WBI ENERGY TRANSMISSION, INC.

North Bakken Expansion Project

Resource Report 6
Geological Resources

Final

Docket No.
CP20-52-000

February 2020

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RESOURCE REPORT 6 – GEOLOGICAL RESOURCES

Minimum Filing Requirements For Environmental Reports:	**Addressed in:**
1. Identify the location (by milepost) of mineral resources and any planned or active surface mines crossed by the proposed facilities – Title 18 of the Code of Federal Regulations (CFR) Part § 380.12(h)(1 & 2)	Section 6.3
2. Identify any geologic hazards to the proposed facilities – 18 CFR § 380.12(h)(2)	Section 6.4
3. Discuss the need for and locations where blasting may be necessary in order to construct the proposed facilities – 18 CFR § 380.12(h)(3)	Section 6.6
4. For LNG projects in seismic areas, the materials required by "Data Requirements for the Seismic Review of LNG Facilities," National Bureau of Standards Information Report 84-2833 – 18 CFR § 380.12(h)(5)	Not Applicable
5. For underground storage facilities, how drilling activity by others within or adjacent to the facilities would be monitored, and how old wells would be located and monitored within the facility boundaries – 18 CFR § 380.12(h)(6)	Not Applicable

Additional Information:	**Addressed in:**
Identify any sensitive paleontological resource areas crossed by the proposed facilities (usually only if raised in scoping or if the project affects federal lands)	Section 6.5
Briefly summarize the physiography and bedrock geology of the project.	Sections 6.1 and 6.2
If proposed pipeline crosses active drilling areas, describe plan for coordinating with drillers to ensure early identification of other companies' planned new wells, gathering lines, and aboveground facilities	Section 6.7
If the application is for underground storage facilities: - Describe monitoring of potential effects of the operation of adjacent storage or production facilities on the proposed facility, and vice versa; - Describe measures taken to locate and determine the condition of old wells within the field and buffer zone and how the applicant would reduce risk from failure of known and undiscovered wells; and - Identify and discuss safety and environmental safeguards required by state and federal drilling regulations	Not Applicable

Federal Energy Regulatory Commission's January 17, 2020 Environmental Information Request:	**Addressed in:**
1. Confirm that there are no inactive, abandoned, or orphaned oil and gas wells within 500 feet of any horizontal directional drill (HDD) or guided bore path, or, if wells are present, discuss site-specific plans to prevent the communication/cross-contamination of drilling fluids with the wells during HDD or guided bore construction.	Section 6.3 and appendix 6A
2. Oil and gas gathering lines in older production areas may be unmarked and undocumented. Explain how WBI Energy Transmission, Inc. (WBI) would identify oil and gas gathering lines that may occur within proposed workspaces and describe how WBI Energy would ensure that production would not be interrupted by the Project. Additionally, describe any coordination that is occurring or would occur between WBI and the owner/operators of oil and gas fields crossed.	Section 6.3; Resource Report 1, section 1.3.1
3. WBI Energy states that there are no active coal or salt mining operations in the vicinity of the project. Confirm that there are also no inactive, abandoned, or proposed surface or subsurface coal or salt mines within 0.25 mile of any project area or identify any such features.	Section 6.3
4. WBI cites the U.S. Geological Survey's 2014 National Seismic Hazard Mapping in its discussion of seismic hazards. WBI Energy's final versions of resource reports should consult and cite the U.S. Geological Survey's updated 2018 mapping.	Section 6.4.1
5. Provide the location of known incidences of induced seismicity from fluid injection (if any) in the project vicinity, their magnitude, and discuss the potential for future induced seismic events, potential impact, and mitigation to the planned natural gas facilities.	Section 6.4.1

Federal Energy Regulatory Commission's January 17, 2020 Environmental Information Request:	**Addressed in:**
6. Provide a table that identifies areas of steep slopes that would be crossed by the project. Include the following in the table: a. start milepost (of steep slope crossing); b. end milepost (of steep slope crossing); and c. the range of slope for each crossing location (i.e., 15%-30% slopes, 30%-50% slopes, 50-70% slopes, and greater than 70%).	Section 6.4.3, table 6.4.3-1
7. Address the following regarding landslide hazards, and steep and unstable slopes and consider development of a landslide mitigation plan: a. plans for additional assessment (such as LiDAR and/or field-based studies evaluating potential landslide hazard areas); b. general guidelines defining where trench plugs, chips, and/or French plugs would and would not be used, or would be modified, to avoid water oversaturation of soils during significant or extended rainfall events which may result in increased pore pressure and potentially destabilize slopes ("bathtub effect"); c. how construction spoils, snow, and cleared brush and timber would be managed to prevent overweighing unstable slopes and triggering landslide; d. identify areas that would not be restored to preconstruction contours and conditions as well as site-specific restoration techniques and how surficial and subsurface drainage would be managed; and e. preconstruction, construction, and long-term (operational) monitoring and mitigation measures that would be used in areas characterized as landslide hazards, steep, and/or unstable slopes (i.e., surface displacement surveys, manual or automated strain gauge monitoring, groundwater level monitoring).	Section 6.4.3
8. File geotechnical studies, including hydrofracture analysis and drill feasibility assessments, for all planned HDDs and guided bores. This information should be provided such that it can be analyzed during the project National Environmental Policy Act review.	Section 6.1; Resource Report 1, section 1.3.2 and appendix 1F-8
9. Identify project areas that would cross floodplains. Describe potential impacts on the function of the floodplain and loss of floodplain storage from construction of any impervious surfaces in the floodplain.	Section 6.4.4
10. Evaluate the potential for flash flooding or scouring that could expose the pipeline or affect aboveground facilities. Identify where this may occur and describe measures to protect the facilities from flood or scour damage.	Section 6.4.4

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT
RESOURCE REPORT 6 – GEOLOGICAL RESOURCES

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Appendix 6B Paleontological Assessment for the North Bakken Expansion Project, North Dakota

ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
FERC	Federal Energy Regulatory Commission
g	gravity
HDD	horizontal directional drill
HDD Plan	Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan
MP	milepost
NDDMR	North Dakota Department of Mineral Resources
NDGS	North Dakota Geological Survey
NDPSC	North Dakota Public Services Commission
Plan	*Upland Erosion Control, Revegetation, and Maintenance Plan*
Project	North Bakken Expansion Project
RFFA	reasonably foreseeable future actions
USGS	U.S. Geological Survey
WBI Energy	WBI Energy Transmission, Inc.

WBI ENERGY TRANSMISSION, INC.
NORTH BAKKEN EXPANSION PROJECT

6.0 RESOURCE REPORT 6 – GEOLOGICAL RESOURCES

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project), which consists of an approximately 61.9-mile-long, new 24-inch-diameter natural gas pipeline from new facilities at WBI Energy's Tioga Compressor Station near Tioga, North Dakota, to a new compressor station (Elkhorn Creek Compressor Station) southeast of Watford City, North Dakota.

The Project also involves construction of approximately 0.3 mile of new 24-inch-diameter natural gas pipeline between the proposed Elkhorn Creek Compressor Station to a new interconnect with Northern Border Pipeline Company, approximately 20.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 25, approximately 9.4 miles of new 12-inch-diameter natural gas pipeline looping along WBI Energy's Line Section 30, approximately 0.5 mile of new 20-inch-diameter receipt lateral to the Tioga Compressor Station, and uprating of WBI Energy's Line Section 25. The Project includes additional horsepower at the Tioga Compressor Station; the installation of new and modifications to existing delivery, receipt, and transfer stations along WBI Energy's pipeline routes; the replacement of small segments of pipeline facilities; and the installation of block valves, pig launcher/receiver stations, and other associated appurtenances. Figure 1.1-1 of Resource Report 1 provides an overview of the proposed pipeline system and associated facilities.

In accordance with Title 18 of the Code of Federal Regulations (CFR) Part 380.12(h), Resource Report 6 describes the surficial and bedrock geological setting of the area, identifies potential mineral and paleontological resources in the vicinity, describes geologic hazards that may affect the Project, and details mitigation measures to avoid or mitigate the impact on geological resources and from potential geological hazards.

6.1 GEOLOGICAL SETTING

The proposed Project is located within the Williston Basin of northwestern North Dakota. The Williston Basin is a large intracratonic structural trough that covers approximately 300,000 square miles across parts of North and South Dakota, Montana, and the Canadian provinces of Manitoba and Saskatchewan (North Dakota Geological Survey [NDGS], 2019a). In the Project area, Precambrian basement rock is overlain by sedimentary rocks of Paleozoic, Mesozoic, and Cenozoic age that range in thickness up to about 15,000 feet and generally dip gently to the south, except near the Nesson Anticline in eastern Williams County (Freers, 1970). Prior to the uplift of the Rocky Mountains in the late Cretaceous period, the Paleozoic and early Mesozoic marine sedimentary rocks were deposited in shallow, retreating and advancing epicontinental seas that covered the Project area. The mountain-building event in the late Cretaceous prompted erosion and deposition of non-marine sediments, which formed Tertiary-age lakes and swamps in the basin that would become coal deposits. During the Quaternary, advancing glaciers from the north deposited mixed glacial till and debris (Keefer, 1974).

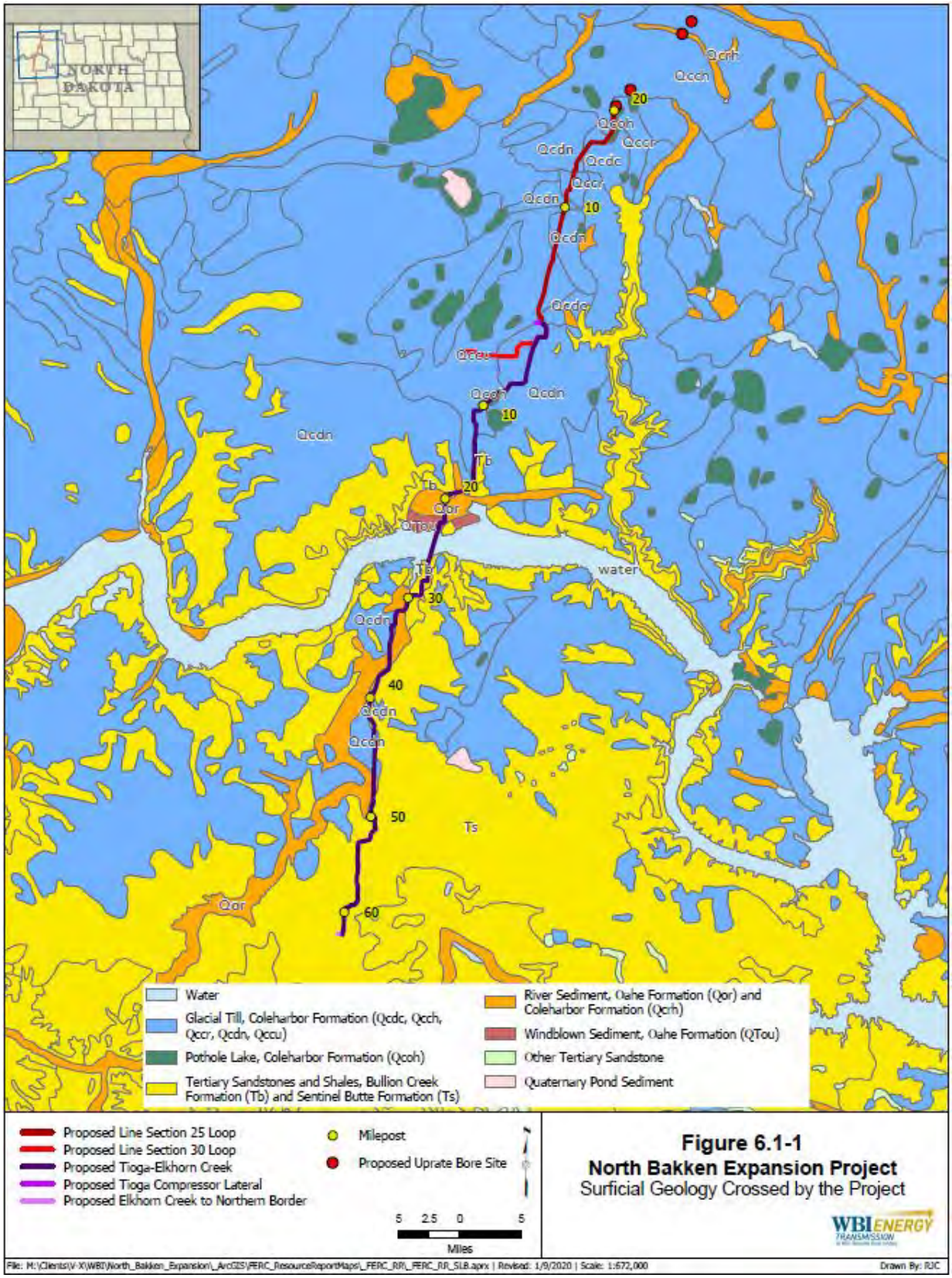
The bedrock underlying surficial deposits in the Project area consists of the Tertiary Sentinel Butte and Bullion Creek formations, which comprise the Fort Union Group and were deposited by rivers carrying sediment eroded from the Rocky Mountains (Bluemle and Biek,

2007). These formations consist primarily of sandstone, shale, and siltstone, with many lignite beds formed from prehistoric swamps. The Sentinel Butte Formation underlies the Line Section 25 Loop, the Tioga Compressor Lateral, the Elkhorn Creek-Northern Border pipeline, the Tioga-Elkhorn Creek pipeline from about mileposts (MP) 0.0 to 3.5, MPs 26.9 to 27.3, MPs 40.8 to 61.9, and the Line Section 30 Loop between about MPs 6.0 and 9.4 (Bluemle, 1983). The Bullion Creek Formation underlies the Tioga-Elkhorn Creek pipeline from about MPs 3.5 to 26.9 and MPs 27.3 to 40.8 in Williams and McKenzie Counties, and the Line Section 30 Loop between about MPs 0.0 and 6.0 in Williams County.

The surficial geology underlying the Project area north of Lake Sakakawea in Burke, Mountrail, and Williams Counties consists primarily of Pleistocene glacial sediments of Late Wisconsin age (NDGS, 2015). The Pleistocene surface deposits, referred to as the Coleharbor Group, that underlie the Line Section 25 Loop, the Tioga Compressor Lateral, Line Section 30 Loop, the uprates to Line Section 25, and MPs 0.0 to 15.3, MPs 31.7 to 34.9, and MPs 42.7 to 46.6 of the Tioga-Elkhorn Creek pipeline predominantly consist of till and glaciofluvial deposits, with some lake sediments, colluvium, and recent alluvium and landslide deposits (NDGS, 2015).

In addition to glacial deposits, portions of the Project area are underlain by fluvial sediments including sand, silt, and clay of late Quaternary age referred to as the Oahe Formation (Freers, 1973). The Oahe Formation consists largely of organic clay and silt deposited in sloughs and in shallow channels eroded during deglaciation. This sediment, which in places overlies the sand and gravel of the fluvial-glacial Coleharbor Group, was deposited by Holocene streams, intermittent runoff from valley sides, and wind. The Oahe Formation deposits are generally thin throughout the Project area (up to 1 meter thick) and confined to valley and slough bottoms. The Oahe Formation found in sloughs throughout the Project area consists of fine-grained, organic-rich sediment deposited by runoff from surrounding higher ground, wind, and the decomposition of vegetation that grows in the wet environment. Along the Missouri River, pebble-size pieces of Knife River Flint are common, as are fossils such as bison bones (Clayton et al., 1976). The Tioga-Elkhorn Creek pipeline will cross windblown deposits of the Oahe Formation between about MPs 21.6 and 23.1, and river sediments of the Oahe Formation between about MPs 18.2 and 18.8, MPs 19.5 and 21.6, MPs 29.9 and 36.6, and MPs 46.6 and 48.4.

South of Lake Sakakawea in McKenzie County, the Coleharbor Group and Oahe Formation deposits become less widespread and the sandstones and shales of the Sentinel Butte and Bullion Creek formations become the predominant surface deposit (NDGS, 2015). The Tioga-Elkhorn Creek pipeline will cross the Bullion Creek formation between about MPs 15.3 and 17.1, MPs 18.9 and 19.5, and MPs 25.4 and 29.9. The Elkhorn Creek-Northern Border pipeline and the Tioga-Elkhorn Creek pipeline between about MPs 36.6 and 42.7, MPs 44.5 and 44.9, and MPs 48.4 and 61.9 will cross the Sentinel Butte Formation (NDGS, 2015). Based on well logs in McKenzie County, the Sentinel Butte and Bullion Creek formations are about 1,220 feet thick. The Bullion Creek Formation consists of interbedded sand, silt, clay, carbonaceous shale, and lignite (silt and clay are dominant lithologies), and the Sentinel Butte Formation consists of interbedded sand, silt, mudstone, lighnite, and carbonaceous shale, with ironstone nodules and petrified wood (Carlson, 1985). Figure 6.1-1 depicts the surficial geologic deposits that underlie the Project area.


NORTH DAKOTA
Qcdn
Qcch
Qccr
Qcdc
Qccu
Qcoh
Tb
Ts
Qor
QTou
water
10
20
30
40
50
60
Water
Glacial Till, Coleharbor Formation (Qcdc, Qcch, Qccr, Qcdn, Qccu)
Pothole Lake, Coleharbor Formation (Qcoh)
Tertiary Sandstones and Shales, Bullion Creek Formation (Tb) and Sentinel Butte Formation (Ts)
River Sediment, Oahe Formation (Qor) and Coleharbor Formation (Qcrh)
Windblown Sediment, Oahe Formation (QTou)
Other Tertiary Sandstone
Quaternary Pond Sediment
Proposed Line Section 25 Loop
Proposed Line Section 30 Loop
Proposed Tioga-Elkhorn Creek
Proposed Tioga Compressor Lateral
Proposed Elkhorn Creek to Northern Border
Milepost
Proposed Uprate Bore Site
5 2.5 0 5
Miles
Figure 6.1-1
North Bakken Expansion Project
Surficial Geology Crossed by the Project
WBI ENERGY TRANSMISSION
File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\FERC_ResourceReportMaps_FERC_RR_FERC_RR_SLB.aprx | Revised: 1/9/2020 | Scale: 1:672,000
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To confirm the surficial and bedrock geology and evaluate feasibility of the proposed 15,371-foot-long horizontal directional drill (HDD) crossing of Lake Sakakawea, a geotechnical survey involved installing three land borings (LB-1, LB-2, and LB-3) to depths of 370 feet, 400 feet, and 400 feet below the ground surface in April and May 2019. Based on coal layers observed in the boring logs, nearby bedrock outcrops on the south side of Lake Sakakawea, and high (greater than 50) standard penetration test values, the study determined that bedrock strata associated with the Tertiary Sentinel Butte Formation will be the primary material encountered during the HDD.

The geotechnical investigation provided data for a model of the HDD crossing that utilized a "poorly graded silt, clay, and sand" parameter to represent the overlying glacial deposits and a "shale bedrock" parameter to represent the Sentinel Butte bedrock. The model assumed that the intersect drill method will be used due to the length of the crossing, and estimated that there will be sufficient overburden to minimize the risk of hydraulic fracture. Based on the geotechnical information available to date, stress analysis, and model results, the feasibility study determined that the proposed HDD will be geometrically feasible, and recommended that additional over-water borings be completed in order to finalize the HDD design. The feasibility study memo is included as attachment A to the *Horizontal Directional Drill/Guided Bore Drilling Fluid Monitoring and Operations Plan* (HDD Plan) included in appendix 1F of Resource Report 1.

Future proposed over-water borings would involve drilling at six locations across Lake Sakakawea to at least 20 feet below the depth of the drill path. The over-water borings would inform the final detailed HDD design and identify any potential bedrock fractures, cobbles, and/or other geotechnical issues that may exist along the drill path that could cause an inadvertent return of drilling fluids. The results of the over-water borings will be provided to Federal Energy Regulatory Commission (FERC) once completed. In the event that an inadvertent return of drilling fluid occurs during the installation, WBI Energy will implement the measures in its HDD Plan. This HDD Plan will continue to be updated as additional information becomes available from HDD/guided bore contractors and the results are received from the over-water geotechnical survey work to be completed in the spring of 2020. An updated HDD Plan will be submitted to FERC once this information has been incorporated into the plan.

WBI Energy did not conduct geotechnical investigations for guided bore installations associated with the Project and does not have future plans to complete geotechnical investigations. The guided bore method is generally being employed to provide additional depth at the crossings, maintain function of the ditches and roads during construction, and minimize disturbance to these features. The majority of the guided bores associated with Project activities are short and shallow guided bores under roads and railroads; however, a few select environmental features (e.g., waterbodies, wetlands) will be crossed via the guided bore method. Generally, these crossings could be installed using the traditional open-cut method; however, WBI Energy has elected to install the crossings using a guided bore to avoid direct impacts on these features. More information regarding the guided bore method is provided in sections 1.3.2.1 and 1.3.2.3 of Resource Report 1. WBI Energy will employ a qualified bore contractor to complete guided bore operations. The bore contractor will minimize risks by being prepared with the proper equipment, tools, and supplies prior to drilling and closely adhering to the measures described in WBI Energy's HDD Plan to monitor drill activities and immediately respond to any abnormal conditions or inadvertent returns.

6.2 PHYSIOGRAPHIC SETTING AND TOPOGRAPHY

Physiographic provinces are distinguished by geologic structures, rock units, soil types, and vegetation that reflect a similar climatic and geological history. The elevations and characteristics of landforms within each physiographic province differ from those in adjacent regions. The proposed Project will be located within the Great Plains physiographic province, which is separated from the Central Lowlands province to the east by a linear topographic boundary referred to as the Missouri Escarpment (Keefer, 1974). Elevations in the Project area range from approximately 1,850 feet above mean sea level at the Lake Sakakawea crossing between about MPs 22.9 and MP 25.8 of the Tioga-Elkhorn Creek pipeline to approximately 2,500 feet above mean sea level near MP 6.0 of the Line Section 25 Loop. Figure 6.2-1 provides an elevation profile of the topography of the Project area from the southern boundary of the Tioga-Elkhorn Creek pipeline to the northern end of the Line Section 25 Loop.

The Great Plains province in western North Dakota is further sub-divided into the Missouri Coteau, Coteau Slope, Missouri Plateau, and Little Missouri Badlands. The northern-most end of the Line Section 25 Loop and excavations to uprate the existing line in Burke County will be located within the Missouri Coteau, which is characterized by hummocky, or undulating and irregular, terrain that is dominated by numerous pothole lakes and ponds, which cause drainage to be unintegrated and are indicative of glacial activity (Keefer, 1974; Bluemle and Biek, 2007). The Line Section 25 Loop will cross into the Coteau Slope near MP 18 in Burke County and extend south through Mountrail County, where the topography becomes rolling to hilly to the south. Streams form integrated drainage that generally flows to the south toward the Missouri River. In Williams County, local relief where the proposed Project will cross the Coteau Slope ranges from low (0 to 15 feet), with 0 to 2 degree slopes in the intraupland flats located between MPs 19.4 and 23.2 of the Tioga-Elkhorn Creek pipeline, to medium (25 to 50 feet) or high (greater than 50 feet), with slopes ranging from 3 to 10 degrees in undulating knob and kettle areas north of MP 19.4 of the Tioga-Elkhorn Creek pipeline (Freers, 1970).

