34.5
Noble Ellenburg, NY (2008)	1.40	54	80
Noble Clinton, NY (2009)	1.17	67	100

A=number of bird fatalities/MW/study period

Appendix XX (*continued*). Wind energy facilities in North America with fatality data for all bird species, grouped by geographic region.

Data from the following sources:

Wind Energy Facility	Fatality Estimate	Wind Energy Facility	Fatality Estimate
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003c	Nine Canyon, WA	Erickson et al. 2003c
Judith Gap, MT	TRC 2008	Stateline, OR/WA (03)	Erickson et al. 2004
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003c	Combine Hills, OR	Young et al. 2006
Foote Creek Rim, WY (Phase I; 01/02)	Young et al. 2003c	Big Horn, WA	Kronner et al. 2008
Summerview, Alb. (2005/2006)	Brown and Hamilton 2006	Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010
Wessington Springs, SD	Derby et al. 2010g	Hay Canyon, OR	Gritski and Kronner 2010a
Blue Sky Green Field, WI	Gruver et al. 2009	Pebble Springs, OR	Gritski and Kronner 2010b
Cedar Ridge, WI	BHE Environmental 2010	Biglow Canyon I, OR (Phase I; 08)	Jeffrey et al. 2009a
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Wild Horse, WA	Erickson et al. 2008
Moraine II, MN	Derby et al. 2010f	Stateline II, OR/WA	Erickson et al. 2007
Buffalo Ridge I, SD	Derby et al. 2010c	Hopkins Ridge, WA (06)	Young et al. 2007a
Winnebago, IA	Derby et al. 2010b	Vansycle, OR	Erickson et al. 2000
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Klondike, OR	Johnson et al. 2003
Ripley, Ont.	Jacques Whitford 2009	Elkhorn, OR	Jeffrey et al. 2009b
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a	Marengo I, WA	URS Corporation 2010a
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Marengo II, WA	URS Corporation 2010b
Kewaunee County, WI	Howe et al. 2002	Buffalo Mountain, TN (00-03)	Nicholson et al. 2005
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	Buffalo Mountain, TN (05)	Fiedler et al. 2007
NPPD Ainsworth, NE	Derby et al. 2007	Maple Ridge, NY (06)	Jain et al. 2007
Elm Creek, MN	Derby et al. 2010e	Mount Storm, WV (09)	Young et al. 2010
Crescent Ridge, IL	Kerlinger et al. 2007	Noble Ellenburg, NY (09)	Jain et al. 2010c
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a	Maple Ridge, NY (07)	Jain et al. 2008
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a	Lempster, NH (09)	Tidhar et al. 2010
Top of Iowa, IA (04)	Jain 2005	Casselman, PA (Spring & Fall 08)	Arnett et al. 2009b
Grand Ridge, IL	Derby et al. 2010h	Wolfe Island, Ont. (Report 2: July-Dec. 09)	Stantec Ltd. 2010
Top of Iowa, IA (03)	Jain 2005	Mountaineer, WV	Kerns and Kerlinger 2004
Buffalo Gap, TX	Tierney 2007	Noble Bliss, NY (08)	Jain et al. 2009e
Oklahoma Wind Energy Center, OK	Piorkowski 2006	Noble Bliss, NY (09)	Jain et al. 2010a
Dillon, CA	Chatfield et al. 2009	Stetson Mountain, ME	Stantec 2009b
Diablo Winds, CA	WEST 2008	Lempster, NH (10)	Tidhar et al. 2011
High Winds, CA (04)	Kerlinger et al. 2006	Noble Clinton, NY (08)	Jain et al. 2009c
High Winds, CA (05)	Kerlinger et al. 2006	Maple Ridge, NY (08)	Jain et al. 2009d
SMUD Solano, CA	Erickson and Sharp 2005	Mount Storm, WV (08)	Young et al. 2009a
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011	Cohocton/Dutch Hill, NY	Stantec 2010
Leaning Juniper, OR	Gritski et al. 2008	Mars Hill, ME (08)	Stantec 2009a
Tuolumne (Windy Point I), WA	Enz and Bay 2010	Mars Hill, ME (07)	Stantec 2008a
Stateline, OR/WA (02)	Erickson et al. 2004	Munnsville, NY	Stantec 2008b
Klondike II, OR	NWC and WEST 2007	Noble Ellenburg, NY (08)	Jain et al. 2009b
Klondike III, OR	Gritski et al. 2009	Noble Clinton, NY (09)	Jain et al. 2010b
Hopkins Ridge, WA (08)	Young et al. 2009b		

Appendix G. Wind energy facilities in North America with use and fatality data for raptors, grouped by geographic region.

Wind Energy Facility	Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
Hermosa West, WY	**1.02**			
		Rocky Mountains		
Summerview, Alb. (2006)		0.11	39	70.2
Judith Gap, MT		0.09	90	135
Foote Creek Rim, WY (Phase I; 1999)		0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)		0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001-2002)		0	69	41.4
		Pacific Northwest		
Tuolumne (Windy Point I), WA		0.29	62	136.6
Leaning Juniper, OR	0.52	0.21	67	100.5
Biglow Canyon, WA (Phase II; 2009/2010)		0.20	65	150
Klondike III, OR		0.15	122	375
Big Horn, WA	0.51	0.15	133	199.5
Hopkins Ridge, WA (2006)	0.70	0.14	83	150
Stateline, OR/WA (2006)		0.11	454	263
Klondike II, OR	0.50	0.11	50	75
Stateline, OR/WA (2002)	0.23	0.09	454	263
Stateline, OR/WA (2003)	0.21	0.09	454	263
Wild Horse, WA	0.29	0.09	127	229
Hopkins Ridge, WA (2008)		0.07	83	150
Elkhorn, OR (2008)		0.06	61	101
Nine Canyon, WA		0.05	37	48
Marengo II, WA (2009)		0.05	39	70.2
Biglow Canyon, WA (Phase I; 2009)		0.04	76	125.4
Pebble Springs, OR		0.04	47	98.7
Biglow Canyon, WA (Phase I; 2008)		0.03	76	125.4
Hay Canyon, OR		0	48	100.8
Combine Hills, OR	0.75	0	41	41
Vansycle, OR	0.66	0	38	24.9
Klondike, OR	0.50	0	16	24
Marengo I, WA (2009)		0	78	140.4
		California		
Diablo Winds, CA	2.16	0.87	31	20
SMUD Solano, CA		0.53		15
Dillon, CA		0	45	45
		Midwest		
Moraine II, MN		0.37	33	49.5
Winnebago, IA		0.27	10	20
Buffalo Ridge I, SD		0.20	24	50.4
NPPD Ainsworth, NE		0.06	36	59.4
Grand Ridge, IL	0.20	0	66	99
Blue Sky Green Field, WI		0	88	145
Elm Creek, MN		0	67	100
		Southern Plains		
Buffalo Gap, TX		0.10	67	134
Oklahoma Wind Energy Center, OK		0	68	102
		Southeast		
Buffalo Mountain, TN (2005)		0	18	29
Buffalo Mountain, TN (2000-2003)		0	3	1.98

Appendix G. Wind energy facilities in North America with use and fatality data for raptors, grouped by geographic region.

Wind Energy Facility	Use Estimate[A]	Raptor Fatality Estimate[B]	No. of Turbines	Total MW
		Northeast		
Noble Ellenburg, NY (2009)		0.49	54	80
Noble Ellenburg, NY (2008)		0.32	54	80
Noble Clinton, NY (2008)		0.29	67	100.5
Maple Ridge, NY (2007)		0.25	195	321.75
Noble Clinton, NY (2009)		0.24	67	100
Noble Bliss, NY (2008)		0.19	67	100
Noble Bliss, NY (2009)		0.18	67	100
Maple Ridge, NY (2006)		0.04	120	198
Wolfe Island, Ont. (Report 2; July - December 2009)		0.04	86	197.8
Maple Ridge, NY (2008)		0.03	195	321.75
Mount Storm, WV (2008)		0	82	164

A=number of raptors/plot/20min survey
B=number of fatalities/MW/study period
Data from the following sources:

Wind Energy Facility	Use Estimate	Fatality Estimate	Wind Energy Facility	Use Estimate	Fatality Estimate
Summerview, Alb. (06)		Brown and Hamilton 2006	Klondike, OR	Johnson et al. 2002a	Johnson et al. 2003
Judith Gap, MT		TRC 2008	Marengo I, WA		URS Corporation 2010a
Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003c	Diablo Winds, CA	WEST 2006	WEST 2008
Foote Creek Rim, WY (Phase I; 00)		Young et al. 2003c	SMUD Solano, CA		Erickson and Sharp 2005
Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003c	Dillon, CA		Chatfield et al. 2009
Tuolumne (Windy Point I), WA		Enz and Bay 2010	Moraine II, MN		Derby et al. 2010f
Leaning Juniper, OR	Kronner et al. 2005	Gritski et al. 2008	Winnebago, IA		Derby et al. 2010b
Biglow Canyon, OR (Phase II; 09/10)		Enk et al. 2011	Buffalo Ridge, SD		Derby et al. 2010c
Klondike III, OR		Gritski et al. 2009	NPPD Ainsworth, NE		Derby et al. 2007
Big Horn, WA	Johnson and Erickson 2004	Kronner et al. 2008	Grand Ridge, IL	Derby et al. 2009	Derby et al. 2010h
Hopkins Ridge, WA (06)	Young et al. 2003a	Young et al. 2007a	Blue Sky Green Field, WI		Gruver et al. 2009
Stateline, OR/WA (06)		Young et al. 2007a	Elm Creek, MN		Derby et al. 2010d
Klondike II, OR	Johnson 2004	NWC and WEST 2007	Buffalo Gap, TX		Tierney 2007
Stateline, OR/WA (02)	Erickson et al. 2002b	Erickson et al. 2004	Oklahoma Wind Energy Center, OK		Piorkowski 2006
Stateline, OR/WA (03)	Erickson et al. 2003b	Erickson et al. 2004	Buffalo Mountain, TN (05)		Fiedler et al. 2007
Wild Horse, WA	Erickson et al. 2003d	Erickson et al. 2008	Buffalo Mountain, TN (00-03)		Nicholson 2003, Nicholson et al. 2005
Hopkins Ridge, WA (08)		Young et al. 2009b	Noble Ellenburg, NY (09)		Jain et al. 2010c
Elkhorn, OR		Jeffrey et al. 2009b	Noble Ellenburg, NY (08)		Jain et al. 2009b
Nine Canyon, WA	Erickson et al. 2001b	Erickson et al. 2003c	Noble Clinton, NY (08)		Jain et al. 2009c
Marengo II, WA		URS Corporation 2010b	Maple Ridge, NY (07)		Jain et al. 2009a
Biglow Canyon, WA (Phase I; 09)		Enk et al. 2010	Noble Clinton, NY (09)		Jain et al. 2010b
Pebble Springs, OR		Gritski and Kronner 2010b	Noble Bliss, NY (08)		Jain et al. 2009e
Biglow Canyon, WA (Phase I; 08)		Jeffrey et al. 2009a	Noble Bliss, NY (09)		Jain et al. 2010a
Hay Canyon, OR		Gritski and Kronner 2010a	Maple Ridge, NY (06)		Jain et al. 2007
Combine Hills, OR	Young et al. 2003d	Young et al. 2006	Wolfe Island, Ont. (Rprt 2: July-Dec. 09)		Stantec Ltd. 2010
Vansycle, OR	WCIA and WEST 1997	Erickson et al. 2000	Maple Ridge, NY (08)		Jain et al. 2009d
Klondike, OR	Johnson et al. 2002a	Johnson et al. 2003	Mount Storm, WV (08)		Young et al. 2009a
Marengo II, WA		URS Corporation 2010b			

Appendix G. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Hermosa West, WY	**2.66**			
Midwest				
Cedar Ridge, WI		30.61[F]	41	67.6
Blue Sky Green Field, WI	7.7[D]	24.57	88	145
Top of Iowa, IA (2004)	34.9[C]	10.27	89	80
Fowler Ridge I, IN (2009)		8.09	162	301
Crystal Lake II, IA		7.42[E]	80	200
Top of Iowa, IA (2003)	34.9[C]	7.16	89	80
Kewaunee County, WI		6.45	31	20
Ripley, Ont.		4.67	38	76
Winnebago, IA		4.54	10	20
Buffalo Ridge, MN (Phase II; 2001)		4.35	143	107.25
Buffalo Ridge, MN (Phase III; 2001)		3.71	138	103.5
Crescent Ridge, IL		3.27	33	49.5
Buffalo Ridge, MN (Phase III; 1999)		2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)		2.59	143	107.25
Morraine II, MN		2.42	33	49.5
Buffalo Ridge, MN (Phase II; 1998)		2.16	143	107.25
Grand Ridge, IL		2.10	66	99
Fowler Ridge III, IN (2009)		1.84[G]	60	99
Buffalo Ridge, MN (Phase III; 2002)		1.81	138	103.5
Buffalo Ridge, MN (Phase II; 2002)		1.64	143	107.25
Elm Creek, MN		1.49	67	100
Wessington Springs, SD	0.18	1.48	34	51
NPPD Ainsworth, NE		1.16	36	59.4
Buffalo Ridge, MN (Phase I; 1999)		0.39	73	25
Buffalo Ridge I, SD		0.16	24	50.4
Timber Road II, OH	2.78			
Rocky Mountains				
Summerview, Alb. (2008)	5.3	11.42	39	70.2
Summerview, Alb. (2006)		10.27	39	70.2
Judith Gap, MT		8.93	90	135
Foote Creek Rim, WY (Phase I; 1999)		3.97	69	41.4
Foote Creek Rim, WY (Phase I; 2001-2002)		1.57	69	41.4
Foote Creek Rim, WY (Phase I; 2000)	2.2	1.05	69	41.4
Southern Plains				
Oklahoma Wind Energy Center, OK		0.53	68	102
Buffalo Gap, TX		0.10	67	134

Appendix G. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
	California			
High Winds, CA (2004)		2.51	90	162
Dillon, CA		2.17	45	45
High Winds, CA (2005)		1.52	90	162
SMUD Solano, CA		0.07		15
Alta-Oak Creek Mojave, CA	2.5			
	Pacific Northwest			
Biglow Canyon, OR (Phase II; 2009/2010)		3.78	65	150
Nine Canyon, WA		2.47	37	48
Stateline, OR/WA (2003)		2.29	454	263
Biglow Canyon, OR (Phase I; 2008)		1.99	76	125.4
Leaning Juniper, OR		1.98	67	100.5
Big Horn, WA		1.90	133	199.5
Combine Hills, OR		1.88	41	41
Pebble Springs, OR		1.55	47	98.7
Hopkins Ridge, WA (2008)		1.39	87	156.6
Elkhorn, OR (2008)		1.26	61	101
Vansycle, OR		1.12	38	24.9
Klondike III, OR		1.11	122	375
Stateline, WA/OR (2002)		1.09	454	263
Stateline, WA/OR (2006)		0.95	454	263
Tuolumne (Windy Point I), WA		0.94	62	136.6
Klondike, OR		0.77	16	24
Hopkins Ridge, WA (2006)		0.63	83	150
Biglow Canyon, OR (Phase I; 2009)		0.58	76	125.4
Hay Canyon, OR		0.53	48	100.8
Klondike II, OR		0.41	50	75
Wild Horse, WA		0.39	127	229
Marengo II, WA (2009)		0.27	39	70.2
Marengo I, WA (2009)		0.17	78	140.4

Appendix G. Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Wind Energy Facility	Bat Activity Estimate[A]	Fatality Estimate[B]	No. of Turbines	Total MW
Northeast				
Mountaineer, WV	38.3	31.69	44	66
Mount Storm, WV (2009)		24,32	132	264
Meyersdale, PA		18.00	20	30
Cohocton/Dutch Hill, NY		16.02	50	125
Maple Ridge, NY (2006)		15.00	120	198
Noble Bliss, NY (2008)		14.66	67	100
Casselman, PA (Spring and Fall 2008)		12.61	23	34.5
Mount Storm, WV (2008)	35.2	12.11	82	164
Casselman, PA (Fall 2008)		9.91	23	34.5
Maple Ridge, NY (2007)		9.42	195	321.75
Noble Clinton, NY (2009)		6.48	67	100
Wolfe Island, Ont. (Report 2; July - December 2009)		6.42	86	197.8
Noble Bliss, NY (2009)		5.50	67	100
Noble Ellenburg, NY (2008)		5.45	54	80
Noble Ellenburg, NY (2009)		5.34	54	80
Maple Ridge, NY (2008)		4.96	195	321.75
Noble Clinton, NY (2008)		3.63	67	100.5
Lempster, NH (2010)		3.57	12	24
Lempster, NH (2009)		3.08	12	24
Mars Hill, ME (2007)		2.91	28	42
Munnsville, NY (2008)		1.93	23	34.5
Stetson Mountain, ME	0.30	1.40	38	57
Mars Hill, ME (2008)		0.45	28	42
Southeast				
Buffalo Mountain, TN (2005)		39.70	18	29
Buffalo Mountain, TN (2000-2003)	23.7	31.54	3	2

A=bat passes per detector-night
B=number of bats fatalities/MW/study period
C=averaged across phases and/or study years, and may not be directly related to fatality estimates
D=bat activity not measured concurrently with bat fatality studies
E=number of bat fatalities/MW/season of occupancy
F=number of bat fatalities/MW spring and fall survey period only
G= number of bat fatalities/MW/spring season only

Appendix G (*continued*). Wind energy facilities in North America with activity and fatality data for bats, grouped by geographic region.

Data from the following sources:

Facility	Activity Estimate	Fatality Estimate
Cedar Ridge, WI		BHE Environmental 2010
Blue Sky Green Field, WI	Gruver 2008	Gruver et al. 2009
Top of Iowa, IA (2004)	Jain 2005	Jain 2005
Fowler Ridge I, IN		Good et al. 2011
Crystal Lake II, IA		Derby et al. 2010a
Top of Iowa, IA (2003)	Jain 2005	Jain 2005
Kewaunee County, WI		Howe et al. 2002
Ripley, Ont.		Jacques Whitford 2009
Winnebago, IA		Derby et al. 2010b
Buffalo Ridge, MN (Phase II; 01)		Johnson et al. 2004
Buffalo Ridge, MN (Phase III; 01)		Johnson et al. 2004
Crescent Ridge, IL		Kerlinger et al. 2007
Buffalo Ridge, MN (Phase III; 99)		Johnson et al. 2004
Buffalo Ridge, MN (Phase II; 99)		Johnson et al. 2004
Moraine II, MN		Derby et al. 2010e
Buffalo Ridge, MN (Phase II; 98)		Johnson et al. 2004
Grand Ridge, IL		Derby et al. 2010h
Fowler Ridge III, IN		Good et al. 2011
Buffalo Ridge, MN (Phase III; 02)		Johnson et al. 2004
Buffalo Ridge, MN (Phase II; 02)		Johnson et al. 2004
Elm Creek, MN		Derby et al. 2010e
Wessington Springs, SD	Derby et al. 2008	Derby et al. 2010g
NPPD Ainsworth, NE		Derby et al. 2007
Buffalo Ridge, MN (Phase I; 99)		Johnson et al. 2000a
Buffalo Ridge, SD		Derby et al. 2010c
Timber Road II, OH	Good et al. 2009	
Summerview, Alb. (08)	Baerwald 2008	Baerwald 2008
Summerview, Alb. (06)		Brown and Hamilton 2006
Judith Gap, MT		TRC 2008
Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003c
Foote Creek Rim, WY (Phase I; 01/02)		Young et al. 2003c
Foote Creek Rim, WY (Phase I; 00)	Gruver 2002	Young et al. 2003c
Oklahoma Wind Energy Center, OK		Piorkowski 2006
Buffalo Gap, TX		Tierney 2007
High Winds, CA (04)		Kerlinger et al. 2006
Dillon, CA		Chatfield et al. 2009
High Winds, CA (05)		Kerlinger et al. 2006
SMUD Solano, CA		Erickson and Sharp 2005
Alta-Oak Creek Mojave, CA	Erickson et al. 2010	
Biglow Canyon, OR (Phase II; 09/10)		Enk et al. 2011
Nine Canyon, WA		Erickson et al. 2003c
Stateline, OR/WA (03)		Erickson et al. 2004
Biglow Canyon, OR (Phase I; 08)		Jeffrey et al. 2009a
Leaning Juniper, OR		Gritski et al. 2008
Big Horn, WA		Kronner et al. 2008
Combine Hills, OR		Young et al. 2006
Pebble Springs, OR		Gritski and Kronner 2010b
Hopkins Ridge, WA (08)		Young et al. 2009b
Elkhorn, OR (08)		Jeffrey et al. 2009b
Vansycle, OR		Erickson et al. 2000
Klondike III, OR		Gritski et al. 2009
Stateline, OR/WA (02)		Erickson et al. 2004
Stateline, OR/WA (06)		Erickson et al. 2007
Tuolumne (Windy Point I), WA		Enz and Bay 2010
Klondike, OR		Johnson et al. 2003
Hopkins Ridge, WA (06)		Young et al. 2007a
Biglow Canyon, OR (Phase I; 09)		Enk et al. 2010
Hay Canyon, OR		Gritski and Kronner 2010a
Klondike II, OR		NWC and WEST 2007
Wild Horse, WA		Erickson et al. 2008
Marengo II, WA		URS Corporation 2010b
Marengo I, WA		URS Corporation 2010a
Buffalo Mountain, TN (05)		Fiedler et al. 2007
Buffalo Mountain, TN (00-03)	Fiedler 2004	Nicholson et al. 2005
Mountaineer, WV	Arnett (pers comm. 2005)	Kerns and Kerlinger 2004
Mount Storm, WV (09)		Young et al. 2010
Meyersdale, PA		Arnett et al. 2005
Cohocton/Dutch Hill, NY		Stantec 2010
Maple Ridge, NY (06)		Jain et al. 2007
Noble Bliss, NY (08)		Jain et al. 2009e
Casselman, PA (Spring & Fall 08)		Arnett et al. 2009b
Mount Storm, WV (08)	Young et al. 2009a	Young et al. 2009a
Casselman, PA (Fall 08)		Arnett et al. 2009a
Maple Ridge, NY (07)		Jain et al. 2008
Noble Clinton, NY (09)		Jain et al. 2010b
Wolfe Island, Ont. (Rprt 2: July-Dec. 09)		Stantec Ltd. 2010
Noble Bliss, NY (09)		Jain et al. 2010a
Noble Ellenburg, NY (08)		Jain et al. 2009b
Noble Ellenburg, NY (09)		Jain et al. 2010c
Maple Ridge, NY (08)		Jain et al. 2009d
Noble Clinton, NY (08)		Jain et al. 2009c
Lempster, NH (09)		Tidhar et al. 2010
Lempster, NH (10)		Tidhar et al. 2011
Mars Hill, ME (07)		Stantec 2008a
Munnsville, NY		Stantec 2008b
Stetson Mountain, ME	Stantec 2009b	Stantec 2009b
Mars Hill, ME (08)		Stantec 2009a

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WILDLIFE BASELINE STUDIES, FINAL REPORT, APRIL 2009 – APRIL 2010

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Wildlife Baseline Studies for the Hermosa West Wind Resource Area Albany County, Wyoming

Final Report
April 2009 – April 2010

Prepared for:

Shell WindEnergy, Inc.

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Western **E**co**S**ystems **T**echnology**,** Inc.

2003 Central Avenue
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WEST, Inc.

July 16, 2010

EXECUTIVE SUMMARY

Shell WindEnergy, Inc. has proposed a wind-energy facility in Albany County, Wyoming, referred to as the Hermosa West Wind Resource Area. Shell WindEnergy, Inc. contracted Western EcoSystems Technology, Inc. to conduct surveys and monitor wildlife resources in the Hermosa West Wind Resource Area to estimate the impacts of facility construction and operations on wildlife. The following document contains results for fixed-point bird use surveys, raptor nest surveys, vegetation and habitat mapping, and incidental wildlife observations. Bat acoustical surveys are summarized in a separate report.