In McKenzie County, the Missouri Plateau sub-province consists primarily of gentle slopes and low relief, except where buttes and ridges associated with Tertiary sandstones and shales of the Fort Union Group form topographic highs (Carlson, 1985; Bluemle and Biek, 2007).

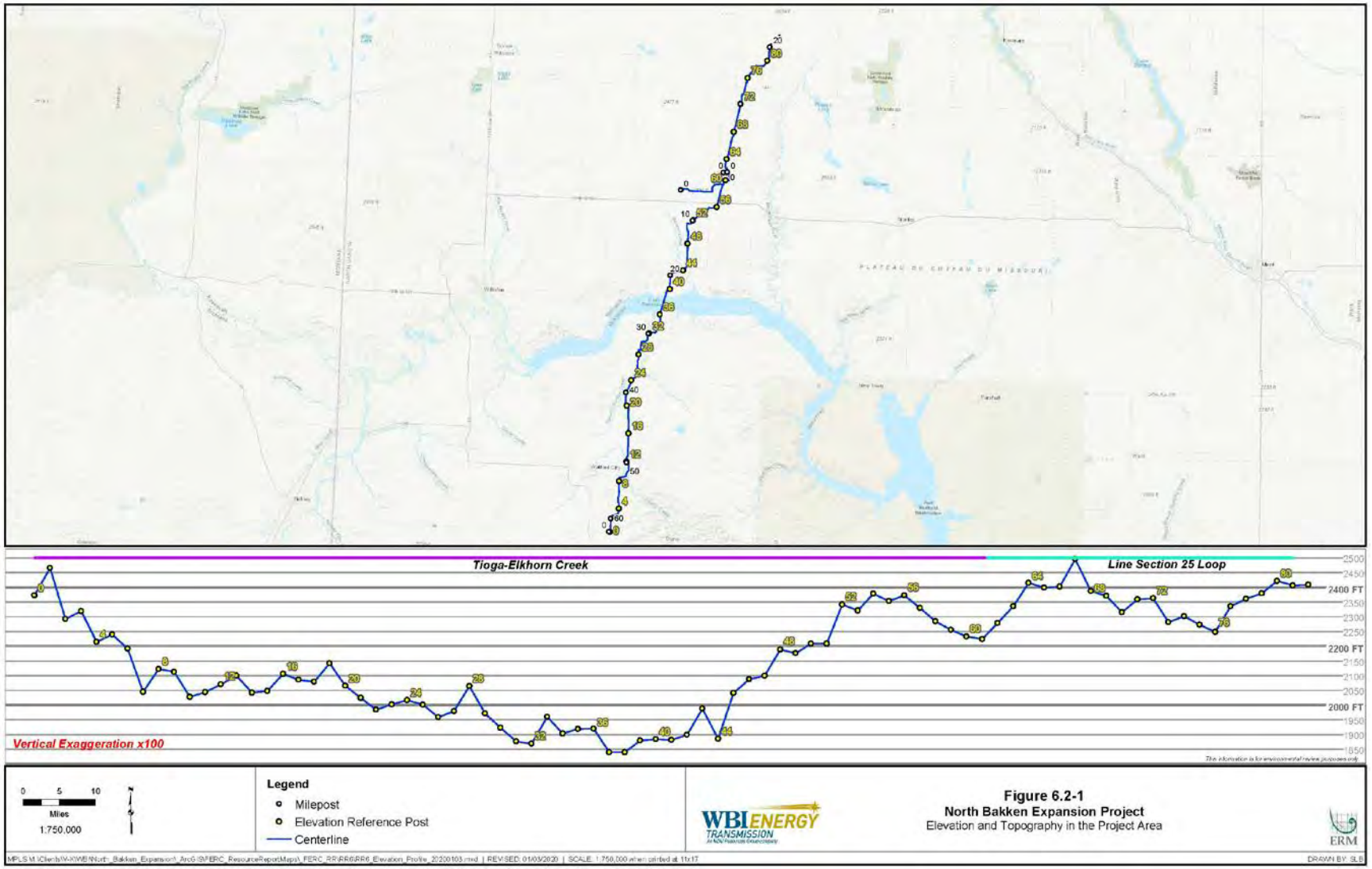


Figure 6.2-1
North Bakken Expansion Project
Elevation and Topography in the Project Area

6.3 MINERAL RESOURCES

Due to the geologic history and structural features in the Williston Basin, the geologic units overlying the Project area host significant oil and gas resources. In addition, the area hosts exploitable deposits of coal/lignite and salt. Finally, glacial sediments cover three-fourths of North Dakota, which contain sand and gravel that is mined for industrial and commercial purposes (Murphy, 2019c; U.S. Geological Survey [USGS], 2019a).

Significant natural gas and oil production is occurring within the Project area. The proposed Project will cross several oil and gas fields, including the Gros Ventre, North Tioga, Tioga, West Bank, Beaver Lodge, West Capa, Sand Creek, Grinnell, Banks, Elidah, Siverston, and Pembroke fields. As described in section 1.3.1 of Resource Report 1, WBI Energy's contractor will coordinate with the North Dakota One-Call system to identify existing underground utilities prior to construction. Additionally, prior to construction WBI Energy or its representative will coordinate with known oil and gas producers to identify potentially unmarked and undocumented lines in older production areas to avoid any Project-related disruption of service. Construction across oil and gas fields and gathering pipelines will use the same general pipeline construction techniques described in section 1.3.1 if Resource Report 1. Crossings of gathering pipelines will be completed as shown in the typical construction right-of-way cross-section diagrams for foreign pipeline crossings (see appendix 1C of Resource Report 1).

Based on a query of the North Dakota Department of Mineral Resources (NDDMR) database, 310 permitted oil and gas wells are located within 0.25 mile of the Project workspaces. Appendix 6A provides a detailed list of well information and an overview map of the oil and gas well locations. Of the 310 permitted wells, approximately 103 wells are listed as plugged and abandoned, abandoned, inactive, or temporarily abandoned, or the permit has been cancelled. The status of an additional 85 wells is listed as confidential, dry, or permitted location to drill. The remaining 122 wells are currently classified as active or drilling. The closest active oil and gas well is approximately 257 feet from the Tioga-Elkhorn Creek pipeline right-of-way at MP 5.6 (NDDMR, 2019). In addition, approximately 13 oil and gas wells are located within 500 feet of proposed guided bore sites associated with roadway crossings. Of these 13 wells, the closest is an oil and gas well (permit now cancelled) approximately 240 feet from the guided bore across 40th Street NW near MP 36.8 of the Tioga-Elkhorn Creek pipeline. Conditions are typically favorable for guided bore drilling operations in North Dakota because the soil is not very rocky and the rock does not fracture easily. On past construction projects in McKenzie and Williams Counties in North Dakota, WBI Energy has used the guided bore method to cross over 30 county and state roads and highways without any cross-contamination with existing oil and gas wells. Because the depth of most guided bore road crossings is less than or equal to 20 feet, any drilling fluid will most likely surface in a road ditch instead of traveling downward and deep enough to cross-contaminate existing oil or gas wells.

Western North Dakota contains an estimated 351 billion tons of lignite (a soft brown coal), the single largest deposit of lignite known in the world. All of the economic or mineable coal in North Dakota, which is Paleocene in age, is found within the lower Fort Union Group in western and central North Dakota (Murphy, 2019a). Although lignite beds underlie the entire Project area, there currently are no active lignite coal mines in the vicinity of the proposed pipeline routes. Based on publicly available information from the North Dakota Public Services Commission (NDPSC), no formal notices for proposed coal mines have been filed in counties that the Project will cross. The most recent coal permit issued by the NDPSC was in 2014 for a mine located in

Mercer County (NDPSC, 2014; 2020). "Scoria," or clinker, is a term used for volcanic-like rocks that are formed when clay, silt, and sandstone deposits are baked by burning lignite beds (Murphy, 2019c; Freers, 1970). Scoria can be found near the Missouri River in strata of the Sentinel Butte and Bullion Creek formations where the interbedded lignite seams baked the overlying and underlying rocks (Freers, 1970).

Three types of salt deposits (i.e., halite, potash, and Glauber salt) are found within the Williston Basin. Halite (sodium chloride or table salt) and potash (potassium chloride) occur in thick deposits in the deeply buried Paleozoic sedimentary deposits in the western part of the basin, and underlie the entire Project area (LaFever and LaFever, 2005). Glauber salt (sodium sulfate) occurs at or within 70 feet of the surface throughout North Dakota. Additionally, Glauber deposits are known to occur in Holocene lacustrine sediments in the region (Murphy, 2019b). Many of the lakes in northwestern North Dakota contain water with a high salt content throughout much of the year. There currently are no commercial halite or potash mines near the Project area, and the Project does not cross any significant natural pothole lakes. Any impacts on smaller, seasonally flooded wetlands from which salts might be harvested will be temporary and localized. As a result, the Project is unlikely to have any substantial impact on mining of salt deposits.

Sand and gravel is the third largest mineral industry in the state after oil and gas and lignite. According to the 2014 Minerals Yearbook for North Dakota (USGS, 2019a), mining of construction sand and gravel decreased while crushed stone volumes increased from 2013 to 2014. The USGS Mineral Resources Data System was queried to determine the number of nonfuel mining sites in the vicinity of the Project. According to the database, two mineral resource sites are present within 2.0 miles of the proposed Project (USGS, 2019b). The Arnstad Pit and Plant site, an active producer of sand and gravel, is about 2.2 miles east of MP 2.0 of the Line Section 25 Loop. The second site is a former gravel pit about 0.4 mile north of the Tioga-Elkhorn Creek pipeline near MP 29.5.

Based on review of available aerial imagery, USGS topographic maps, and mines mapped by the North Dakota Department of Transportation and NDPSC, 24 gravel or scoria pits and 3 abandoned mines were identified within 0.5 mile of the proposed Project (see table 6.3-1) (ESRI, 2019; North Dakota Department of Transportation, 2019; NDPSC, 2019). According to the Skogheim Coal Mine abandoned mine site summary, the mine reportedly operated between 1938 and 1960; however, the exact location of the Skogheim Coal Mine site is unknown (NDPSC, 2019). No additional documentation was available regarding the locations of the John Gustafson surface mine in McKenzie County or the Quality Coal Company underground mine in Williams County. A retired scoria pit is located at the proposed location of the Elkhorn Creek Compressor Station. WBI Energy is working with the landowner of the proposed compressor station location who has indicated that they do not have future plans of continuing to produce scoria in this location.

Due to the distance from the Project and the inactive nature of many of the mining sites, it is not anticipated that the Project will affect existing nonfuel mineral resources.

TABLE 6.3-1

North Bakken Expansion Project
Non-Fuel Mineral Resources Within 0.5 Mile of the Project Area [a]

Facility/Milepost [b]	Distance (miles)/ Direction from Project	Mine Type	Mine Status [c]
PIPELINE FACILITIES			
Tioga-Elkhorn Creek			
19.0	0.1/South	Quality Coal Company Mine	Abandoned Subsurface
29.4	0.4/North	Gravel Pit	Inactive
30.9	0.3/East	Gravel Pit	Inactive
35.0	0.3/West	Mine Shaft or Drift/Scoria Pit	Inactive
37.5	0.1/Southeast	Scoria Pit	Inactive
38.2	0.12/Northwest	Scoria Pit	Inactive
38.3	<0.1/East	Mine Shaft or Drift/Scoria Pit	Inactive
38.3	0.1/West	Skogheim Coal Mine	Abandoned Surface
38.4	0.1/Northwest	Scoria Pit	Inactive
39.3	0.4/Southeast	Scoria Pit	Inactive
39.4	0.1/North	Gravel Pit	Inactive
39.8	0.2/South	John Gustafson Mine	Abandoned Surface
39.9	0.2/East	Scoria Pit	Inactive
40.9	0.3/Southeast	Gravel Pit	Inactive
41.3	0.3/East	Scoria Pit	Active
53.4	0.2/North	Gravel Pit	Inactive
53.4	0.3/North	Gravel Pit	Inactive
53.4	0.4/North	Gravel Pit	Inactive
55.7	0.5/West	Gravel Pit	Inactive
58.7	0.2/Southeast	Gravel Pit	Active
Line Section 25 Loop			
0.9	0.3/West	Gravel Pit	Inactive
7.5	0.1/West	Gravel Pit	Inactive
13.3	0.4/Southeast	Gravel Pit	Inactive
13.6	0.3/East	Gravel Pit	Inactive
14.0	0.2/East	Gravel Pit	Inactive
Uprate Line Section 25			
NA	0.4/East	Gravel Pit	Active
ABOVEGROUND FACILITIES			
Elkhorn Creek Compressor Station			
NA	0.0	Scoria Pit	Inactive

[a] Sourced from USGS, 2019b; ESRI, 2019; North Dakota Department of Transportation, 2019; NDPSC, 2019
[b] Mileposts are inserted as approximate reference points.
[c] Mine status was determined based on observations of the mine sites using available aerial photography.

6.4 GEOLOGIC HAZARDS

Geologic hazards encompass geologic conditions capable of causing damage or loss of property and life. These hazards include seismic events and earthquakes, mass wasting events such as landslides and slump or debris flows, land subsidence or collapse, and flooding and scouring along waterbodies. Potential hazards in the Project area are described below.

6.4.1 Seismic-Related Hazards

Seismicity refers to the frequency, intensity, and distribution of earthquakes within a given area. Earthquakes generally occur when the two sides of a fault suddenly slip past each other. The movement creates ground motion, which can damage property and structures if the motion is sufficiently intense. The majority of earthquakes occur along boundaries of tectonic plates.

Seismic risk can be quantified by the motions experienced by the ground surface or structures during a given earthquake. The USGS Hazard Mapping Program produced probabilistic seismic hazard maps that show an estimate of the probability that ground motion would exceed a certain value, the peak ground acceleration, in 50 years (Rukstales and Petersen, 2019). The maps are generally based on the historic distribution, frequency, and magnitude of earthquakes in the United States. The peak ground acceleration, or the force caused by shaking, is expressed as a percentage of gravity (g). Low percentage g values reflect low ground acceleration values, and are generally associated with low seismic risk. According to the USGS, probabilistic hazard maps for the Project area indicate a 10 percent probability of experiencing an earthquake with an effective peak ground acceleration of between 0 and 1 percent g in a 50-year period and a 2 percent probability of experiencing an earthquake with an effective peak ground acceleration of 2 to 4 percent g in a 50-year period (Rukstales and Petersen, 2019). Additionally, according to the USGS Quaternary Fault and Fold Database, there are no Quaternary faults or Quaternary fault areas mapped within North Dakota (USGS, 2019c).

Based on earthquake records from the NDGS, the closest recorded earthquake to the Project area was a 3.3-magnitude earthquake that occurred in 2012 (Anderson, 2012). The earthquake was located about 15 miles west of the Tioga-Elkhorn Creek pipeline near MP 36.0 at a depth of approximately 0.4 mile below the ground surface (Anderson, 2012). The shaking was categorized as a III on the Modified Mercalli Intensity Scale (Anderson, 2012), which classifies earthquake intensity based on observed effects on people and structures, and ranges from Roman numeral I (not felt) to X (extreme shaking). An earthquake classified as III would be felt noticeably by people indoors, but would feel similar to the vibrations of a passing truck (USGS, 1989). The USGS 2018 seismic hazard model estimated a less than 4 percent chance of ground shaking corresponding to a Modified Mercalli Intensity of IV to occur in the Project area over a 100-year time period (Rukstales and Petersen, 2019).

A study of induced seismicity in the Williston Basin recorded nine earthquakes in the region between 2008 and 2011 (Frohlich et al., 2015). Three of these earthquakes were located near injection wells; however, based on the results of the study, only one earthquake may have been induced. This potentially induced magnitude-2.5 earthquake occurred in 2010 and was located approximately 37 miles west of the Tioga-Elkhorn Creek pipeline at MP 40. Overall, the study noted that the Williston Basin produced the fewest number of potentially induced earthquakes compared to oil and gas production areas in Texas, Oklahoma, and Arkansas. A 2018 study concluded that induced seismicity is low or absent in the Williston Basin because the vertical distance between faults in the Precambrian basement rock and depth of wastewater

injection is greater than 1 kilometer (Skoumal et al., 2018). Based on the observations that induced seismicity is very low or absent in the Williston Basin, it is not anticipated that induced earthquakes will affect the Project area.

Soil liquefaction is a process whereby earthquake shaking or other rapid loading reduces the strength and stiffness of a saturated sandy soil. The result is a transformation of soil to a liquid state. Due to the reported absence of Quaternary faults and low seismic hazard, it is not anticipated that soil liquefaction will affect the Project area.

6.4.2 Subsidence

Subsidence can manifest as rapid sinking or gradual settling of the ground surface, and can be caused by aquifer-system compaction, drainage of organic soils, underground mining, hydro-compaction, natural compaction, sinkholes (dissolution of bedrock), and thawing permafrost. Underground mining also poses risks to engineered structures due to the potential of the overlying strata to collapse into the void formed by the extraction of minerals.

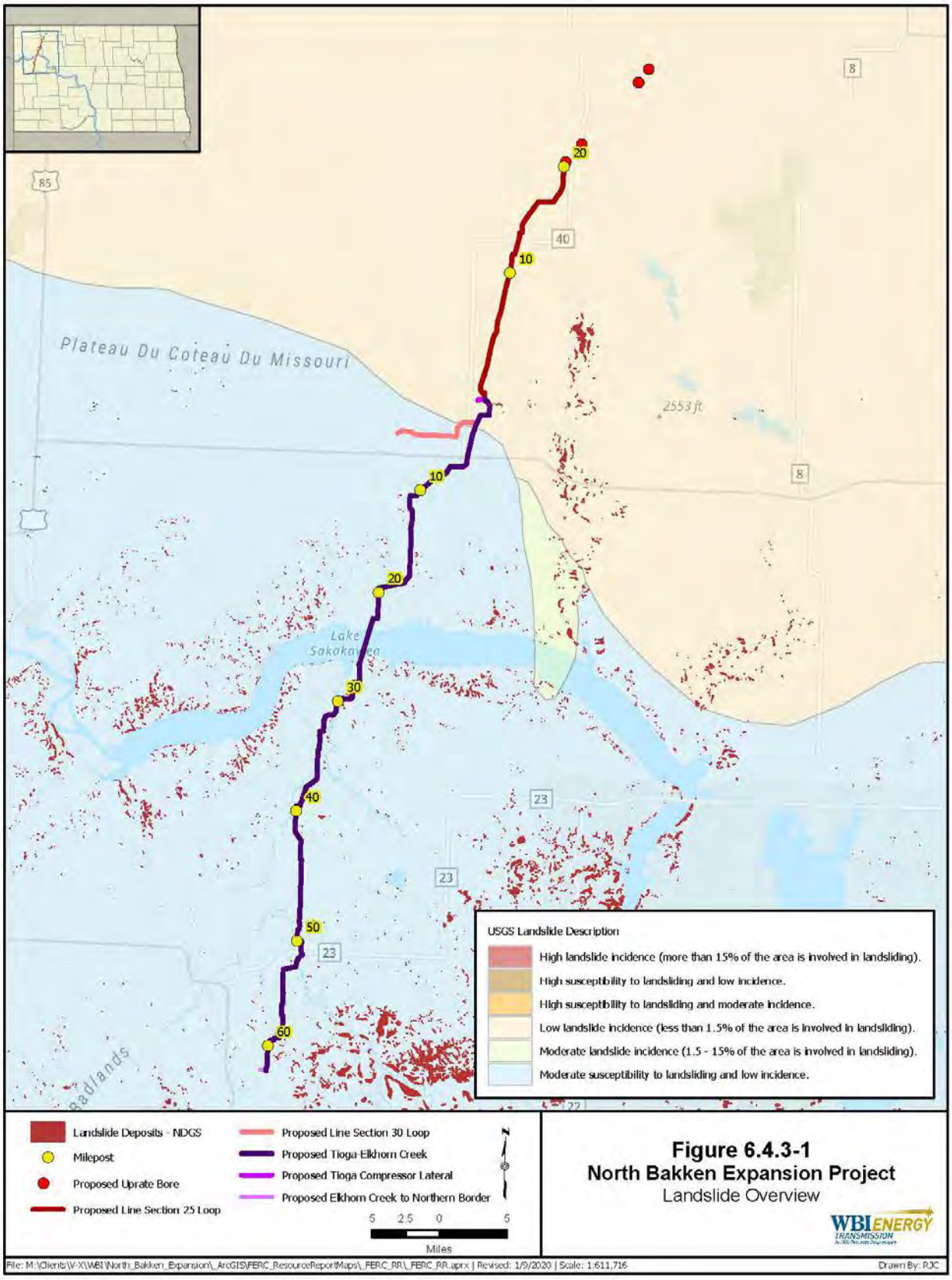
Potential subsidence in the vicinity of the Project area could occur from the dissolution of evaporate rocks (salt) deep beneath the land surface or from mining exploration and extraction activities. However, no karst topography, recent subsidence events, or large-scale mineral mining sites are in or near the Project area (Bluemle, 1983; Trimble, 1979). Furthermore, the Project will require excavating a trench averaging only 6 feet in depth through the surface sediments and, therefore, it is unlikely to contribute to land subsidence.

6.4.3 Landslides

Landslides are defined as the downslope movement of soil, rock, and organic materials induced by gravity, and include but are not limited to rock falls, debris flows, and slumps. Common landslide triggers include earthquakes, heavy rains, volcanic eruptions, erosion, or human activities. Landslides are more likely to occur in areas with steep slopes and soils that shrink or swell due to changes in moisture content. Landslide hazards are often assessed by evaluating landslide incidence, or areas where landslides have occurred in the past, and by evaluating landslide susceptibility, or areas where previous landslides are susceptible to future movement. Susceptibility to landslides is rated from low to high, based on the percent of an area affected by landslides (Godt, 1997):

- low (less than 1.5 percent of the area affected by landslides);
- moderate (1.5 to 15 percent of the area affected); and
- high (greater than 15 percent of the area affected).

The Tioga-Elkhorn Creek pipeline between about MPs 3.0 and 61.9, the Elkhorn Creek-Northern Border pipeline, and the Line Section 25 Loop between about MPs 0.0 and 5.6 are located within an area of moderate landslide susceptibility; however, the incidence is classified as low. Figure 6.4.3-1 depicts the landslide susceptibility ratings and locations of mapped landslides in the Project area (NDGS, 2019b).


Plateau Du Coteau Du Missouri
Lake Sakakawea
2553 ft
Badlands
20
10
10
20
30
40
50
60
85
8
40
8
23
23
23
USGS Landslide Description
High landslide incidence (more than 15% of the area is involved in landsliding).
High susceptibility to landsliding and low incidence.
High susceptibility to landsliding and moderate incidence.
Low landslide incidence (less than 1.5% of the area is involved in landsliding).
Moderate landslide incidence (1.5 - 15% of the area is involved in landsliding).
Moderate susceptibility to landsliding and low incidence.
Landslide Deposits - NDGS
Milepost
Proposed Uprate Bore
Proposed Line Section 25 Loop
Proposed Line Section 30 Loop
Proposed Tioga-Elkhorn Creek
Proposed Tioga Compressor Lateral
Proposed Elkhorn Creek to Northern Border
N
5 2.5 0 5
Miles
Figure 6.4.3-1
North Bakken Expansion Project
Landslide Overview
WBI ENERGY TRANSMISSION
File: M:\Clients\W-X\WBI\North_Bakken_Expansion_ArcGIS\FERC_ResourceReportMaps_FERC_RR_FERC_RR.aprx | Revised: 1/9/2020 | Scale: 1:611,716
Drawn By: RJC

In North Dakota, landslides typically occur in the form of soil slides or rotational slumps, where soil and weathered rock glide or rotate downslope as a coherent layer caused by a combination of saturated soils and gravity. Soil slides or slumps tend to occur along steep slopes of river valleys and in unglaciated areas where the Tertiary Sentinel Butte and Bullion Creek formations are exposed (Trimble, 1979; Murphy, 2017). Landslide deposit maps indicate that most landslide deposits are associated with high-relief topography, such as those located approximately 5 miles east of Line Section 25 Loop MP 5.1 and approximately 3 miles east of MP 60.2 of the Tioga-Elkhorn Creek pipeline (NDGS, 2019b). Smaller-scale landslide deposits are associated with the north and south banks of Lake Sakakawea (NDGS, 2019b); however, the proposed intersect bore entry and exit locations for the HDD crossing of Lake Sakakawea will be set back from the bank by approximately 800 and 2,015 feet, respectively.

Based on the National Elevation Dataset provided by the USGS, the Project is located within areas with slopes of less than or equal to 15 percent (USGS, 2017). Table 6.4.3-1 provides a summary of the percent slope crossed by the proposed pipeline routes. According to the USGS data, the pipeline routes cross slopes from 10 to 15 percent along only about 0.1 mile (464 feet of the Tioga-Elkhorn Creek pipeline and 87 feet of the Line Section 30 Loop). The remainder of the pipeline routes (99.9 percent) cross areas where slopes are 0 to 10 percent.

TABLE 6.4.3-1

North Bakken Expansion Project
Summary of Slopes Crossed by the Proposed Pipeline Routes [a]

Facility	County	Slope (percent)	Crossing Length (feet)	Crossing Length (miles)
Tioga-Elkhorn Creek				
	Williams	0 to 5	131,158	24.8
	Williams	5 to 10	1,545	0.3
	Williams	10 to 15	176	<0.1
	McKenzie	0 to 5	184,607	35.0
	McKenzie	5 to 10	8,942	1.7
	McKenzie	10 to 15	288	<0.1
Elkhorn Creek-Northern Border				
	McKenzie	0 to 5	1,530	0.3
	McKenzie	5 to 10	29	<0.1
Line Section 25 Loop				
	Burke [b]	0 to 5	53,701	10.1
	Burke	5 to 10	144	<0.1
	Mountrail	0 to 5	19,334	3.7
	Williams	0 to 5	35,372	6.7
	Williams	5 to 10	91	<0.1
Line Section 30 Loop				
	Williams	0 to 5	49,474	9.4
	Williams	5 to 10	318	<0.1
	Williams	10 to 15	87	<0.1
Tioga Compressor Lateral				
	Williams	0 to 5	2,495	0.5
Uprate Line Section 25				
	Burke	0 to 5	1,285	0.2

[a] Sourced from USGS, 2017
[b] Total includes 86th Street Northwest/Norse Plant Reroute crossing length.

Because the Project is primarily located within areas of rolling hills and low relief, it is not anticipated that landslides will affect the Project. WBI Energy does not plan to conduct additional slope studies or prepare a landslide mitigation plan due to the low risk of landslides in the Project area.

6.4.4 Flooding

Hazards associated with flooding include stream bank erosion, scour, channel relocation, bedload movement, and debris flows. Based on information available from the Federal Emergency Management Agency for McKenzie County, the Project area is located within a minimal flood hazard zone (Zone X). Flood hazard information is not available for the Project area located within Williams, Mountrail, and Burke Counties. In these counties, WBI Energy will consult with county floodplain managers and will obtain approvals, as necessary, prior to construction within a flood zone. No aboveground structures will be installed within the mapped floodplain. As such, construction and operation of the Project will not affect flood storage or floodplain elevations.

Heavy or excessive rainfall in a relatively short time period can cause flash flooding and scour along streambanks and within flood zones. The U.S. Army Corps of Engineers manages the water level of the Lake Sakakawea reservoir through operations at the Garrison Dam to control flooding. Depth of this crossing will be finalized based on the over water geotechnical analysis to be completed in the spring of 2020. Estimated depth of cover is 300 feet; which will prevent damage to the pipeline from scour. A search of publicly available information did not return studies or evidence of past scour or flash flooding events where the Project crosses perennial waterbodies, including Tobacco Garden Creek, Beaver Creek, Cherry Creek, and White Earth Creek. Where the Project crosses these perennial waterbodies, the Project will be designed and installed at a burial depth necessary to prevent scour from exposing the pipelines in accordance with 49 CFR 192.

6.5 PALEONTOLOGICAL RESOURCES

Paleontological resources are vertebrate and invertebrate fossils that are sometimes discovered at locations under excavation or in areas exposed by erosion. Direct effects on paleontological resources could occur during Project construction by activities such as grading or trenching. Indirect effects on fossil beds could result from erosion caused by slope regrading, vegetation clearing, and/or unauthorized collection. The Project will cross several geologic units that may host paleontological resources, including the Tertiary Sentinel Butte and Bullion Creek formations, and the Quaternary Coleharbor Group.

The sandstones and shales of the Sentinel Butte and Bullion Creek formations were deposited between 65 and 55 million years ago during erosion of the rising Rocky Mountains. The climate was sub-tropical with abundant swamps in the lowlands, and many types of vertebrates including turtles, alligators, crocodiles, and similar reptiles inhabited the area. Invertebrates such as insects, snails, and clams lived in the aquatic habitats. In addition, fossils of mammals, fish, fossil tracks, and plants are associated with the Sentinel Butte and Bullion Creek formations, and are considered to be relatively abundant within the formations. The Quaternary Coleharbor Group hosts fossils of vertebrates that existed during the Pleistocene, including mammoths, mastodons, ground sloths, giant bison, beavers, and horses, in addition to

smaller organisms such as frogs, insects, fish, mollusks, and crustaceans. The remains found in these Pleistocene-age deposits tend to be poorly preserved (Hoganson, 2006).

Paleontological resources on land owned by the State of North Dakota and its political subdivisions are protected and managed under Chapters 54-17.3 and 43-04 of the North Dakota Century and Administrative Codes, respectively. A permit is required to investigate, excavate, collect, or otherwise record paleontological resources on these lands (NDGS, 2019c). The Project will cross North Dakota state lands between MPs 4.2 and 5.2 of the Line Section 25 Loop. Century Code Chapter 54-17.3-05 requires the reporting of all Quaternary paleontological finds potentially or actually containing cultural resources to the State Historical Society of North Dakota in addition to the State Geologist (State of North Dakota, 2019).

Paleontological resources on U.S. Army Corps of Engineers and U.S. Forest Service lands are protected under the Paleontological Resources Preservation Act per 36 CFR 291.1. The Project will cross U.S. Forest Service lands between MPs 27.2 to 27.6 and MPs 28.1 to 29.7 of the Tioga-Elkhorn Creek pipeline. The Project will cross U.S. Army Corps of Engineers land between MPs 23.0 and 25.7 of the Tioga-Elkhorn Creek pipeline; all of the U.S. Army Corps of Engineers land will be encompassed within the proposed HDD crossing of Lake Sakakawea. WBI Energy obtained an Archaeological Resources Protection Act permit, which is required to conduct paleontological surveys within U.S. Forest Service and U.S. Army Corps of Engineers lands. These surveys were completed in October 2019, and the survey report is included in appendix 6B. No fossil localities were identified during the paleontological surveys. Multiple isolated and poorly preserved fossils of unidentifiable plant fragments and one incomplete invertebrate shell cast were identified; however, these fossils were not determined to be significant paleontological resources. No other paleontological resources were identified during the surveys.

If paleontological resources are discovered during construction of the Project, they will be treated as cultural resources in accordance with WBI Energy's *Plan for Unanticipated Discovery of Paleontological Resources during Construction*, which is provided in appendix 1F of Resource Report 1.

6.6 BLASTING

Based on a query of the Soil Survey Geographic database for soil characteristics in Mountrail, Burke, Williams, and McKenzie Counties (U.S. Department of Agriculture Natural Resources Conservation Service, 1991, 2002, 2003, 2006), approximately 144.3 acres (10 percent) of the Project area overlies soils where bedrock is shallower than 60 inches from the ground surface.

The shallow bedrock in the Project area is classified as paralithic, indicating it is weathered and could be ripped using typical construction equipment. As such, WBI Energy does not anticipate that blasting will be required during Project construction. The location of shallow bedrock by facility and milepost is listed in table 6.6-1. A total of approximately 14.8 miles of shallow bedrock will be crossed by the proposed pipeline facilities. Shallow bedrock is also present at approximately 1.6 acres associated with the Elkhorn Creek Compressor Station site, 0.1 acre at the Northern Border Interconnect, and 4.6 acres along temporary access roads.

TABLE 6.6-1

North Bakken Expansion Project
Shallow Bedrock Along the Proposed Pipeline Routes [a]

Pipeline Facility	Approximate Milepost Beginning	Approximate Milepost Ending	Crossing Length (miles)	Bedrock Type [b]
Tioga-Elkhorn Creek				
	12.1	12.2	<0.1	Paralithic
	18.8	18.9	0.1	Paralithic
	19.0	19.3	0.3	Paralithic
	25.5	25.6	<0.1	Paralithic
	27.0	27.1	<0.1	Paralithic
	27.3	27.4	0.1	Paralithic
	27.4	27.5	<0.1	Paralithic
	27.9	28.0	0.1	Paralithic
	28.8	28.9	0.1	Paralithic
	29.6	29.7	<0.1	Paralithic
	33.1	33.4	0.3	Paralithic
	33.4	33.7	0.3	Paralithic
	33.8	33.9	0.1	Paralithic
	34.1	34.1	<0.1	Paralithic
	34.2	34.9	0.7	Paralithic
	38.1	38.2	0.1	Paralithic
	38.3	38.5	0.1	Paralithic
	40.0	40.4	0.3	Paralithic
	40.4	40.7	0.3	Paralithic
	40.9	41.5	0.6	Paralithic
	41.6	41.8	0.2	Paralithic
	41.9	41.9	<0.1	Paralithic
	42.4	42.6	0.2	Paralithic
	42.7	42.8	0.1	Paralithic
	44.3	44.4	0.2	Paralithic
	44.7	45.2	0.5	Paralithic
	45.3	45.7	0.3	Paralithic
	48.1	48.2	<0.1	Paralithic
	48.6	48.8	0.2	Paralithic
	49.3	49.4	<0.1	Paralithic
	49.6	50.7	1.1	Paralithic
	51.2	51.3	0.1	Paralithic
	51.5	51.9	0.4	Paralithic
	52.6	53.2	0.6	Paralithic
	53.3	53.4	0.1	Paralithic
	53.5	53.5	<0.1	Paralithic
	54.3	54.4	0.1	Paralithic
	54.7	54.7	0.1	Paralithic
	54.8	57.2	2.4	Paralithic
	57.2	58.0	0.8	Paralithic
	58.2	58.4	0.2	Paralithic
	58.6	58.6	<0.1	Paralithic
	58.7	59.7	0.9	Paralithic
	59.7	59.8	<0.1	Paralithic

TABLE 6.6-1 (cont'd)

North Bakken Expansion Project
Shallow Bedrock Along the Proposed Pipeline Routes [a]

Facility	Approximate Milepost Beginning	Approximate Milepost Ending	Crossing Length (miles)	Bedrock Type [b]
	59.8	60.2	0.3	Paralithic
	60.4	61.6	1.2	Paralithic
	61.6	61.9	0.1	Paralithic
Elkhorn Creek-Northern Border				
	0.2	0.2	<0.1	Paralithic
	0.3	0.3	<0.1	Paralithic
Line Section 25 Loop				
	2.5	2.5	<0.1	Paralithic
Total			**14.8**	

[a] Based on soil mapping units that contain bedrock within 60 inches of the soil surface as identified by the U.S. Department of Agriculture Natural Resources Conservation Service

[b] Paralithic = Rippable with standard construction equipment, will not likely require blasting

6.7 DESIGN, CONSTRUCTION, AND MITIGATION

The proposed pipelines will be designed and installed in accordance with U.S. Department of Transportation standards (49 CFR 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*), which will minimize or avoid potential impacts on the proposed facilities from potential geological hazards. Under these regulations, pipelines must be designed and constructed to provide adequate protection from washouts, floods, unstable soils, landslides or other hazards that may cause the pipe to move or sustain abnormal loads. For the proposed Project, no areas requiring special design or construction considerations as a result of geological hazards have been identified. Where the pipeline routes cross areas of steep slopes, potential impacts will be mitigated through the use of erosion control measures as described below. Additionally, WBI Energy notes that it avoided steep slopes to the extent practicable in routing the proposed pipelines.

With regard to topography, the construction techniques described in Resource Reports 1 and 7 will minimize the potential for slope failure and erosion. These techniques include the use of erosion control devices and other best management practices described in the FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures*. In areas of steep side slope or rolling terrain, WBI Energy will install temporary sediment barriers such as silt fences, straw bales, straw logs, or snow berms during construction to prevent the movement of disturbed soil off the right-of-way (in accordance with the FERC Plan). As necessary, trench breakers (stacked sand bags or foam) will be installed in the trench around the pipe in steeply sloped areas to prevent movement of subsurface water along the pipeline. Temporary slope breakers consisting of mounded and compacted soil also will be installed across the right-of-way during construction (in accordance with the FERC Plan, and permanent slope breakers will be installed during cleanup or as soon as weather conditions permit. Trench breakers are designed to prevent preferential water flow along the pipeline trench by diverting subsurface water flow to the land surface; groundwater discharging at the land surface is then redirected off the right-of-way by the slope breakers. Used

in combination, these structures prevent subsurface piping of soils that can lead to slope instability and failure.

Construction and operation of the proposed Project are not anticipated to have an impact on oil and natural gas resources. The trench excavations for the pipeline routes will not be deep enough to affect oil and gas deposits, which occur thousands of feet below ground surface. With regard to surface infrastructure, WBI Energy is working with producers to avoid or otherwise accommodate active or potential well sites and any feeder or gathering pipelines serving oil or gas wells in the vicinity of the proposed pipeline routes to minimize the potential for inadvertent damage to these facilities. Future oil and gas exploration within the new permanent right-of-way for the pipelines will be prohibited. The Project will be located near several former or currently active quarries; however, the Project is not expected to result in any significant impacts on industrial sand and gravel, scoria, or other mineral resources (e.g., lignite, salt,). Future extractive activities will be prohibited within the pipeline rights-of-way and aboveground facility footprints.

Based on the soils present in the Project area, WBI Energy does not expect that blasting will be required to excavate the trench; however, if shallow bedrock or boulders are encountered that cannot be removed by conventional methods, blasting may be required. If blasting is necessary, WBI Energy's construction contractor will use blasting techniques in compliance with state and federal regulations governing the use of explosives to assist in the removal of rock from the pipeline trench. WBI Energy will use the minimum explosive charge necessary to fracture bedrock and keep shot-rock from leaving the construction right-of-way. To avoid damage, the contractor will conduct pre-blasting evaluations of the rock, as needed, and develop specific blasting operations and monitoring plans. Control of blasting will limit stresses on existing pipelines, nearby domestic structures, water supply wells, or electric transmission tower footings that may be located near the Project area. Blasting will be conducted during daylight hours and will not begin until occupants of nearby buildings, stores, residences, places of business, and farms have been notified.

Due to the soil types in the Project area, WBI Energy does not anticipate that the Project will generate substantial quantities of rock debris. However, if rock debris is generated during construction, WBI Energy will not permanently windrow rock along the right-of-way without permission from the landowner. Disposal of rock debris will be in areas approved by the individual landowners in accordance with the Plan and regulatory requirements. Should WBI Energy have to dispose of excess rock outside of the rights-of-way, an approved landfill or alternative upland area will be utilized. The necessary permits and clearances will be obtained for off right-of-way disposal areas.

6.8 CUMULATIVE IMPACTS

Section 1.10 of Resource Report 1 defines a cumulative impact and describes the general scope of the cumulative impact analysis. This section describes the potential cumulative impacts on geological resources from the Project combined with the past, present, and reasonably foreseeable future actions (RFFA) identified in appendix 1J and figure 1.10-1 of Resource Report 1. The location, proposed schedule, and a description of each RFFA are provided in appendix 1J.

Impacts on geologic resources and hazards will be limited to the time of active construction within the Hydrologic Unit Code 12 subwatershed. Primary impacts will be limited to construction activities and will include temporary disturbance of slopes within the Project's right-of-way

resulting from grading and trenching operations. The overall effects of construction and operation of the proposed Project facilities on topography and geological resources is anticipated be minor, pending the results of the paleontological survey. Primary impacts will be limited to the period of active construction and will include temporary disturbance of slopes within the right-of-way resulting from grading and trenching operations. WBI Energy will minimize impacts by returning contours to preconstruction conditions to the extent practicable, with the exception of the proposed Tioga Compressor Station, Elkhorn Creek Compressor Station, and other aboveground facility sites where grading and filling will be required to create a safe and stable land surface to support the facilities.

The following RFFAs fall within the Project's geographic and temporal scope for geological resources:

- Construction activities associated with the Aurora Wind electric transmission line may cause the soil surface to become more prone to wind and water erosion and may result in soil compaction. Erosion and sediment control measures will include segregation of topsoil and the use of appropriately sized construction equipment. Additionally, Aurora Wind will verify that access road grades fit closely with the natural terrain, soil cuttings are properly disposed of, and proper drainage is maintained.

- Several pipeline transmission projects (Bakken natural gas pipeline, Cenex refined fuels pipeline, a water transmission line in Watford City, and the Western Area Water Supply Project) could result in short-term impacts similar to the impacts described for the Project.

WBI Energy will implement mitigation measures to avoid or mitigate the Project's impact on geological resources as described in section 6.7, which will include but not be limited to implementing best management practices, regrading contours, and revegetating disturbed areas to minimize soil erosion. The Project will therefore generate limited temporary impacts on geological resources. While both the Project and the RFFAs could contribute to impacts on geological resources within the overlapping construction areas during pipeline construction and restoration, these impacts would be temporary and highly localized. As a result, the Project, when combined with other RFFAs, is not expected to have a significant cumulative impact on geological resources.

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NORTH BAKKEN EXPANSION PROJECT

Resource Report 6

APPENDIX 6A

APPENDIX 6A

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
Tioga-Elkhorn Creek					
0.5	Tioga-Elkhorn Creek	818	TI-Larson-157-95 2536H-1	Hess Bakken Investments II, LLC	Active
1.4	Tioga-Elkhorn Creek	837	Tioga-Madison Unit H-108	Hess Bakken Investments II, LLC	Plugged and Abandoned
2.1	Tioga-Elkhorn Creek	588	Leroy Nelson Tract 3 2	Amerada Hess Corporation	Dry
5.1	Tioga-Elkhorn Creek	1183	Michael Douglas 8-5h	Murex Petroleum Corporation	Permitted location to drill
5.1	Tioga-Elkhorn Creek	2689	Eskeland Herfindahl 7-6h	Murex Petroleum Corporation	Active
5.1	Tioga-Elkhorn Creek	973	Beaver Lodge-Madison Unit O-29	Amerada Hess Corporation	Plugged and Abandoned
5.2	Tioga-Elkhorn Creek	719	Jacquie Lisset 5-8h	Murex Petroleum Corporation	Active
5.4	Tioga-Elkhorn Creek	456	Beaver Lodge-Madison Unit P-28	Amerada Hess Corporation	Plugged and Abandoned
5.6	Tioga-Elkhorn Creek	749	Beaver Lodge-Madison Unit O-27	Amerada Hess Corporation	Plugged and Abandoned
5.6	Tioga-Elkhorn Creek	257	BLMU P-27AH	Hess Bakken Investments II, LLC	Active
5.7	Tioga-Elkhorn Creek	560	BLMU P-27H	Hess Bakken Investments II, LLC	Plugged and Abandoned
5.8	Tioga-Elkhorn Creek	858	Beaver Lodge-Madison Unit P-26	Amerada Hess Corporation	Plugged and Abandoned
5.9	Tioga-Elkhorn Creek	932	Beaver Lodge-Devonian Unit I-315	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
6.1	Tioga-Elkhorn Creek	932	BLMU O-25 BH	Hess Bakken Investments II, LLC	Active
6.1	Tioga-Elkhorn Creek	1149	Beaver Lodge-Madison Unit O-25a	Amerada Hess Corporation	Plugged and Abandoned
6.1	Tioga-Elkhorn Creek	1013	Beaver Lodge-Madison Unit O-25	Amerada Hess Corporation	Plugged and Abandoned
6.2	Tioga-Elkhorn Creek	545	Beaver Lodge-Madison Unit N-26	Amerada Hess Corporation	Plugged and Abandoned
6.4	Tioga-Elkhorn Creek	1197	BLDU H-315	Hess Bakken Investments II, LLC	Plugged and Abandoned
6.5	Tioga-Elkhorn Creek	731	Beaver Lodge-Madison Unit M-25	Amerada Hess Corporation	Plugged and Abandoned
6.7	Tioga-Elkhorn Creek	622	Beaver Lodge-Madison Unit L-26	Hess Corporation	Plugged and Abandoned
6.7	Tioga-Elkhorn Creek	145	Beaver Lodge-Devonian Unit G-315	Hess Bakken Investments II, LLC	Plugged and Abandoned
6.8	Tioga-Elkhorn Creek	606	Beaver Lodge-Ordovician Unit 7	Hess Bakken Investments II, LLC	Plugged and Abandoned
6.9	Tioga-Elkhorn Creek	691	Beaver Lodge-Madison Unit K-25	Hess Bakken Investments II, LLC	Plugged and Abandoned
7.1	Tioga-Elkhorn Creek	830	Nels Anderson 1	Amerada Hess Corporation	Dry