The principal objectives of the baseline wildlife studies were to: 1) provide site-specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed wind-energy facility, 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats, and 3) recommend further studies or potential mitigation measures, if warranted.

The proposed wind-energy facility is dominated by grasslands. Vegetation/habitat mapping determined that approximately 87.6% of the Hermosa West Wind Resource Area contains grasslands, while the remaining areas are comprised of coniferous forest, riparian, mountain mahogany, shrub steppe, and riparian/willow. In addition to the vegetation and habitat mapping effort, two small white-tailed prairie dog colonies were identified and mapped within the Hermosa West Wind Resource Area.

The objective of the fixed-point bird use surveys was to estimate the seasonal, spatial, and temporal use of the Hermosa West Wind Resource Area by birds, particularly raptors. Fixed-point bird surveys were conducted from April 29, 2009, through April 13, 2010, at six points established throughout the Hermosa West Wind Resource Area. A total of 194 20-minute fixed-point bird surveys were completed and 45 unique bird species were identified, representing 1,903 individuals in 848 separate groups. A total of 156 individual raptors were recorded, representing 10 species.

Two mallards were recorded during fall surveys (0.03 birds/800-meter plot/20-minute survey) and were the only waterfowl observed during fixed-point bird use surveys. Waterbird use was highest in the spring (0.65 birds/plot/20-minute survey), with the majority of use by sandhill crane. Raptor use was highest during the fall and summer (0.98 and 0.94 birds/plot/20-minute survey), followed by spring (0.74) and winter (0.44). The most common raptors observed in the study area were red-tailed hawk and ferruginous hawk. Passerine use ranged from 10.28 birds/100-meter plot/20-minute survey in fall to 6.85 in spring. However, the focus for small birds was within a 100-meter viewshed, thus use by small bird types is not directly comparable to the large bird types.

During the study, 194 groups of large birds totaling 276 individuals were observed flying during fixed-point bird use surveys. For all large bird species combined, 61.6% of birds were observed flying below the likely rotor-swept heights, 37.7% were within the rotor-swept heights, and 0.7% were observed flying above the rotor-swept heights for typical turbines that could be used in the

Hermosa West Wind Resource Area. Raptors were typically observed below the rotor-swept heights (62.6%). However, the remaining 37.4% of flying raptors were observed within the rotor-swept heights. Bird types most often observed flying within the turbine rotor-swept heights were waterfowl (100%), waterbirds (66.7%), and vultures (47.8%). A total of 1,546 passerines or other small bird species within 588 separate groups were observed flying in the 100-meter plot. All flying passerines and other small birds were observed below the estimated rotor-swept heights.

Five large bird species had at least 20 separate groups of flying birds (golden eagle, red-tailed hawk, turkey vulture, ferruginous hawk, and Swainson’s hawk), and only golden eagle was observed within the rotor-swept heights during at least half of initial observations (59.3%). Based on the use (measure of abundance) of the Hermosa West Wind Resource Area by each species and the flight characteristics observed for that species, the sandhill crane had the highest probability of turbine exposure, with an exposure index of 0.13. The raptor species with the highest exposure indices were golden eagle (0.08) and red-tailed hawk (0.07), which were ranked second and third out of all large bird species. For passerines and other small birds (within 100 meters), no individuals were observed flying within the rotor-swept heights; therefore, all small bird species had an exposure index of zero.

Levels of bird use varied within the Hermosa West Wind Resource Area by point. For all large bird species combined, use was highest at point 16 (2.66 birds/20-minute survey); large bird use at the other points ranged from 0.82 to 1.68 birds/20-minute survey. Higher large bird use at point 16 was largely due to waterbird use at this point (1.16 birds/20-minute survey). Waterbirds were only recorded at one other point (13) and use was 0.55. Raptor use was also highest at point 16 (1.19 birds/20-minute survey), comprised primarily of buteo and eagle use. Passerine use (within 100 meters) was highest at point 12, with 13.2 birds/20-minute survey, and ranged from 5.97 to 8.59 at other points.

Mapped flight paths suggest that the northern portion of the Hermosa West Wind Resource Area had increased ferruginous hawk flights. Prairie falcon flight paths were more numerous in the vicinity of point 11 than at other points. Points 13 and 16 had a higher number of mapped golden eagle flight paths compared to other points. Turkey vulture flight paths were more numerous in the vicinity of point 12.

The annual mean raptor use estimate (number of raptors divided by the number of plots and the total number of surveys) in the Hermosa West Wind Resource Area was compared to mean raptor use estimates from 39 other studies that implemented similar protocols to the present study and had data for three or four different seasons. Mean annual raptor use was 0.75 raptors/20-minute survey, based on fixed-point bird use data collected for the Hermosa West Wind Resource Area and mean annual raptor use at the Hermosa West Wind Resource Area ranked eleventh relative to raptor use at the other wind-energy facilities.

Within the Rocky Mountain Region, the mean annual raptor use estimates for the Foote Creek Rim Facility in Wyoming was 0.55 raptors/plot/20-min survey. Raptor fatality rates at Foote Creek Rim averaged 0.04/MW/year. To date, no other raptor use estimates coupled with fatality estimates are publicly available for the Rocky Mountain Region. Excluding two California facilities, raptor use estimates for 11 modern facilities that also had fatality estimates in the western US ranged from zero to 0.75 raptors/plot/20-min survey. Raptor fatality estimates were available for the same 11 facilities, and raptor fatality estimates ranged from zero to 0.21/MW/year and averaged 0.08/MW/year. Assuming a correlation between use and fatality rates exists, rates at the Hermosa West Wind Resource Area would be expected to be lower than the fatality rates at the California facilities, and would likely be similar to the fatality rates seen at sites in the Rocky Mountain Region and western US (excluding California).

A regression analysis of raptor use and mortality for 13 new-generation wind-energy facilities (where similar methods were used to estimate raptor use and mortality) found a significant correlation between use and mortality (R^2 = 69.9%). Based on a mean raptor use estimate of 0.75 raptors/20-min survey, the regression equation predicts that raptor fatalities at the Hermosa West Wind Resource Area will be within the range of fatalities observed at existing facilities in the western US and Rocky Mountain Region. This regression includes two California facilities which had substantially higher use and fatality estimates than other western US and Rocky Mountain facilities. As more data on raptor use and fatalities at wind energy facilities in the western US and Rocky Mountain Region becomes publicly available, the predictive ability of this tool will be better understood.

The objective of the raptor nest mapping was to record raptor nests that may be subject to disturbance and/or displacement by wind-energy facility construction and/or operation. Ground-based surveys were conducted in conjunction with bird use surveys in the spring of 2009. The surveys were conducted prior to leaf-out to improve the chances of finding nests. Seventeen raptor nests (0.38 total nests/square mile; 0.15 total nests/square kilometer), including six active nests (0.13 active nests/square mile; 0.05 active nests/square kilometer), were identified within the Hermosa West Wind Resource Area and a surrounding one-mile buffer. Species on active nests within the study area included Swainson's hawk, prairie falcon, red-tailed hawk, great horned owl, American kestrel, and golden eagle. Access issues limited the survey coverage outside of leased lands within the study area, and it is likely that additional nests exist within the one-mile buffer surrounding leased lands. Of the six active nests, four nests were successful (67%). Eight chicks were observed from the four successful nests resulting in a productivity estimate of 2.00 chicks/successful nest in 2009 for the Hermosa West Wind Resource Area and a surrounding one-mile buffer.

The objective of incidental wildlife observations was to record wildlife seen outside of the standardized surveys. The most abundant large bird species recorded as an incidental observation was ferruginous hawk (six individuals). Three mammal species were also observed outside the standardized surveys, with elk being the most commonly recorded species (295 observations) followed by pronghorn antelope (85 observations). In addition, two coyote observations were recorded within the Hermosa West Wind Resource Area. According to the Wyoming Game and Fish Department, the Hermosa West Wind Resource Area is not in an area designated as crucial winter range, parturition, or migration route for either species. The impacts to big game including elk and pronghorn antelope from wind-energy facilities are not well known as there has been very little research conducted to date. The Hermosa West Wind Resource Area is not in a designated core greater sage-grouse area and no greater sage-grouse were observed within the Hermosa West Wind Resource Area.

Some species considered to be sensitive or of conservation concern were observed within the Hermosa West Wind Resource Area. Ten bird species with native species status rankings one through four in the state of Wyoming were observed in the Hermosa West Wind Resource Area, including two waterbird species and three raptor species: sandhill crane, American white pelican, bald eagle, ferruginous hawk, and Swainson's hawk. Golden eagles were also observed within the Hermosa West Wind Resource Area. Golden eagles are not listed as a Wyoming species of special concern, but both golden and bald eagles are protected under the Federal Bald and Golden Eagle Act. Five Wyoming sensitive passerine species were observed: Brewer's sparrow, chestnut-collared longspur, grasshopper sparrow, lark bunting, and McCown's longspur. Two federally listed species of concern (not previously listed above), loggerhead shrike and prairie falcon, were observed during fixed-point bird use surveys.

Impacts to raptor species can be minimized by placing spatial buffers (following the recommendations provided by the WGFD in a letter dated June 22, 2009) around known nest sites during siting of the wind-energy facility as well as avoiding the two small white-tailed prairie dog colonies identified. Implementing spatial buffers surrounding known nest sites will minimize displacement/disturbance impacts to nesting raptors and may reduce collision impacts although the latter is not well understood. Avoiding the two small white-tailed prairie dog colonies will help to minimize impacts to foraging raptors. Research concerning displacement impacts to songbirds, waterfowl, and waterbirds at wind-energy facilities is limited, but some studies show the potential for small-scale (180 meters [591 feet] or less) displacement, while impacts to densities of birds at larger scales have not been shown. Due to the lack of waterfowl and waterbird habitat within the Hermosa West Wind Resource Area, displacement impacts to waterfowl and waterbirds are unlikely.

STUDY PARTICIPANTS

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REPORT REFERENCE

Taylor, K. and K. Bay. 2010. Wildlife Baseline Studies for the Hermosa West Wind Resource Area, Albany County, Wyoming. Final Report: April 2009 – April 2010. Prepared for Shell WindEnergy, Inc., Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

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INTRODUCTION

Shell WindEnergy, Inc. (SWE) has proposed a wind-energy facility in Albany County, Wyoming (Figures 1, 2). SWE contracted Western EcoSystems Technology, Inc. (WEST) to conduct surveys and monitor wildlife resources in the Hermosa West Wind Resource Area (HWWRA) to estimate the impacts of wind-energy facility construction and operations on wildlife.

The principal objectives of the study were to: 1) provide site-specific bird and bat resource and use data that would be useful in evaluating potential impacts from the proposed HWWRA; 2) provide information that could be used in project planning and design of the facility to minimize impacts to birds and bats; and 3) recommend further studies or potential mitigation measures, if warranted. The protocols for the baseline studies are similar to those used at other wind-energy facilities across the nation and follow the guidance of the National Wind Coordinating Collaborative (Anderson et al. 1999). The protocols have been developed based on WEST's experience studying wildlife at proposed wind-energy facilities throughout the United States and were designed to help predict potential impacts to bird (particularly raptors and waterfowl) and bat species. Input from the Wyoming Game and Fish Department (WGFD) and US Fish and Wildlife Service (USFWS) were incorporated into the survey protocols. In addition, baseline wildlife surveys are being conducted in 2010 at the request of the WGFD.

Baseline surveys were conducted from April 29, 2009, through April 13, 2010, at the HWWRA, and consisted of fixed-point bird use surveys, ground-based raptor nest surveys, acoustic bat surveys, vegetation and habitat mapping, and incidental wildlife observations. Bat acoustical surveys are summarized in a separate report. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities. The ability to estimate potential bird mortality at the proposed HWWRA is greatly enhanced by operational monitoring data collected at existing facilities. For several wind-energy facilities, standardized data on fixed-point bird surveys were collected in association with standardized post-construction (operational) monitoring, allowing comparisons of bird use with bird mortality. Where possible, comparisons were made among regional and local studies.

STUDY AREA

The HWWRA, approximately 11,118 acres (17.4 square miles [mi^2]) in size, is located in southeastern Wyoming (Figure 1). The proposed HWWRA contains a variety of topographic features from generally flat/rolling areas to large drainage features and prominent ridges. Based on a vegetation and habitat mapping effort conducted within the HWWRA, grassland is the dominant landcover type (87.6%), followed by coniferous forest (6.0%), riparian (3.6%), and mountain mahogany (*Cercocarpus* spp., 1.2%; Table 1). Shrub steppe and riparian/willow (*Salix* spp.) each cover one percent of the HWWRA or less (Table 1; Figure 3). The HWWRA is a mixture of private and state lands, with the dominant land use being rangeland for grazing livestock.

The number and size of wind turbines that will be installed within the HWWRA is currently unknown. A rotor-swept height (RSH) for potential collision with a turbine blade of 115 to 427 foot (ft; 35 to 130 meters [m]) above ground level (AGL) was used for the purposes of the analyses.

METHODS

Fixed-Point Bird Use Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal and spatial use of the HWWRA by birds, particularly raptors. Fixed-point bird surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980).

Survey Plots

Six points were selected to survey representative habitats and topography of the HWWRA while also providing relatively even coverage of the study area (Figure 4). Each survey plot was a 2,625-ft (800-m) radius circle centered on the point.

Survey Methods

All species of birds observed during each 20-minute (min) fixed-point bird use survey were recorded. Observations of large birds beyond the 2,625-ft (800-m) radius were recorded, but were not included in the statistical analyses; for small birds, observations beyond a 328-ft (100-m) radius were excluded from the analyses. A unique observation number was assigned to each observation.

The date, start, and end time of the survey period and weather information (e.g., temperature, wind speed, wind direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. The behavior of each bird observed and the vegetation type in which (or over which) the bird occurred were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest 16-ft (5-m) interval. Other information recorded about the observation included whether or not the observation was auditory only and the 10-min interval of the 20-min survey in which it occurred.

The locations of species of interest (i.e., raptors, other large birds, and species of concern) seen during fixed-point bird use surveys were recorded on field maps by unique observation number. Flight paths and perched locations were digitized using ArcGIS 9.3. Any comments or unusual observations were recorded in the comments section of the data sheet.

Observation Schedule

Sampling intensity was designed to document bird use and behavior by habitat and season within the HWWRA. Surveys were conducted weekly during spring (March 16 to May 31) and fall (September 1 to November 15), and were conducted twice per month during summer (June 1 to August 31) and winter (November 16 to March 15). Surveys were carried out during daylight hours, and survey periods varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed about the same number of times. However, the schedule varied in response to adverse weather conditions (e.g., fog, rain, heavy snow), which caused delays and/or missed surveys.

Raptor Nest Surveys

The objectives of the raptor nest surveys were to: 1) identify the species and nest densities occurring within the HWWRA, and 2) record raptor nest locations to identify areas with a potential for increased risk of disturbance or collisions associated with nest sites.

A small proportion of the overall HWWRA is suitable raptor nesting habitat. However, suitable raptor nesting habitat is present at the HWWRA in the form of coniferous trees, rocky outcrops, and scattered deciduous trees. Ground-based raptor nest surveys were conducted within the HWWRA lease boundary and within a one-mile (1.6 kilometer [km]) buffer surrounding the lease boundary. However, access issues limited the raptor nest survey effort for areas outside of the lease boundary. The survey effort focused on species that build large nest structures, such as red-tailed hawk (*Buteo jamaicensis*). Other species that nest on the ground or in cavities were recorded if observed, but were not the focus of surveys. To the greatest extent possible, care was taken to minimize disturbance to raptors at nest sites during surveys. The raptor nest survey was conducted during the spring of 2009 and follow up visits to previously identified raptor nests were conducted from July 14 through July 16, 2009, to document success and productivity of raptor nests. Raptor nest success was determined to be the number of successful nests (nests that fledged at least one chick) divided by the total number of active nests checked. Productivity estimates were calculated as the total number of young fledged per successful nests checked. Raptor chicks were assumed to have fledged based on their size and stage of development.

Several items were recorded for each nest site, including nest status (active or inactive), the number of adults and young present, species occupying nest site, behavior of adults at the nest, nest condition (poor, fair, good), nest location (global positioning system [GPS] coordinates), and nest substrate.

Vegetation and Habitat Mapping

The objective of vegetation and habitat mapping was to identify important habitat for sensitive or protected species. Vegetation types in the HWWRA were mapped using the latest available aerial imagery and ground verification. Vegetation types (e.g., grassland, coniferous forest, mountain mahogany) were described and mapped, and this habitat information was digitized using ArcGIS 9.3. Habitat mapping was conducted during the summer of 2009.

Incidental Wildlife Observations

The objective of incidental wildlife observations was to record wildlife seen outside of the standardized surveys. All raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), and habitat were recorded. The locations of sensitive species were recorded by collecting GPS coordinates using a hand-held unit.

Statistical Analysis

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented during all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® ACCESS database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

<u>Bird Diversity and Species Richness</u>
Bird diversity was illustrated by the total number of unique species observed. Species lists (with the number of observations and the number of groups) were generated by season and included all observations of birds detected, regardless of their distance from the observer. Species richness was calculated as the mean number of species observed per plot per survey (number of species/plot/20-min survey). Species diversity and richness were compared among seasons for fixed-point bird use surveys.

<u>Bird Use, Percent Composition, and Frequency of Occurrence</u>
For the standardized fixed-point bird use estimates, only observations of large birds detected within the 2,625-ft (800-m) radius plot were used; small bird observations were limited to 328 ft (100 m). Estimates of mean bird use (number of birds/plot/20-min survey) were used to compare and contrast among bird types, seasons, and other wind-energy facilities.

Percent composition was calculated as the proportion of the overall mean use for a particular bird type or species, and the frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Frequency of occurrence and percent composition provide relative estimates of species exposure to the proposed wind-energy facility. For example, a particular species might have high use estimates for the study area based on just a few observations of large groups. However, the frequency of occurrence would indicate that the species only occurred during a few of the surveys, therefore it would be less likely to be affected by the wind-energy facility or transmission corridor.

<u>Bird Flight Height and Behavior</u>
To calculate potential risk to bird species, the first flight height recorded was used to estimate the percentages of birds flying within the likely rotor-swept heights (RSH) for collision with turbine blades of 115 to 427 ft (35 to 130 m) above ground level (AGL). Since the type of turbines to be

installed at the HWWRA is currently unknown, the blade height of typical modern turbines that could be used at the HWWRA was used for the RSH. Bird data was recorded in terms of height and as such, risk to birds is evaluated using the RSH of 115 to 427 ft (35 to 130 m) rather than using a rotor swept area (RSA).

Bird Exposure Index

A relative index of collision exposure (R) was calculated for bird species observed during the fixed-point bird use surveys using the following formula:

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (large bird observations within 2,625 ft [800 m] of the observer or 328 ft [100 m] for small birds) averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t equals the proportion of all initial flight height observations of species *i* within the likely RSH.

Spatial Use

To determine spatial use of the HWWRA by birds, data were analyzed by comparing use among plots. Mapped flight path were qualitatively compared to study area features (e.g., topographic features). The objective of mapping observed bird locations and flight paths was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the study area. Spatial information is useful in turbine layout design or adjustments of individual turbines for micro-siting.

RESULTS

Surveys were completed at the HWWRA from April 29, 2009, through April 13, 2010. During the first year of baseline wildlife surveys, 45 bird species and three mammal species were identified during at the HWWRA. Results of the fixed-point bird use surveys, raptor nest surveys, vegetation and habitat mapping, and incidental wildlife observations (and the specific numbers of unique species for each survey type) are discussed in the sections below.

Fixed-Point Bird Use Surveys

A total of 194 20-minute fixed-point bird use surveys were conducted during 34 visits to the HWWRA (Table 2). Two different viewsheds were utilized when calculating the different statistics (species richness, use, percent composition, percent frequency, and exposure index): 800 m for large bird observations and 100 m for small bird observations. For the purposes of this report, small birds were determined to be passerines, hummingbirds, and woodpeckers.

Bird Diversity and Species Richness

Forty-five unique bird species were observed during all fixed-point bird use surveys, with a mean number of 0.90 large bird species/800-m plot/20-min survey and 1.62 small bird species/100-m plot/20-min survey (Table 2). Bird diversity (number of unique species) was greater in the fall (31 species), followed by spring (28), summer (26), and winter (14; Table 2). Large bird species richness (mean number of species per survey) was higher in the summer (1.28

species/survey), fall (1.00), and spring (0.91), than in the winter (0.54; Table 2). For small birds, species richness was highest in the summer (2.64 species/survey), followed by fall (1.80) and spring (1.78); small bird species richness was relatively low in winter (0.61; Table 2). A total of 1,903 individual bird observations within 848 separate groups were recorded during the fixed-point bird surveys (Table 3). Horned lark (*Eremophila alpestris*; 2.2% of all species) composed 56.5% of the observations. Individually, all other species comprised less than 10% of the observations. The most abundant large bird species observed was American crow (*Corvus brachyrhynchos*), with 43 individuals observed in 15 groups. A total of 156 individual raptors were recorded within the HWWRA, representing 10 species (Table 3).

Bird Use, Percent Composition, and Frequency of Occurrence

Mean bird use, percent composition, and frequency of occurrence were calculated by season (Tables 4a and 4b). The highest overall large bird use occurred in the spring (1.87 birds/800-m plot/20-min survey), followed by summer and fall (1.47, each), and winter (1.26; Table 4a). Small bird use was highest in the fall (10.30), followed by the summer (7.33), winter (7.07), and spring (6.85; Table 4b).

Waterbirds

Waterbirds had the highest use in spring (0.65 birds/800-m plot/20-min survey), compared to other times of the year (fall 0.28, summer 0.06, and winter 0; Table 4a). The majority of spring waterbird use (53.8%) was by sandhill crane (*Grus canadensis*; 0.35), and this species accounted for all waterbird use in fall. Sandhill crane use was comprised of one group of 19 individuals in the spring and one group of 17 individuals in the fall. American white pelican (*Pelecanus erythrorhyncos*) was the only waterbird species observed in the summer, with one group of two individuals observed. Waterbirds comprised 34.7% of overall large bird use in spring and 19.3% in fall, compared to only 3.8% of overall large bird use in summer. Waterbirds were seldom observed; they were observed during less than four percent of the surveys in any given season (Table 4a).

Waterfowl

Mallard (*Anas platyrhynchos*) was the only waterfowl species observed, and this species was only observed in fall (0.03 birds/800-m plot/20-min survey; Table 4a). Mallards comprised 2.3% of overall large bird use in the fall and were observed during 1.7% of fall surveys (Table 4a).

Raptors

Raptor use was highest in the fall and summer (0.98 and 0.94 birds/800-m plot/20-min survey, respectively), followed by spring (0.74) and winter (0.44; Table 4a). Higher use in the fall was primarily due to use of the area by ferruginous hawks (*Buteo regalis*; 0.35 birds/plot/20-min survey) and red-tailed hawks (0.25). Higher summer use was largely due to use by four species: red-tailed hawks (0.22 birds/plot/20-min survey), Swainson's hawks (*B. swainsoni*; 0.19), prairie falcons (*Falco mexicanus*; 0.19), and ferruginous hawks (0.17). In the spring, Swainson's hawks (0.22 birds/plot/20-min survey) and red-tailed hawks (0.19) had the highest use of any raptor species, and golden eagle (*Aquila chrysaetos*; 0.19) had the highest use in winter. Raptors comprised the majority of large bird use in fall and summer (67.0% and 64.2%, respectively), compared to 39.6% of spring use and 35.3% of overall large bird use in winter. Raptors were commonly observed during surveys in summer (61.1%), fall (60.7%), and spring (51.9%); raptors were less common during winter surveys (33.3%; Table 4a).