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
7.6	Tioga-Elkhorn Creek	249	Knutson-Walla Unit 1	Hunt Oil Company	Permit Now Cancelled
7.7	Tioga-Elkhorn Creek	1147	Josie Knutson 1	Hunt Oil Company	Dry
7.8	Tioga-Elkhorn Creek	453	Tioga-Madison Unit G-109	Amerada Hess Corporation	Plugged and Abandoned
8.4	Tioga-Elkhorn Creek	449	Tioga-Madison Unit H-110	Amerada Hess Corporation	Plugged and Abandoned
9.0	Tioga-Elkhorn Creek	83	Tioga-Madison Unit H-112	Amerada Hess Corporation	Plugged and Abandoned
12.2	Tioga-Elkhorn Creek	1844	BL-Kerbaugh-156-96-3427h-1	Hess Bakken Investments II, LLC	Active
12.3	Tioga-Elkhorn Creek	1802	Beaver Lodge-Devonian Unit B-308i	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
13.0	Tioga-Elkhorn Creek	4433	Beaver Lodge-Madison Unit C-9	Amerada Hess Corporation	Plugged and Abandoned
13.0	Tioga-Elkhorn Creek	494	Halvor Davidson 1	C. W. Williams & O. D. Clark	Dry
13.0	Tioga-Elkhorn Creek	1792	Beaver Lodge-Devonian Unit B-307	Hess Bakken Investments II, LLC	Plugged and Abandoned
13.1	Tioga-Elkhorn Creek	3143	Beaver Lodge-Madison Unit B-8	Amerada Hess Corporation	Plugged and Abandoned
13.9	Tioga-Elkhorn Creek	174	Beaver Lodge-Devonian Unit A-305	Hess Bakken Investments II, LLC	Temporarily Abandoned Observation
14.0	Tioga-Elkhorn Creek	589	Oford Boe 1	Amerada Hess Corporation	Dry
14.1	Tioga-Elkhorn Creek	1320	BL-Olson-155-96-1003h-1	Hess Bakken Investments II, LLC	Active
14.2	Tioga-Elkhorn Creek	823	BL-Olson-155-96-1003h-6pnc	Hess Bakken Investments II, LLC	Permit Now Cancelled
14.2	Tioga-Elkhorn Creek	856	BL-Olson-155-96-1003H-5PNC	Hess Bakken Investments II, LLC	Permit Now Cancelled
14.2	Tioga-Elkhorn Creek	889	BL-Olson-155-96-1003H-4PNC	Hess Bakken Investments II, LLC	Permit Now Cancelled
14.2	Tioga-Elkhorn Creek	922	BL-Olson-155-96-1003H-3PNC	Hess Bakken Investments II, LLC	Permit Now Cancelled
14.2	Tioga-Elkhorn Creek	955	BL-Olson-155-96-1003H-2PNC	Hess Bakken Investments II, LLC	Permit Now Cancelled
14.2	Tioga-Elkhorn Creek	988	BL-Olson-LW-155-96-1003H-1	Hess Bakken Investments II, LLC	Permit Now Cancelled
16.5	Tioga-Elkhorn Creek	755	Hanson 27-22	Amerada Hess Corporation	Dry
16.9	Tioga-Elkhorn Creek	189	Boe 27-24	Amerada Hess Corporation	Permit Now Cancelled
17.3	Tioga-Elkhorn Creek	409	Brownell 34-11	Amerada Hess Corporation	Dry

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
17.8	Tioga-Elkhorn Creek	1902	Mortenson 33-44	Murex Petroleum Corporation	Plugged and Abandoned
19.1	Tioga-Elkhorn Creek	496	Woodrow 34x-32	XTO Energy Inc.	Active
19.5	Tioga-Elkhorn Creek	684	Helen 11x-5	XTO Energy Inc.	Active
19.7	Tioga-Elkhorn Creek	653	Woodrow N. Sveen Et Ux 1	Home-Stake Production Co.	Dry
21.8	Tioga-Elkhorn Creek	469	Kenneth 11x-17a	XTO Energy Inc.	Confidential
21.8	Tioga-Elkhorn Creek	499	Kenneth 11x-17e	XTO Energy Inc.	Confidential
21.8	Tioga-Elkhorn Creek	529	Kenneth 11x-17b	XTO Energy Inc.	Confidential
21.8	Tioga-Elkhorn Creek	559	Kenneth 11x-17f	XTO Energy Inc.	Confidential
22.3	Tioga-Elkhorn Creek	1511	Arley 21x-18b	XTO Energy Inc.	Active
22.3	Tioga-Elkhorn Creek	1581	Arley 21x-18e	XTO Energy Inc.	Active
22.3	Tioga-Elkhorn Creek	1558	Arley 21x-18a	XTO Energy Inc.	Active
22.3	Tioga-Elkhorn Creek	1534	Arley 21x-18f	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	1163	Ruby State Federal 34x-36f	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	1163	Ruby State Federal 34x-36b	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	1163	Ruby State 34x-36g	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	728	Ruby State Federal 34x-36h	XTO Energy Inc.	Confidential
26.1	Tioga-Elkhorn Creek	847	Lundstrom 44-36h	Encore Operating, L.P.	Permit Now Cancelled
26.1	Tioga-Elkhorn Creek	1163	Ruby State Federal 34x-36a	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	728	Ruby State Federal 34x-36d	XTO Energy Inc.	Confidential
26.1	Tioga-Elkhorn Creek	1163	Ruby State Federal 34x-36e	XTO Energy Inc.	Active
26.1	Tioga-Elkhorn Creek	728	Ruby State Federal 34x-36gxh	XTO Energy Inc.	Confidential
26.1	Tioga-Elkhorn Creek	727	Ruby State Federal 34x-36c	XTO Energy Inc.	Confidential
26.3	Tioga-Elkhorn Creek	346	Gunslinger Federal 15-1-12tf2h	Slawson Exploration Company, Inc.	Confidential
26.3	Tioga-Elkhorn Creek	386	Gunslinger Federal 4-1-12h	Slawson Exploration Company, Inc.	Active
26.3	Tioga-Elkhorn Creek	426	Gunslinger Federal 7-1-12tfh	Slawson Exploration Company, Inc.	Confidential

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
26.3	Tioga-Elkhorn Creek	466	Gunslinger Federal 5-1-12h	Slawson Exploration Company, Inc.	Confidential
26.3	Tioga-Elkhorn Creek	506	Gunslinger Federal 16-1-12tf2h	Slawson Exploration Company, Inc.	Confidential
26.3	Tioga-Elkhorn Creek	546	Gunslinger Federal 6-1-12tfh	Slawson Exploration Company, Inc.	Confidential
26.6	Tioga-Elkhorn Creek	797	Wold Federal 42-1-1h	Whiting Oil And Gas Corporation	Active
26.6	Tioga-Elkhorn Creek	797	Wold Federal 42-1-1tfh	Whiting Oil And Gas Corporation	Active
26.6	Tioga-Elkhorn Creek	796	Wold Federal 42-1-2h	Whiting Oil And Gas Corporation	Active
26.6	Tioga-Elkhorn Creek	795	Wold Federal 42-1-2tfh	Whiting Oil And Gas Corporation	Active
26.6	Tioga-Elkhorn Creek	795	Wold Federal 42-1-3h	Whiting Oil And Gas Corporation	Active
26.7	Tioga-Elkhorn Creek	817	Wold Federal 43-1-1tfh	Whiting Oil And Gas Corporation	Active
26.7	Tioga-Elkhorn Creek	817	Wold Federal 43-1-1h	Whiting Oil And Gas Corporation	Active
26.7	Tioga-Elkhorn Creek	816	Wold Federal 43-1-2tfh	Whiting Oil And Gas Corporation	Active
26.7	Tioga-Elkhorn Creek	815	Wold Federal 43-1-2h	Whiting Oil And Gas Corporation	Active
27.1	Tioga-Elkhorn Creek	493	Wold Federal 44-1-4h	Whiting Oil And Gas Corporation	Drilling
27.1	Tioga-Elkhorn Creek	538	Wold Federal 44-1-3tfh	Whiting Oil And Gas Corporation	Drilling
27.1	Tioga-Elkhorn Creek	583	Wold Federal 44-1-3h	Whiting Oil And Gas Corporation	Permitted location to drill
27.1	Tioga-Elkhorn Creek	628	Wold Federal 44-1-2tfh	Whiting Oil And Gas Corporation	Permitted location to drill
27.1	Tioga-Elkhorn Creek	673	Wold Federal 44-1-2h	Whiting Oil And Gas Corporation	Permitted location to drill
27.1	Tioga-Elkhorn Creek	718	Wold Federal 44-1-1tfh	Whiting Oil And Gas Corporation	Permitted location to drill
27.1	Tioga-Elkhorn Creek	763	Wold Federal 44-1-1h	Whiting Oil And Gas Corporation	Permitted location to drill
27.1	Tioga-Elkhorn Creek	808	Wold Federal 44-1tfhu	Whiting Oil And Gas Corporation	Permitted location to drill
28.6	Tioga-Elkhorn Creek	467	Gunslinger Federal 11-12-1tfh	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	507	Gunslinger Federal 1-12-1h	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	547	Gunslinger Federal 12-12-1tf2h	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	588	Gunslinger Federal 10-12-1tfh	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	628	Gunslinger Federal 13-12-1tf2h	Slawson Exploration Company, Inc.	Confidential

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
28.6	Tioga-Elkhorn Creek	668	Gunslinger Federal 2-12-1h	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	708	Gunslinger Federal 9-12-1tfh	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	748	Gunslinger Federal 3-12-1h	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	788	Gunslinger Federal 14-12-1tf2h	Slawson Exploration Company, Inc.	Confidential
28.6	Tioga-Elkhorn Creek	828	Gunslinger Federal 8-12-1tfh	Slawson Exploration Company, Inc.	Confidential
28.7	Tioga-Elkhorn Creek	1005	Gladstone 4-1-13tfh	Burlington Resources Oil & Gas Company LP	Confidential
28.7	Tioga-Elkhorn Creek	1024	Gladstone 4-1-13mbh	Burlington Resources Oil & Gas Company LP	Confidential
28.7	Tioga-Elkhorn Creek	1069	Gladstone 5-1-13tfh	Burlington Resources Oil & Gas Company LP	Confidential
28.7	Tioga-Elkhorn Creek	1115	Gladstone 6-1-13mbh	Burlington Resources Oil & Gas Company LP	Confidential
28.7	Tioga-Elkhorn Creek	1315	Gladstone 7-1-13tfh	Burlington Resources Oil & Gas Company LP	Confidential
28.7	Tioga-Elkhorn Creek	1360	Gladstone 8-1-13mbh	Burlington Resources Oil & Gas Company LP	Confidential
33.6	Tioga-Elkhorn Creek	441	Joshua Tree 1-34h	Zenergy, Inc	Permit Now Cancelled
34.5	Tioga-Elkhorn Creek	394	Thelen 5297 11-6 5t [a]	Oasis Petroleum North America LLC	Permitted location to drill
34.5	Tioga-Elkhorn Creek	370	Thelen 5297 11-6 4b [a]	Oasis Petroleum North America LLC	Permitted location to drill
34.5	Tioga-Elkhorn Creek	346	Thelen 5297 11-6 3tx [a]	Oasis Petroleum North America LLC	Permitted location to drill
34.6	Tioga-Elkhorn Creek	183	Wold 1-6h	Zenergy, Inc	Permit Now Cancelled
34.6	Tioga-Elkhorn Creek	1127	Wold Federal 15-33h	Oasis Petroleum North America LLC	Active
34.7	Tioga-Elkhorn Creek	1724	A. Johnson 5397 43-33 11b	Oasis Petroleum North America LLC	Drilling
36.7	Tioga-Elkhorn Creek	388	Dennis 1-12h [a]	Zenergy, Inc	Permit Now Cancelled
36.8	Tioga-Elkhorn Creek	129	Vonnie 1-18h [a]	Zenergy, Inc	Permit Now Cancelled
36.8	Tioga-Elkhorn Creek	1220	Rolfsrud Federal 18-19h	Oasis Petroleum North America LLC	Inactive (Shut-In >= 3 months and <= 12 Months)

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
39.3	Tioga-Elkhorn Creek	1038	Mildred Nelson 4-25h	Oasis Petroleum North America LLC	Active
39.3	Tioga-Elkhorn Creek	599	Nelson 5298 14-26 11tx	Oasis Petroleum North America LLC	Active
39.3	Tioga-Elkhorn Creek	600	Nelson 5298 14-26 12bx	Oasis Petroleum North America LLC	Active
39.3	Tioga-Elkhorn Creek	602	AAGVIK 5298 14-26 13BX	Oasis Petroleum North America LLC	Active
39.3	Tioga-Elkhorn Creek	603	AAGVIK 5298 14-26 14TX	Oasis Petroleum North America LLC	Active
39.5	Tioga-Elkhorn Creek	647	Nelson 5298 13-26 10b	Oasis Petroleum North America LLC	Active
39.5	Tioga-Elkhorn Creek	647	Nelson 5298 13-26 9t	Oasis Petroleum North America LLC	Active
39.5	Tioga-Elkhorn Creek	647	Nelson 5298 13-26 8b	Oasis Petroleum North America LLC	Active
39.5	Tioga-Elkhorn Creek	649	AAGVIK 5298 13-26 12T	Oasis Petroleum North America LLC	Active
39.5	Tioga-Elkhorn Creek	649	AAGVIK 5298 13-26 11B	Oasis Petroleum North America LLC	Active
39.6	Tioga-Elkhorn Creek	649	AAGVIK 5298 13-26 10T	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	1920	AAGVIK 5298 41-35 6T	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	1953	AAGVIK 5298 41-35 5B	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	1986	AAGVIK 5298 41-35 4T	Oasis Petroleum North America LLC	Plugged and Abandoned
41.4	Tioga-Elkhorn Creek	2019	AAGVIK 5298 41-35 3BX	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	2052	AAGVIK 5298 41-35 2TX	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	2085	AAGVIK 5298 41-35 15T	Oasis Petroleum North America LLC	Active
41.4	Tioga-Elkhorn Creek	3061	Johnsrud 1-34h	Zenergy, Inc	Permit Now Cancelled
41.6	Tioga-Elkhorn Creek	526	Berquist 31x-2d	XTO Energy Inc.	Active
41.6	Tioga-Elkhorn Creek	509	Berquist 31x-2g	XTO Energy Inc.	Active
41.6	Tioga-Elkhorn Creek	492	Berquist 31x-2c	XTO Energy Inc.	Active
43.5	Tioga-Elkhorn Creek	453	Abercrombie 1-8-12 Mbh	Burlington Resources Oil & Gas Company LP	Confidential
43.6	Tioga-Elkhorn Creek	453	Abersom 1-8-12 Utfh -Ulw [a]	Burlington Resources Oil & Gas Company LP	Confidential

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
43.6	Tioga-Elkhorn Creek	454	Abercrombie 2-8-12 Utfh [a]	Burlington Resources Oil & Gas Company LP	Confidential
43.8	Tioga-Elkhorn Creek	1287	Johnsrud 21-13seh	XTO Energy Inc.	Active
43.8	Tioga-Elkhorn Creek	1281	Johnsrud 21x-13e	XTO Energy Inc.	Confidential
43.8	Tioga-Elkhorn Creek	1284	Johnsrud 21x-13a	XTO Energy Inc.	Confidential
43.8	Tioga-Elkhorn Creek	1201	Rink 13-24h	Zenergy, Inc	Permit Now Cancelled
43.8	Tioga-Elkhorn Creek	1285	Johnsrud 21x-13axd	XTO Energy Inc.	Permit Now Cancelled
45.6	Tioga-Elkhorn Creek	1478	Mccoy 44x-23g2	XTO Energy Inc.	Active
45.7	Tioga-Elkhorn Creek	1478	Mccoy 44x-23d	XTO Energy Inc.	Active
45.7	Tioga-Elkhorn Creek	1479	Mccoy 44-23nwh	XTO Energy Inc.	Active
45.7	Tioga-Elkhorn Creek	1479	Mccoy 44x-23h	XTO Energy Inc.	Active
45.8	Tioga-Elkhorn Creek	1362	Sax 41x-26c	XTO Energy Inc.	Active
45.8	Tioga-Elkhorn Creek	1317	Sax 41x-26h	XTO Energy Inc.	Active
45.8	Tioga-Elkhorn Creek	1272	Sax 41x-26d	XTO Energy Inc.	Active
49.7	Tioga-Elkhorn Creek	323	Lundin 44x-11d [a]	XTO Energy Inc.	Active
49.7	Tioga-Elkhorn Creek	323	Lundin 44x-11h [a]	XTO Energy Inc.	Active
49.7	Tioga-Elkhorn Creek	323	Lundin 44x-11c [a]	XTO Energy Inc.	Active
49.9	Tioga-Elkhorn Creek	537	Lundin 41x-14c	XTO Energy Inc.	Active
49.9	Tioga-Elkhorn Creek	507	Lundin 41x-14g	XTO Energy Inc.	Active
49.9	Tioga-Elkhorn Creek	477	Lundin 41-14swh [a]	XTO Energy Inc.	Active
49.9	Tioga-Elkhorn Creek	447	Lundin 41x-14d [a]	XTO Energy Inc.	Active
50.2	Tioga-Elkhorn Creek	730	Lundin 11-13seh	XTO Energy Inc.	Active
52.0	Tioga-Elkhorn Creek	572	Shafer State 1-23-3b	Gulf Oil Corp.	Dry
52.5	Tioga-Elkhorn Creek	263	Hartel 1-26hb	Oasis Petroleum North America LLC	Active
52.5	Tioga-Elkhorn Creek	286	Hartel 1x-26h	Oasis Petroleum North America LLC	Active

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
52.5	Tioga-Elkhorn Creek	310	Hartel 1-26ha	Oasis Petroleum North America LLC	Active
52.9	Tioga-Elkhorn Creek	640	Koeser 3x-26hb	Oasis Petroleum North America LLC	Active
52.9	Tioga-Elkhorn Creek	663	Koeser 3-26h	Oasis Petroleum North America LLC	Active
52.9	Tioga-Elkhorn Creek	687	Koeser 3x-26ha	Oasis Petroleum North America LLC	Active
53.2	Tioga-Elkhorn Creek	1170	Koeser 4x-26h	Oasis Petroleum North America LLC	Active
55.0	Tioga-Elkhorn Creek	901	Johnson 16-34h	Oasis Petroleum North America LLC	Active
55.1	Tioga-Elkhorn Creek	1170	Broderson 13-35h	Oasis Petroleum North America LLC	Active
56.1	Tioga-Elkhorn Creek	562	Johnsrud 1-3	Pogo Producing Co.	Plugged and Abandoned
56.3	Tioga-Elkhorn Creek	1164	Betty Berg 1-11	Pogo Producing Co.	Dry
57.1	Tioga-Elkhorn Creek	967	Malm 149-98-11-2-1h	Newfield Production Company	Active
57.2	Tioga-Elkhorn Creek	972	Malm 149-98-14-23-1h	Newfield Production Company	Active
57.3	Tioga-Elkhorn Creek	375	Malm 149-98-14-23-4h	Newfield Production Company	Active
57.3	Tioga-Elkhorn Creek	330	Malm 149-98-14-23-5h	Newfield Production Company	Active
57.3	Tioga-Elkhorn Creek	305	Malm 149-98-11-2-6h	Newfield Production Company	Active
57.3	Tioga-Elkhorn Creek	280	Malm 149-98-11-2-7hlw	Newfield Production Company	Active
59.9	Tioga-Elkhorn Creek	909	Smokey 16-21 Swd	Mckenzie Energy Partners, LLC	Active
60.0	Tioga-Elkhorn Creek	948	Knut Berg Trust 41-28hu	Whiting Oil And Gas Corporation	Active
60.0	Tioga-Elkhorn Creek	993	Knut Berg Trust 41-28h	Whiting Oil And Gas Corporation	Active
60.0	Tioga-Elkhorn Creek	1039	Knut Berg Trust 41-28-2h	Whiting Oil And Gas Corporation	Active
Line Section 25 Loop					
0.1	Line Section 25 Loop	1019	Tioga-Madison Unit F-114	Amerada Hess Corporation	Plugged and Abandoned
0.5	Line Section 25 Loop	288	Tioga-Madison Unit G-115	Amerada Hess Corporation	Plugged and Abandoned
0.8	Line Section 25 Loop	1368	Tioga-Madison Unit E-115	Hess Bakken Investments II, LLC	Plugged and Abandoned
0.9	Line Section 25 Loop	432	Tioga-Madison Unit F-116	Amerada Hess Corporation	Plugged and Abandoned
0.9	Line Section 25 Loop	804	Rehak 1 Swd	Landtech Enterprises, LLC	Active

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
1.2	Line Section 25 Loop	585	Tioga-Madison Unit E-117	Amerada Hess Corporation	Plugged and Abandoned
1.4	Line Section 25 Loop	744	Pederson 14-33	Hess Bakken Investments II, LLC	Plugged and Abandoned
1.5	Line Section 25 Loop	363	Pederson Fresh Water Facility 1	Hess Bakken Investments II, LLC	Plugged and Abandoned
1.6	Line Section 25 Loop	1278	Tioga-Madison Unit E-119	Amerada Hess Corporation	Plugged and Abandoned
1.7	Line Section 25 Loop	910	TI-Syverson-157-95 1318H-1	Hess Bakken Investments II, LLC	Inactive (Shut-In >= 3 months and <= 12 Months)
1.8	Line Section 25 Loop	1270	Tioga-Madison Unit G-119	Hess Bakken Investments II, LLC	Plugged and Abandoned
1.9	Line Section 25 Loop	360	Tioga-Madison Unit F-120	Amerada Hess Corporation	Plugged and Abandoned
2.3	Line Section 25 Loop	505	Tioga-Madison Unit G-121	Amerada Hess Corporation	Plugged and Abandoned
2.4	Line Section 25 Loop	1131	Tioga-Madison Unit F-122	Amerada Hess Corporation	Plugged and Abandoned
2.6	Line Section 25 Loop	1331	Tioga-Madison Unit H-122	Amerada Hess Corporation	Plugged and Abandoned
2.6	Line Section 25 Loop	410	H. Bakken 12-07h	Hess Bakken Investments II, LLC	Active
2.7	Line Section 25 Loop	285	Tioga-Madison Unit G-123	Amerada Hess Corporation	Plugged and Abandoned
3.0	Line Section 25 Loop	1672	Tioga-Madison Unit F-124	Hess Corporation	Plugged and Abandoned
3.0	Line Section 25 Loop	814	Tioga-Madison Unit H-124	Amerada Hess Corporation	Plugged and Abandoned
3.3	Line Section 25 Loop	696	Tioga-Madison Unit G-125	Hess Bakken Investments II, LLC	Plugged and Abandoned
3.5	Line Section 25 Loop	1305	Ti-Ives-157-95 0106h-1	Hess Bakken Investments II, LLC	Active
3.5	Line Section 25 Loop	347	Tioga-Madison Unit H-126	Amerada Hess Corporation	Plugged and Abandoned
3.8	Line Section 25 Loop	1078	Tioga-Madison Unit G-127	Hess Bakken Investments II, LLC	Plugged and Abandoned
4.0	Line Section 25 Loop	160	Tioga-Madison Unit H-128	Amerada Hess Corporation	Plugged and Abandoned
4.3	Line Section 25 Loop	889	Tioga-Madison Unit I-129	Hess Corporation	Plugged and Abandoned
4.5	Line Section 25 Loop	696	Tioga-Madison Unit H-130i	Hess Bakken Investments II, LLC	Plugged and Abandoned
4.8	Line Section 25 Loop	263	Tioga-Madison Unit I-131 HR	Hess Bakken Investments II, LLC	Active
5.0	Line Section 25 Loop	1310	Tioga-Madison Unit H-132	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
5.1	Line Section 25 Loop	1210	Tioga-Madison Unit J-132	Hess Bakken Investments II, LLC	Plugged and Abandoned

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
5.3	Line Section 25 Loop	547	Tioga-Madison Unit I-133	Amerada Hess Corporation	Plugged and Abandoned
5.5	Line Section 25 Loop	751	TI-Stenbak-158-95-2526H-7	Hess Bakken Investments II, LLC	Drilling
5.5	Line Section 25 Loop	732	TI-Stenbak-158-95-2526H-6	Hess Bakken Investments II, LLC	Drilling
5.5	Line Section 25 Loop	712	TI-Stenbak-158-95-2526H-5	Hess Bakken Investments II, LLC	Drilling
5.5	Line Section 25 Loop	656	TI-Stenbak-158-95-2526H-2	Hess Bakken Investments II, LLC	Drilling
5.5	Line Section 25 Loop	674	TI-Stenbak-158-95-2526H-3	Hess Bakken Investments II, LLC	Drilling
5.5	Line Section 25 Loop	692	TI-Stenbak-158-95-2526H-4	Hess Bakken Investments II, LLC	Drilling
5.6	Line Section 25 Loop	197	Tioga-Madison Unit J-134	Amerada Hess Corporation	Plugged and Abandoned
5.7	Line Section 25 Loop	466	TI-Blestrud-158-94-3029H-3	Hess Bakken Investments II, LLC	Permit Now Cancelled
5.7	Line Section 25 Loop	464	TI-Hilleren-158-95-2526H-3	Hess Bakken Investments II, LLC	Permit Now Cancelled
5.8	Line Section 25 Loop	462	TI-Blestrud-158-94-3029H-2	Hess Bakken Investments II, LLC	Permit Now Cancelled
5.8	Line Section 25 Loop	460	TI-Hilleren-158-95-2526H-2	Hess Bakken Investments II, LLC	Permit Now Cancelled
5.8	Line Section 25 Loop	458	TI-Blestrud-158-94-3029H-1	Hess Bakken Investments II, LLC	Permit Now Cancelled
5.8	Line Section 25 Loop	416	TI-Stenbak-158-95-2526H-1	Hess Bakken Investments II, LLC	Active
5.9	Line Section 25 Loop	1177	Tioga-Madison Unit I-135	Amerada Hess Corporation	Plugged and Abandoned
6.1	Line Section 25 Loop	52	Tioga-Madison Unit J-136	Hess Bakken Investments II, LLC	Plugged and Abandoned
6.3	Line Section 25 Loop	1681	TMU I-137AH	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
6.3	Line Section 25 Loop	1498	Tioga-Madison Unit I-137	Amerada Hess Corporation	Plugged and Abandoned
6.5	Line Section 25 Loop	998	Tioga-Madison Unit K-137	Amerada Hess Corporation	Plugged and Abandoned
6.6	Line Section 25 Loop	579	Tioga-Madison Unit J-138	Amerada Hess Corporation	Plugged and Abandoned
6.9	Line Section 25 Loop	245	Tioga-Madison Unit K-139	Amerada Hess Corporation	Plugged and Abandoned
7.1	Line Section 25 Loop	1285	Tioga-Madison Unit J-140	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
7.2	Line Section 25 Loop	1200	Tioga-Madison Unit L-140	Amerada Hess Corporation	Plugged and Abandoned
7.4	Line Section 25 Loop	248	Tioga-Madison Unit K-141	Hess Bakken Investments II, LLC	Abandoned (Shut-In > 12 months)
7.6	Line Section 25 Loop	1725	Tioga-Madison Unit J-142	Amerada Hess Corporation	Plugged and Abandoned

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
7.7	Line Section 25 Loop	769	Tioga-Madison Unit L-142	Amerada Hess Corporation	Plugged and Abandoned
7.9	Line Section 25 Loop	690	Tioga-Madison Unit K-143hr	Hess Bakken Investments II, LLC	Plugged and Abandoned
8.2	Line Section 25 Loop	308	Tioga-Madison Unit L-144	Hess Bakken Investments II, LLC	Plugged and Abandoned
8.4	Line Section 25 Loop	1153	Tioga-Madison Unit K-145	Amerada Hess Corporation	Plugged and Abandoned
8.5	Line Section 25 Loop	1403	Tioga-Madison Unit M-145	Amerada Hess Corporation	Plugged and Abandoned
8.7	Line Section 25 Loop	13	Tioga-Madison Unit L-146	Amerada Hess Corporation	Plugged and Abandoned
8.8	Line Section 25 Loop	431	Tioga-Madison Unit L-146xhr	Hess Bakken Investments II, LLC	Active
9.0	Line Section 25 Loop	861	Tioga-Madison Unit M-147	Amerada Hess Corporation	Plugged and Abandoned
9.2	Line Section 25 Loop	706	Tioga-Madison Unit L-148	Amerada Hess Corporation	Plugged and Abandoned
9.5	Line Section 25 Loop	254	Tioga-Madison Unit M-149	Amerada Hess Corporation	Plugged and Abandoned
9.7	Line Section 25 Loop	1315	Tioga-Madison Unit L-150hr	Hess Bakken Investments II, LLC	Plugged and Abandoned
9.8	Line Section 25 Loop	1231	Tioga-Madison Unit N-150	Amerada Hess Corporation	Plugged and Abandoned
10.0	Line Section 25 Loop	370	Tioga-Madison Unit M-151	Hess Bakken Investments II, LLC	Plugged and Abandoned
10.2	Line Section 25 Loop	1942	Tioga-Madison Unit L-152	Amerada Hess Corporation	Plugged and Abandoned
10.3	Line Section 25 Loop	611	Tioga-Madison Unit N-152	Hess Bakken Investments II, LLC	Plugged and Abandoned
10.5	Line Section 25 Loop	433	Tioga-Madison Unit N-153	Amerada Hess Corporation	Plugged and Abandoned
11.0	Line Section 25 Loop	1724	Tioga-Madison Unit O-155	Amerada Hess Corporation	Plugged and Abandoned
11.3	Line Section 25 Loop	795	L. Hoiby 159-94-30d-19-4h	Petro-Hunt, L.L.C.	Active
11.3	Line Section 25 Loop	722	L. Hoiby 159-94-30d-19-5h	Petro-Hunt, L.L.C.	Active
11.4	Line Section 25 Loop	597	Clair Marie 1-30	Badger Oil Co.	DRY
11.6	Line Section 25 Loop	988	Tande 159-94-29c-20-3h	Petro-Hunt, L.L.C.	Active
12.0	Line Section 25 Loop	1356	Pollard A 1	Phillips Petroleum Company	Dry
12.2	Line Section 25 Loop	112	North Tioga-Madison Unit K-3	Prosper Energy Corp.	Plugged and Abandoned
12.5	Line Section 25 Loop	768	Ole Tande 3	Murex Petroleum Corporation	Plugged and Abandoned
12.7	Line Section 25 Loop	823	North Tioga-Madison Unit K-5	Prosper Energy Corp.	Plugged and Abandoned

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
13.0	Line Section 25 Loop	137	North Tioga-Madison Unit L-6	Prosper Energy Corp.	Plugged and Abandoned
13.2	Line Section 25 Loop	1193	North Tioga-Madison Unit K-7	Prosper Energy Corp.	Plugged and Abandoned
13.4	Line Section 25 Loop	3234	North Tioga-Madison Unit O-7	Prosper Energy Corp.	Dry
13.4	Line Section 25 Loop	558	North Tioga-Madison Unit M-7	Prosper Energy Corp.	Plugged and Abandoned
13.6	Line Section 25 Loop	919	Arlo Moberg 2	Phoenix Petroleum LLC	Active
13.7	Line Section 25 Loop	2203	Moberg 159-94-20a-28-1hs	Petro-Hunt, L.L.C.	Permit Now Cancelled
13.7	Line Section 25 Loop	2278	Moberg 159-94-20a-19-1hs	Petro-Hunt, L.L.C.	Permit Now Cancelled
13.8	Line Section 25 Loop	1076	Producer`s Corporation 159-94-17c-8-2h	Petro-Hunt, L.L.C.	Active
13.8	Line Section 25 Loop	566	State Moberg 1-17 1	Phoenix Petroleum LLC	Active
14.3	Line Section 25 Loop	544	North Tioga-Madison Unit M-11	Prosper Energy Corp.	Plugged and Abandoned
Line Section 30 Loop					
0.1	Line Section 30 Loop	213	Justin Swd 1	Bosque Disposal Systems, LLC	Inactive (Shut-In >= 3 months and <= 12 Months)
0.7	Line Section 30 Loop	833	Tioga-Madison Unit I-111	Amerada Hess Corporation	Plugged and Abandoned
1.2	Line Section 30 Loop	829	Tioga-Madison Unit I-109	Amerada Hess Corporation	Plugged and Abandoned
2.3	Line Section 30 Loop	754	Moe 2-1	Donald C. Slawson	Plugged and Abandoned
5.2	Line Section 30 Loop	365	Davidson 14x-34 [a]	XTO Energy Inc.	Active
8.8	Line Section 30 Loop	1027	Plant Disposal 2	Hess Tioga Gas Plant LLC	Active
9.4	Line Section 30 Loop	20	Tioga-Madison Unit G-113	Amerada Hess Corporation	Plugged and Abandoned
Tioga Compressor Lateral					
0.0	Tioga Compressor Lateral	126	Tioga-Madison Unit E-113	Amerada Hess Corporation	Plugged and Abandoned
Staging Areas					
N/A	Weflen Staging Yard	6144	Tioga-Madison Unit B-122	Amerada Hess Corporation	Plugged and Abandoned
N/A	Weflen Staging Yard	5310	Tioga-Madison Unit C-123	Amerada Hess Corporation	Plugged and Abandoned

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
N/A	Weflen Staging Yard	6951	Tioga-Madison Unit B-124	Hess Corporation	Plugged and Abandoned
N/A	Weflen Staging Yard	4447	Tioga-Madison Unit D-124	Amerada Hess Corporation	Plugged and Abandoned
N/A	Weflen Staging Yard	5963	H. Bakken 11-11h	Hess Corporation	Permit Now Cancelled
N/A	Schmidt Yard	9003	State 1	Calvert Drilling & Producing Co.	Dry
N/A	Flatlands Yard 1	7598	Flatland 43-9-1h	Whiting Oil And Gas Corporation	Active
N/A	Flatlands Yard 1	7636	Flatland 43-9-1xh	Whiting Oil And Gas Corporation	Active
N/A	Flatlands Yard 1	7476	TG-Flatland SWD	Tobacco Garden SWD LLC	Active
N/A	Flatlands Yard 1	7520	Flatland 43-9hu	Whiting Oil And Gas Corporation	Active
N/A	Flatlands Yard 1	7559	Flatland 43-9-2h	Whiting Oil And Gas Corporation	Active
N/A	Flatlands Yard 1	7679	Flatland 9-9h	Whiting Oil And Gas Corporation	Plugged and Abandoned
N/A	Flatlands Yard 2	2658	Outlaw Wagon 14-23mbh-Ulw-A	Burlington Resources Oil & Gas Company LP	Active
N/A	Flatlands Yard 2	2687	Outlaw Gap 14-23tfh-A	Burlington Resources Oil & Gas Company LP	Active
N/A	Flatlands Yard 2	2716	Outlaw Gap 14-23mbh-A	Burlington Resources Oil & Gas Company LP	Active
N/A	Flatlands Yard 2	2745	Outlaw Gap 24-23tfh-A	Burlington Resources Oil & Gas Company LP	Active
N/A	Flatlands Yard 2	2775	Outlaw Gap 24-23mbh-A	Burlington Resources Oil & Gas Company LP	Active
N/A	Lobell Yard	8785	Kristin Denise 16-21h	Murex Petroleum Corporation	Active
N/A	68th Street Yard	7723	Olson 32-28	Williams Exploration Co.	Dry
N/A	68th Street Yard	9312	Hove 12-28	Ranch Oil Company	Plugged and Abandoned
N/A	68th Street Yard	10466	Hove 24-21	Tiger Oil Company	Permit Now Cancelled
N/A	Boehm Staging Yard	2057	Flatland 24x-11	XTO Energy Inc.	Permit Now Cancelled
N/A	Delta Contractors Yard	19618	Watford Swd 1	Secure Energy Services USA, LLC	Active

APPENDIX 6A (cont'd)

North Bakken Expansion Project
Summary of Oil and Gas Wells Within 0.25 Mile of the Proposed Project

Facility/Milepost	Nearest Project Workspace	Distance From Workspace (feet)	Well Name	Well Operator/ Owner	Well Status
Aboveground Facilities					
N/A	Elkhorn Creek Compressor Station	1476	Wilson 31-6h	Burlington Resources Oil & Gas Company LP	Active
N/A	Elkhorn Creek Compressor Station	1024	Pembroke Swd #1	E-Source Energy SWD, LLC	Active
N/A	Lignite Tract	46399	Anderson 1	Phoenix Petroleum LLC	Active
N/A	Lignite Tract	47139	Lignite-Madison Unit 30	MCOR Oil & Gas Corp.	Plugged and Abandoned
N/A	Lignite Tract	47883	Lignite Gas Plant Swd Well 1	Citco	Plugged and Abandoned

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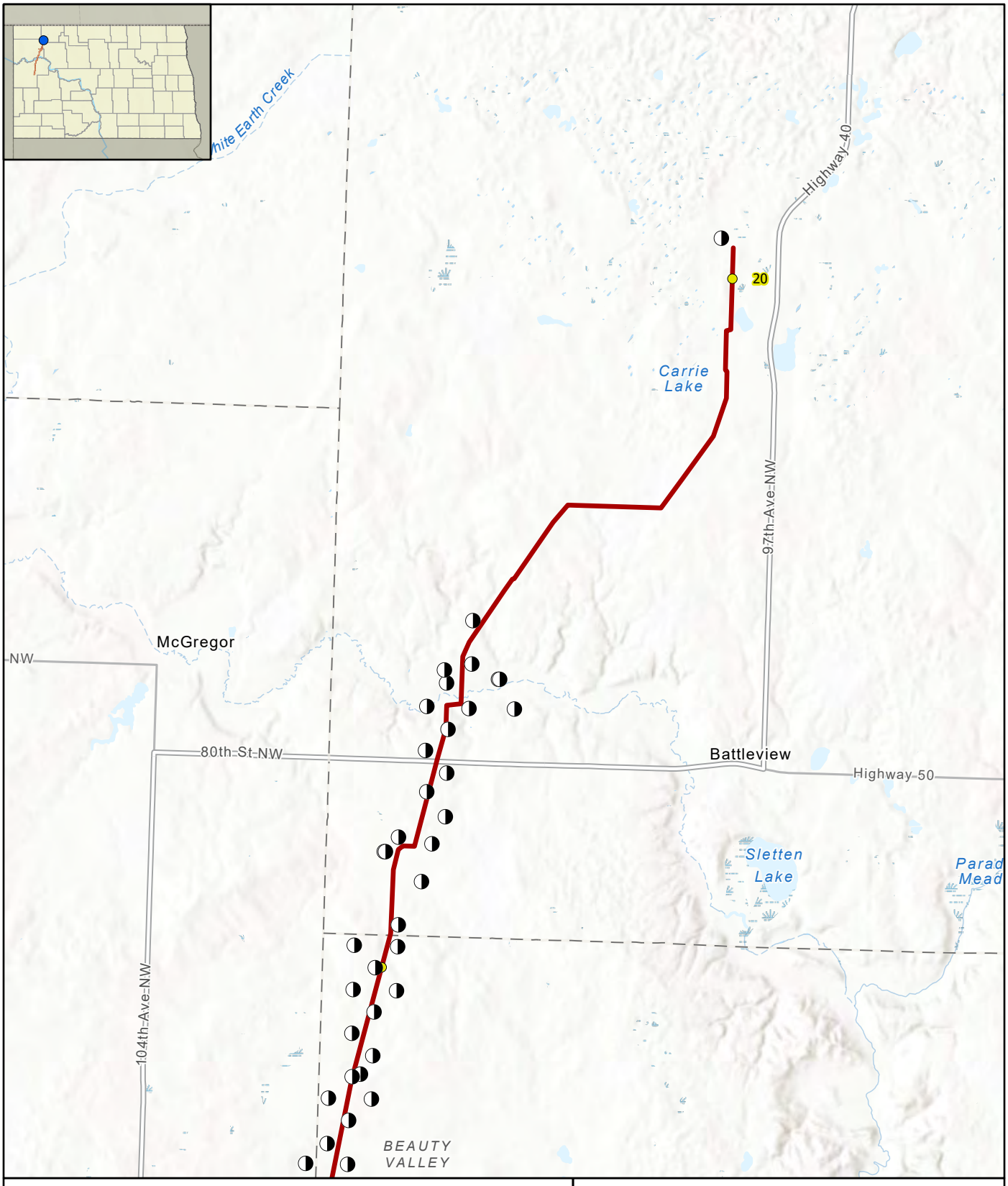
Source: North Dakota Department of Mineral Resources. 2019. Oil and Gas Division – Oil and Gas GIS Shapefiles. Available online at https://www.dmr.nd.gov/OaGIMS/viewer.htm. Downloaded September 2019.

[a] These wells are also located within 500 feet of a proposed guided bore roadway crossing. The distance from the guided bores to the oil and gas wells ranges from 240 to 500 feet and, in all cases, is greater than the distance to the nearest Project workspace shown in this table.

Notes: NA = Not available.



Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

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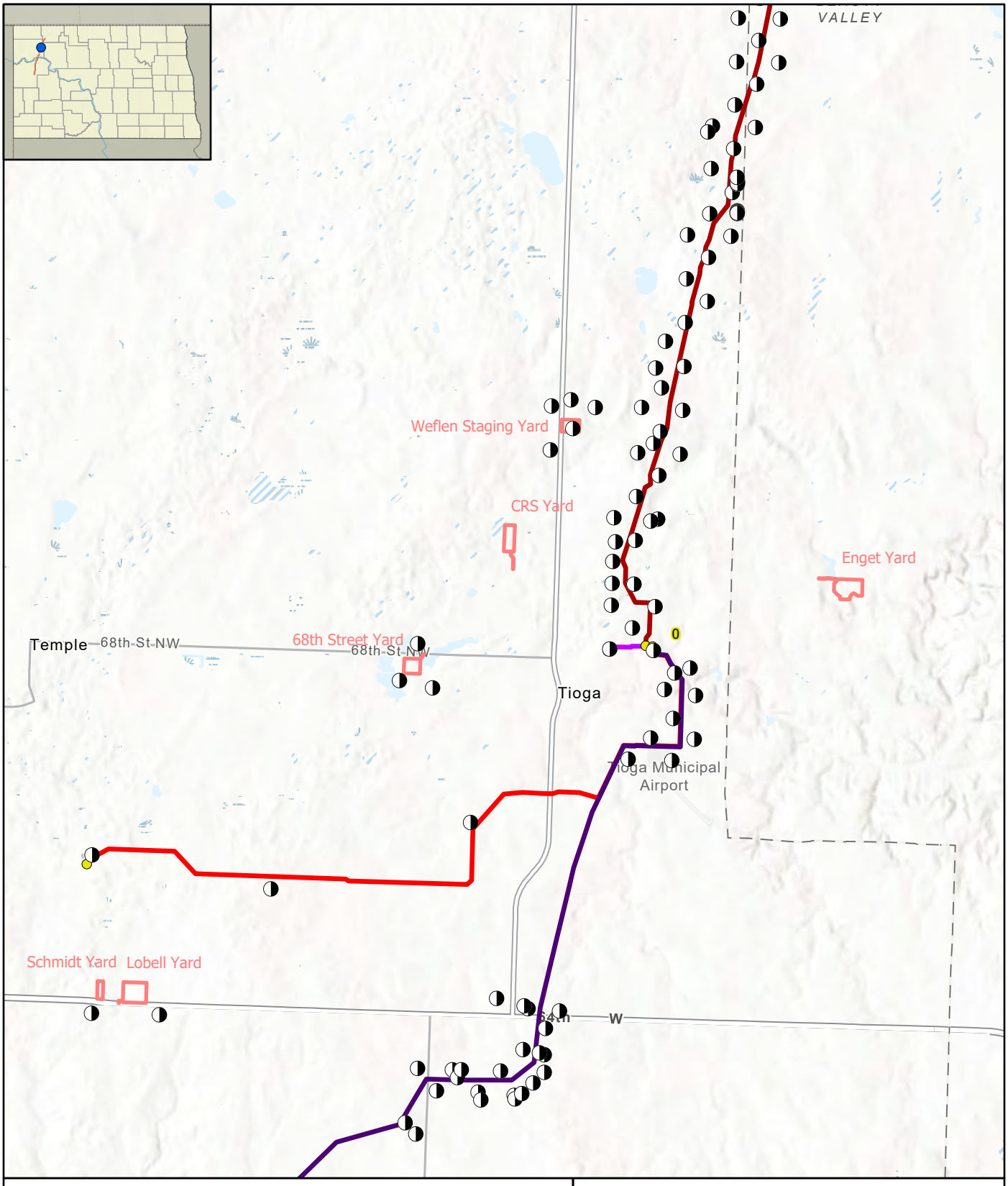

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project
Page 2 of 9

WBI ENERGY TRANSMISSION

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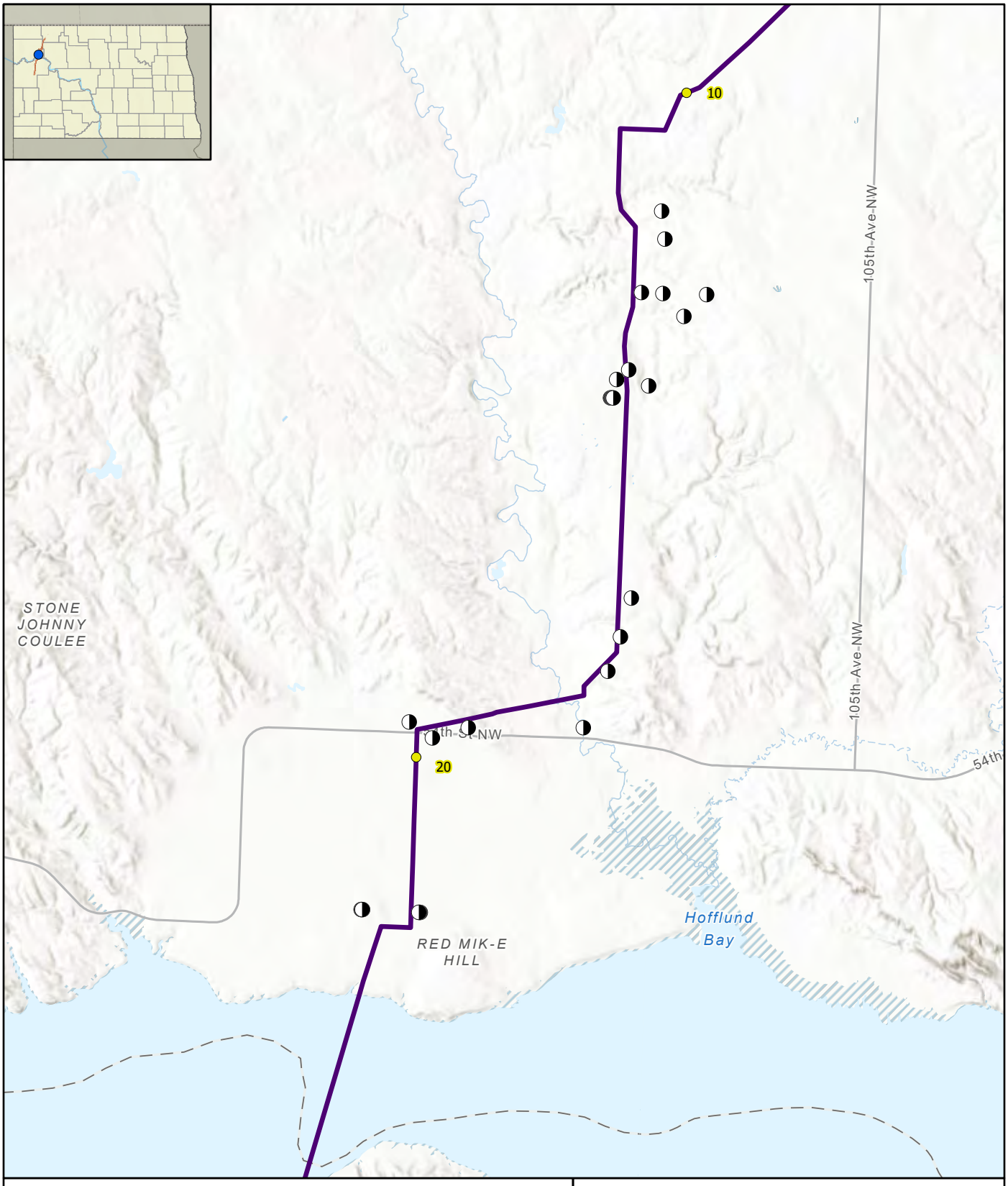