Vultures

Turkey vulture (*Cathartes aura*) was the only vulture species observed; and use by this species was much higher in the summer (0.36 birds/800-m plot/20-min survey), compared to other times of the year (spring 0.09, fall 0.08, and winter 0; Table 4a). In summer, turkey vulture comprised 24.5% of overall large bird use, and this species comprised less than six percent of overall use in other seasons. Turkey vulture was observed during one-third of summer surveys, 9.3% of spring surveys, and 8.3% of surveys in the fall (Table 4a).

Large Corvids

Use by large corvids was much higher in winter (0.81 birds/800-m plot/20-min survey) compared to other times of the year (spring 0.39, summer 0.11, and fall 0.03; Table 4a). American crow was the only large corvid observed during all seasons and accounted for the majority of large corvid use during all four seasons. Black-billed magpie (*Pica pica*) was only observed during spring and winter surveys, and common raven (*Corvus corax*) was only observed during spring surveys. Large corvids accounted for the majority of large bird use in the winter (64.7%) and a large proportion of large bird use in the spring (20.8%); in summer, large corvids accounted for 7.5% of overall use and only 2.3% of large bird use in fall. Large corvids were observed more often during winter (14.8% of surveys) and spring surveys (13.0%) than in summer (5.6%) and fall surveys (1.7%; Table 4a).

Passerines

A 100-m viewshed was used for small bird observations; therefore, small bird data are not directly comparable to large bird data. Passerine use was highest in the fall (10.28 birds/100-m plot/20-min survey), compared to the summer (7.28), winter (7.07), and spring (6.85; Table 4b). Horned lark had the highest use by any one passerine species across all seasons (spring 3.54, summer 3.92, fall 7.01, and winter 6.30 birds/plot/20-min survey). Passerines were observed during all summer surveys, the majority of fall and spring surveys (96.3% and 87.0%, respectively), and during half of the surveys in winter (Table 4b).

Bird Flight Height and Behavior

Flight height characteristics were estimated for both bird types and species (Tables 5 and 6). During fixed-point bird use surveys, 194 groups of large birds totaling 276 individuals were observed flying within the 800-m plot (Table 5). Overall, 37.7% of large birds observed flying were recorded within the RSH for collision with turbine blades of 115 to 427 ft (35 to 130 m) AGL, 61.6% were below the RSH, and 0.7% were flying above the RSH (Table 5). Nearly two-thirds (62.6%) of flying raptors were observed below the RSH, 37.4% were flying within the RSH, and no flying raptors were observed above the RSH. All flying waterfowl were observed within the RSH; although, only one group of two mallards was observed. Waterbirds had the second highest percentage of flying birds within the RSH (66.7%), followed by vultures (47.8%). Raptors had the fourth highest percentage of birds within the RSH, due to 39.4% of 94 buteo observations and 58.1% of 31 eagle observations recorded at this height. Large corvids and doves/pigeons were only observed flying below the RSH. A total of 1,546 passerines or other small bird species were observed flying in 588 separate groups. All passerines and other small birds within the 100-m plot were observed below the RSH (Table 5).

Of all large bird species, five species (golden eagle, red-tailed hawk, turkey vulture, ferruginous hawk, and Swainson's hawk) had at least 20 groups observed flying; of the species with at least 20 groups observed flying, only golden eagle was initially observed flying within the likely RSH during at least 50% of the observations (59.3%; Table 6a). Two species (sandhill crane and mallard) were always seen flying within the likely RSH. However, these were only based on one (mallard) and two (sandhill crane) groups. Of all passerines and small birds, four species had at least 20 groups observed flying: horned lark, McCown's longspur (*Calcarius mccownii*), mountain bluebird (*Sialia currucoides*), and vesper sparrow (*Pooecetes gramineus*). However, no small bird species were observed flying within the RSH at anytime (Table 6b).

Bird Exposure Index

A relative exposure index (R) was calculated for each bird species based on initial flight height observations and relative abundance (defined as the use estimate; Tables 6a and 6b). This index does not account for other possible collision risk factors (e.g., foraging or courtship behavior). Sandhill crane had a higher exposure index than other large bird species (0.13); all other large bird species had an exposure index of 0.08 or less. Several raptor species had exposure indices, which ranged from 0.08 and 0.07 (golden eagle and red-tailed hawk) to 0.01 (rough-legged hawk [*Buteo lagopus*] and bald eagle [*Haliaeetus leucocephalus*]); ferruginous hawk and Swainson's hawk had intermediate exposure indices (0.04, each). Prairie falcon, northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), and sharp-shinned hawk (*Accipiter striatus*) had no exposure to the RSH based on initial flight height observations (Table 6a). Based on observations within 100 m, no small bird species were observed flying within the RSH; therefore, all small bird species had an exposure index of zero (Table 6b).

Spatial Use

For all large bird species combined, use was slightly higher at point 16 (2.66 birds/20-min survey) than at other points, which ranged from 0.82 to 1.68 birds/20-min survey (Figure 5). The higher mean use estimate for point 16 was largely due to waterbird use at this point (1.16 birds/20-min survey). Waterbird use was also observed at point 13 (0.55 birds/20-min survey). Waterfowl were only observed at point 14 (0.06 birds/20-min survey). Raptor use was highest at point 16 (1.19 birds/20-min survey) and was lowest at point 12 (0.36); use by raptors ranged from 0.65 to 0.91 birds/20-min survey at other points. Accipiter use was only observed at point 11 (0.06 birds/20-min survey); while buteo use was observed at all points, with the lowest use at point 12 (0.24 birds/20-min survey) and the highest use at points 15 and 16 (0.72 and 0.75, respectively). Northern harriers were observed at points 14 and 16 (0.06 and 0.03 birds/20-min survey, respectively). Eagle use was highest at points 13 and 16 (0.35 and 0.31 birds/20-min survey, respectively), and ranged from 0.03 to 0.12 at other points. Use by falcons was highest at point 11 (0.25 birds/20-min survey) and ranged from zero to 0.09 at other points. Vulture use was higher at points 12 and 16 (0.33 and 0.22 birds/20-min survey, respectively), and ranged from zero to 0.09 at the remaining points. Large corvid use was highest at point 14 (0.74 birds/20-min survey), and ranged from zero to 0.41 birds/20-min survey at other points. Passerine use (within 100 m) was highest at point 12 (13.2 birds/20-min survey), and ranged from 5.97 to 8.59 birds/20-min survey at other points (Figure 5).

Flight paths for raptors and vultures were digitized and mapped (Figures 6a-d). Mapped flight paths suggest that the northern portion of the HWWRA had increased ferruginous hawk flights. Prairie falcon flight paths were more numerous in the vicinity of point 11 than at other points in the HWWRA. Points 13 and 16 had a higher number of mapped golden eagle flight paths compared to other points. Turkey vulture flight paths were more numerous in the vicinity of point 12.

Sensitive Species Observations

Ten bird species with native species status (NSS) rankings one through four in the state of Wyoming were observed in the HWWRA during fixed-point bird use surveys. Of these species, three were raptors: bald eagle (four observations), ferruginous hawk (37 observations), and Swainson's hawk (21 observations). In addition, 28 golden eagle observations were recorded. Golden eagles are not listed as a Wyoming species of special concern, but both golden and bald eagles are protected under the Federal Bald and Golden Eagle Act (BGEPA 1940). McCown's longspur (*Calcarius mccownii*) was the most common high ranking NSS species observed during fixed-point bird surveys, with 166 observations in 92 groups. Nine Brewer's sparrows (*Spizella breweri*) were observed in five groups, two lark buntings (*Calamospiza melanocorys*) were observed in one group, two chestnut-collared longspurs (*Calcarius ornatus*) and five grasshopper sparrows (*Ammodramus savannarum*) were observed individually. Thirty-six sandhill cranes in two groups and two American white pelicans in one group were also observed within the HWWRA (Tables 3, 7). Two federal species of concern not listed above were also observed during fixed-point surveys. Eight individual loggerhead shrikes (*Lanus ludovicianus*), a federally listed species of concern, and 15 prairie falcons were observed during fixed-point bird use surveys in the HWWRA (Tables 3, 7).

The majority (68.1%) of all special status bird species observed in the HWWRA were at or near points 16 (85 observations), 12 (69), and 15 (64; Figure 4). The remainder of the observations were at or near points 13 (46 observations), 14 (41), and 11 (15). The majority (58.9%) of special status raptor species were observed at or near points 16 (31 observations) and 15 (22). Bald eagle was observed at or near point 16 (two individual observations), point 15 (one), and point 11 (one). Ferruginous hawk was observed at or near points 12 (two individual observations), 13 (one), 14 (seven), 15 (eight), and 16 (19; 51.4% of all observations for this species). Golden eagle was observed at or near points 11 (three observations), 12 (two), 13 (11; 39.3% of golden eagle observations), 14 (one), 15 (three), and 16 (eight). Swainson's hawk was observed at or near points 11 (four observations), 13 (two), 14 (three), 15 (10; 47.6% of observations for this species), and 16 (two).

Raptor Nest Surveys

Seventeen raptor nests were identified in or within one mile of the HWWRA (0.38 nests/mi^2; 0.15 nests/km^2; Figure 7; Table 8). Of the 17 total nests, 6 active nests were identified in or within the one-mile buffer of the HWWRA (0.13 active nests/mi^2; 0.05 active nests/km^2). Species on active nests included Swainson's hawk (one nest), prairie falcon (one nest), red-tailed hawk (two nests), great horned owl (one nest), and golden eagle (one nest). All six nests were revisited on July 14, 15, or 16, and four of the six nests (66.7%) were determined to be successful. Eight raptor chicks were observed from the four successful nests, resulting in an overall productivity estimate of 2.00 raptor chicks/successful nest in 2009 for the HWWRA and the surrounding one-mile buffer.

Vegetation and Habitat Mapping

At a landscape scale, the HWWRA is dominated by grasslands. Other mapped vegetation and habitat types included coniferous forest, riparian, mountain mahogany, shrub steppe, and riparian/willow (Table 1; Figure 3). Vegetation types were identified and mapped based on dominant over-story vegetation.

Approximately 87.6% of the roughly 11,118-acre HWWRA is composed of grassland (Table 1; Figure 3). The next most common vegetation community is coniferous forest, which composes approximately 6.0% of the HWWRA. Riparian areas compose approximately 3.6% of the proposed HWWRA and mountain mahogany cover 1.2%. Shrub steppe and riparian/willow cover 1.0% of the HWWRA or less (Table 1).

In addition to the vegetation and habitat mapping effort, two small white-tailed prairie dog (*Cynomys leucurus*) colonies were identified and mapped within the HWWRA (Figure 3).

Incidental Wildlife Observations

Incidental wildlife observations in the HWWRA included four raptor species and three mammal species (Table 9).

Bird Observations

Four raptor species were recorded as incidental observations, representing nine individuals. Ferruginous hawk was the most common incidental species recorded, with six individuals. Golden eagle (one observation), bald eagle (one), and red-tailed hawk (one) were also recorded outside of standardized surveys (Table 9).

Mammal Observations

Elk (*Cervus elaphus*) observations represented 295 individuals in four groups. Coyote (*Canis latrans*; two observations) and pronghorn (*Antilocapra americana*; 85 observations in 11 groups) were also observed.

Sensitive Species Observations

Two sensitive Wyoming NSS birds were observed incidentally; one bald eagle and six ferruginous hawks. One golden eagle was also recorded. Golden eagles are not listed as a Wyoming species of special concern, but both golden and bald eagles are protected under the BGEPA (1940). All three species are also federal species of concern in Wyoming.

DISCUSSION AND IMPACT ASSESSMENT

Bird Impacts

Direct Effects

The most probable direct impact to birds from wind-energy facilities is mortality or injury due to collisions with turbines or guy wires of meteorological (met) towers. SWE has installed bird diverters on met towers to help minimize collision risk to birds from guy wires. Collisions may occur with resident birds foraging and flying within the study area or with migrant birds seasonally moving through the HWWRA. Facility construction could affect birds through loss of habitat or potential fatalities from construction equipment. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment. Potential mortality from construction equipment is expected to be very low, as equipment used in wind-energy facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The risk of direct mortality to birds from construction is most likely the potential destruction of a nest for ground- and shrub-nesting species during initial site clearing.

At 14 modern facilities in the western US region where raptor fatality estimates are available, raptor fatality rates have ranged from zero to 0.87/MW/year, and averaged 0.18/MW/year (Table 10). The three facilities with the highest raptor fatality rates (0.87, 0.53, and 0.39/MW/year) are in California. Of the 11 facilities within the western US region located outside California, raptor fatality rates have ranged from zero to 0.21, and averaged 0.08/MW/year. Three modern facilities within the Rocky Mountain Region have raptor fatality estimates. Fatality estimates within the Rocky Mountain Region have ranged from zero to 0.11/MW/year and averaged 0.07/MW/year (Table 10). The closest facility to the HWWRA is the Foote Creek Rim facility located approximately 60 miles (96.6 km) northwest of the HWWRA. Three comparable raptor fatality estimates are available for the Foote Creek Rim facility (Table 10). Raptor fatality estimates at Foote Creek Rim ranged from zero to 0.08/MW/year and averaged 0.04/MW/year.

Sixteen comparable mortality estimates for all bird species combined are publicly available for 14 modern wind energy facilities in the western US (Table 11). Overall bird fatality rates have ranged from 0.95 – 6.66/MW/year, and averaged 2.59/MW/year. Four overall bird fatality estimates from the two modern Rocky Mountain facilities ranged from 1.93 to 3.40/MW/year and averaged 2.69/MW/year (Table 11). At the Foote Creek Rim facility, overall bird fatality estimates ranged from 1.93 to 3.40/MW/year and averaged 2.58/MW/year.

Avian mortality estimates in the western US and the Rocky Mountain Region are lower than the national average. Using mortality data from a 10-year period from wind-energy facilities throughout the entire U.S., the average number of bird collision fatalities is 3.1/MW/year, or 2.3/turbine/year (NWCC 2004). Substantial data on bird mortality at wind-energy facilities are available from studies in California and throughout the West and Midwest. During 12 fatality monitoring studies conducted outside of California, diurnal raptor fatalities comprised two percent of the wind-energy facility-related fatalities. Passerines (excluding house sparrows [*Passer domesticus*] and European starlings [*Sturnus vulgaris*]) comprised about 82% of the 225 fatalities documented. Of 841 bird fatalities reported from California studies (more than 70%

from the Altamont Pass facility in California), approximately 39% were diurnal raptors, about 19% were passerines (excluding house sparrows European starlings), and about 12% were owls (Erickson et al. 2002b). Non-protected birds (including house sparrows, European starlings, and rock doves [*Columba livia*]) comprised about 15% of the fatalities. Other bird types generally made up less than 10% of the fatalities (Erickson et al. 2002b).

Although collision mortality is well documented at most wind-energy facilities, population level effects have not been detected, although few studies have addressed this issue. According to The Wildlife Society (TWS 2007), available data from wind-energy facilities suggest that fatalities of passerines from turbine strikes generally are not significant at the population level, although exceptions to this could occur if facilities are sited in areas where rare species are concentrated. Johnson and Erickson (2008) examined the potential for population level impacts caused by avian collision mortality associated with 6,700 MW of existing and proposed wind-energy development in the Columbia Plateau Ecoregion of eastern Oregon and Washington. The number and species composition of bird collision fatalities was estimated based on results of 11 existing mortality studies in the Ecoregion. Estimated breeding population sizes were available for most birds in the Ecoregion based on Breeding Bird Survey (BBS) data. Predicted mortality rates for avian groups as well as species of concern were compared to published annual mortality rates. Because the additional wind-energy associated mortality was found to comprise only a small fraction of existing mortality rates, it was concluded that population level impacts would not be expected for the Ecoregion as a whole, but that local impacts to some species could occur. In the only study to quantitatively assess potential population level impacts, Hunt (2002) conducted a 4-year radio telemetry study of golden eagles at the Altamont Pass Wind Resource Area (APWRA) in California and found that the resident golden eagle population appeared to be self sustaining despite sustaining high levels of fatalities, but the effect of these fatalities on eagle populations wintering within and adjacent to the APWRA was unknown. Additional research conducted in 2005 by Hunt and Hunt (2006) found that all 58 territories occupied by golden eagle pairs in the APWRA in 2000 remained active in 2005.

<u>Raptor Use and Exposure Risk</u>

Annual mean raptor use (number of raptors divided by the number of 800-m plots and the total number of surveys) at the HWWRA was compared with 39 other wind-energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/plot/20-min survey (Figure 8). Mean raptor use at the HWWRA (0.75 raptors/plot/20-min survey) ranked eleventh compared to the other wind-energy facilities (Figure 8).

Within the Rocky Mountain Region, the mean annual raptor use estimates for the Foote Creek Rim Facility in Wyoming was 0.55 raptors/plot/20-min survey (Erickson et al. 2002b). Raptor fatality rates at Foote Creek Rim averaged 0.04/MW/year. To date, no other raptor use estimates coupled with fatality estimates are publicly available for the Rocky Mountain Region. Within the western US, raptor use estimates at 13 modern facilities coupled with fatality estimates ranged from 0.21 to 2.34 raptors/plot/20-min survey (Table 10). Excluding the two California facilities, raptor use estimates in the western US ranged from zero to 0.75 raptors/plot/20-min survey. Raptor fatality estimates were available for the same 13 facilities, and estimates ranged from zero to 0.87/MW/year. Excluding the two California facilities, raptor fatality estimates ranged from zero to 0.21/MW/year and averaged 0.08/MW/year. Assuming a correlation between use and fatality rates exists, rates at the HWWRA would be expected to be lower than the fatality rates at the California facilities, and would likely be similar to the fatality rates seen at sites in the Rocky Mountain region and western US (excluding California; Table 11).

Although raptor fatality rates varied, a review of studies at wind-energy facilities across the United States reported that only 3.2% of casualties were raptors (Erickson et al. 2001a). Indeed, although raptors occur in most areas with the potential for wind-energy development, individual species appear to differ from one another in their susceptibility to collision (NRC 2007). Results from Altamont Pass in California suggest that mortality for some species is not necessarily related to abundance (Orloff and Flannery 1992). American kestrels, red-tailed hawks, and golden eagles were found dead more often than predicted based on abundance. Thus far, few northern harrier fatalities at existing wind-energy facilities have been reported in publicly available documents, despite the fact they are commonly observed during fixed-point bird counts at these facilities (Erickson et al. 2001a, Whitfield and Madders 2006). Northern harriers often forage close to the ground; therefore, risk of collision with turbine blades is considered low for this species. It is likely that many factors, in addition to abundance, are important in predicting raptor mortality. Two small white-tailed prairie dog colonies were identified within the HWWRA. Siting wind turbines outside of white-tailed prairie dog colonies may minimize impacts to foraging raptors.

Exposure indices analysis may also provide insight into which species might be the most likely turbine casualties. However, the index only considers relative probability of exposure based on abundance, proportion of observations flying, and proportion of flight height of each species within the RSH for turbines likely to be used at the wind-energy facility. This analysis is based on observations of birds during the surveys and does not take into consideration behavior (e.g., foraging, courtship), habitat selection, the ability to detect and avoid turbines, and other factors that may vary among species and influence likelihood for turbine collision. For these reasons, the index is only a relative index among species observed during the fixed-point bird use surveys and within the study area. Actual risk for some species may be lower or higher than indicated by these data. At the HWWRA, the raptor species with the highest exposure indices were golden eagle and red-tailed hawk. The relatively high golden eagle exposure index was influenced by a relatively high proportion of individuals observed within the RSH. The relatively high red-tailed hawk exposure index was influenced by relatively high use estimates. Although the use estimates for ferruginous hawks and red-tailed hawks were the same, the proportion of ferruginous hawks observed within in the RSH was lower than the proportion of red-tailed hawks observed within the RSH.

A regression analysis of raptor use and mortality for 13 new-generation wind-energy facilities (where similar methods were used to estimate raptor use and mortality) found a significant correlation between use and mortality (R^2 = 69.9%; Figure 9). Using this regression to predict raptor collision mortality at the HWWRA (based on an adjusted mean raptor use of 0.75 raptors/20-min survey) yields an estimated potential fatality rate of 0.13 fatalities/MW/year. A 90% prediction interval around this estimate is zero to 0.39 fatalities/MW/year. This regression includes the two California facilities which had substantially higher use and fatality estimates than other western US and Rocky Mountain facilities. As more data on raptor use and fatalities at wind energy facilities in the western US and Rocky Mountain Region becomes publicly available, the predictive ability of this tool will be better understood. Given the available data, the regression equation predicts that raptor fatalities at the HWWRA will be within the range of fatalities observed at existing facilities in the western US and Rocky Mountain Region.

Active raptor nest density within the HWWRA and surrounding one-mile buffer was 0.13 active nests/mi^2 (0.05 active nests/km^2). Access issues limited the survey coverage outside of leased lands within the study area, and it is likely that additional nests exist within the one-mile buffer surrounding leased lands. The active raptor nest density identified was moderate compared to 10 other wind resource areas evaluated in the western United States, where active raptor nest density ranged from 0.03 to 0.30 nests/mi^2 (0.01 to 0.12 nests/km^2) and averaged 0.15 nests/mi^2 (0.06 nests/km^2; Erickson et al. 2002b). Raptors nesting closer to turbines are more likely to be impacted by disturbance due to construction or operation of the facility. The potential for collision with turbines for raptors nesting close to turbines may be increased by adults foraging in the vicinity of active nests as well as fledglings learning to fly in the vicinity of active nests however this is not well understood. Currently, data on nests very close to turbines (e.g., within a half-mile [0.8 km]) are currently inadequate to determine the level of these impacts. Most of the nests within two miles (3.2 km) of the Foote Creek Rim wind-energy facility in Wyoming were red-tailed hawk nests, but no red-tailed hawk fatalities were documented at this facility (Johnson et al. 2000b, Young et al. 2003c).

<u>Non-Raptor Use and Exposure Risk</u>

Most bird species in the United States are protected by the Migratory Bird Treaty Act (MBTA 1918). At wind-energy facilities outside California, passerines (primarily perching birds) often comprise more than 80% of the bird fatalities (Erickson et al. 2001a, 2002b). Both migrant and resident passerine fatalities have been observed. Given that passerines made up a large proportion of the birds observed during the baseline study, passerines would be expected to make up the largest proportion of fatalities at the HWWRA. However, none of the passerines (within 100m) were recorded flying within the RSH, suggesting that passerines are less likely to be exposed to collision from wind turbines at the HWWRA (Table 6b).

Wind-energy facilities with year-round use by water-dependent species have shown the highest mortality; although, the levels of waterfowl, waterbird, and shorebird mortality appear insignificant compared to the use of the facilities by these groups. Of 1,033 bird carcasses collected at United States wind-energy facilities, waterbirds comprised about two percent, waterfowl comprised about three percent, and shorebirds comprised less than one percent (Erickson et al. 2002b). Only two Canada goose (*Branta canadensis*) fatalities were documented at the Klondike wind-energy facility in Oregon, even though 43 groups totaling 4,845 individual Canada geese were observed during pre-construction surveys (Johnson et al. 2002a, 2003). The recently constructed Top of Iowa wind-energy facility is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use, including migrant and resident waterfowl. During a recent study, approximately one million goose-use days and 120,000 duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during concurrent and standardized wind-energy facility fatality studies (Jain 2005). Similar findings were observed at the Buffalo Ridge wind-energy facility in southwestern Minnesota, which is located in an area with relatively high waterfowl and waterbird use, and some shorebird use. Snow geese (*Chen caerulescens*), Canada geese, and mallards were the most common waterfowl observed. Three of the 55 fatalities observed during the fatality monitoring studies were waterfowl, including two mallards and one blue-winged teal (*Anas discors*); two American coots (*Fulica americana*), one grebe, and one shorebird fatality were also found (Johnson et al. 2002b). Sandhill crane had the highest exposure index of any species at the HWWRA due to all observations recorded within the RSH. However, only two groups of sandhill cranes were recorded within the HWWRA. Based on available evidence, waterfowl do not seem especially vulnerable to turbine collisions and significant impacts are not likely.