Well (Oil/Gas)
Milepost
Proposed Tioga-Elkhorn Creek

1 0.5 0 1
Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

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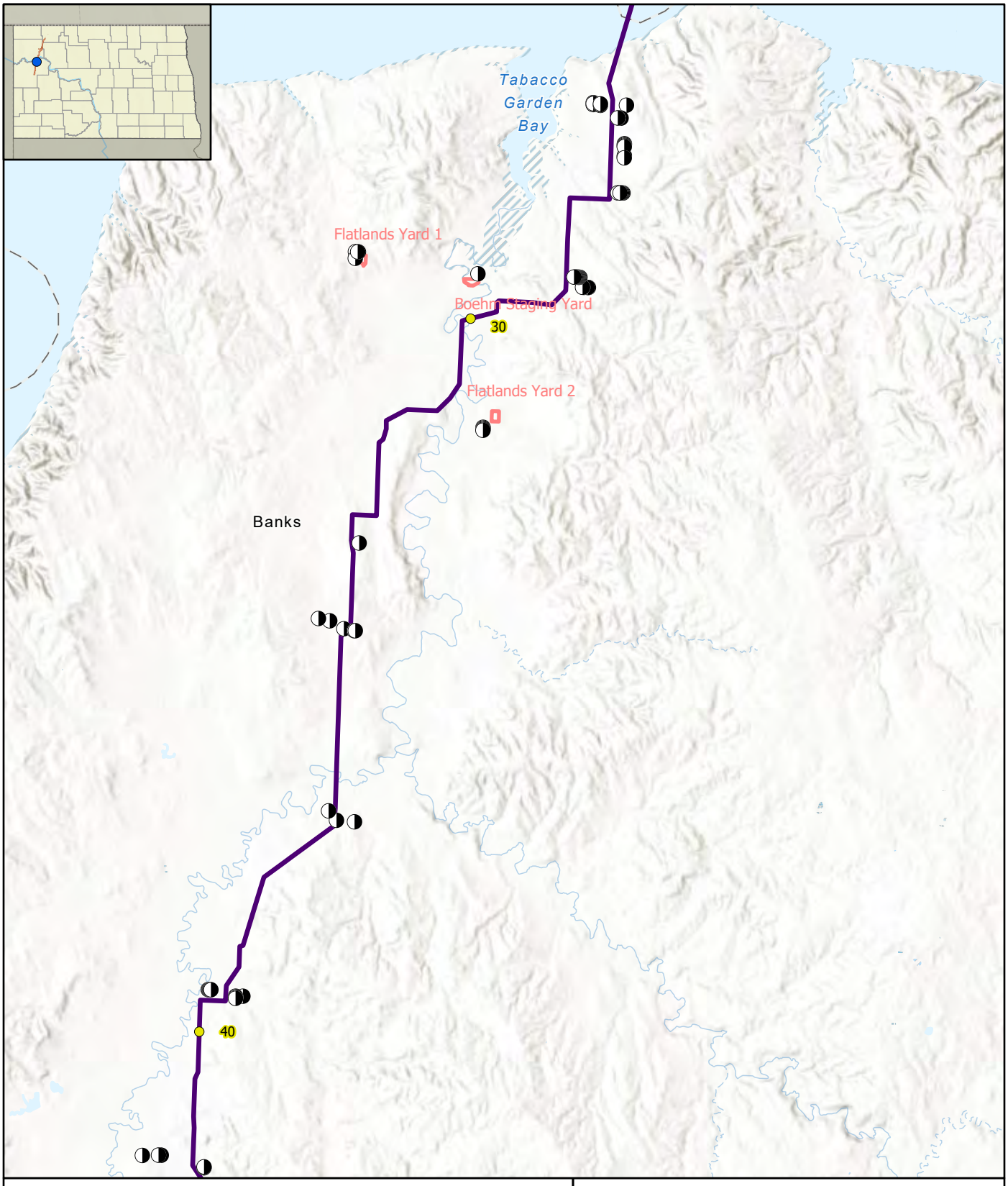

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

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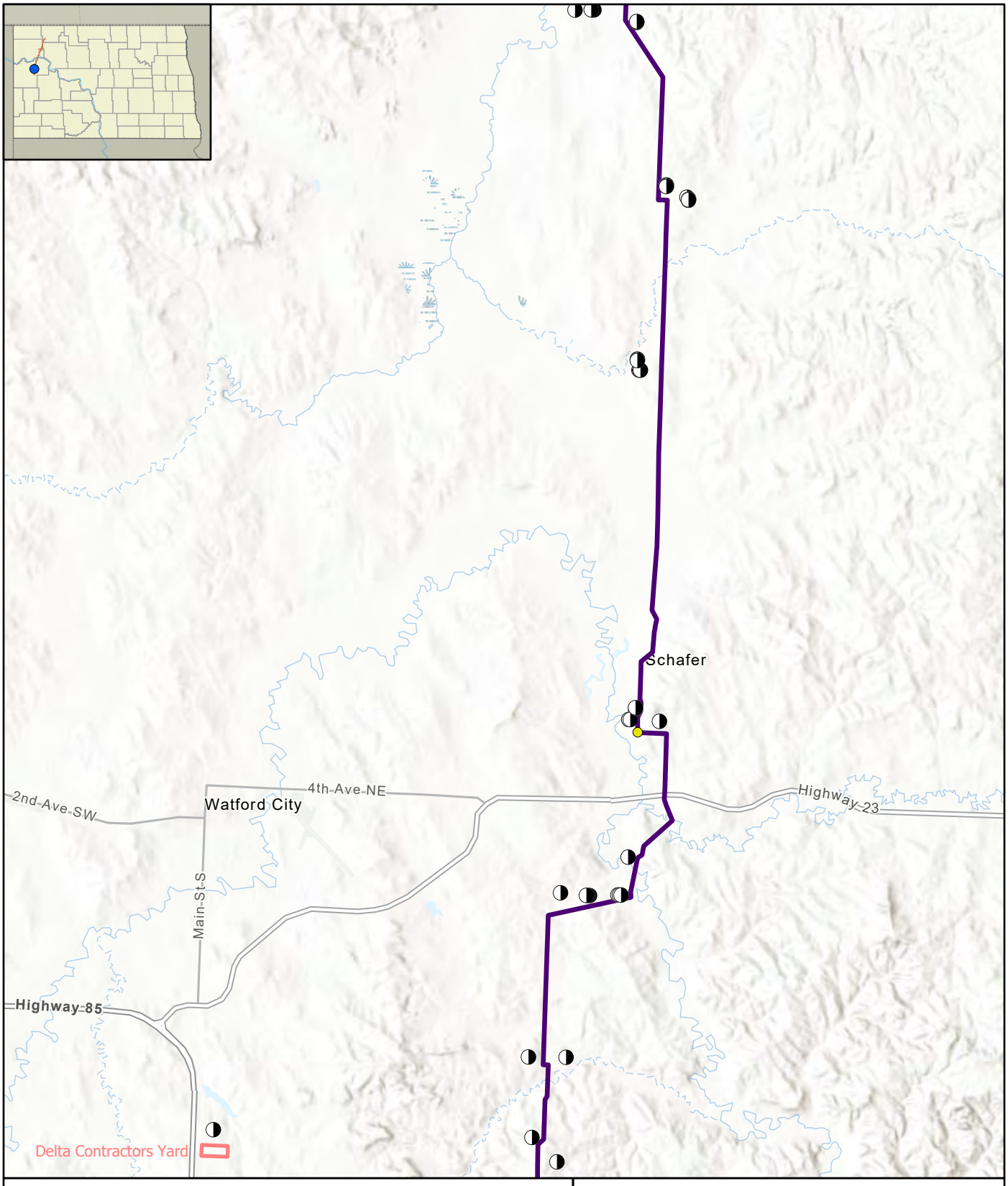

Well (Oil/Gas)
Milepost
Staging Area
Proposed Tioga-Elkhorn Creek

1 0.5 0 1
Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

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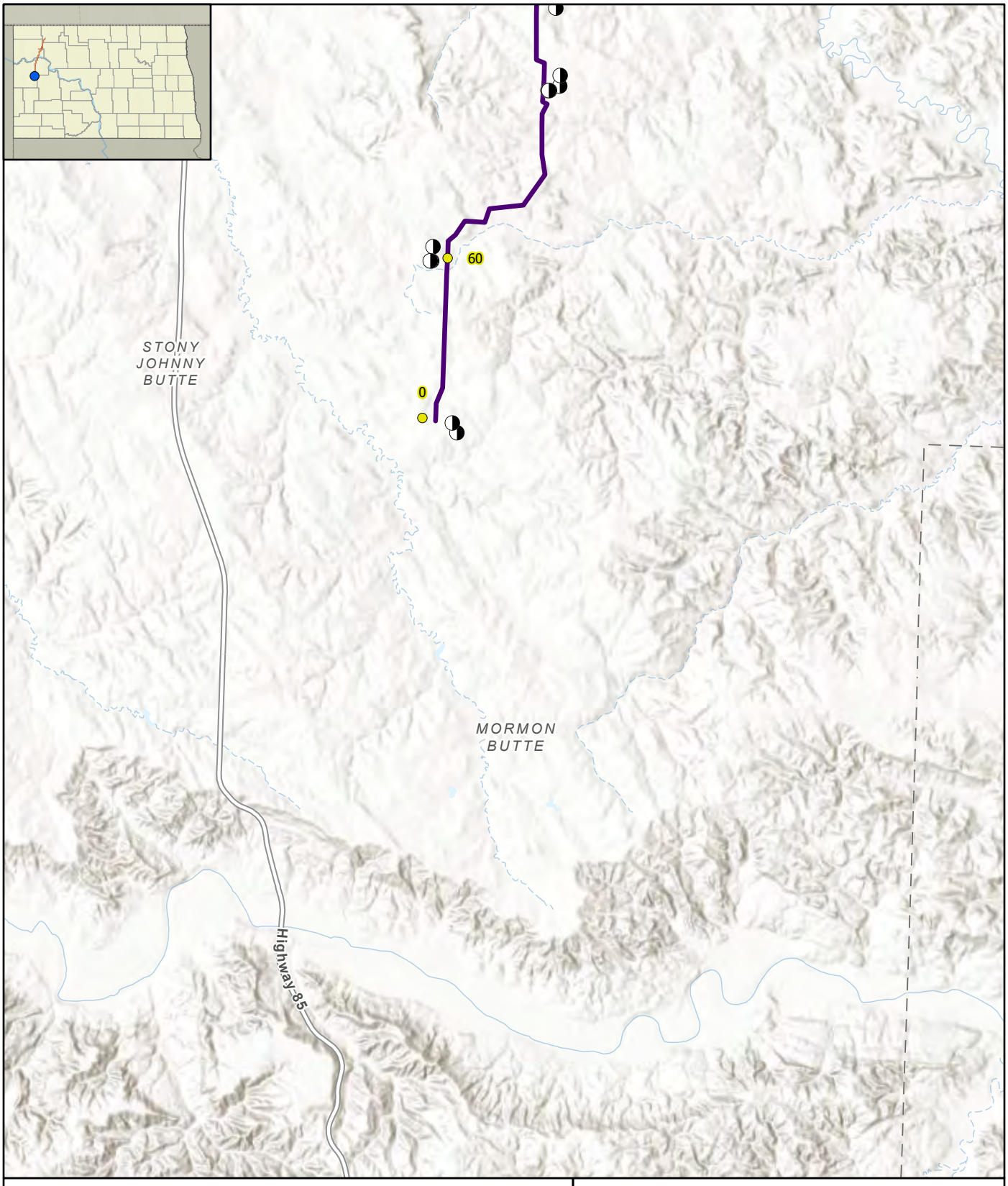


Well (Oil/Gas)
Milepost
Proposed Tioga-Elkhorn Creek

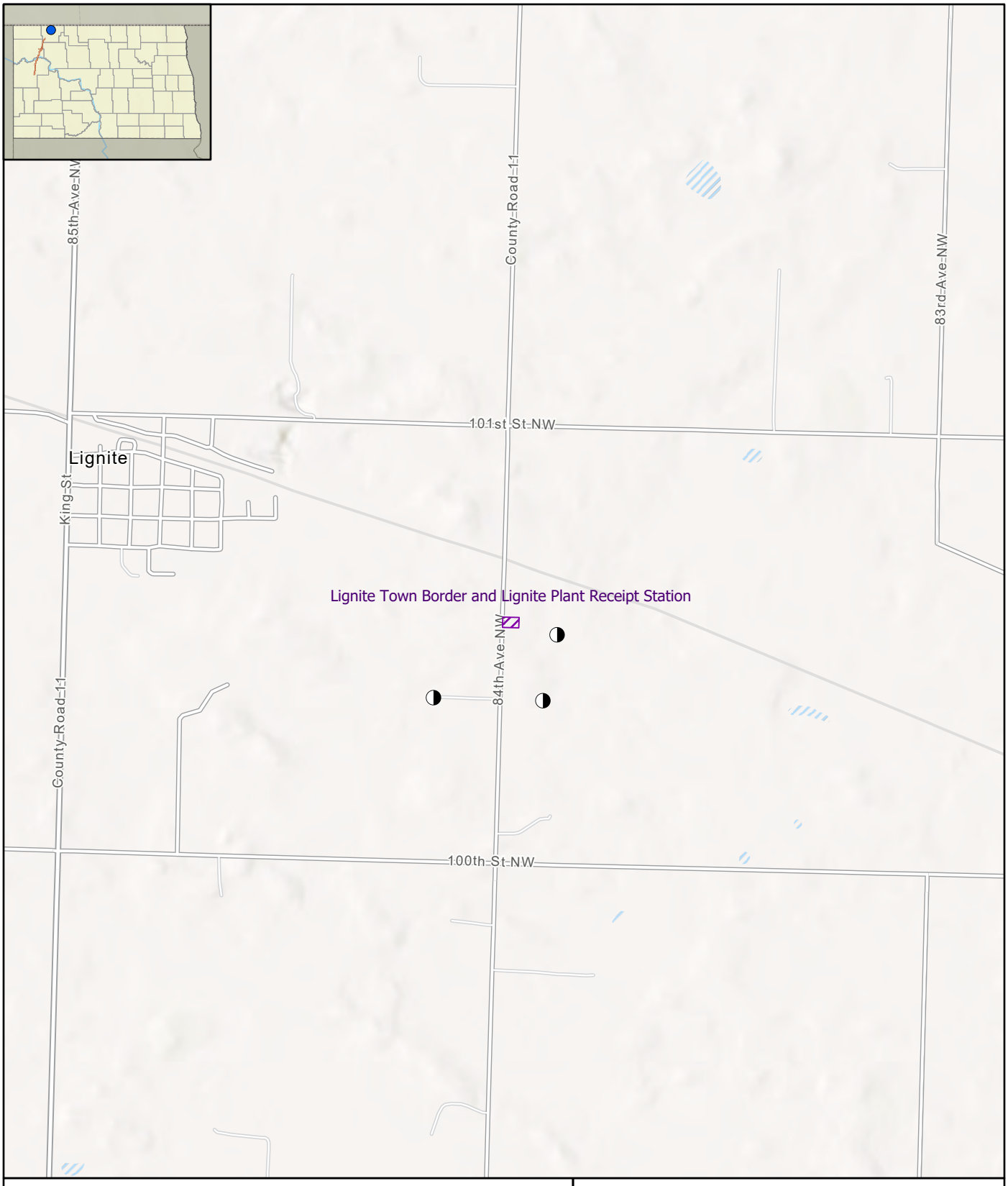
N

1 0.5 0 1
Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\FERC_ResourceReportMaps_FERC_RR_FERC_RR.aprx | Revised: 1/6/2020 | Scale: 1:100,000 Drawn By: RJC



Well (Oil/Gas)

Above Ground Facility

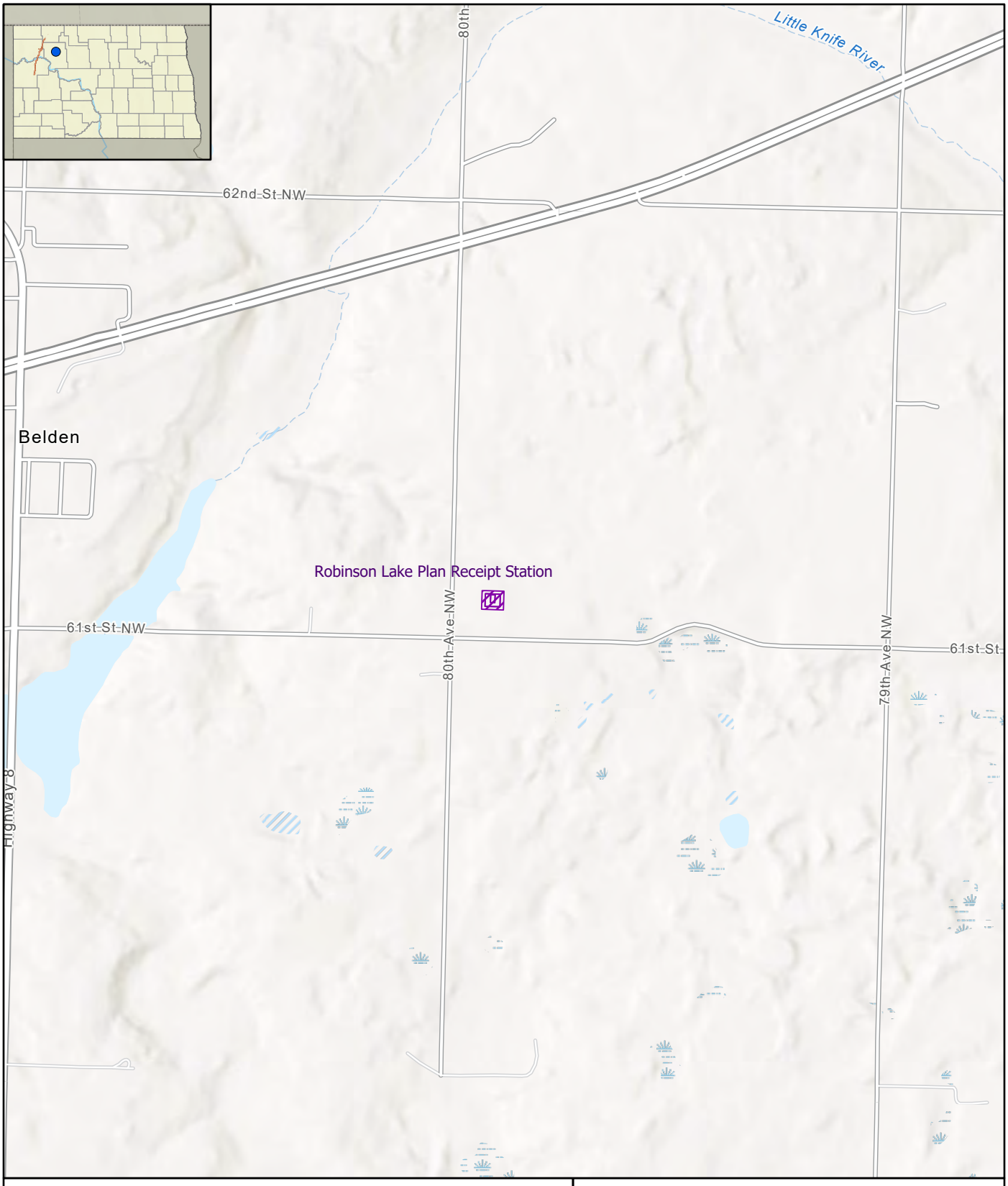
0.2 0.1 0 0.2

Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\FERC_ResourceReportMaps_FERC_RR_FERC_RR.aprx | Revised: 1/6/2020 | Scale: 1:20,000 Drawn By: RJC



Above Ground Facility

0.2 0.1 0 0.2

Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

File: M:\Clients\V-X\WBI\North_Bakken_Expansion_ArcGIS\FERC_ResourceReportMaps_FERC_RR_FERC_RR.aprx | Revised: 1/6/2020 | Scale: 1:20,000 Drawn By: RJC

Above Ground Facility

N

0.2 0.1 0 0.2

Miles

Appendix 6A
North Bakken Expansion Project
Oil and Gas Wells Within 0.25 Mile of the Project

WBI ENERGY TRANSMISSION

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Paleontological Assessment for the North Bakken Expansion Project, North Dakota

DECEMBER 2019

PREPARED ON BEHALF OF

WBI Energy Transmission

PREPARED BY

SWCA Environmental Consultants

PALEONTOLOGICAL ASSESSMENT FOR THE NORTH BAKKEN EXPANSION PROJECT, NORTH DAKOTA

Prepared on behalf of

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Prepared by

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USDA Forest Service Authorization to Conduct Paleontological Resource Research or Collections No. R1-DPG-MGM-FY19-01
Department of the Army Antiquities Act Permit No. DACW45-3-20-8008

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SWCA Paleontological Resources Report No. ND19-53975-01

December 2019

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1 INTRODUCTION

WBI Energy Transmission, Inc. (WBI Energy) proposes to construct and operate the North Bakken Expansion Project (or Project). The Project consists of an approximately 61.7-mile-long, 24-inch-diameter natural gas pipeline from WBI Energy's existing Tioga Compressor Station near Tioga, North Dakota, to a new interconnect with Northern Border Pipeline Company's (Northern Border) mainline southeast of Watford City, North Dakota (Figure 1). A new compressor station (Elkhorn Creek Compressor Station) will be constructed near this interconnect. The Project also involves construction of approximately 20.2 miles of 12-inch-diameter natural gas pipeline between the existing Tioga Compressor Station and an existing receipt station along WBI Energy's existing Line Section 25, approximately 9.6 miles of 12-inch-diameter natural gas pipeline along WBI Energy's existing Line Section 30, and approximately 0.5 mile of 20-inch-diameter receipt lateral at the Tioga Compressor Station. Additionally, the Project includes the addition of horsepower at the existing Tioga Compressor Station, uprates to WBI Energy's existing Line Section 25, and the installation of new and modifications to existing receipt/delivery points and lateral pipeline facilities along the pipeline routes. The project crosses United States Forest Service Little Missouri National Grasslands (USFS LMNG); United States Army Corps of Engineers (USACE); State of North Dakota; and private lands.

Environmental Resources Management (ERM) is assisting WBI with various aspects of the Project, including agency consultations, environmental surveys, and acquisition of environmental permits necessary for the Project. ERM contracted with SWCA Environmental Consultants (SWCA) to conduct a paleontological resource assessment for the Project. This report presents the results of the assessment, which included an analysis of existing data and partial field survey.

Based on state scale geologic mapping (Clayton et al. 1980), the Project crosses the Paleocene-age Fort Union Formation (e.g., Sentinel Butte and Bullion Creek Members) and multiple Quaternary surficial and glacial deposits of the Oahe and Colharbor Formations. These units were ranked according to the USFS's Paleontological Resources Rapid Assessment System (PRRAS) (USFS 2013) and according to the BLM's Potential Fossil Yield Classification (PFYC) System (BLM 2016) to determine the areas requiring field survey. Using the PRRAS, the USFS determined that paleontological resources are present or are most likely to exist only in the Paleocene-age geologic unit (PRRAS code 2); accordingly, the BLM (2015) considers the unit to have high potential (PFYC 4) for containing scientifically significant paleontological resources.

In accordance with existing federal and state laws, regulations, and policies a detailed paleontological analysis of public lands was conducted. SWCA refined the survey area through discussions with the USFS, USACE, and North Dakota State Paleontologist; a review of detailed geologic maps (Carlson 1985; Clayton 1972; Freers 1970, 1973); and aerial imagery review, looking for exposures of paleontologically sensitive geologic units. As a result of the pre-survey desktop analysis and coordination with the North Dakota State Paleontologist (Boyd 2019) paleontological surveys were not required or recommended for North Dakota State lands. SWCA limited the paleontological field survey (or reconnaissance) to portions of the proposed pipeline corridor where the route passes through the LMNG and USACE land, adjacent to and south of Lake Sakakawea in Sections 12, 13, and 14, Township (T) 153 North (N), Range (R) 97 West (W); Section 36, T154N, R97W; and Section 18, T154, R96W, McKenzie and Williams Counties, North Dakota (Figure 2).

The objectives of the assessment are to provide paleontological surface clearance through a pedestrian examination of select survey areas and to provide information which was used to formulate recommendations for Project construction. SWCA paleontologist Andrew N. Gerwitz conducted this survey on October 23, 2019, under U.S. Department of Agriculture Forest Service Authorization to Conduct Paleontological Resources Research or Collection No. R1-DPG-MGM-FY19-01 and Department of the Army Antiquities Act Permit No. DACW45-3-20-8008. Copies of these authorizations (or permits) are provided in Appendixes A and B, respectively.

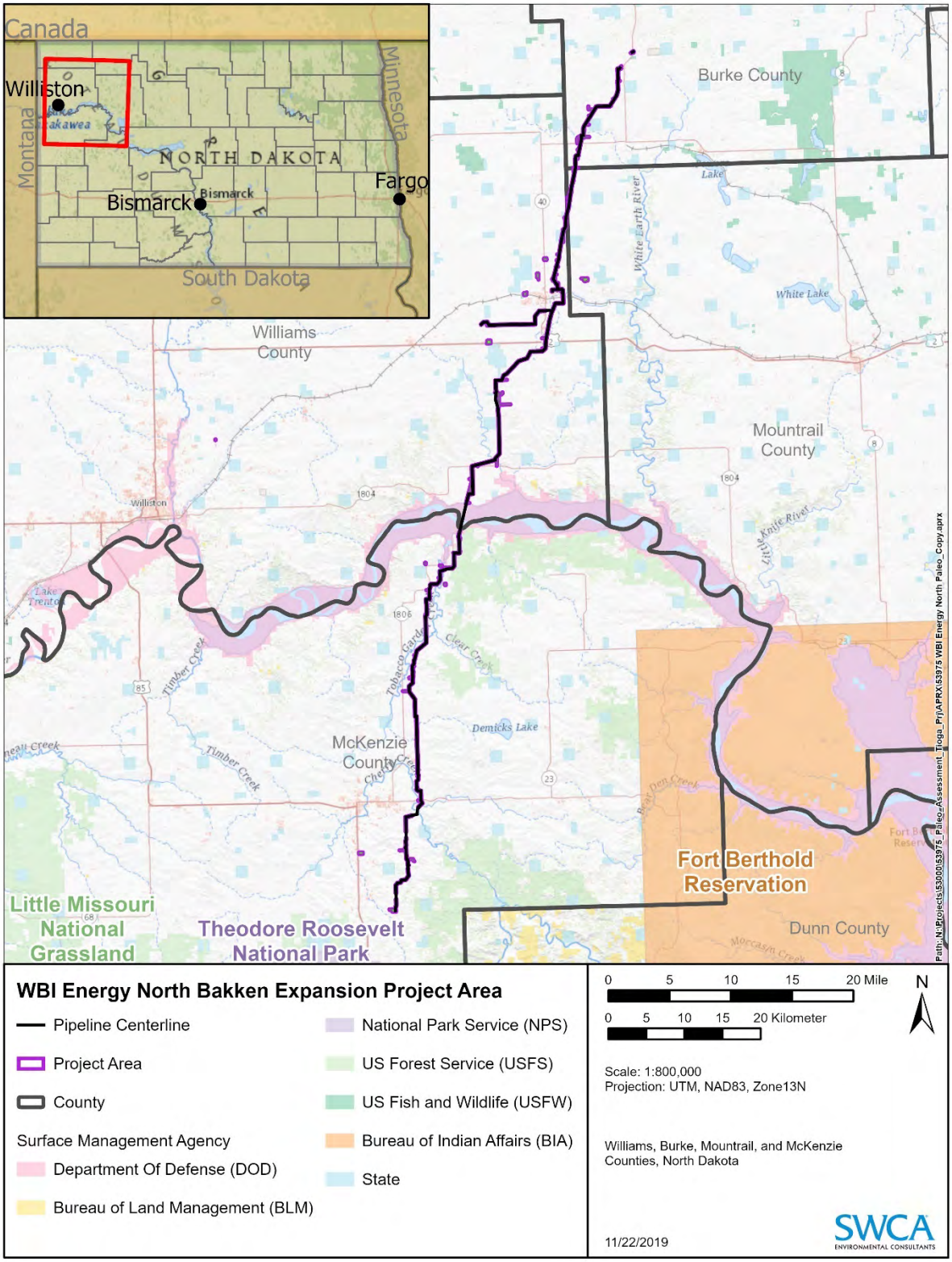

Figure 1. Overview map of the North Bakken Expansion Project.

2 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

Fossils are defined as any fossilized remains, traces, or imprints of organisms preserved in or on the earth's crust. They are considered non-renewable resources because the organisms they represent no longer exist, and such resources, if destroyed, cannot be replaced. As defined in 36 Code of Federal Regulations (CFR) 291, paleontological resources are any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest, and that provide information about the history of life on earth. The term does not include any materials associated with an archaeological resource (as defined in Section 3[1] of the Archaeological Resources Protection Act of 1979 [16 United States Code 470bb(1)]; or any cultural item (as defined in Section 2 of the Native American Graves Protection and Repatriation Act [25 United States Code 3001]).

Fossils are important scientific and educational resources that paleontologists use to study taphonomic processes. Paleontologists also use the morphologic information that fossils provide to reconstruct phylogenetic relationships of extinct and extant organisms; to study evolution, extinction, and speciation patterns; to reconstruct ancient environments and paleobiogeographic relationships; and to provide relative geologic dates through biochronology and biostratigraphy. As objects of national significance, paleontological resources must be preserved for the inspiration and benefit of the people of the United States. The value of fossils may be greatly diminished or lost entirely in the absence of proper management. The USACE, USFS, and State of North Dakota recognize their responsibility to manage and protect that part of the fossil record which occurs on public land as a national legacy for future generations.

While more than one significance criteria maybe used to determine fossil importance, the USFS defined significant paleontological resources as those possessing scientific importance due to distinguishing characteristics of identity, context, or preservation. Significant paleontological resources include invertebrate, plant, and vertebrate fossils which further paleontological knowledge about the history of life on earth. Scientific importance may be attributed to the actual fossil specimen, to fossil context (location in time and space, intimate association with other evidence of scientific significance), or to fossil preservation. Paleontological resources are deemed significant by meeting any one of the criteria discussed below (modified from USFS 2005).

Specimen-Based Criteria

- Represents an unknown or undescribed/unnamed taxon.
- Represents a rare taxon, or rare morphological/anatomical element or feature (rareness criterion comprises either absolute rareness in the fossil record, or contextual rareness as described below).
- Exhibits a remarkable type or quality of preservation (unaltered hard parts, evidence or preservation of soft tissue, preservation in amber or ice).

Context-Based Criteria

- Intimate association with other evidence of scientific significance, providing new ecological, environmental, or behavioral information.
- Evidence that extends or constrains the geographic or temporal distribution of a species or higher-level taxonomic group, providing new information about evolution.

3 GUIDANCE AND METHODS

This section describes the guidance and methods SWCA used to perform paleontological work for the project.

3.1 Authorities and Standards

SWCA conducted the paleontological analysis of existing data and the field survey in accordance with the following regulations for paleontological resources management on state, USACE, and USFS lands in the Project area and following best practices for paleontological resource assessment and management, as outlined in Murphey et al. (2019), BLM Manual H-8720-1 (1998), and BLM Instructional Memorandum (IM) 2009-011 (BLM 2008), IM 2012-141 (2012), and IM2016-124 (2016).

There are no state or federal laws applicable to paleontological resources management or preservation on private lands in the state of North Dakota. Paleontological resources from private or split-estate lands are the property of the surface-estate owner, and their disposition shall take place in accordance with the agreement between the surface landowner and the project proponent. Surface owners are encouraged to consider the scientific value of finds made on their lands and to donate potentially important finds to a public museum for the benefit of society.

Chapters 43-04 and 54-17.3 of the North Dakota State Century and Administrative Codes include state level-requirements for the assessment and management of paleontological resources on lands owned by the state or its political subdivisions. These statutes 1) define vertebrate fossils as paleontological resources unless they are determined to be insignificant by the state geologist and 2) note that invertebrate, plant, and trace fossils are not paleontological resources unless they are determined to be significant by the state geologist. Additionally, these statutes require a permit for identifying or evaluating paleontological resources to satisfy state or federal requirements or for investigating, excavating, collecting, or otherwise recording paleontological resources on state lands.

The National Environmental Policy Act (NEPA) of 1970 (Public Law 91-190; 31 Statute 852; 42 United States Code 4321–4327) requires the consideration of important natural aspects of our national heritage during the assessment of the environmental consequences of proposed projects with federal land or in some cases federal oversite. In addition, the USACE, like other federal land managing agencies, the USACE issues permits for paleontological investigations and mitigation on lands under their jurisdiction (United States Code Annotated 54 U.S.C.A § 320302). Conditions applicable to permits for examination, excavation, and gathering of objects of antiquities on USACE land include that authorization be limited to qualified individuals working to increase knowledge of the objects and that collected objects be permanently preserved in a public museum, but remain the property of the United States Government. Applicable specifically to USFS lands within the project, in 2009, the Paleontological Resources Preservation Act (PRPA) became law; the PRPA is codified in Title VI of the Omnibus Public Lands Management Act of 2009 (Public Law 11-011, VI, Subtitle D). The PRPA states that the Secretaries of the Interior and Agriculture shall use scientific principles and expertise to manage and protect paleontological resources on federal land (Section 6302). The PRPA incorporates many of the recommendations of the Secretary of the Interior's May 2000 report, *Assessment of Fossil Management on Federal and Indian Lands* (U.S. Department of the Interior 2000), which details actions to formulate a consistent paleontological resources management framework. With the passage of the PRPA, Congress

defined paleontological resources and reaffirmed that paleontological resources collected from federal land (e.g., BLM, BOR, USFS) are federal property. The PRPA provides the following.

- The establishment of a program to increase public awareness about the significance of paleontological resources.
- A definition for casual collecting.
- Minimum requirements for paleontological resource–use permit issuance (terms, conditions, and applicant qualifications).
- Criminal and civil penalties for the illegal sale, transport, theft, or vandalism of paleontological resources from federal land; required forfeiture of such paleontological resources; and an option to offer rewards for information that leads to the finding of a civil violation or conviction of a criminal violation.
- Requirements for curation of paleontological resources in approved repositories.
- Direction that information concerning the nature and specific location of a paleontological resource is exempt from disclosure under 5 United States Code 552 and any other applicable law unless otherwise specified.

In 2015, the U.S. Department of Agriculture completed the Paleontological Resources Preservation Final Rule (36 CFR 291) and it was published in the *Federal Register* (U.S. Department of Agriculture 2015). The purpose of 36 CFR 291 is to implement provisions of the PRPA. It contains the primary information related to the preservation of paleontological resources on USFS administered land; as a result, some of the previously cited rules and regulations are no longer applicable. For example, the definition for paleontological resources was removed from 36 CFR 261.2.

3.2 Assessment of Paleontological Potential

Historically the USFS used the Fossil Yield Potential Classification (FYPC) system for assessing the potential for paleontological resources of a specific area without a full on-site evaluation (e.g., field surveys or monitoring of ground disturbance) (USFS 2005). The BLM currently using a similar ranking system, the PFYC, in which the BLM has assigned a PFYC ranking (1–5) to each geological unit (formation, member, or other distinguishable units) at the most detailed mappable level based on the taxonomic diversity and abundance of previously recorded scientifically significant paleontological resources associated with the unit and the potential for future discoveries, with a higher-class number indicating higher potential (BLM 2016). Additional rankings are provided for geological units of unknown potential (U), water (W), and ice (I). The PFYC system is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally exist in a geological unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment. The PFYC system provides baseline guidance for predicting, assessing, and mitigating paleontological resources in areas of development.

In 2013, the FYPC system was abandoned by the USFS in response to PRPA paleontological resource management mandates and it was replaced by the PRRAS which designed by USFS paleontologists to generate indicators of paleontological resources on USFS land (USFS 2013). In short, the PRRAS is based on the fundamental assumption that mapped geology adequately represents the distribution of paleontological resources; and that the distribution of paleontological resources in geologic units is fundamentally related to objective attributes such as lithology and geologic age.

The PRRAS assigns a code (0, 1, or 2) to each geologic unit (formation, member, or other distinguishable unit) at the most detailed mappable level. The three PRRAS codes are as follows.

- PRRAS code 0: paleontological resources absent or unlikely to occur
- PRRAS code 2: paleontological resources present or likely to occur
- PRRAS code 1: likelihood of paleontological resource occurrence unknown

This system provides baseline guidance for predicting and assessing paleontological resources in areas of proposed development. The coding of geologic units is not a substitute for field surveys. The PRRAS focuses attention on areas where paleontological resource management is merited and where field surveys should be required to inventory, monitor, and ensure paleontological resource protection. A 1:500,000-scale North Dakota Geological Survey map (Clayton et al. 1980) indicates that the project would cross multiple Quaternary units and the Paleocene-age Fort Union Formation; these units are assigned a PRRAS code of 0 and 2, respectively, by the USFS and PFYC values of 2 to 3 and 4, respectively by the BLM (Table 1).

Table 1. Mapped Geologic Units within the Project Area (1:500,000-scale map)

Geologic Unit	Map Symbol	Age	Typical Fossils	PRRAS Code	PFYC Value
Oahe Formation; river sediments and windblown sand (post glacial sediments)	Qor, QTou	Holocene to Pleistocene to Pliocene	Few, such as bison bones, known. Pleistocene deposits may contain mineralized or partially mineralized remains. Holocene deposits are too young to contain in-situ fossils.	0	2
Coleharbor Formation; multiple glacial deposits including Offshore Sediments (ice-walled lake); River Sediment (uncollapsed river, and collapsed), Glacial Sediment (collapsed, collapsed/draped transition, draped on older surface)	Qcoh, Qcrf, Qcrh, Qccu Qccr, Qcch, Qcdc, Qcdn	Holocene and Pleistocene	Few known. Pleistocene deposits may contain mineralized or partially mineralized remains. Holocene deposits are too young to contain in-situ fossils.	0	3
Sentinel Butte Formation	Ts	Paleocene	Vertebrates: mammals, turtles Invertebrates: mollusks Plants: fruit, leaf impressions, silicified wood.	2	4
Bullion Creek Formation (prior to 1977 generally mapped as part of the Tongue River Formation)	Tb	Paleocene	Vertebrates: mammals, turtles Invertebrates: mollusks Plants: fruit, leaf impressions, silicified wood	2	4

Note: Geologic units are listed approximately in descending stratigraphic order from youngest to oldest. Typical fossil information is summarized from the author's personal experience and literature review.

Source for geologic units: Clayton et al. 1980

3.3 Desktop Analysis Methods

SWCA conducted background research for the Project area to identify known fossil resources therein and nearby in the same geological formation. SWCA's research included geological map and literature reviews, previous locality data searches, coordination with the USFS, USACE, and North Dakota State Paleontologist, and discussion with paleontologists conducting active research in the area. In addition, SWCA requested access to paleontological records maintained by the USFS National Zone Paleontologist and the North Dakota Geologic Survey State Fossil Collection to 1) determine whether any previously recorded fossil localities exist in the project area, 2) assess the potential for disturbance of these localities during construction, and 3) evaluate the paleontological sensitivity of the project area.

3.4 Field Survey Methods

Paleontological field survey are required on public land with geologic units with high potential for containing important paleontological resources. SWCA designed the paleontological field survey to determine the surface presence of previously unknown significant vertebrate fossils and/or noteworthy invertebrate, plant, or trace fossils, and to evaluate potential adverse impacts to subsurface paleontological resources during construction. The pedestrian survey covered an approximately 300-foot-wide corridor along a 2.30-mile-long section of the pipeline within the USFS LMNG and on USACE lands along the shoreline of Lake Sakakawea. No surveys took place on State of North Dakota lands. North Dakota State Paleontologist Dr. Clint Boyd (2019) confirmed via email communication with SWCA that North Dakota State lands in the analysis area (Sections 24 and 36, T. 158 N., R. 95 W.; Section 6, T. 157 N., R. 94 W.; Sections 19 and 31, T. 158 N., T. 94 W.; Sections 25 and 36, T. 155 N., R. 92 W.) have surficial exposures limited to Quaternary-age sediments (=low paleontological potential) and noted that there are no previously documented localities in these areas; and therefore saw no need for field reconnaissance (or survey) of these state managed lands.

Surveyors inspected the survey area for 1) surface fossils, 2) exposures of potentially fossiliferous rock, and 3) areas in which construction would expose or otherwise affect fossiliferous rock. Exposures of paleontologically sensitive geological units received a thorough pedestrian survey. A visual review from a distance is appropriate only for areas in which the absence of bedrock exposures can be visually confirmed from that distance.

SWCA's standard operating procedure is to record all fossils discovered during field surveys as significant fossil localities (SFLs) or non-significant fossil occurrences (NFOs). An SFL requires documentation of the location, identification, and description of the qualifying significant paleontological resources along with their geological context and may require avoidance or mitigation of impact from project activities. The presence of highly weathered, fragmentary, or otherwise unidentifiable fossils is recorded as an NFO to communicate the presence of fossils in a manner that avoids unnecessarily triggering avoidance or mitigation measures. NFOs typically consist of more than five fragments of turtle shell, unidentifiable bone and tooth fragments, and/or unidentifiable plant fossils and fragments of fossilized wood. In addition, SWCA used a Geode global positioning system (GPS) unit to record points for locations of surface fossils with essentially no individual importance because of their poor preservation, lack of identifiable features, or commonality. Although such surface fossils include no resources that require full documentation, those locations are useful in determining the potential of the survey area to contain subsurface fossils. Fossil locality data are sensitive and are exempt from the Freedom of Information Act.

With the completion of the field survey, SWCA made recommendations for the project area. Typical post-survey recommendations include one or more of the recommendations listed in Table 2.

Table 2. Types of Post-Survey Paleontological Recommendations

Recommendation	Description
Clearance	If adverse impacts on paleontological resources are anticipated to be nonexistent or below the level of significance for a given surface-disturbing action in a given area based on pre-field survey research and/or field survey or monitoring results and if no further consideration of paleontological resources is deemed necessary, immediate paleontological clearance is recommended. A clearance recommendation can be made for an entire project area or any portion thereof (including surface and/or subsurface), depending on paleontological sensitivity.

Recommendation	Description
Fossil Collection	If isolated small, medium, or large fossils are discovered within a project area during field surveys or mitigation monitoring and if they are determined to be scientifically significant, they should be collected. This may involve simply collecting a fully exposed fossil from the ground surface, or may involve a systematic excavation, depending on the nature of the fossil discovery. Excavations should be designed to minimize construction delays while properly collecting the fossil and associated data according to professional paleontological standards. Depending on land ownership, curation agreements, and the size of a planned excavation, additional authorizations may be required prior to fieldwork. For all extensive discoveries, a detailed locality-specific plan should be completed prior to initiating a full excavation and collection.
Avoidance	If the cost of locality collection or other mitigation to the project schedule or budget is determined to be too high or if permanent damage to the resource caused by surface disturbance is considered to be unavoidable, avoiding or rerouting the portion of the project that intersects the fossil locality may be necessary to prevent adverse impacts on the resource. Avoidance should also be considered if a known fossil locality appears to contain critical scientific information that should be left undisturbed for subsequent scientific evaluation. Avoidance for later scientific research is the typical mitigation recommendation made for extensive scientifically significant paleontological discoveries.
Monitoring	If significant (well-preserved, uncommon, and/or identifiable) paleontological resources are known to exist in an area or if there is a high likelihood that subsurface fossils are present in geologic formations or members thereof within a given project area based on prior field surveys, museum records, or scientific or technical literature, paleontological monitoring of construction excavations (e.g., surface-disturbing actions) should be recommended. Monitoring involves systematic inspections of graded cut slopes, trench sidewalls, spoils piles, and other rock or surficial sediment surfaces exposed during excavation for the presence of fossils and the collection and documentation of these fossils before they are destroyed by further ground-disturbing actions. There are two types of monitoring: standard (or on-site) monitoring and spot-check monitoring. Standard, or on-site, monitoring requires the presence of a monitor at all times that applicable surface disturbance is occurring and is typically required in the most paleontologically sensitive areas. Spot-check monitoring involves the non-continuous examination of excavations or spoil piles during project activities instead of maintaining the continuous monitoring of operations. This type of monitoring is typically used in areas with moderate paleontological potential or areas with surface cover where a low volume of geologic units with higher potential may be disturbed.

3.5 Distribution of Data

SWCA will submit electronic copies of this report and associated electronic shapefiles to ERM; USACE Garrison Project Office representatives Todd Lindquist, Project Manager, and Richard Rogers, Archeologist; and LMNG McKenzie Ranger District representatives Barbara A. Beasley, USFS Paleontologist, and Cale E. Bickerdyke, Minerals and Lands Supervisor. SWCA will also maintain an electronic file of the report with relevant field notes, maps, and other data on SWCA's corporate server.