Indirect Effects

The presence of wind turbines may alter the landscape so that wildlife use patterns are affected, displacing wildlife away from the wind-energy facilities and suitable habitat. Some studies from wind-energy facilities in Europe consider displacement effects to have a greater impact on birds than collision mortality (Gill et al. 1996). The greatest concern with displacement impacts for wind-energy facilities in the United States has been where these facilities have been constructed in grassland or other native habitats (Leddy et al. 1999, Mabey and Paul 2007). One study suggests that disturbance appears to impact feeding, resting, and migrating birds; rather than breeding birds (Crockford 1992). The results from studies at the Stateline wind-energy facility in Washington and Oregon and the Buffalo Ridge wind-energy facility in Minnesota suggest that breeding birds are also affected by wind-energy facility operations (Erickson et al. 2004, Johnson et al. 2000a).

<u>Raptor Displacement</u>
In addition to possible direct effects on raptors within the study area, indirect effects caused by disturbance-type impacts (e.g., construction activity near an active nest or primary foraging area) also have a potential impact on raptor species. Active raptor nest density within the HWWRA and one-mile buffer was 0.13 nests/mi^2, which is moderate when compared to most other regional wind-energy facilities. Birds displaced from wind-energy facilities might move to areas of lower habitat quality with fewer disturbances, with an overall effect of reducing breeding success. Most studies on raptor displacement at wind-energy facilities, however, indicate effects to be negligible (Howell and Noone 1992; Johnson et al. 2000a, 2003; Madders and Whitfield 2006). Notable exceptions to this include a study in Scotland that described territorial golden eagles avoiding the entire wind-energy facility area, except when intercepting non-territorial birds (Walker et al. 2005). A study at the Buffalo Ridge wind-energy facility in Minnesota found evidence of northern harriers avoiding turbines on both a small scale (less than 100 m from turbines) and a larger scale in the year following construction (Johnson et al. 2000a). Two years following construction, however, no large-scale displacement of northern harriers was detected.

The only published report of avoidance of wind turbines by nesting raptors occurred at the Buffalo Ridge facility in Minnesota. Raptor nest density on 101 mi^2 (262 km^2) of land surrounding the Buffalo Ridge wind-energy facility was 5.94 nests/39 mi^2 (101 km^2); yet no nests were present in the 12 mi^2 (31 km^2) facility itself, even though habitat was similar (Usgaard et al. 1997). However, this analysis assumes that raptor nests are uniformly distributed across the landscape (an unlikely event), and only two nests would be expected for an area 12 mi^2 in size if the nests were distributed uniformly. Based on extensive monitoring using helicopter flights and ground observations at a wind-energy facility in eastern Washington, raptors nested in the study area at approximately the same levels before and after construction and several nests were located within a half-mile of turbines (Erickson et al. 2004). At the Foote Creek Rim wind-energy facility in southern Wyoming, one pair of red-tailed hawks nested within 0.3 miles (0.5 km) of the turbine strings; and seven red-tailed hawk nests, one great horned owl (*Bubo virginianus*) nest, and one golden eagle nest located within one mile of the wind-energy facility successfully fledged young (Johnson et al. 2000b). The golden eagle pair successfully nested a half-mile from the facility for three different years after it became operational. In Oregon, a Swainson's hawk also nested within a quarter-mile (0.4 km) of a turbine string at the Klondike I wind-energy facility after the facility was operational (Johnson et al. 2003). These observations suggest that there will be limited nesting displacement of raptors at the HWWRA. The creation of a spatial buffer (following the recommendations provided by the WGFD in a letter dated June 22, 2009) surrounding known raptor nests when siting turbines will help to minimize disturbance/displacement impacts to nesting raptors by reducing human activities in close proximity to raptor nests.

<u>Displacement of Non-Raptor Bird Species</u>
Studies concerning the displacement of non-raptor species have concentrated on grassland passerines, waterfowl, and waterbirds (Winkelman 1990, Larsen and Madsen 2000, Mabey and Paul 2007). Wind-energy facility construction appears to cause small-scale local displacement of grassland passerines, which is likely due to the birds avoiding turbine noise and maintenance activities. Construction also reduces habitat effectiveness because of the presence of access roads and gravel pads surrounding turbines (Leddy 1996, Johnson et al. 2000a). Bird densities were surveyed in Conservation Reserve Program (CRP) grasslands at the Buffalo Ridge wind-energy facility in Minnesota, and the mean densities of 10 grassland bird species were found to be four times higher at areas located 591 ft (180 m) from turbines than they were at grasslands nearer turbines (Leddy et al. 1999). Reduced use of habitat by seven of 22 grassland-breeding birds was observed following construction of the Buffalo Ridge wind-energy facility (Johnson et al. 2000a). Results from surveys conducted at the Stateline wind-energy facility in Oregon and Washington and the Combine Hills wind-energy facility in Oregon suggest that these facilities had a relatively small impact on grassland-nesting passerines (Erickson et al. 2004, Young et al. 2005). Transect surveys conducted prior to and after construction of the wind-energy facilities found that grassland passerine use was significantly reduced within approximately 164 ft (50 m) of turbine strings, but areas farther away from turbine strings did not have reduced bird use. There is the potential for small-scale displacement of grassland passerines at the HWWRA.

The results of studies to determine the displacement effects of wind-energy facilities on waterfowl and shorebirds appear to be mixed. At the Buffalo Ridge wind-energy facility in Minnesota, the abundance of several bird types (including shorebirds and waterfowl) were found to be significantly lower at survey plots with turbines than at reference plots without turbines (Johnson et al 2000a). The report concluded that the area of reduced use was limited primarily to those areas within 100 m of the turbines. Disturbance tends to be greatest for migrating birds while feeding and resting (Crockford 1992, NRC 2007). The majority of waterfowl and waterbirds use at the HWWRA included two groups of sandhill cranes comprising a total of 36 individuals (64.3% of waterfowl and waterbird observations). The sandhill cranes were flying over the HWWRA. The amount waterfowl and waterbird habitat within the HWWRA is very limited, suggesting that any displacement impacts to waterfowl and waterbirds are unlikely to impact their populations.

Much debate has occurred recently regarding the potential impacts of wind-energy facilities on prairie grouse, including greater sage-grouse (*Centrocercus urophasianus*). While the potential exists for wind turbines to displace prairie grouse from occupied habitat, well-designed studies examining the potential impacts of wind turbines on prairie grouse are currently lacking. The greater sage-grouse has recently been designated as a candidate species for listing under the Endangered Species Act (ESA 1973) by the United States Fish and Wildlife Service (USFWS). Greater sage-grouse conservation in Wyoming is currently managed by the Wyoming Game and Fish Department (WGFD) in cooperation with regional greater sage-grouse working groups in an attempt to increase grouse population levels and avoid federal listing under the ESA. The State of Wyoming has designated core sage-grouse areas within Wyoming, and the current position of the State is that no wind-energy development shall occur within core sage-grouse areas in Wyoming until it can be demonstrated that wind-energy development can occur with no impact to sage-grouse in core areas. The HWWRA is not within a designated core sage-grouse area, and no greater sage-grouse were observed within the HWWRA.

Big Game

Two-hundred and ninety-five elk in four groups and 85 pronghorn antelope in 11 groups were observed while conducting surveys within the HWWRA. According to the Wyoming Game and Fish Department (WGFD), the HWWRA is not in an area designated as crucial winter range, parturition, or migration route for either species. The impacts to big game, including elk and pronghorn antelope, from wind-energy facilities are not well known as very little research has been conducted to date. At the Foote Creek Rim facility in Carbon County, Wyoming, pronghorn antelope observed during raptor use surveys were recorded year round (Johnson et al. 2000b). The mean number of pronghorn antelope observed at the six fixed-point bird use points was 1.07 animals/survey prior to construction of the wind-energy facility and 1.59 and 1.14 animals/survey the two years immediately following construction, indicating no reduction in use of the immediate area. A study of interactions of elk with operating wind-energy facilities was recently conducted in Oklahoma, and the study found no evidence that operating wind turbines have a measurable impact on elk use of the surrounding area (Walter et al. 2004).

Sensitive Species

All sensitive species observed at the HWWRA are summarized in Table 7. No federally-listed threatened or endangered species were observed within the HWWRA. Ten bird species with native NSS rankings one through four in the state of Wyoming were observed in the HWWRA during the surveys. Of these species, three were raptors: bald eagle (five observations), ferruginous hawk (43 observations), and Swainson’s hawk (21 observations). Twenty-nine golden eagles were also observed within the HWWRA. Golden eagles are not listed in Wyoming, but both bald and golden eagles are legally protected under the BGEPA (1940), while the others are further protected under the MBTA (1918). One federally-listed raptor species of concern (not previously listed above; prairie falcon; 15 observations) was observed during fixed-point surveys. Impacts to raptor species may be minimized by placing spatial buffers around known nest sites and avoiding known foraging areas such as the two white-tailed prairie dog colonies identified while siting the wind-energy facility. Two of the Wyoming sensitive species were waterbirds: sandhill crane (two groups totaling 36 observations) and American white pelican (one group of two observations). The five remaining Wyoming sensitive species were passerines: McCown's longspur (166 observations), Brewer's sparrow (nine observations), lark bunting (two observations), chestnut-collared longspur (two observations), and grasshopper sparrow (five observations). In addition, one federally-listed passerine species of concern (not previously listed above) was observed during fixed point surveys. Some small-scale displacement of grassland passerines is possible in close proximity to turbines.

CONCLUSIONS AND RECOMMENDATIONS

Based on data collected during this study, raptor and all bird use of the HWWRA is within the range of raptor and all bird use reported at wind resource areas evaluated throughout the US using similar methods. Based on the results of the studies to date, bird mortality at the HWWRA would likely be similar to bird mortality documented at other wind-energy facilities located in the western US and Rocky Mountain Region where bird collision mortality has been relatively low.

Currently, one study is available from the Rocky Mountain Region that compares bird use to bird mortality rates. Based on research conducted at wind-energy facilities throughout the western US and the Rocky Mountain Region, raptor use at the HWWRA is within the range of use levels recorded at other wind-energy facilities. Raptor fatality rates are expected to be within the range of fatality rates observed at other facilities in the western US and Rocky Mountain Region. To date, no relationships have been observed between overall use by other bird types, and fatality rates of those bird groups at wind-energy facilities. However, the flight characteristics and foraging habits of some species may result in increased exposure for these species at the HWWRA. To date, overall fatality rates for birds at wind-energy facilities have been relatively low and consistent in the western US and Rocky Mountain Region. As more research is conducted at facilities in the western US and Rocky Mountain Region, more information regarding the potential direct impacts of wind-energy facilities to bird species will be obtained.

The proposed wind-energy facility is dominated by grasslands, comprising approximately 88% of the HWWRA. Some species considered to be sensitive or of conservation concern were observed within the HWWRA. Impacts to raptor species can be minimized by placing spatial buffers (following the recommendations provided by the WGFD in a letter dated June 22, 2009) around nest sites during siting of the wind-energy facility and avoiding the two small white-tailed prairie dog colonies identified. Research concerning displacement impacts to songbirds, waterfowl, and waterbirds at wind-energy facilities is limited. However, some studies show the potential for small-scale (591 ft [180 m] or less) displacement, while impacts to densities of birds at larger scales have not been shown. Due to the lack of waterfowl and waterbird habitat within the HWWRA, displacement impacts to waterfowl and waterbirds are unlikely.

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Table 1. Mapped vegetation and habitat types, coverage, and percent composition (%) within the Hermosa West Wind Resource Area.

Habitat	Acres	% Composition
Grassland	9,735.14	87.6
Coniferous Forest	661.33	6.0
Riparian	397.70	3.6
Mountain Mahogany	131.30	1.2
Shrub Steppe	106.46	1.0
Riparian/Willow	86.01	0.8
Total	**11,117.94**	**100**

Table 2. Summary of species richness (species/plot[a]/20-minute survey) and sample size, by season and overall, during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness	
				Large Birds	Small Birds
Spring	9	54	28	0.91	1.78
Summer	6	36	26	1.28	2.64
Fall	10	59	31	1.00	1.80
Winter	9	45	14	0.54	0.61
Overall	**34**	**194**	**45**	**0.90**	**1.62**

[a] 800-meter (m) radius for large birds and 100-m radius for small birds.

Table 3. Summary of individuals (# obs) and group observations (# grps) by bird type and species for fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

		Spring		Summer		Fall		Winter		Total	
Bird Type or Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**2**	**35**	**1**	**2**	**1**	**17**	**0**	**0**	**4**	**54**
American white pelican	*Pelecanus erythrorhyncos*	0	0	1	2	0	0	0	0	1	2
sandhill crane	*Grus canadensis*	1	19	0	0	1	17	0	0	2	36
unidentified tern		1	16	0	0	0	0	0	0	1	16
Waterfowl		**0**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**1**	**2**
mallard	*Anas platyrhynchos*	0	0	0	0	1	2	0	0	1	2
Raptors		**40**	**40**	**34**	**34**	**58**	**58**	**24**	**24**	**156**	**156**
Accipiters		*1*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	*2*	*2*
sharp-shinned hawk	*Accipiter striatus*	1	1	0	0	1	1	0	0	2	2
Buteos		*30*	*30*	*21*	*21*	*41*	*41*	*10*	*10*	*102*	*102*
ferruginous hawk	*Buteo regalis*	5	5	6	6	21	21	5	5	37	37
red-tailed hawk	*Buteo jamaicensis*	10	10	8	8	15	15	4	4	37	37
rough-legged hawk	*Buteo lagopus*	3	3	0	0	3	3	1	1	7	7
Swainson's hawk	*Buteo swainsoni*	12	12	7	7	2	2	0	0	21	21
Northern Harrier		*0*	*0*	*2*	*2*	*1*	*1*	*0*	*0*	*3*	*3*
northern harrier	*Circus cyaneus*	0	0	2	2	1	1	0	0	3	3
Eagles		*5*	*5*	*4*	*4*	*11*	*11*	*12*	*12*	*32*	*32*
bald eagle	*Haliaeetus leucocephalus*	0	0	0	0	2	2	2	2	4	4
golden eagle	*Aquila chrysaetos*	5	5	4	4	9	9	10	10	28	28
Falcons		*4*	*4*	*7*	*7*	*4*	*4*	*2*	*2*	*17*	*17*
American kestrel	*Falco sparverius*	2	2	0	0	0	0	0	0	2	2
prairie falcon	*Falco mexicanus*	2	2	7	7	4	4	2	2	15	15
Vultures		**5**	**5**	**13**	**13**	**5**	**5**	**0**	**0**	**23**	**23**
turkey vulture	*Cathartes aura*	5	5	13	13	5	5	0	0	23	23
Doves/Pigeons		**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**1**	**3**
mourning dove	*Zenaida macroura*	0	0	0	0	1	3	0	0	1	3

Table 3. Summary of individuals (# obs) and group observations (# grps) by bird type and species for fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

Bird Type or Species	Scientific Name	Spring # grps	Spring # obs	Summer # grps	Summer # obs	Fall # grps	Fall # obs	Winter # grps	Winter # obs	Total # grps	Total # obs
Large Corvids		**8**	**21**	**2**	**4**	**1**	**2**	**9**	**22**	**20**	**49**
American crow	*Corvus brachyrhynchos*	5	17	2	4	1	2	7	20	15	43
black-billed magpie	*Pica pica*	1	2	0	0	0	0	2	2	3	4
common raven	*Corvus corax*	2	2	0	0	0	0	0	0	2	2
Passerines		**191**	**370**	**169**	**262**	**191**	**615**	**89**	**366**	**640**	**1,613**
American robin	*Turdus migratorius*	1	1	0	0	0	0	0	0	1	1
American tree sparrow	*Spizella arborea*	0	0	0	0	0	0	1	10	1	10
barn swallow	*Hirundo rustica*	4	4	2	5	0	0	0	0	6	9
black-headed grosbeak	*Pheucticus melanocephalus*	0	0	0	0	1	3	0	0	1	3
Brewer's sparrow	*Spizella breweri*	1	1	3	6	1	2	0	0	5	9
Cassin's kingbird	*Tyrannus vociferans*	0	0	0	0	1	1	0	0	1	1
chestnut-collared longspur	*Calcarius ornatus*	2	2	0	0	0	0	0	0	2	2
chipping sparrow	*Spizella passerina*	2	7	0	0	0	0	0	0	2	7
Clark's nutcracker	*Nucifraga columbiana*	1	1	1	4	1	1	1	2	4	8
cliff swallow	*Petrochelidon pyrrhonota*	1	1	1	3	0	0	0	0	2	4
grasshopper sparrow	*Ammodramus savannarum*	1	1	3	3	1	1	0	0	5	5
green-tailed towhee	*Pipilo chlorurus*	0	0	1	1	0	0	0	0	1	1
horned lark	*Eremophila alpestris*	104	191	81	141	114	420	79	324	378	1,076
Lapland longspur	*Calcarius lapponicus*	0	0	0	0	4	10	3	17	7	27
lark bunting	*Calamospiza melanocorys*	0	0	0	0	1	2	0	0	1	2
lark sparrow	*Chondestes grammacus*	0	0	2	2	0	0	0	0	2	2
lazuli bunting	*Passerina amoena*	0	0	1	1	2	3	0	0	3	4
loggerhead shrike	*Lanius ludovicianus*	4	4	3	3	1	1	0	0	8	8
McCown's longspur	*Calcarius mccownii*	31	48	40	53	21	65	0	0	92	166
mountain bluebird	*Sialia currucoides*	34	102	5	7	19	68	4	12	62	189
savannah sparrow	*Passerculus sandwichensis*	0	0	3	4	9	13	0	0	12	17
vesper sparrow	*Pooecetes gramineus*	4	6	16	22	9	19	0	0	29	47

Table 3. Summary of individuals (# obs) and group observations (# grps) by bird type and species for fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

		Spring		Summer		Fall		Winter		Total	
Bird Type or Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
western meadowlark	*Sturnella neglecta*	1	1	7	7	5	5	0	0	13	13
white-breasted nuthatch	*Sitta carolinenis*	0	0	0	0	1	1	1	1	2	2
Other Birds		**0**	**0**	**2**	**2**	**1**	**1**	**0**	**0**	**3**	**3**
broad-tailed hummingbird	*Selasphorus platycercus*	0	0	1	1	0	0	0	0	1	1
northern flicker	*Colaptes auratus*	0	0	1	1	1	1	0	0	2	2
Overall		**246**	**471**	**221**	**317**	**259**	**703**	**122**	**412**	**848**	**1,903**

[a] Regardless of distance from observer

Table 4a. Mean bird use (number of birds/800-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type and species, by season, during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

	Mean Use				% Composition				% Frequency			
Bird Type or Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**0.65**	**0.06**	**0.28**	**0**	**34.7**	**3.8**	**19.3**	**0**	**3.7**	**2.8**	**1.7**	**0**
American white pelican	0	0.06	0	0	0	3.8	0	0	0	2.8	0	0
sandhill crane	0.35	0	0.28	0	18.8	0	19.3	0	1.9	0	1.7	0
unidentified tern	0.30	0	0	0	15.8	0	0	0	1.9	0	0	0
Waterfowl	**0**	**0**	**0.03**	**0**	**0**	**0**	**2.3**	**0**	**0**	**0**	**1.7**	**0**
mallard	0	0	0.03	0	0	0	2.3	0	0	0	1.7	0
Raptors	**0.74**	**0.94**	**0.98**	**0.44**	**39.6**	**64.2**	**67.0**	**35.3**	**51.9**	**61.1**	**60.7**	**33.3**
Accipiters	*0.02*	*0*	*0.02*	*0*	*1.0*	*0*	*1.1*	*0*	*1.9*	*0*	*1.7*	*0*
sharp-shinned hawk	0.02	0	0.02	0	1.0	0	1.1	0	1.9	0	1.7	0
Buteos	*0.56*	*0.58*	*0.69*	*0.19*	*29.7*	*39.6*	*47.0*	*14.7*	*38.9*	*52.8*	*45.7*	*18.5*
ferruginous hawk	0.09	0.17	0.35	0.09	5.0	11.3	24.1	7.4	9.3	13.9	27.0	9.3
red-tailed hawk	0.19	0.22	0.25	0.07	9.9	15.1	17.0	5.9	16.7	22.2	21.7	7.4
rough-legged hawk	0.06	0	0.05	0.02	3.0	0	3.6	1.5	3.7	0	5.3	1.9
Swainson's hawk	0.22	0.19	0.03	0	11.9	13.2	2.3	0	14.8	16.7	3.3	0
Northern Harrier	*0*	*0.06*	*0.02*	*0*	*0*	*3.8*	*1.1*	*0*	*0*	*5.6*	*1.7*	*0*
northern harrier	0	0.06	0.02	0	0	3.8	1.1	0	0	5.6	1.7	0
Eagles	*0.09*	*0.11*	*0.19*	*0.22*	*5.0*	*7.5*	*13.2*	*17.6*	*9.3*	*11.1*	*15.3*	*16.7*
bald eagle	0	0	0.04	0.04	0	0	2.7	2.9	0	0	2.0	3.7
golden eagle	0.09	0.11	0.15	0.19	5.0	7.5	10.5	14.7	9.3	11.1	15.3	13.0
Falcons	*0.07*	*0.19*	*0.07*	*0.04*	*4.0*	*13.2*	*4.5*	*2.9*	*7.4*	*16.7*	*6.7*	*3.7*
American kestrel	0.04	0	0	0	2.0	0	0	0	3.7	0	0	0
prairie falcon	0.04	0.19	0.07	0.04	2.0	13.2	4.5	2.9	3.7	16.7	6.7	3.7
Vultures	**0.09**	**0.36**	**0.08**	**0**	**5.0**	**24.5**	**5.7**	**0**	**9.3**	**33.3**	**8.3**	**0**
turkey vulture	0.09	0.36	0.08	0	5.0	24.5	5.7	0	9.3	33.3	8.3	0
Doves/Pigeons	**0**	**0**	**0.05**	**0**	**0**	**0**	**3.4**	**0**	**0**	**0**	**1.7**	**0**
mourning dove	0	0	0.05	0	0	0	3.4	0	0	0	1.7	0

Table 4a. Mean bird use (number of birds/800-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type and species, by season, during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

	Mean Use				% Composition				% Frequency			
Bird Type or Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Large Corvids	**0.39**	**0.11**	**0.03**	**0.81**	**20.8**	**7.5**	**2.3**	**64.7**	**13.0**	**5.6**	**1.7**	**14.8**
American crow	0.31	0.11	0.03	0.78	16.8	7.5	2.3	61.8	9.3	5.6	1.7	13.0
black-billed magpie	0.04	0	0	0.04	2.0	0	0	2.9	1.9	0	0	1.9
common raven	0.04	0	0	0	2.0	0	0	0	3.7	0	0	0
Overall	**1.87**	**1.47**	**1.47**	**1.26**	**100**	**100**	**100**	**100**				

Table 4b. Mean bird use (number of birds/100-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species, by season, during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

	Mean Use				% Composition				% Frequency			
Bird Type or Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**6.85**	**7.28**	**10.28**	**7.07**	**100**	**99.2**	**99.8**	**100**	**87.0**	**100**	**96.3**	**50.0**
American robin	0.02	0	0	0	0.3	0	0	0	1.9	0	0	0
American tree sparrow	0	0	0	0.19	0	0	0	2.6	0	0	0	1.9
barn swallow	0.07	0.14	0	0	1.1	1.9	0	0	5.6	2.8	0	0
black-headed grosbeak	0	0	0.05	0	0	0	0.5	0	0	0	1.7	0
Brewer's sparrow	0.02	0.17	0.03	0	0.3	2.3	0.3	0	1.9	5.6	1.7	0
Cassin's kingbird	0	0	0.02	0	0	0	0.2	0	0	0	1.7	0
chestnut-collared longspur	0.04	0	0	0	0.5	0	0	0	3.7	0	0	0
chipping sparrow	0.13	0	0	0	1.9	0	0	0	1.9	0	0	0
Clark's nutcracker	0.02	0.11	0.02	0.04	0.3	1.5	0.2	0.5	1.9	2.8	2.0	1.9
cliff swallow	0.02	0.08	0	0	0.3	1.1	0	0	1.9	2.8	0	0
grasshopper sparrow	0.02	0.08	0.02	0	0.3	1.1	0.2	0	1.9	8.3	1.7	0
green-tailed towhee	0	0.03	0	0	0	0.4	0	0	0	2.8	0	0
horned lark	3.54	3.92	7.03	6.30	51.6	53.4	68.3	89.0	79.6	97.2	84.3	48.1
Lapland longspur	0	0	0.17	0.31	0	0	1.6	4.5	0	0	5.0	3.7
lark bunting	0	0	0.03	0	0	0	0.3	0	0	0	1.7	0
lark sparrow	0	0.06	0	0	0	0.8	0	0	0	5.6	0	0
lazuli bunting	0	0.03	0.05	0	0	0.4	0.5	0	0	2.8	3.3	0
loggerhead shrike	0.07	0.08	0.02	0	1.1	1.1	0.2	0	7.4	8.3	1.7	0
McCown's longspur	0.89	1.47	1.08	0	13.0	20.1	10.5	0	29.6	55.6	25.0	0
mountain bluebird	1.89	0.19	1.13	0.22	27.6	2.7	11.0	3.1	33.3	11.1	20.0	3.7
savannah sparrow	0	0.11	0.22	0	0	1.5	2.1	0	0	5.6	8.3	0
vesper sparrow	0.11	0.61	0.32	0	1.6	8.3	3.1	0	5.6	27.8	10.0	0
western meadowlark	0.02	0.19	0.08	0	0.3	2.7	0.8	0	1.9	19.4	8.3	0
white-breasted nuthatch	0	0	0.02	0.02	0	0	0.2	0.3	0	0	1.7	1.9

Table 4b. Mean bird use (number of birds/100-meter plot/20-minute survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species, by season, during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

	Mean Use				% Composition				% Frequency			
Bird Type or Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Other Birds	**0**	**0.06**	**0.02**	**0**	**0**	**0.8**	**0.2**	**0**	**0**	**5.6**	**1.7**	**0**
broad-tailed hummingbird	0	0.03	0	0	0	0.4	0	0	0	2.8	0	0
northern flicker	0	0.03	0.02	0	0	0.4	0.2	0	0	2.8	1.7	0
Overall	**6.85**	**7.33**	**10.30**	**7.07**	**100**	**100**	**100**	**100**				

Table 5. Flight height characteristics, by bird type, observed during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010. Large bird observations were limited to within an 800-meter (m) radius, and small bird observations were limited to within a 100-m radius.

	# Groups	# Obs	Mean Flight	% Obs	% Within Flight Height Categories		
Bird Type	**Flying**	**Flying**	**Height (m)**	**Flying**	**0 - 35 m**	**35 - 130 m[a]**	**> 130 m**
Waterbirds	4	54	93.75	100	29.6	66.7	3.7
Waterfowl	1	2	50.00	100	0	100	0
Raptors	147	147	28.20	94.2	62.6	37.4	0
Accipiters	*2*	*2*	*22.50*	*100*	*100*	*0*	*0*
Buteos	*94*	*94*	*28.73*	*92.2*	*60.6*	*39.4*	*0*
Northern Harrier	*3*	*3*	*13.33*	*100*	*100*	*0*	*0*
Eagles	*31*	*31*	*35.29*	*96.9*	*41.9*	*58.1*	*0*
Falcons	*17*	*17*	*15.65*	*100*	*100*	*0*	*0*
Vultures	23	23	29.04	100	52.2	47.8	0
Doves/Pigeons	1	3	4.00	100	100	0	0
Large Corvids	18	47	6.06	95.9	100	0	0
Large Birds Overall	**194**	**276**	**27.59**	**96.2**	**61.6**	**37.7**	**0.7**
Passerines	585	1,543	2.19	95.7	100	0	0
Other Birds	3	3	3.67	100	100	0	0
Small Birds Overall	**588**	**1,546**	**2.20**	**95.7**	**100**	**0**	**0**

[a] The likely rotor-swept heights for potential collision with a turbine blade or 115 to 427 feet (35 to 130 m) above ground level.

Table 6a. Relative exposure index and flight characteristics for large bird species during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying Within RSH[a] Based on Initial Obs	Exposure Index	% Flying Within RSH at Anytime
sandhill crane	2	0.13	100	100	0.13	100
golden eagle	27	0.14	96.4	59.3	0.08	63.0
red-tailed hawk	34	0.17	91.9	44.1	0.07	64.7
turkey vulture	23	0.13	100	47.8	0.06	56.5
ferruginous hawk	33	0.17	89.2	30.3	0.04	36.4
Swainson's hawk	20	0.10	95.2	45.0	0.04	80.0
rough-legged hawk	7	0.03	100	42.9	0.01	42.9
bald eagle	4	0.02	100	50.0	0.01	75.0
mallard	1	<0.01	100	100	<0.01	100
American crow	13	0.36	95.3	0	0	0
prairie falcon	15	0.08	100	0	0	13.3
unidentified tern	1	0.06	100	0	0	0
black-billed magpie	3	0.02	100	0	0	0
northern harrier	3	0.02	100	0	0	0
American white pelican	1	0.01	100	0	0	0
mourning dove	1	0.01	100	0	0	0
American kestrel	2	<0.01	100	0	0	0
common raven	2	<0.01	100	0	0	0
sharp-shinned hawk	2	<0.01	100	0	0	0

[a] RSH - the likely rotor-swept heights for potential collision with a turbine blade or 115 to 427 feet (35 to 130 meters) above ground level.

Table 6b. Relative exposure index and flight characteristics for small bird species during the fixed-point bird use surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying Within RSH[a] Based on Initial Obs	Exposure Index	% Within RSH at Anytime
horned lark	345	5.27	96.2	0	0	0
McCown's longspur	91	0.78	98.8	0	0	0
mountain bluebird	60	0.76	97.4	0	0	0
vesper sparrow	24	0.24	89.4	0	0	0
Lapland longspur	6	0.14	85.2	0	0	0
savannah sparrow	11	0.07	94.1	0	0	0
western meadowlark	7	0.07	53.8	0	0	0
American tree sparrow	1	0.06	100	0	0	0
Brewer's sparrow	5	0.05	100	0	0	0
barn swallow	6	0.05	100	0	0	0
Clark's nutcracker	4	0.05	100	0	0	0
loggerhead shrike	7	0.04	87.5	0	0	0
grasshopper sparrow	2	0.03	40.0	0	0	0
chipping sparrow	2	0.03	100	0	0	0
cliff swallow	2	0.02	100	0	0	0
lazuli bunting	2	0.02	75.0	0	0	0
lark sparrow	2	0.01	100	0	0	0
northern flicker	2	0.01	100	0	0	0
black-headed grosbeak	1	0.01	100	0	0	0
white-breasted nuthatch	1	<0.01	50.0	0	0	0
chestnut-collared longspur	2	<0.01	100	0	0	0
broad-tailed hummingbird	1	<0.01	100	0	0	0
green-tailed towhee	1	<0.01	100	0	0	0
lark bunting	1	<0.01	100	0	0	0
American robin	1	<0.01	100	0	0	0
Cassin's kingbird	1	<0.01	100	0	0	0

[a] RSH - the likely rotor-swept heights for potential collision with a turbine blade or 115 - 427 feet (35 to 130 meters) above ground level.

Table 7. Summary of sensitive species observed at the Hermosa West Wind Resource Area during fixed-point bird use surveys (FP) and as incidental wildlife observations (Inc.), April 29, 2009 to April 13, 2010.

Species	Scientific Name	Status	FP		Inc.		Total	
			# of grps	# of obs	# of grps	# of obs	# of grps	# of obs
McCown's longspur	*Calcarius mccownii*	NSS4;F-SOC	92	166	0	0	**92**	**166**
ferruginous hawk	*Buteo regalis*	NSS3; F-SOC	37	37	6	6	**43**	**43**
sandhill crane	*Grus canadensis*	NSS3	2	36	0	0	**2**	**36**
golden eagle	*Aquila chrysaetos*	EA;F-SOC	28	28	1	1	**29**	**29**
Swainson's hawk	*Buteo swainsoni*	NSS4	21	21	0	0	**21**	**21**
prairie falcon	*Falco mexicanus*	F-SOC	15	15			**15**	**15**
Brewer's sparrow	*Spizella breweri*	NSS4;F-SOC	5	9	0	0	**5**	**9**
loggerhead shrike	*Lanius ludovicianus*	F-SOC	8	8	0	0	**8**	**8**
bald eagle	*Haliaeetus leucocephalus*	NSS2;EA;F-SOC	4	4	1	1	**5**	**5**
grasshopper sparrow	*Ammodramus savannarum*	NSS4;F-SOC	5	5	0	0	**5**	**5**
chestnut-collared longspur	*Calcarius ornatus*	NSS4;F-SOC	2	2	0	0	**2**	**2**
American white pelican	*Pelecanus erythrorhyncos*	NSS3	1	2	0	0	**1**	**2**
lark bunting	*Calamospiza melanocorys*	NSS4;F-SOC	1	2	0	0	**1**	**2**
Overall	**12 species**		**221**	**335**	**8**	**8**	**229**	**343**

NSS1 - Populations greatly restricted or declining, extirpation possible OR ongoing significant loss of habitat.

NSS2 - Populations declining, extirpation possible; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; ongoing significant loss of habitat.

NSS3 - Populations greatly restricted or declining, extirpation possible; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR species widely distributed; population status or trends unknown but suspected to be stable; on-going significant loss of habitat.

NSS4 - Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance OR populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat.

NSS Definitions from WGFD (2005) and Wyoming's Natural Diversity Database (WYNDD 2009).
F-SOC – Federal species of concern (USFWS 2010)
EA – Federal Bald and Golden Eagle Protection Act (BGEPA 1940).

Table 8. Nesting raptor species and nest density observed at the Hermosa West Wind Resource Area and within a one-mile buffer.

Species	# of Nests Within HWWRA	# of Nests Within One-Mile Buffer of HWWRA	Density (nests/mi^2) Within HHWRA	Density (nests/mi^2) Within One-Mile Buffer of the HHWRA
red-tailed hawk	2	2	0.11	0.04
golden eagle	1	1	0.06	0.02
great horned owl	1	1	0.06	0.02
Swainson's hawk	1	1	0.06	0.02
prairie falcon	0	1	0	0.02
unknown/inactive	9	11	0.52	0.25
Overall	**14**	**17**	**0.80**	**0.38**

Table 9. Incidental wildlife observed while conducting all surveys at the Hermosa West Wind Resource Area, April 29, 2009 – April 13, 2010.

Species	Scientific Name	#grps	# obs
ferruginous hawk	*Buteo regalis*	6	6
golden eagle	*Aquila chrysaetos*	1	1
bald eagle	*Haliaeetus leucocephalus*	1	1
red-tailed hawk	*Buteo jamaicensis*	1	1
Bird Subtotal	**4 species**	**9**	**9**
elk	*Cervus elaphus*	4	295
pronghorn	*Antilocapra americana*	11	85
coyote	*Canis latrans*	2	2
Mammal Subtotal	**3 species**	**17**	**382**

Table 10. Comparison of raptor use estimates and raptor mortality among wind-energy facilities in North America and the Hermosa West Wind Resource Area.

Wind-Energy Facility	Use Estimate[a]	Raptor Mortality[b]	# of Turbines	Total MW
Hermosa West, WY	0.75			
Rocky Mountains				
Summerview, Alb. (2005/2006)		0.11	39	70.2
Judith Gap, MT		0.09	90	135
Foote Creek Rim, WY (Phase I; 1999)		0.08	69	41.4
Foote Creek Rim, WY (Phase I; 2000)		0.05	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)		0	69	41.4
Western				
Diablo Winds, CA	2.16	0.87	31	20
SMUD, CA		0.53	22	15
High Winds, CA	2.34	0.39	90	162
Leaning Juniper, OR	0.52	0.21	67	100.5
Big Horn, WA	0.51	0.15	133	199.5
Hopkins Ridge, WA	0.70	0.14	83	150
Klondike II, OR	0.50	0.11	50	75
Stateline, OR/WA (2002)	0.23	0.09	454	300
Stateline, OR/WA (2003)	0.21	0.09	454	300
Wild Horse, WA	0.29	0.09	127	229
Zintel, WA	0.43	0.05	38	50
Nine Canyon, WA	0.35	0.05	37	48
Combine Hills, OR	0.75	0	41	41
Vansycle, OR	0.66	0	38	24.9
Klondike, OR	0.50	0	16	24
Northeastern				
Noble Ellenburg, NY		0.32	54	80
Noble Clinton, NY		0.29	67	100.5
Maple Ridge, NY (2007)		0.25	195	321.75
Noble Bliss, NY		0.19	67	100
Maple Ridge, NY (2006)		0.04	120	198
Buffalo Mountain, TN (2006)		0	18	29
Buffalo Mountain, TN (2000-2003)		0	3	1.98
Mount Storm, WV (2008)		0	82	164

Table 10. Comparison of raptor use estimates and raptor mortality among wind-energy facilities in North America and the Hermosa West Wind Resource Area.

	Midwest			
NPPD Ainsworth, NE		0.06	36	59.4
Buffalo Ridge, MN	0.64	0.02	281	210.75
	Southern Plains			
Buffalo Gap, TX		0.10	67	134

[a] number of raptors/plot/20-minute survey
[b] number of fatalities/MW/year
Data from the following sources:

Wind-Energy Facility	Use Estimate	Mortality Estimate	Wind-Energy Facility	Use Estimate	Mortality Estimate
Summerview, Alb. (05/06)		Brown and Hamilton 2006	Nine Canyon, WA	Erickson et al. 2001b	Erickson et al. 2003c
Judith Gap, MT		TRC 2008	Combine Hills, OR	Young et al. 2003d	Young et al. 2006
Foote Creek Rim, WY (Phase I; 99)		Young et al. 2003c	Vansycle, OR	WCIA and WEST 1997	Erickson et al. 2000
Foote Creek Rim, WY (Phase I; 00)		Young et al. 2003c	Klondike, OR	Johnson et al. 2002a	Johnson et al. 2003
Diablo Winds, CA	WEST 2006	WEST 2008a	Noble Ellensburg, NY		Jain et al. 2009a
SMUD, CA		URS et al. 2005	Noble Clinton, NY		Jain et al. 2009b
High Winds, CA	Kerlinger et al. 2005	Kerlinger et al. 2006	Maple Ridge, NY (07)		Jain et al. 2008
Leaning Juniper, OR	Kronner et al. 2005	Gritski et al. 2008	Noble Bliss, NY		Jain et al. 2009c
Big Horn, WA	Johnson and Erickson 2004	Kronner et al. 2008	Maple Ridge, NY (06)		Jain et al. 2007
Hopkins Ridge, WA	Young et al. 2003a	Young et al. 2007a	Buffalo Mountain, TN (06)		Fiedler et al. 2007
Klondike II, OR	Johnson 2004	NWC and WEST 2007	Buffalo Mountain, TN (00-03)		Nicholson 2003, 2005
Stateline, OR/WA (02)	Erickson et al. 2002b	Erickson et al. 2004	Mount Storm, WV (08)		Young et al. 2009
Stateline, OR/WA (03)	Erickson et al. 2003b	Erickson et al. 2004	NPPD Ainsworth, NE		Derby et al. 2007
Wild Horse, CA	Erickson et al. 2003d	Erickson et al. 2008	Buffalo Ridge, MN	Erickson et al. 2002b	Erickson et al. 2002b
Zintel, WA	Erickson et al. 2002a	Erickson et al. 2008	Buffalo Gap, TX		Tierney 2007

Table 11. Wind-energy facilities in North America with mortality data for all bird species, grouped by geographic region.

Wind-Energy Facility	Mortality Estimate[a]	# of Turbines	Total MW
Rocky Mountains			
Foote Creek Rim, WY (Phase I; 1999)	3.40	69	41.4
Judith Gap, MT	3.01	90	135
Foote Creek Rim, WY (Phase I; 2000)	2.42	69	41.4
Foote Creek Rim, WY (Phase I; 2001/2002)	1.93	69	41.4
Western			
Leaning Juniper, OR	6.66	67	100.5
Dillon, CA	4.71	45	45
Diablo Winds, CA	4.29	31	20
Stateline, OR/WA (2002)	3.48	454	300
Klondike II, OR	3.14	50	75
Stateline, OR/WA (2003)	2.95	454	300
Nine Canyon, WA	2.76	37	48
Combine Hills, OR	2.56	41	41
Big Horn, WA	2.54	133	199.5
High Winds, CA (2004)	1.62	90	162
Wild Horse, WA	1.55	127	229
Hopkins Ridge, WA	1.23	83	150
High Winds, CA (2005)	1.10	90	162
SMUD, CA	0.99		15
Vansycle, OR	0.95	38	24.9
Klondike, OR	0.95	16	24
Midwest			
Blue Sky Green Field, WI	7.17	88	145
Kewaunee County, WI	6.55	31	20
Buffalo Ridge, MN (Phase III; 1999)	5.93	138	103.5
Buffalo Ridge, MN (Phase I; 1996)	4.14	73	25
Buffalo Ridge, MN (Phase II; 1999)	3.57	143	107.25
Buffalo Ridge, MN (Phase I; 1998)	3.14	73	25
Ripley, Ont.	3.09	38	76
Wolfe Island, Ont.	3.04	86	197.8
Buffalo Ridge, MN (Phase I; 1997)	2.51	73	25
Buffalo Ridge, MN (Phase II; 1998)	2.47	143	107.25
NPPD Ainsworth, NE	1.63	36	59.4
Buffalo Ridge, MN (Phase I; 1999)	1.43	73	25
Crescent Ridge, IL	0.87	33	49.5
Top of Iowa, IA (2004)	0.73	89	80
Top of Iowa, IA (2003)	0.42	89	80
Southern Plains			
Buffalo Gap, TX	1.32	67	134
Oklahoma Wind Energy Center, OK	0.08	68	102

Table 11. Wind-energy facilities in North America with mortality data for all bird species, grouped by geographic region.

Wind-Energy Facility	Mortality Estimate[a]	# of Turbines	Total MW
Northeastern			
Buffalo Mountain, TN (2000-2003)	13.93	3	2
Maple Ridge, NY (2006)	5.81	120	198
Noble Ellenburg, NY (2009)	3.79	54	80
Maple Ridge, NY (2007)	3.44	195	321.75
Mountaineer, WV	3.00	44	66
Noble Bliss, NY (2008)	2.86	67	100
Noble Bliss, NY (2009)	2.81	67	100
Noble Clinton, NY (2008)	2.17	67	100.5
Mount Storm, WV (2008)	1.91	82	164
Cohocton/Dutch Hill, NY	1.88	50	125
Mars Hill, ME (2008)	1.76	28	42
Mars Hill, ME (2007)	1.67	28	42
Munnsville, NY	1.48	23	34.5
Noble Ellenburg, NY (2008)	1.40	54	80
Noble Clinton, NY (2009)	1.17	67	100
Buffalo Mountain, TN (2006)	1.10	18	29
Summerview, Alb. (2005/2006)	1.06	39	70.2

[a] = number of bird fatalities/megawatt (MW)/year

Data from the following sources:

Wind-Energy Facility	Mortality Estimate	Wind-Energy Facility	Mortality Estimate
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003c	Wolfe Island, Ont.	Stantec Ltd. 2010
Judith Gap, MT	TRC 2008	Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000a
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003c	Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000a
Foote Creek Rim, WY (Phase I; 01/02)	Young et al. 2003c	NPPD Ainsworth, NE	Derby et al. 2007
Leaning Juniper, OR	Gritski et al. 2008	Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000a
Dillon, CA	Chatfield et al. 2009	Crescent Ridge, IL	Kerlinger et al. 2007
Diablo Winds, CA	WEST 2008a	Top of Iowa, IA (2004)	Jain 2005
Stateline, OR/WA (02)	Erickson et al. 2004	Top of Iowa, IA (2003)	Jain 2005
Klondike II, OR	NWC and WEST 2007	Buffalo Gap, TX	Tierney 2007
Stateline, OR/WA (03)	Erickson et al. 2004	Oklahoma Wind Energy Center, OK	Piorkowski 2006
Nine Canyon, WA	Erickson et al. 2003c	Buffalo Mountain, TN (00-03)	Nicholson 2005
Combine Hills, OR	Young et al. 2006	Maple Ridge, NY (06)	Jain et al. 2007
Big Horn, WA	Kronner et al. 2008	Noble Ellensburg, NY (2009)	Jain et al. 2010c
High Winds, CA (04)	Kerlinger et al. 2006	Maple Ridge, NY (07)	Jain et al. 2008
Wild Horse, CA	Erickson et al. 2008	Mountaineer, WV	Kerns and Kerlinger 2004
Hopkins Ridge, WA	Young et al. 2007a	Noble Bliss, NY (2008)	Jain et al. 2009c
High Winds, CA (05)	Kerlinger et al. 2006	Noble Bliss, NY (2009)	Jain et al. 2010a
SMUD, CA	URS et al. 2005	Noble Clinton, NY (2008)	Jain et al. 2009b
Vansycle, OR	Erickson et al. 2000	Mount Storm, WV (08)	Young et al. 2009
Klondike, OR	Johnson et al. 2003	Cohocton/Dutch Hill, NY	Stantec 2010
Blue Sky Green Field, WI	Gruver et al. 2009	Mars Hill, ME (08)	Stantec 2009
Kewaunee County, WI	Howe et al. 2002	Mars Hill, ME (07)	Stantec 2008a
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000a	Munnsville, NY	Stantec 2008b
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000a	Noble Ellensburg, NY (2008)	Jain et al. 2009a
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000a	Noble Clinton, NY (2009)	Jain et al. 2010b
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000a	Buffalo Mountain, TN (06)	Fiedler et al. 2007
Ripley, Ont.	Jacques Whitford 2009	Summerview, Alb. (05/06)	Brown and Hamilton 2006

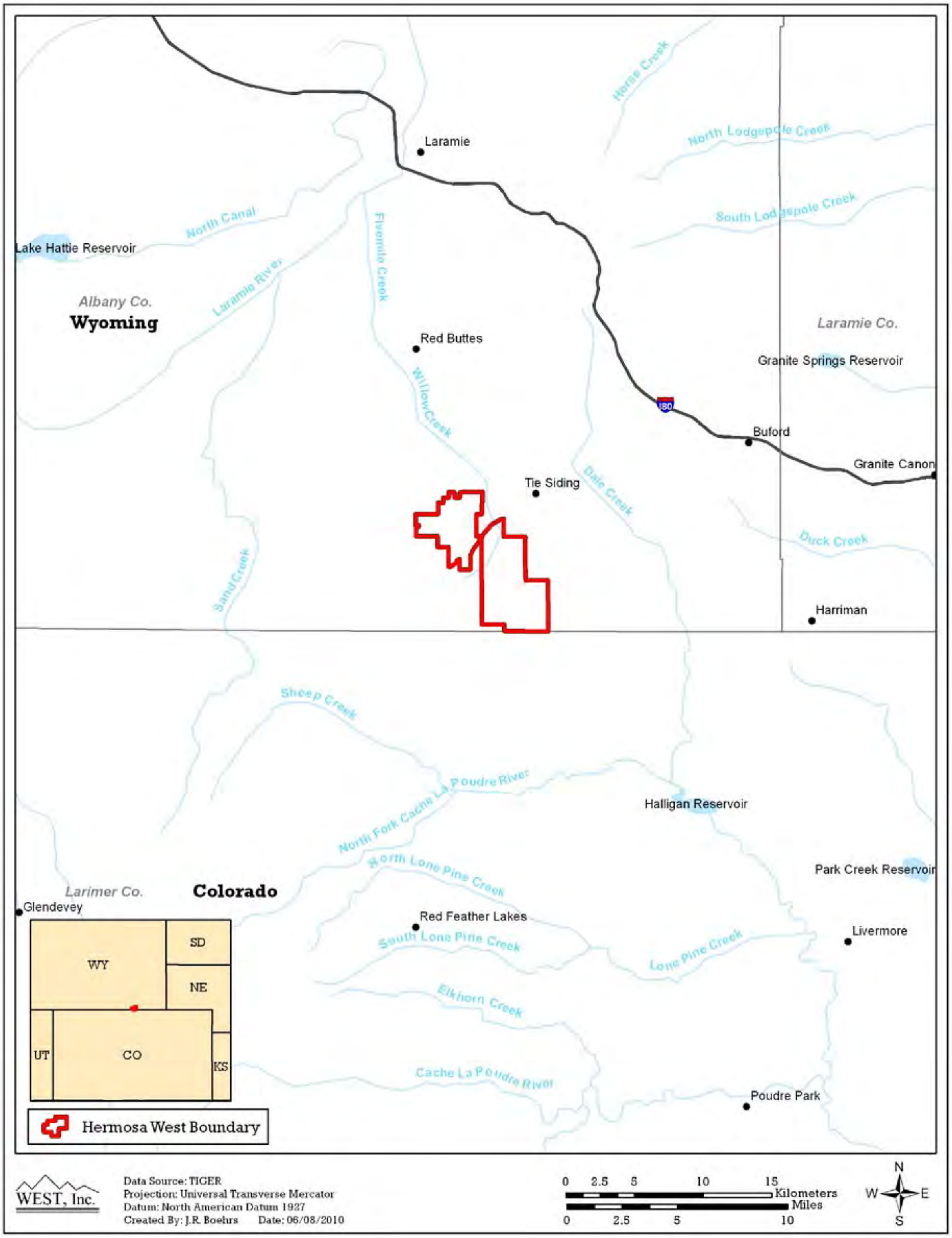


Figure 1. Location of the Hermosa West Wind Resource Area.

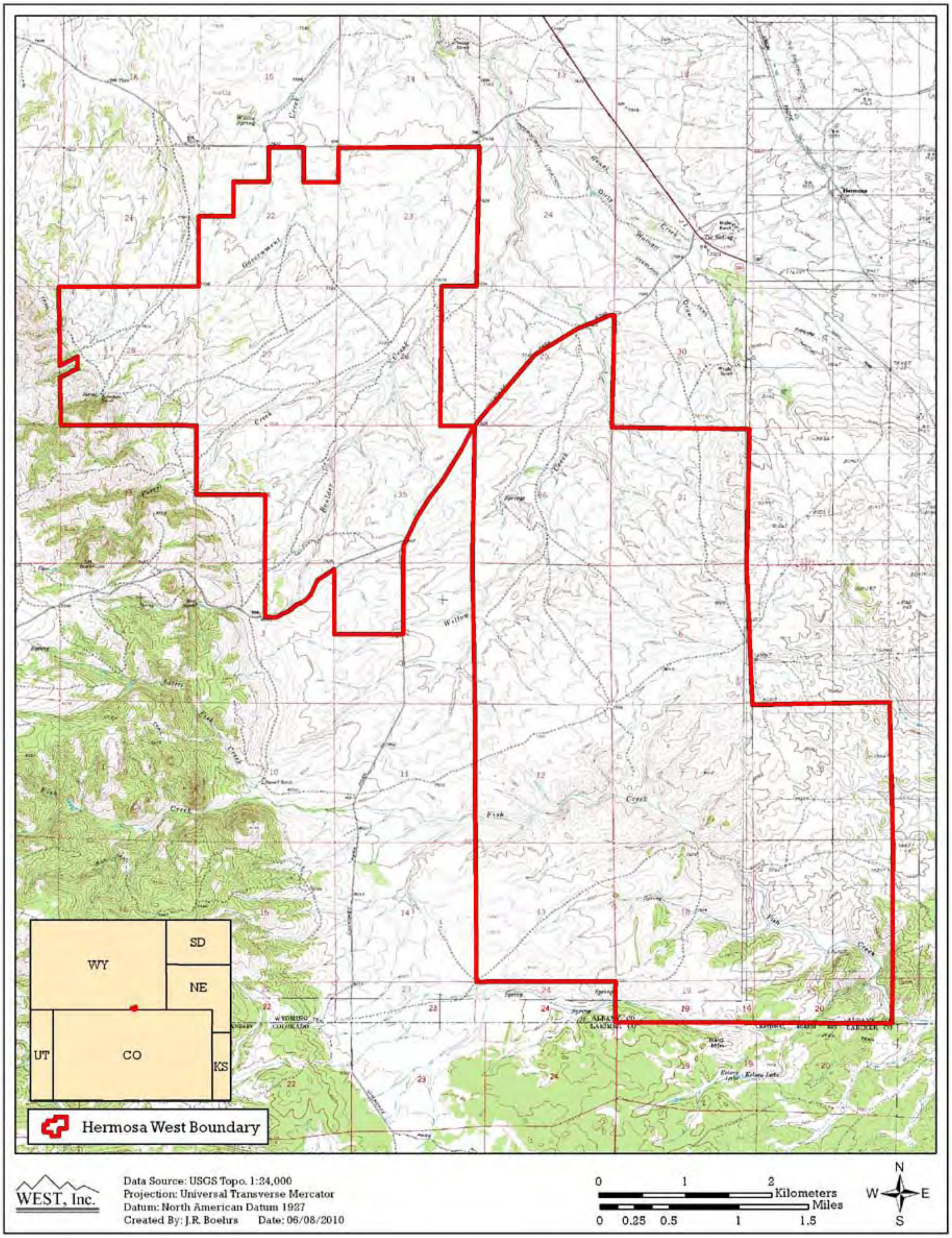


Figure 2. Overview of the Hermosa West Wind Resource Area.

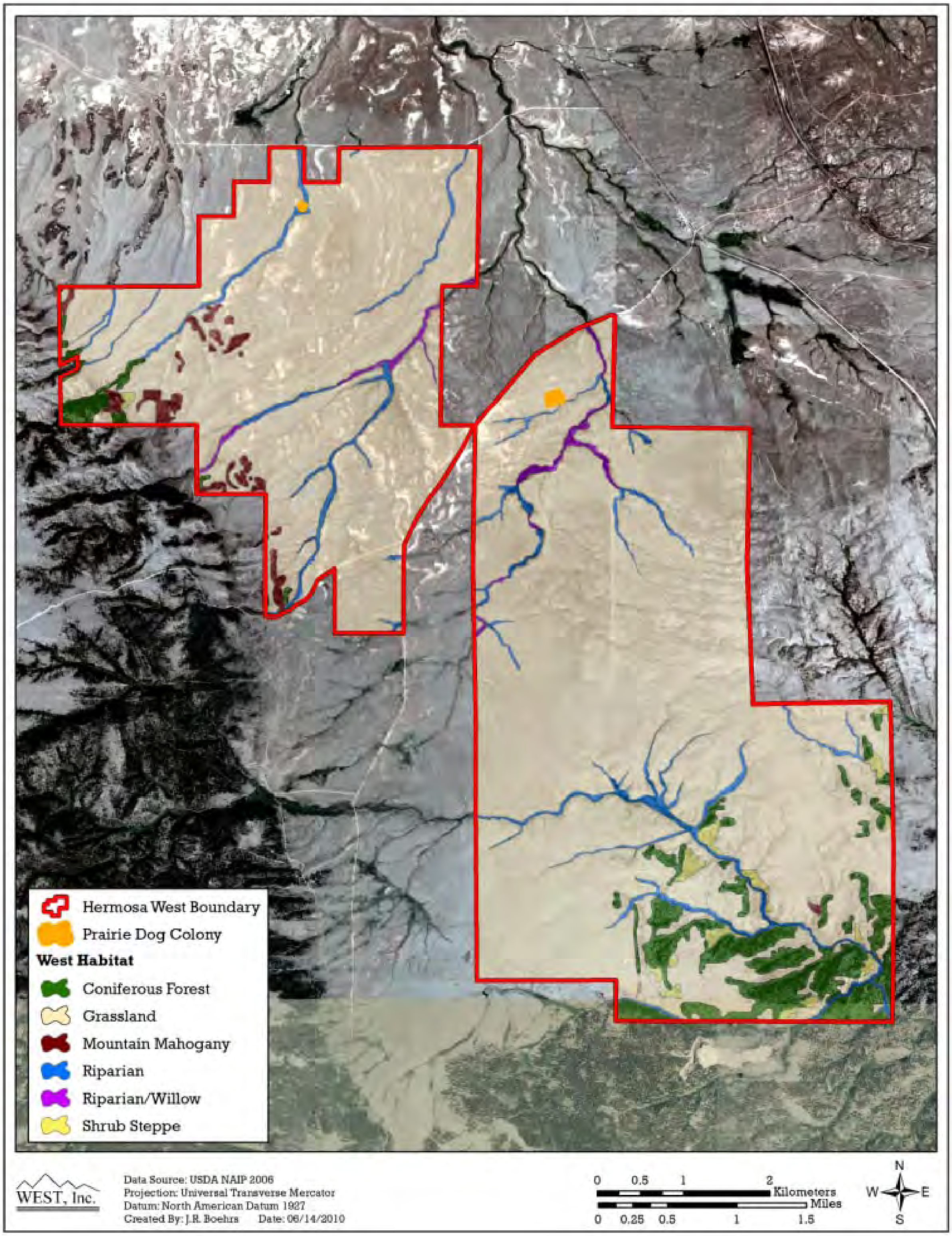


Figure 3. Mapped vegetation and habitat types within the Hermosa West Wind Resource Area.

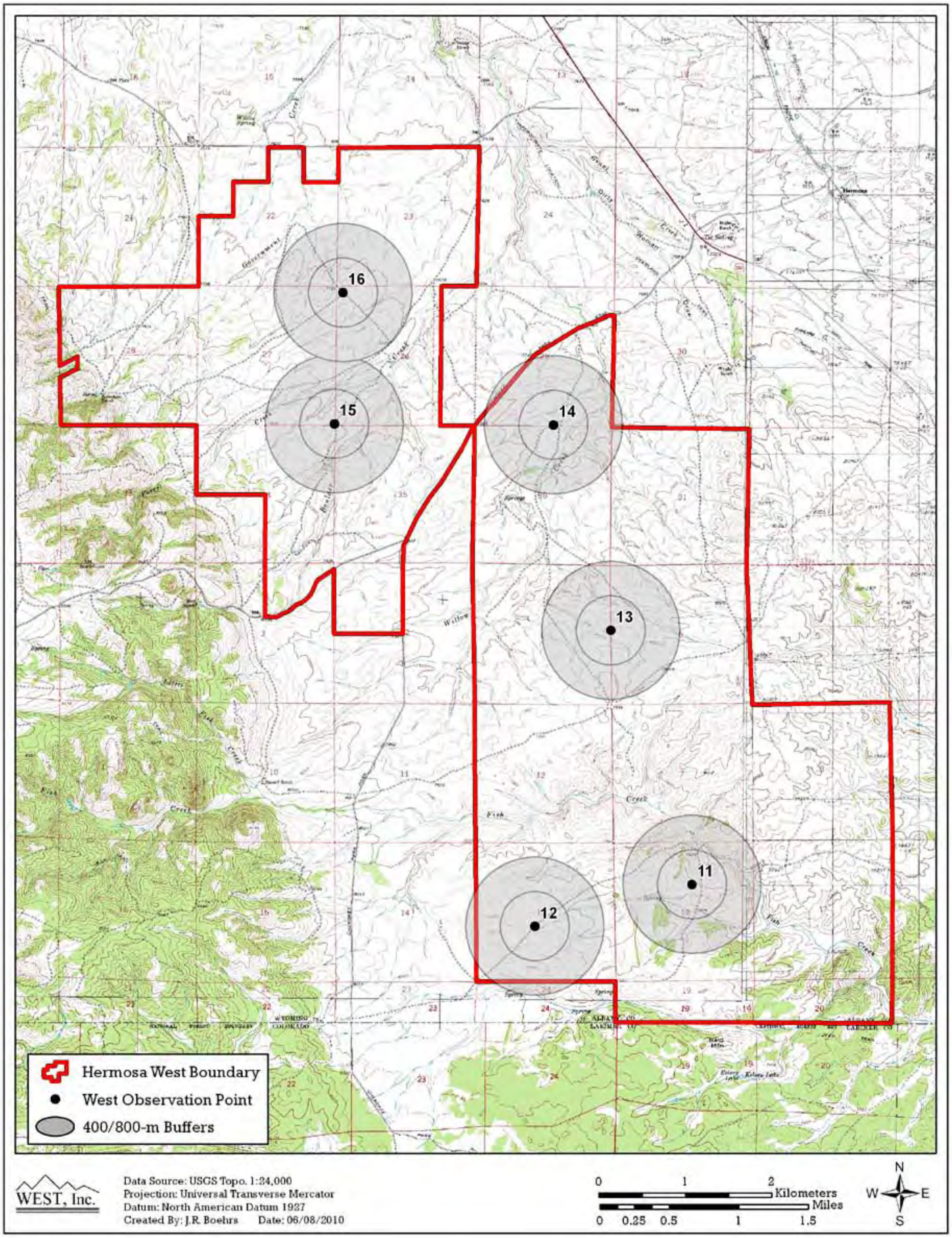
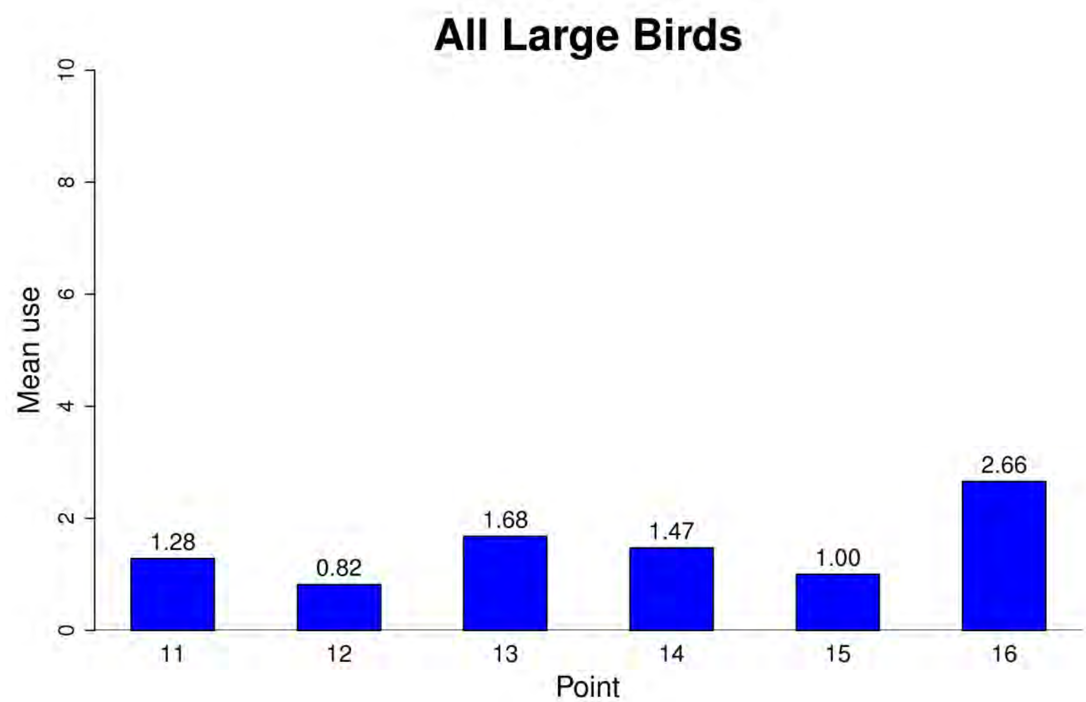


Figure 4. Fixed-point bird use points at the Hermosa West Wind Resource Area.



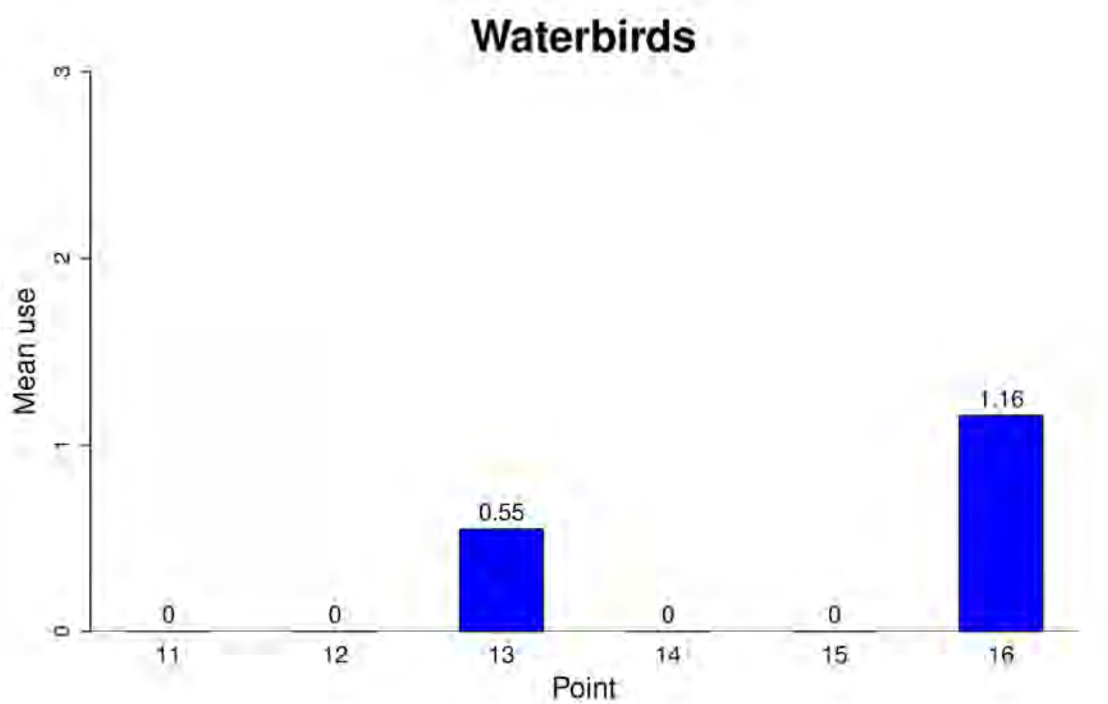
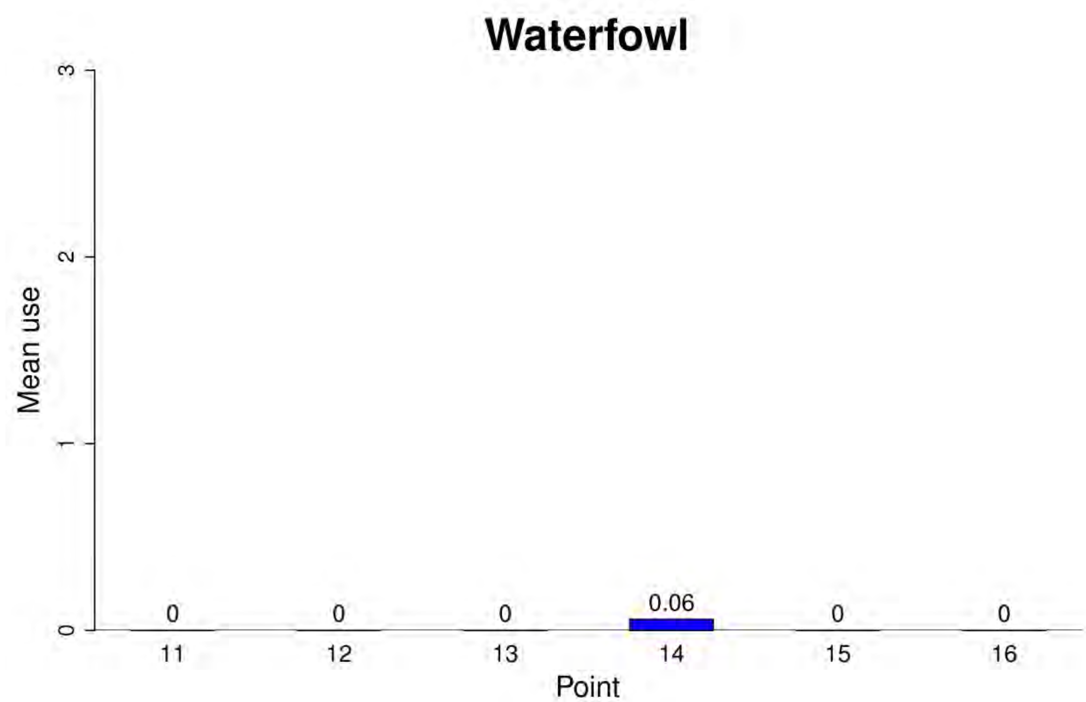


Figure 5. Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtypes at the Hermosa West Wind Resource Area.



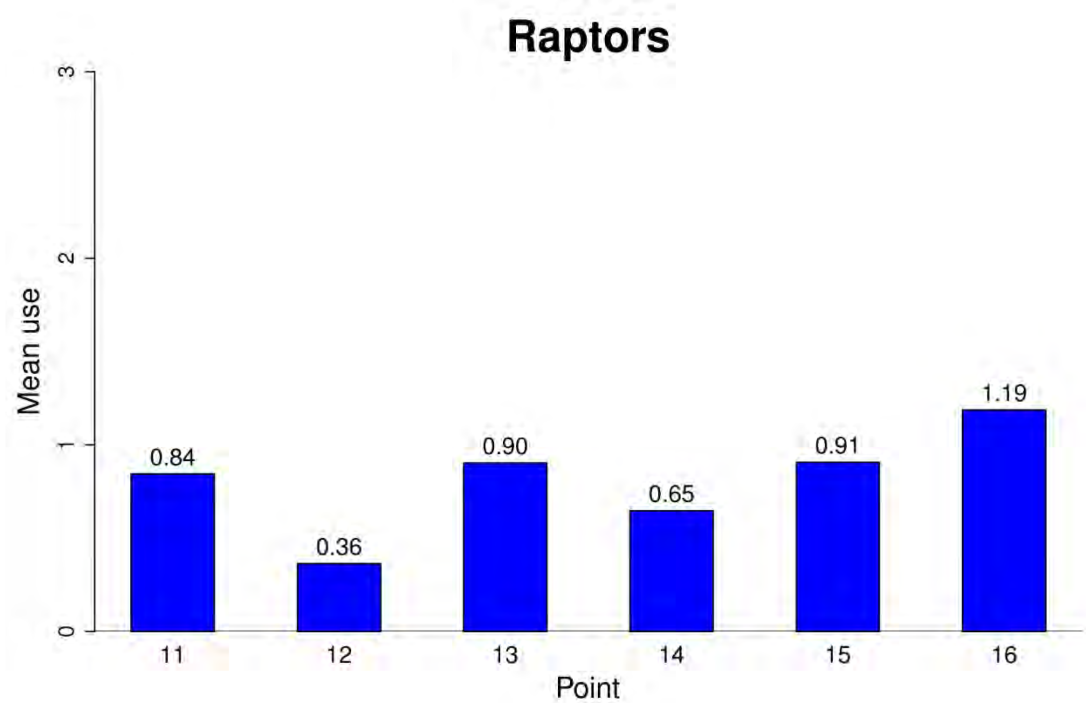
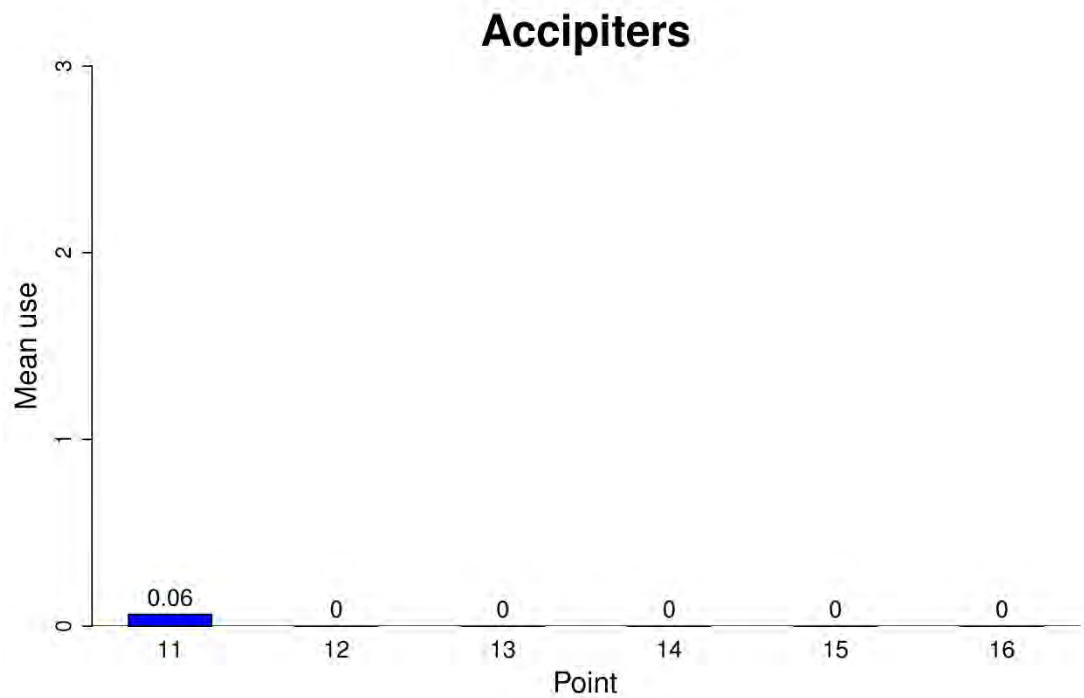


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtypes at the Hermosa West Wind Resource Area.



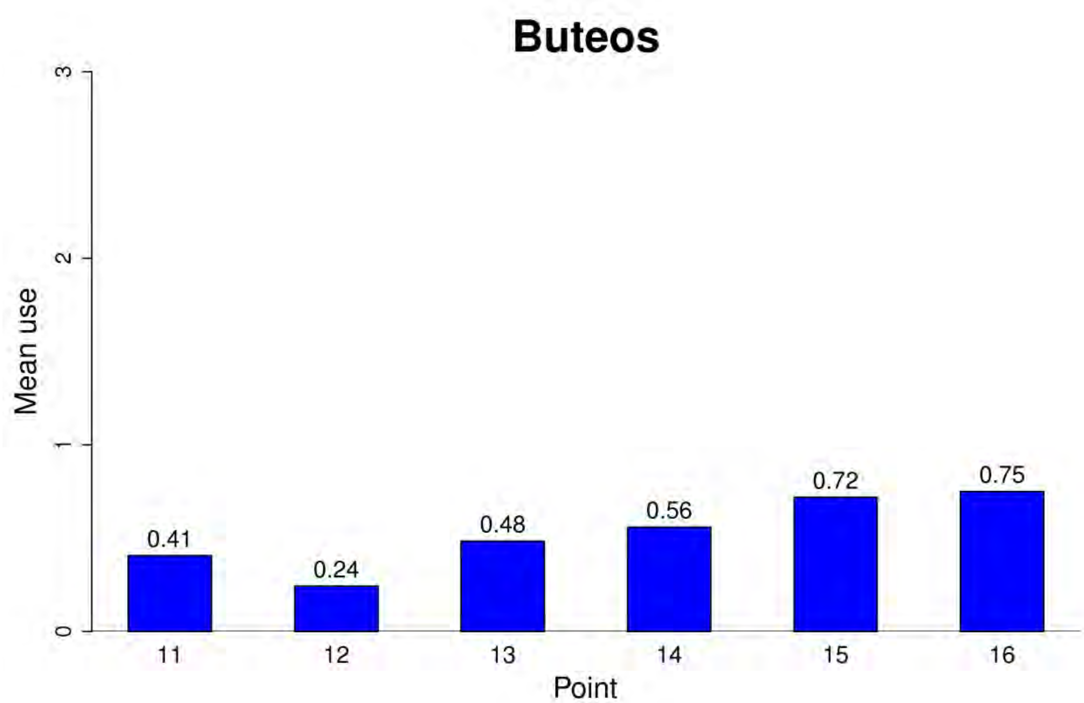
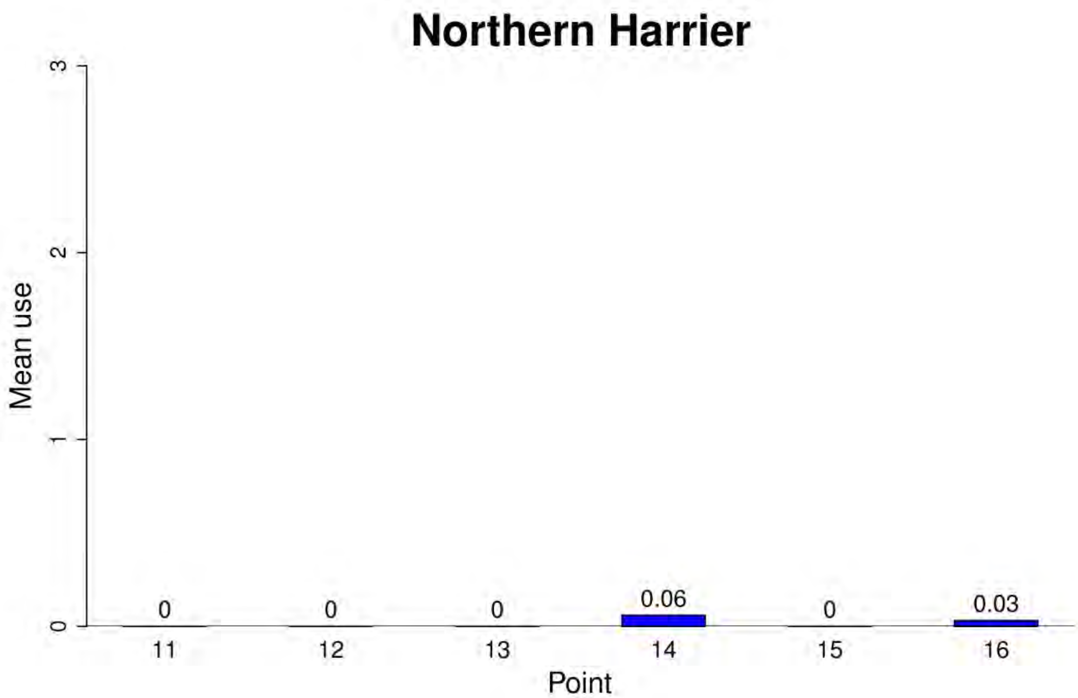


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtypes at the Hermosa West Wind Resource Area.



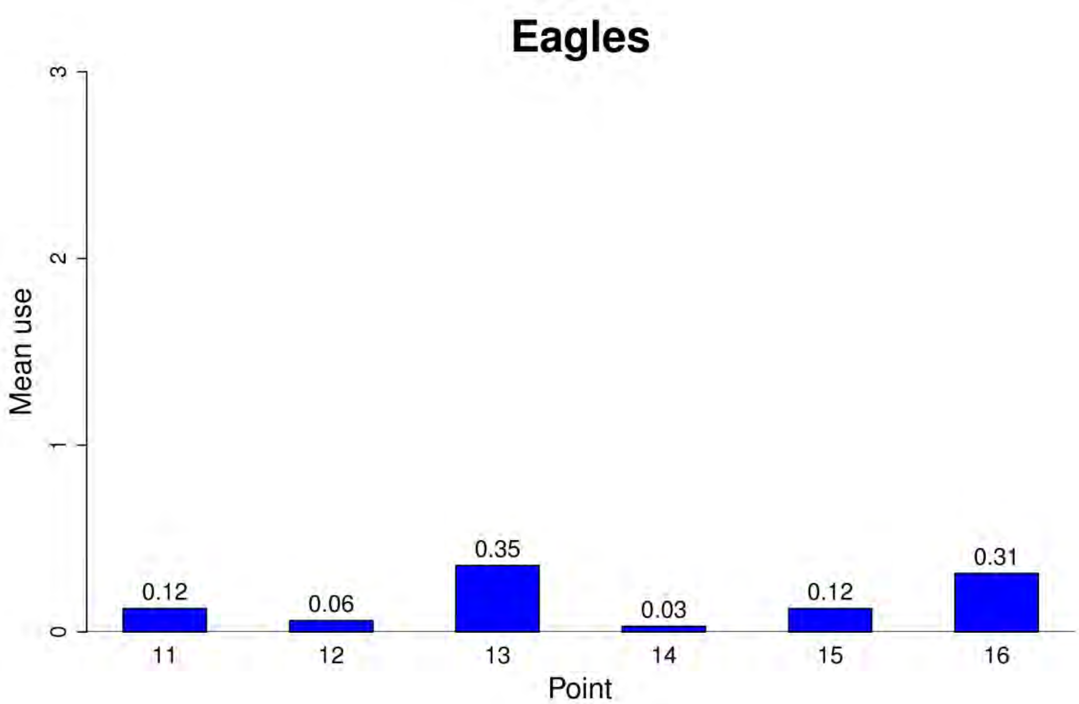
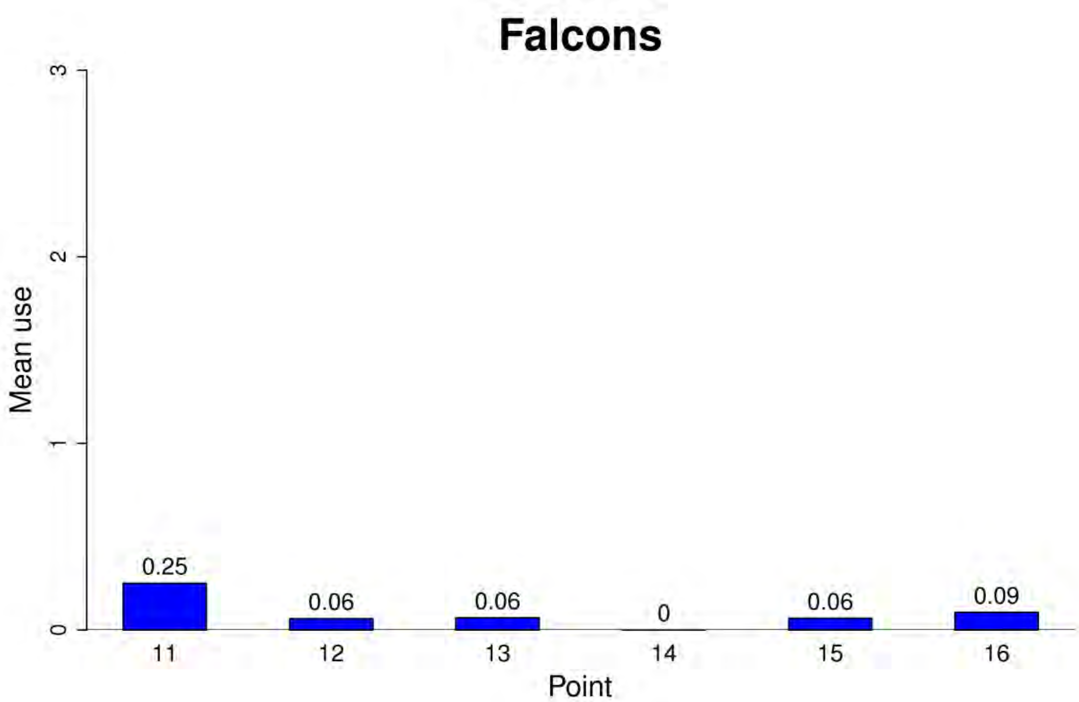


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtypes at the Hermosa West Wind Resource Area.



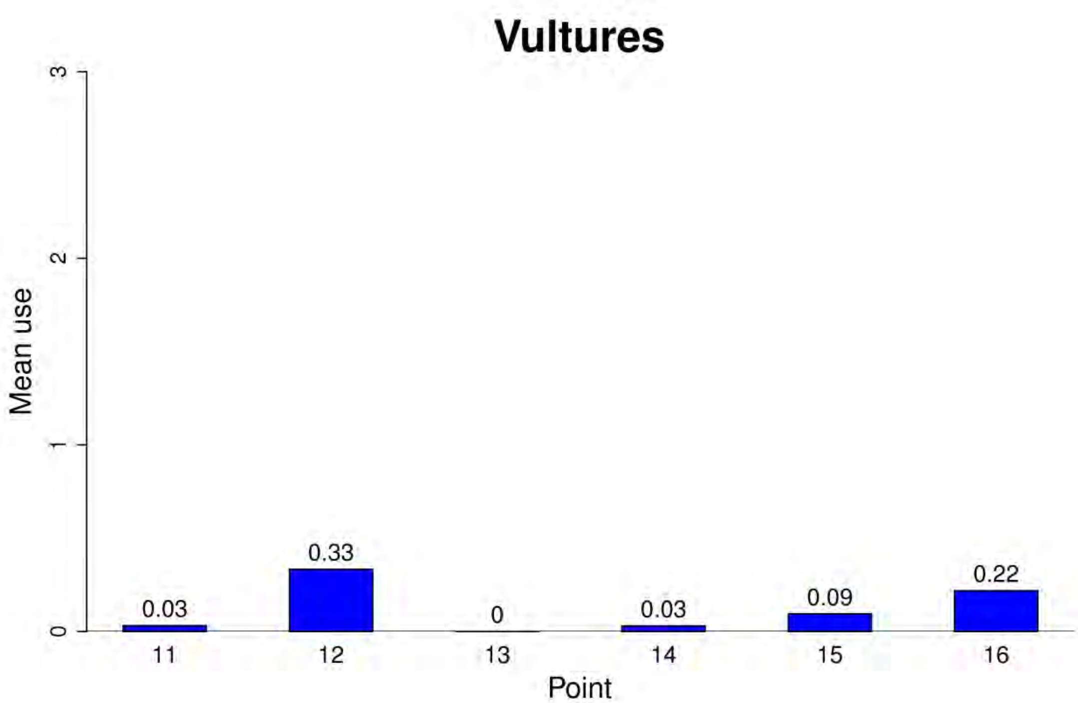
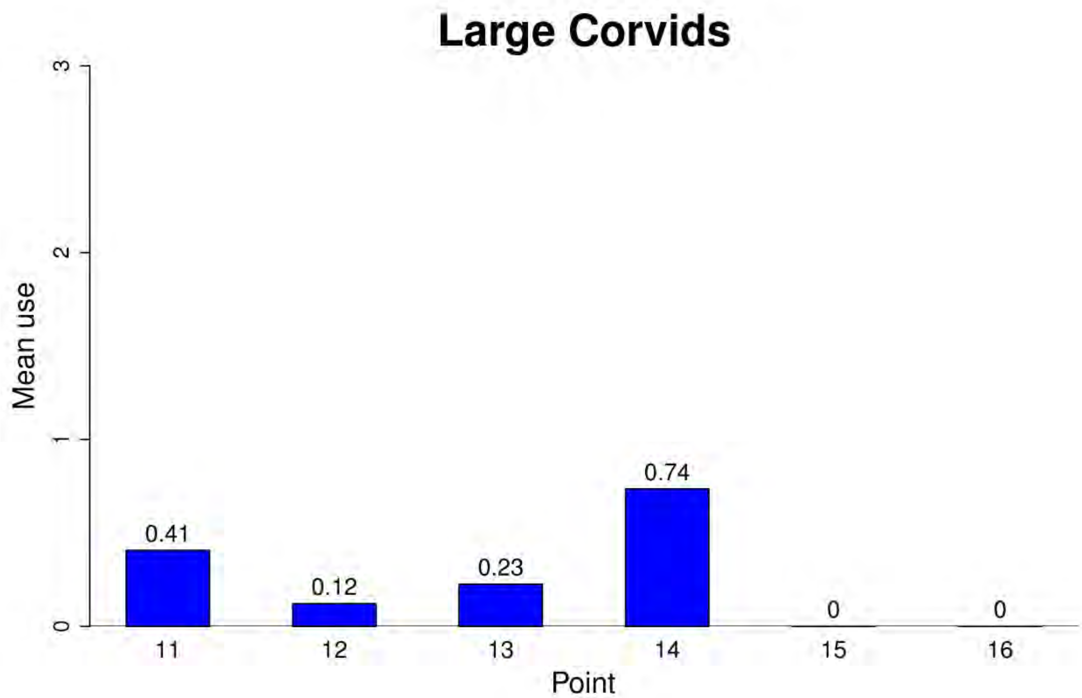


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtypes at the Hermosa West Wind Resource Area.



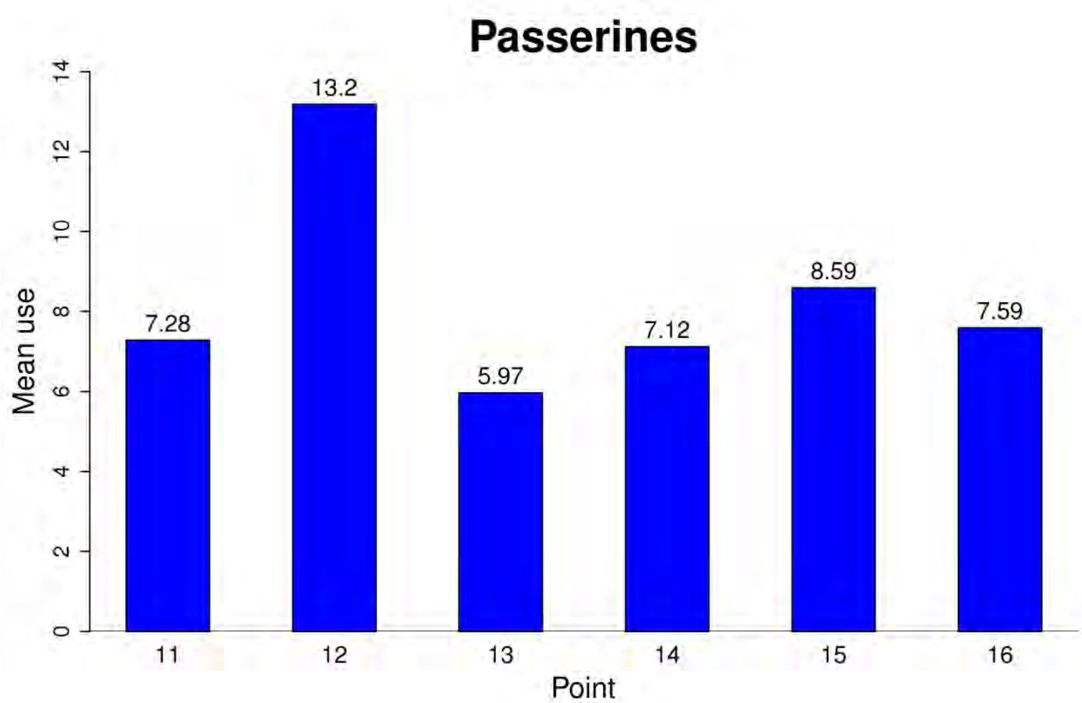


Figure 5 (*continued*). Mean use (number of birds/20-minute survey) at each fixed-point bird use point for all birds, major bird types, and raptor subtype at the Hermosa West Wind Resource Area. Passerine observations were focused within 100-meter viewsheds.

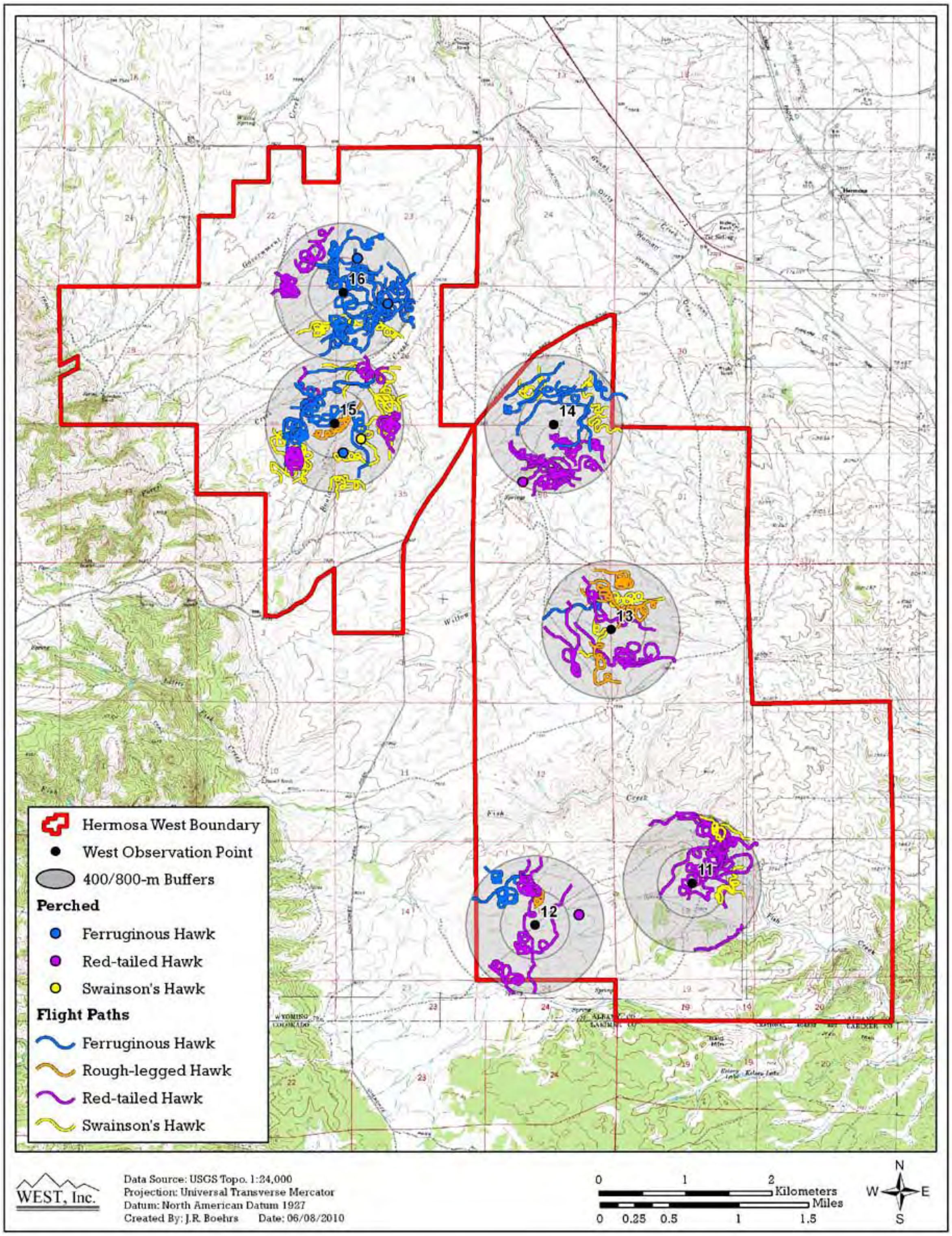


Figure 6a. Spatial use by flight paths of buteos at the Hermosa West Wind Resource Area.

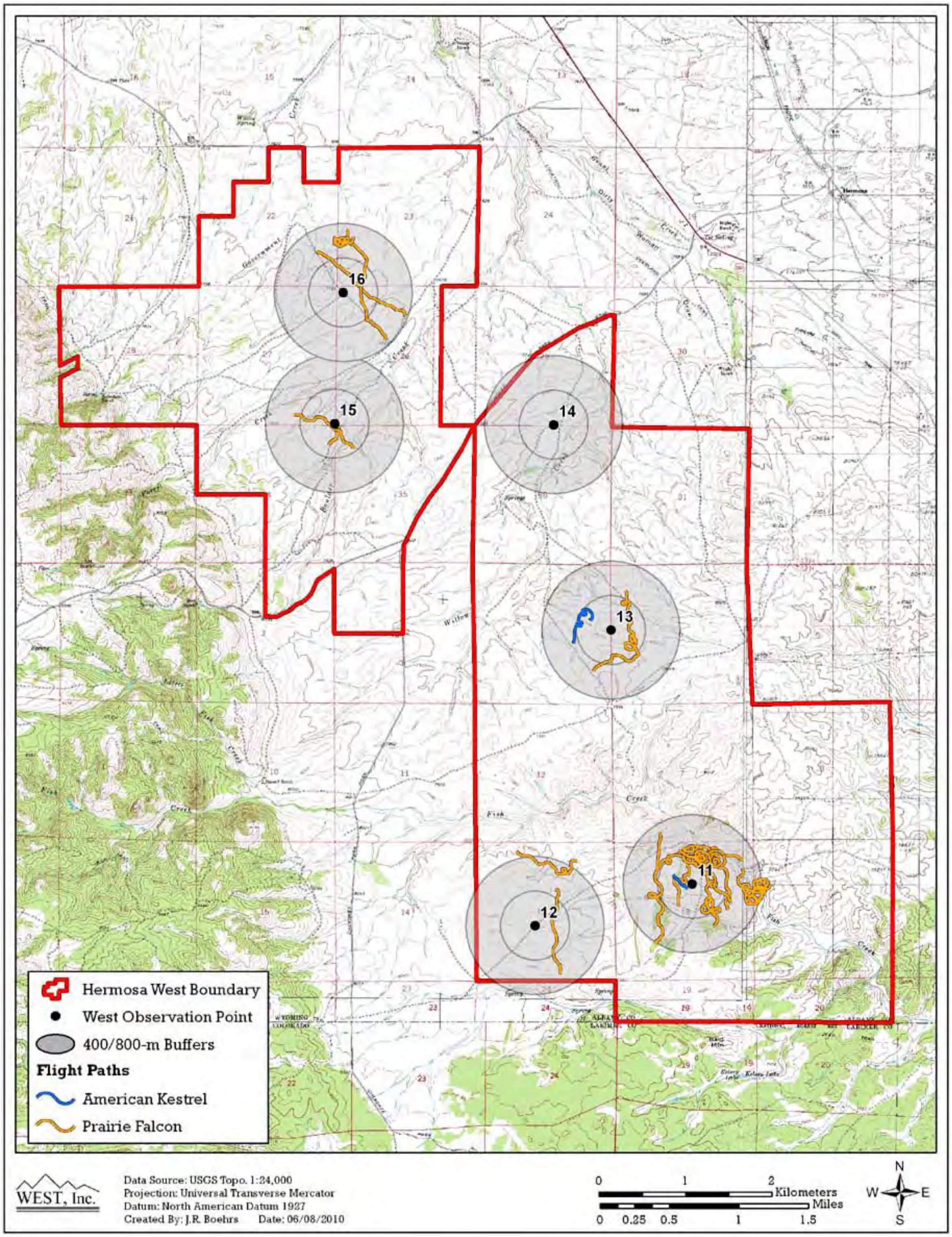


Figure 6b. Spatial use by flight paths of falcons at the Hermosa West Wind Resource Area.

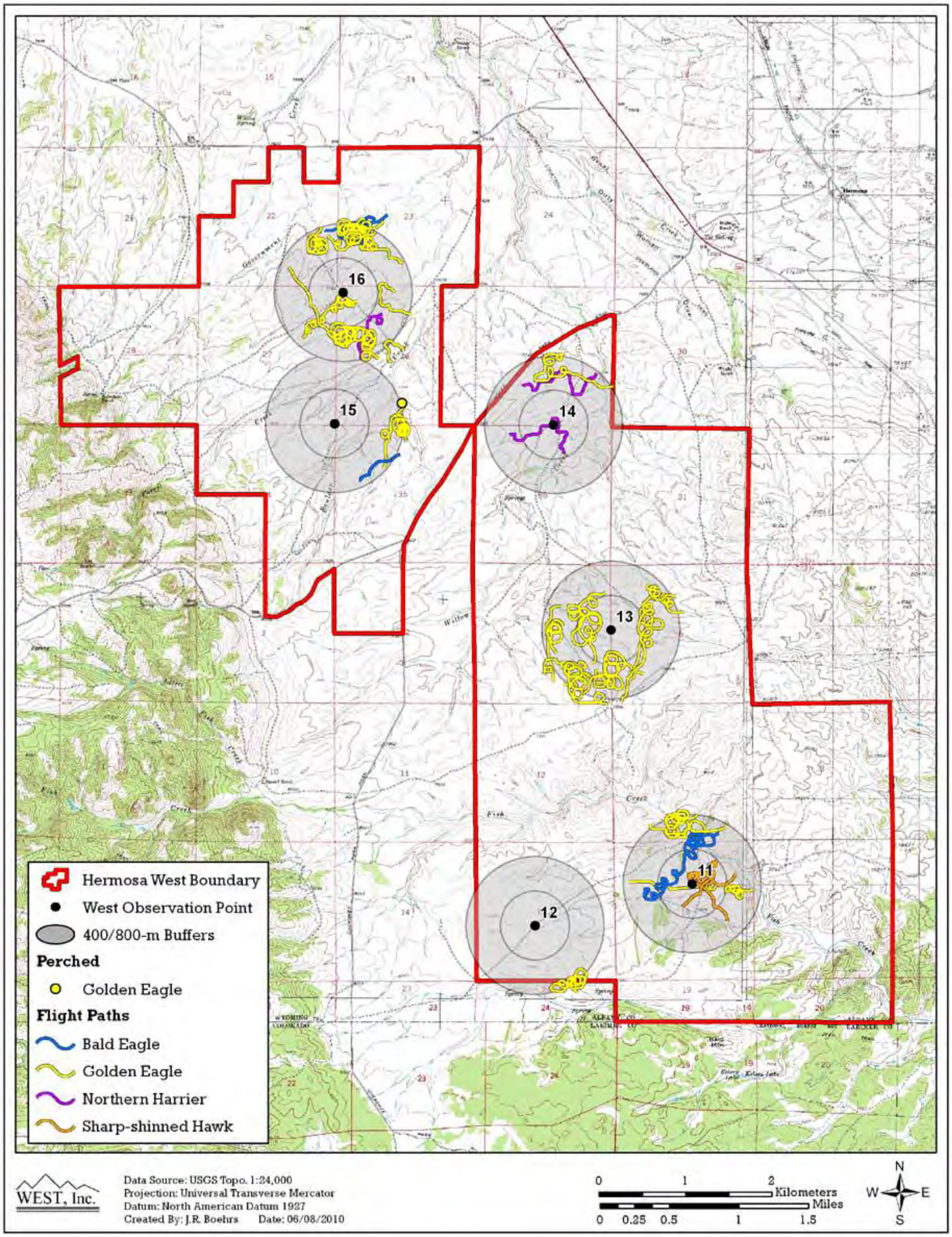


Figure 6c. Spatial use by flight paths of accipiters, norther harriers, and eagles at the Hermosa West Wind Resource Area.

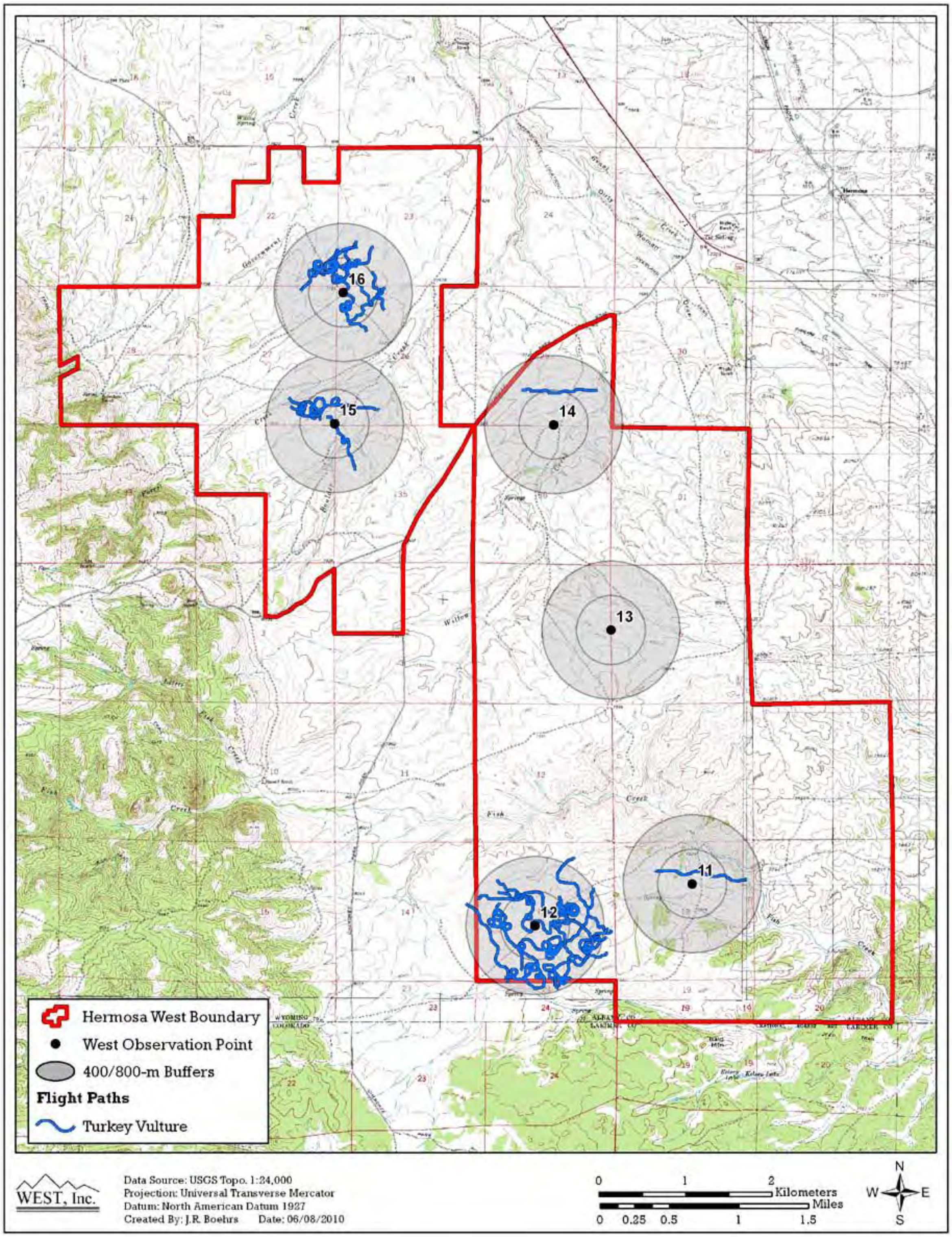


Figure 6d. Spatial use by flight paths of vultures at the Hermosa West Wind Resource Area.

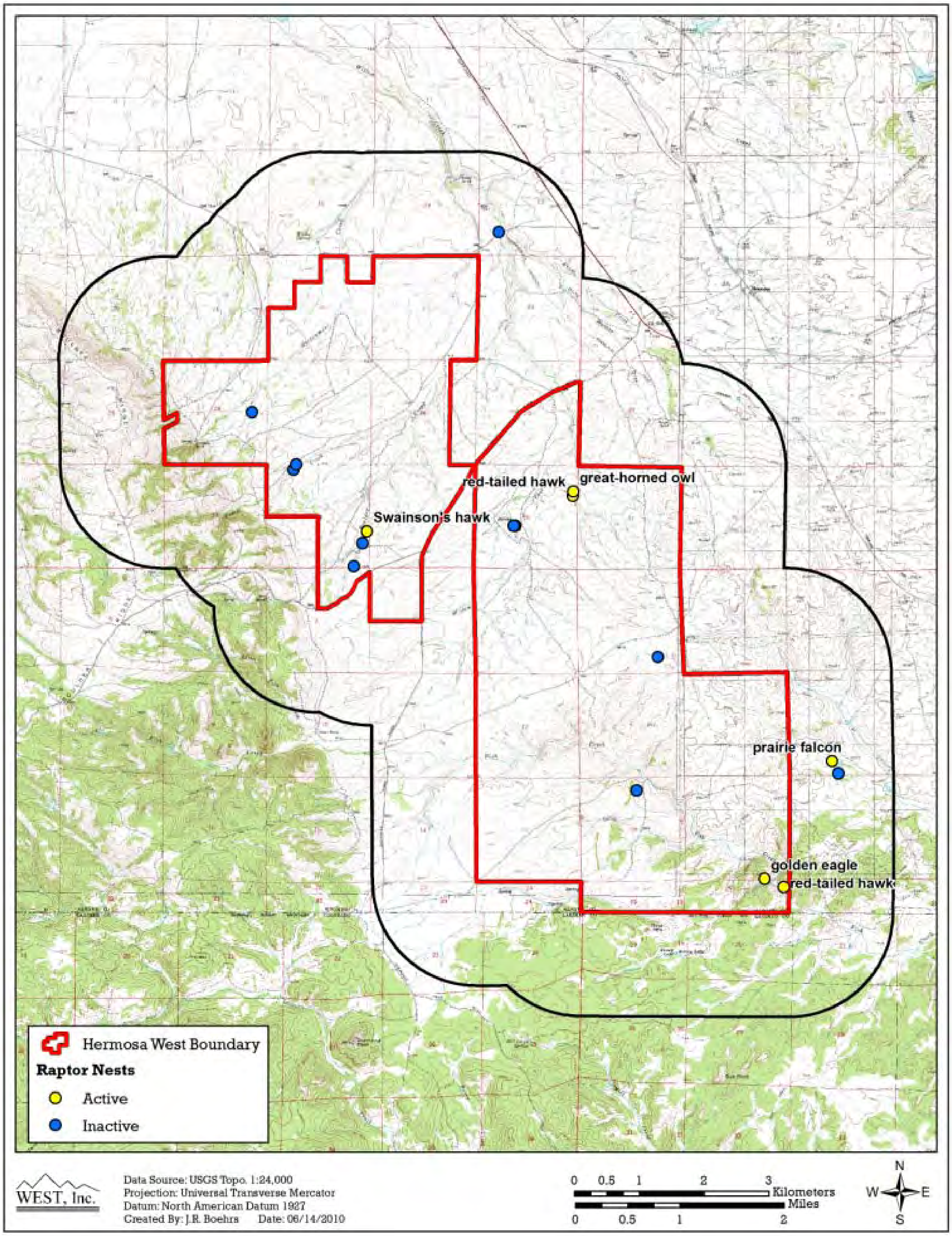


Figure 7. Location of raptor nests at the Hermosa West Wind Resource Area.

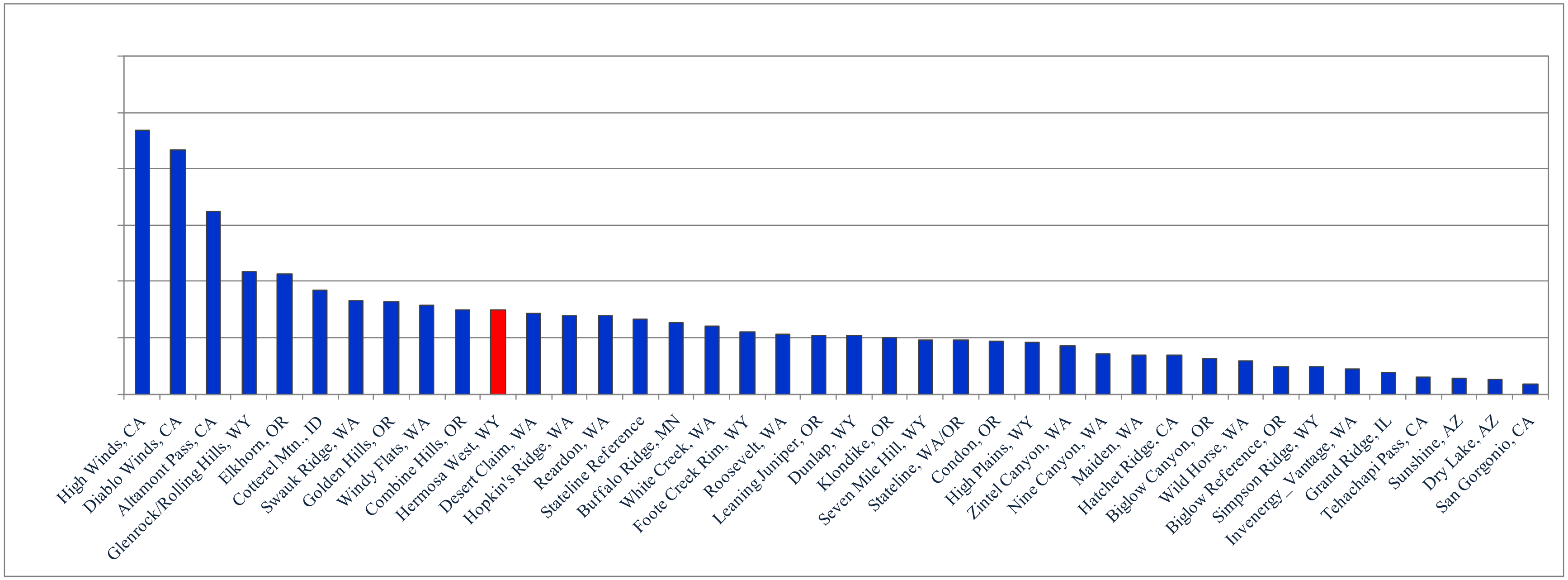
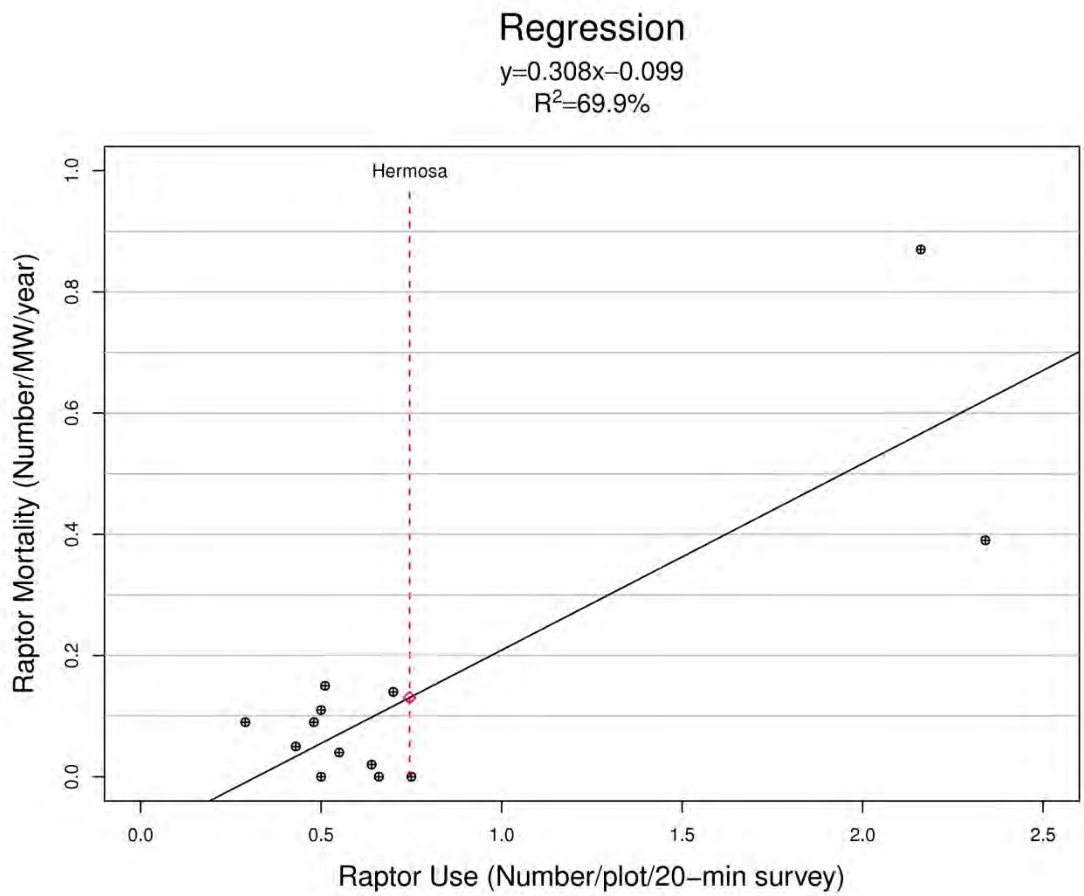


Figure 8. Comparison of annual raptor use between the Hermosa West Wind Resource Area and other United States wind-energy facilities.

Data from the following sources:

Wind-Energy Facility	Reference	Wind-Energy Facility	Reference	Wind-Energy Facility	Resource
Hermosa West, WY	This study.				
High Winds, CA	Kerlinger et al. 2005	Stateline Reference	URS et al. 2001	Nine Canyon, WA	Erickson et al. 2001b
Diablo Winds, CA	WEST 2006	Buffalo Ridge, MN	Erickson et al. 2002b	Maiden, WA	Erickson et al. 2002b
Altamont Pass, CA	Erickson et al. 2002b	White Creek, WA	NWC and WEST 2005	Hatchet Ridge, CA	Young et al. 2007b
Glenrock/Rolling Hills, WY	Johnson et al. 2008a	Foote Creek Rim, WY	Erickson et al. 2002b	Biglow Canyon, OR	WEST 2005c
Elkhorn, OR	WEST 2005a	Roosevelt, WA	NWC and WEST 2004	Wild Horse, WA	Erickson et al. 2003d
Cotterel Mtn., ID	BLM 2006	Leaning Juniper, OR	Kronner et al. 2005	Biglow Reference, OR	WEST 2005c
Swauk Ridge, WA	Erickson et al. 2003a	Dunlap, WY	Johnson et al. 2009a	Simpson Ridge, WY	Johnson et al. 2000b
Golden Hills, OR	Jeffrey et al. 2008	Klondike, OR	Johnson et al. 2002a	Invenergy_Vantage, WA	WEST 2007
Windy Flats, WA	Johnson et al. 2007	Seven Mile Hill, WY	Johnson et al. 2008b	Grand Ridge, IL	Derby et al. 2009
Combine Hills, OR	Young et al. 2003d	Stateline, WA/OR	Erickson et al. 2002b	Tehachapi Pass, CA	Erickson et al. 2002b
Desert Claim, WA	Young et al. 2003b	Condon, OR	Erickson et al. 2002b	Sunshine, AZ	WEST and the CPRS 2006
Hopkin's Ridge, WA	Young et al. 2003a	High Plains, WY	Johnson et al. 2009b	Dry Lake, AZ	Young et al. 2007c
Reardon, WA	WEST 2005b	Zintel Canyon, WA	Erickson et al. 2002a	San Gorgonio, CA	Erickson et al. 2002b



Overall Raptor Use 0.75
Predicted Fatality Rate 0.13 fatalities/MW/year
90.0% Prediction Interval (0, 0.39 fatalities/MW/year)

Figure 9. Regression analysis comparing raptor use estimations versus estimated raptor mortality.

Data from the following sources:

Wind-Energy Facility	Raptor Use (birds/plot /20-min survey)	Reference	Raptor Mortality (fatalities/MW/yr)	Reference
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003d	0.00	Young et al. 2006
Diablo Winds, CA	2.161	WEST 2006	0.87	WEST 2008b
Foote Creek Rim, WY	0.55	Johnson et al. 2000b	0.04	Young et al. 2003c
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Klondike, OR	0.50	Johnson et al. 2002a	0.00	Johnson et al. 2003
Stateline, WA/OR	0.48	Erickson et al. 2004	0.09	Erickson et al. 2002b
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2000
Wild Horse, WA	0.29	Erickson et al. 2003d	0.09	Erickson et al. 2008
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b
Bighorn, WA	0.51	Johnson and Erickson 2004	0.15	Kronner et al. 2008