4 RESULTS

This section presents the results of SWCA's paleontological work for the project.

4.1 Literature Search Results

The Project area is in the central portion of the Williston Basin, starting north of the Killdeer Mountains and traveling north, east of Watford City, and along the southern shore of Lake Sakakawea before continuing north-northeast and ending southwest of Lignite, North Dakota. Although at least two geologic units, the Paleocene-age Fort Union Formation and surficial deposits of Pleistocene to Holocene age, underlie the full Project area, paleontological survey was limited to the portions of the project area that overlap of the Fort Union Formation. The fossils contained within the Paleocene age sediments, together with the sediments in which they are preserved, provide evidence of the history of life in the western interior of North America during the earliest Cenozoic. These units were deposited in a terrestrial setting

after the Western Interior Seaway, which had covered much of central North American during the Cretaceous, underwent its final major regressive depositional cycle, and strand line, estuarine, beach, and marine sediments gave way to fully terrestrial predominantly alluvial and floodplain deposits. From Quaternary to recent times, the landscape was altered as the result of erosion by water and wind, and the modern topography was formed.

The following sections provide a summary of the geologic and paleontological information for the Fort Union Formation, previously determined by multiple agencies to have high potential for containing scientifically important paleontological resources (PRRAS Code 2; PFYC 4), and a basic overview of Quaternary units, which have moderate to low potential for containing important paleontological resources, in relation to the project area.

4.1.1 *Fort Union Group (or Formation)*

Although recognized by the U.S. Geological Survey (USGS) as a formation, the Fort Union is recognized by the North Dakota Geological Survey (NDGS) as a group, and is divided into the Ludlow, Cannonball, Slope, Bullion Creek (or Tongue River), and Sentinel Butte formations (Hartman et al. 2002). The Fort Union Group (or Formation) is an expansive 'unit' and has been mapped using surficial exposures and well logs in Montana, South Dakota, Wyoming, North Dakota, and Colorado.

The Bullion Creek and Sentinel Butte formations are mapped within the Project area (Carlson 1985, Clayton et al. 1980, Freers 1970). The following subsections describe the stratigraphy, fossils, and paleontological sensitivity of these two units. In general, the Bullion Creek is composed of light-colored rocks (bright colored siltstone and mudstones), while the Sentinel Butte is darker gray and the boundary between the two is often noted by a lignite or "clinker" if it has burned. The Fort Union is conformably underlain by the Hell Creek Formation (mapped using well log data; Freers 1970), and unconformably overlain in the study area by Quaternary surficial deposits. Minor exposures of the Golden Valley Formation, composed of brightly colored beds, lie conformably on the Sentinel Butte Formation approximately 20 miles southeast of the Project area.

4.1.1.1 BULLION CREEK FORMATION (OR TONGUE RIVER FORMATION)

Exposed throughout western North Dakota and westward into Montana as far as the Cedar Creek anticline (Clayton et al. 1977), the Bullion Creek is recognized by the NDGS as a formation, while the USGS considers it an informal member of the Fort Union Formation (Group). The type area is near Bullion Butte, in Golden Valley County, North Dakota. The name Bullion Creek was proposed in 1977 for rocks that were previously thought to be equivalent to all or a portion of the Tongue River Formation (Clayton et al. 1977). However, this nomenclature is not widely accepted, as a review of recent literature revealed that several authors have reverted to attributing these beds to the Tongue River Formation (Hunter and Hartman 2004; Peppe 2010). The Bullion Creek Formation consists of yellow-brown siltstone, claystone, sandstone, and lignite beds (usually 1 to 4 meters thick) which were deposited in a variety of environments including deltas, rives, and lakes (Clayton et al. 1977). Although sandstones comprise a small percentage of the formation, sandstone beds form prominent features, usually preserved as recognizable channel deposits composed of cross-stratified, fine- to medium-grained lenticular sandstone bodies. The Bullion Creek Formation has a maximum thickness of approximately 600 feet (183 meters) in subsurface logs near the middle of the Williston Basin and thins to the east and west (Clayton et al. 1980; Clayton et al. 1977). It conformably underlies the Sentinel Butte Formation and unconformably overlies the Slope Formation ("Rhame Bed") in the western part of North Dakota, and the Cannonball Formation in the central portion of the state.

Fossil from the Bullion Creek Formation include mammals, reptiles, fish, fossil trackways, invertebrates, and plants (Hanks et al. 2002; Erickson 1991; Hartman 1984). There are several highly productive vertebrate fossil localities from the Bullion Creek Formation. Wannagan Creek, the best-known Bullion Creek locality, was first collected in 1971 by the Science Museum of St. Paul and has produced thousands of fossil vertebrates including a famous reptilian fauna (Erickson 1982a, 1982b, 1991). The Judson locality is an important mammal-rich locality which was for a time thought to be within the Slope Formation (Hartman and Kihm 1991; Kihm and Hartman 2004). Fossils collected indicate that the Bullion Creek is of Torrejonian and Tiffanian North American Land Mammal Age (NALMA) (Hartman and Kihm 1995). Fossils are relatively abundant in the Bullion Creek Formation.

4.1.1.2 SENTINEL BUTTE FORMATION

The Sentinel Butte is considered to be a member of the Fort Union Formation by the U.S. Geological Survey but is regarded as a formation of the Fort Union Group by the NDGS. In North Dakota the Fort Union Formation has been divided into the Ludlow, Cannonball, Slope, Bullion Creek (or Tongue River), and Sentinel Butte formations (Hartman et al. 2002). The Fort Union Group (or Formation) is an expansive 'unit' and has been mapped using surficial exposures and well logs in Montana, South Dakota, Wyoming, North Dakota, and Colorado. In northwestern North Dakota the Fort Union Group is conformably underlain by the Hell Creek Formation (mapped using well log data; Freers 1970) and unconformably overlain in a small portion of the Project area by Quaternary surficial deposits. All these sedimentary units were deposited in a terrestrial setting after the Western Interior Seaway, which had covered much of central North America during the Cretaceous, underwent its final major regressive depositional cycle, and strand line, estuarine, beach, and marine sediments gave way to fully terrestrial, predominantly alluvial and floodplain deposits. From Quaternary to recent times, the landscape was altered as the result of erosion by water and wind, and the modern topography was formed.

The Sentinel Butte type area is located along the northeastern slope of Sentinel Butte in Golden Valley County, North Dakota (Clayton et al. 1977). The rocks of the Sentinel Butte Formation consist primarily of poorly cemented gray-brown claystone, mudstone, siltstone, sandstone, and lignite with locally present, isolated, well-lithified channel sandstone beds. The rocks of the Sentinel Butte are differentiated from the conformably underlying Bullion Creek by lying above the HT Butte lignite (sometimes clinker) marker bed (where present); drab color compared to the bright yellowish-brown of the Bullion Creek; weathering to steep, narrow gullies, as compared to smooth slopes of the Bullion Creek; and prevalence of fossil wood (Biek and Gonzalez 2001). These sediments were deposited in lakes, rivers, and swamps. While buried, some of the rocks within the Sentinel Butte Formation were baked as adjacent coal seams burned. These individual baked "clinker" beds can reach a thickness of 40 feet (12 meters [m]) and vary depending on their mineral composition and grain size; coal thickness, and length, quality; and type of burn (Biek and Gonzalez 2001). The total thickness of the Sentinel Butte Formation varies from 600 to 750 feet (183 to 229 m) (Clayton et al. 1980). At least four marker beds are recognized within the Sentinel Butte; these include the "blue" bentonitic bed and the low and high yellow markers.

Mammal fossils, including a number of specimens of Titanoides (Pantodonta), are known from the lower Sentinel Butte Formation (Hartman and Kihm 1991). The mammal fossils collected from the Red Springs Quarry in central North Dakota indicate a late Tiffanian North American Land Mammal Age for the Sentinel Butte Formation (Kihm et al. 1993). In addition to the mammals, other vertebrate fossils are known and have been collected from the Sentinel Butte Formation; however, many of these fossils are known from unpublished fossil collections located primarily in the North Dakota State Fossil Collection (Hoganson 2012). A soft-shell turtle death assemblage was collected by the NDGS and was the subject of an unpublished master's thesis (Kays 1999). Several molluscan fossil localities were also found near the Red Springs Quarry and are known from elsewhere in west-central North Dakota (Hartman 1984). While leaves and other plant fossils including fruits have been documented during stratigraphic studies and

collections have been made from a few well-preserved and diverse silicified floras including Almont (Morton County, North Dakota) and Beicegel Creek (McKenzie County, North Dakota), these collections remain largely unpublished (Crane et al. 1990; Stull et al. 2012; Pigg et al. 2008; Pigg and DeVore 2005). Silicified wood as indicated above is prominent within the formation, and much of it has been referred to as conifer (Taxodiaceae, sequoia family), including those specimens analyzed within two units in the lower Sentinel Butte, which preserve silicified stumps in upright position and are exposed in the southern portion of Theodore Roosevelt National Park (Fastovsky and McSweeney 1991).

4.1.2 *Quaternary Deposits*

Two Quaternary deposits underly the Project area, the glacial derived Coleharbor Formation and post glacial Oahe Formation (Clayton et al. 1980). Both units are divided into multiple subunits, yet these subdivisions are not true lithostratigraphic units as the inferred geologic history of the units has had no bearing on their definitions. For example, the Coleharbor Formation hummocky collapse topography (Qccu, Qccr, and Qcch) has been subdivided based on its three most conspicuous variables: slope angles, presence or absence of ring-shaped hummocks, and presence or absence of transverse ridges. The Coleharbor Formation is 600 feet thick in places and composed of offshore ice-walled-lake sediments (up to 200 feet thick), river sediments (up to 100 feet thick), and glacial sediments (up to 100 feet). The Oahe Formation river sediments (Qor) of dark, obscurely bedded clay and silt (overbank sediment) overlying cross-bedded channel sand are a maximum of 30 feet thick and the partially older (Pliocene) windblown sand (QTou) are limited to a thickness of 10 feet (Clayton et al. 1980).

In general the Coleharbor is distinguished from other Pleistocene deposits in North Dakota by the presence of pebbles derived from the Canadian Shield and the lower Paleozoic formations fringing the Canadian Shield; in contrast, the Pleistocene deposits of southwestern North Dakota contain pebbles derived from the Black Hills and the Rocky Mountains and from local Paleocene formations. As currently recognized, the Oahe Formation includes sediment of all grain sizes above the Coleharbor Group, though originally limited to only silt. The Oahe differs from the Coleharbor in lacking glacial sediment. The Coleharbor in most outcrops can be distinguished from the overlying Oahe Formation (Holocene) by the absence of diffuse organic material.

Pleistocene-age surficial deposits, particularly alluvium, may contain mineralized or partially mineralized animal bones, invertebrates, and plant remains of paleontological significance. Except for some caves, hot springs, and tar deposits, these fossils typically occur in low density and usually consist of scattered and poorly preserved remains. Erratics and glacial outwash vary in thickness and glacial outwash sands and gravels have produced fossils including those of plants (spruce and aspen), animals including the giant ground sloth (*Megalonyx jeffersonii*), horses, deer, *Bison latifrons*, and insects (Hoganson and Murphy 2003). However, most deposits of Pleistocene age in North Dakota contain few fossils and are considered to have low paleontological sensitivity. Holocene-age alluvium and colluvium may contain the unfossilized remains of modern taxa but are too young to contain in situ fossils.

4.2 Records Search Results

According to the USFS (Beasley 2019), the North Dakota State Paleontologist (Boyd 2019), and published literature, the survey area contains no fossil localities but at least three previously recorded fossils localities are within 1 mile of the Project (Table 3); however, the project would not cross any of those localities.

Table 3. Previously Recorded Fossil Localities within 1 Mile of the Project

Fossil Locality ID	Source (Collector or Researcher)	Section	Township	Range	Ownership	Geologic Unit	Description	Comment
L1136/ USGS 10103	Hartman 1984	31	154N	96W	USFS	Fort Union, Bullion Creek or Sentinel Butte Formation	Snail *(Viviparus* sp.*)*	Location accurate to legal location and is outside project disturbance area
Not provided	Kihm 2012; previous project request	1	148N	99W	Private	Sentinel Butte Formation	Mollusks (clams and snail fragments)	Location accurate to legal location and is outside project disturbance area
Not provided	NDGS	24	160N	94W	Private	Fort Union	Plant	Location accurate to legal location and is outside project disturbance area

Notes: NDGS = North Dakota Geological Survey and State Fossil Collection

4.3 Field Survey Results

This section presents the results of the pedestrian field survey for the project, which SWCA performed on October 23, 2019, in accordance with resource best practices and USFS and USDA standards. During the field survey, SWCA documented no fossil localities but did record, in separate locations, multiple isolated and poorly preserved fossils consisting of one invertebrate shell cast and multiple plant fragments. Figure 2 depicts the survey area, which is limited to USFS- and USACE-administered land, and Tables 4 and 5 summarize the survey results. Photographs of the USFS portion of the survey area are provided as Figures 3 through 6, and photographs of the USACE portion of the survey area and representative fossils are provided as Figures 7 through 11. SWCA did observe fossils, unidentifiable plant material and a weathered and incomplete internal mollusk cast in ex-situ blocks and small pieces of silicified wood, within the USACE portion of the survey area, due the fossils being poorly preserved, eroded, and representatives of common taxonomic groups they are determined not to be important paleontological resources and were not fully document. No other paleontological resources (or fossils) were observed during field survey

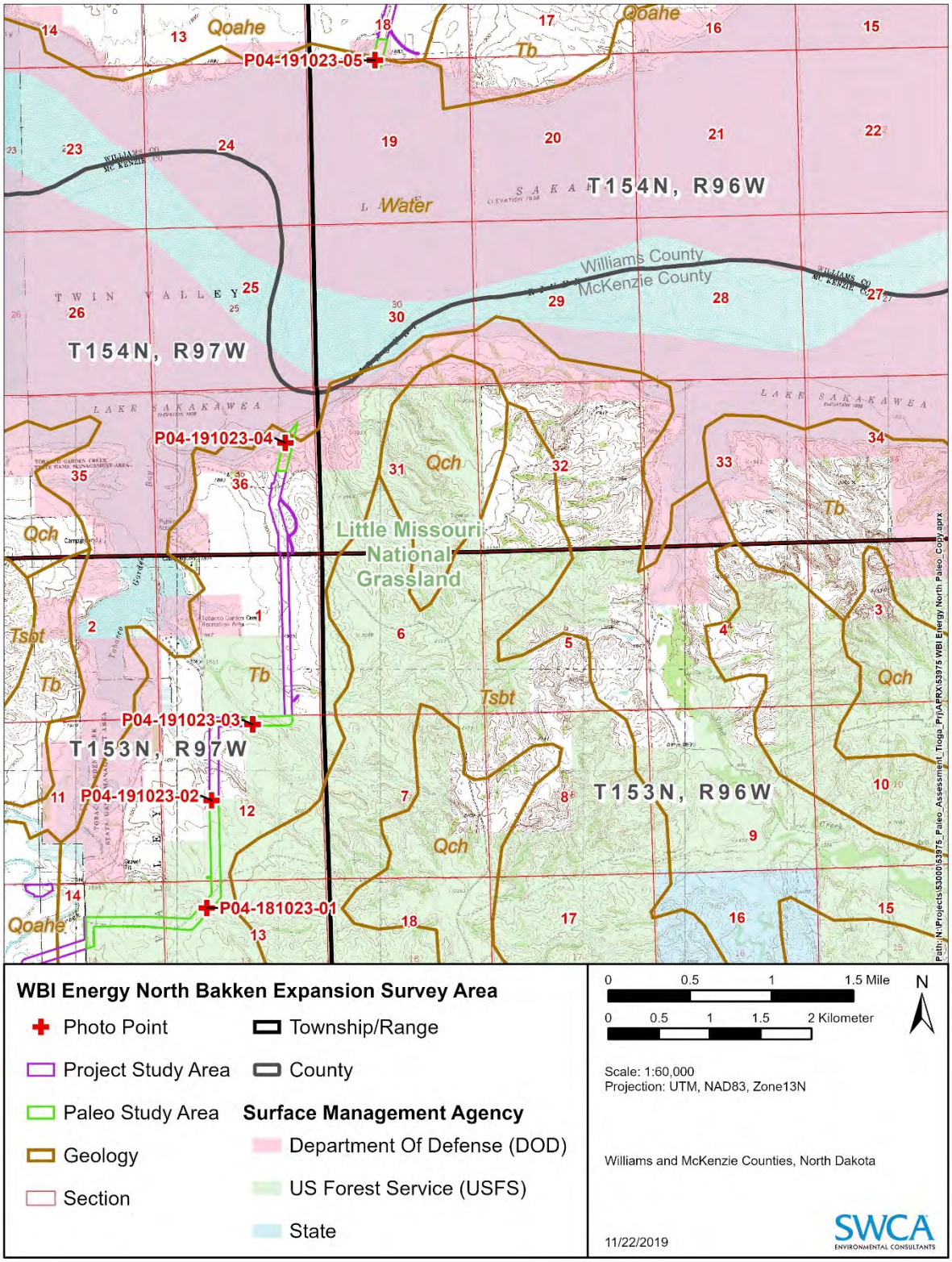

Figure 2. Paleontological survey area map for the portion of the North Bakken Expansion Project (geologic units from Clayton et al. 1980).

Table 4. Survey Summary USFS Little Missouri National Grasslands

Project Name	North Bakken Expansion Project				
Project Description	Paleontological pedestrian field survey for the proposed North Bakken Expansion Project				
Managing Land Agency	Forest Service USFS Region 1 Dakota Prairie Grassland, Little Missouri National Grassland, McKenzie Ranger District				
Location (PLSS*)	Sections 12, 13, and 14, T153N, R97W				
Topographic Map	Tobacco Garden (1979)				
Geological Map	Clayton, L., S.R. Moran, and J.P. Bluemle. 1980. Geologic Map of North Dakota. U.S. Geological Survey, Scale 1:500,000 Carlson, C.G. 1985. Geology of McKenzie County, North Dakota. North Dakota Geological Survey, B-80, Part I.				
Previously Mapped Geological Formation	**Age**	**Geological Unit State Map (Clayton et al. 1980)**	**Geological Unit County Maps (Carlson 1985)**	**PRRAS Code**	**PFYC Value**
	Holocene and Pleistocene	-	Coleharbor group Qct, till facies	0	3
	Paleocene	-	Sentinel Butte Formation (Tsb)	2	4
	Paleocene	Bullion Creek Formation (Tb)	Bullion Creek Formation (Tongue River Formation, Ttr)	2	4
Principal Investigator	Georgia E. Knauss	**USFS Authorization**	R1-DPG-MGM-FY19-01		
Surveyor(s)	Andrew N. Gerwitz				
Survey Date(s)	October 23, 2019	**Total Acres Surveyed**	69.37		
Area Surveyed	Drainage channels and cuts				
Topography	The project area is on gradually sloping valley sides toward the Missouri River and wave-cut platforms along the shoreline of Lake Sakakawea. Much of the project area is heavily vegetated with grasses and trees and features limited outcrop exposures along drainage cuts. Elevation within the survey area ranges from 1,880 to 1,838 feet above mean sea level.				
Bedrock Exposure Status	< 5%: weathered exposures on small mounds, buttes with steep slopes, and cuts in drainages lacking in vegetation				

Geological Description (in approximate stratigraphic ascending order from bottom to top)	**Unit**	**Lithology**	**Abbreviation**	**Description**	**Estimated Thickness (meters)**	**New Localities**
	1	Topsoil / glacial till	Qct	Medium-brown, mostly covered by vegetation; cobbles and gravels eroding out on the surface	1–3	–
	0	Silty mudstone	Tsb/Tb	Light-gray to light-tan weathered, small mounds, buttes with steep slopes and cuts in drainages lacking in vegetation	2	–

Nearest Previously Documented Fossil Locality	L1136/ USGS 10103: snail (*Viviparus* sp.), located less than 1 mile from survey area; exact location is unknown, only the legal description to the nearest section was readily available		
Previously Documented Fossil Localities within Survey Area	N/A		
Fossil Localities Discovered During the Survey	NFOs: 0 SFLs: 0		
Status of New Specimens	No collection; as no scientifically important specimens	**Repository of New Specimens**	N/A

* PLSS = Public Land Survey System.

Figure 3. Vegetated drainage in southern portion of survey area in Little Missouri National Grasslands without outcrops of Fort Union Formation; surface exposures revealed hills to be glacial till (P04-191023-01). Direction: southwest.

Figure 4. Vegetated drainage, terraces, and small hills mapped as alluvium and glacial till deposits of the Coleharbor Formation underlying the Project within the Little Missouri National Grasslands (P04-191023-02). Direction: south.

Figure 5. Localized exposures of typical Fort Union Formation light-grayish tan mudstone with some silty gravelly horizons along drainage edge on Little Missouri National Grasslands (P04-191023-03). Direction: northeast.

Figure 6. Localized exposures of typical Fort Union Formation in head cuts and blowouts along drainage edge on Little Missouri National Grasslands (P04-191023-03). Direction: northwest.

Table 5. Survey Summary USACE Lands

Project Name	North Bakken Expansion Project					
Project Description	Paleontological pedestrian field survey for the proposed North Bakken Expansion Project					
Managing Land Agency	USACE, Garrison Project Office					
Location (PLSS*)	Section 36, T154N, R97W and Section 18, T154, R96W					
Topographic Map	Red Mike (1972), Tobacco Garden Bay (1979)					
Geological Map	Clayton, L., S.R. Moran, and J.P. Bluemle. 1980. Geologic Map of North Dakota. U.S. Geological Survey, Scale 1:500,000 Carlson, C.G. 1985. Geology of McKenzie County, North Dakota. North Dakota Geological Survey, B-80, Part I. Freers, T.F. 1970. Geology of Williams County, North Dakota. North Dakota Geological Survey, B-48, Part I.					
Previously Mapped Geological Formation	**Age**	**Geological Unit State Map (Clayton et al. 1980)**	**Geological Unit County Maps (Carlson 1985; Freers 1970)**		**PRRAS Code**	**PFYC Value**
	Northside of Lake Sakakawea					
	Holocene and Pleistocene	Oahe Formation (QTou), windblown Oahe sand and of older formations	Sand Dunes (SD), non-glacial area of aeolian deposits (low mounds of sand and blowouts)		0	2
	Southside of Lake Sakakawea					
	Pleistocene	-	Coleharbor Group (Qct), till facies		0	2
	Paleocene	Bullion Creek Formation (Tb)	-		2	4
Principal Investigator	Georgia E. Knauss	**USACE Authorization**	DACW45-3-20-8008			
Surveyor(s)	Andrew N. Gerwitz					
Survey Date(s)	October 23, 2019	**Total Acres Surveyed**	15.38			
Area Surveyed	Shorelines and wave-cut cliff exposures along southern shore of Lake Sakakawea					
Topography	The project would pass south of Lake Sakakawea, and USACE-owned land consists of small rolling hills and a steep wave-cut approximately 50-foot-tall cliffs along the shorelines of Lake Sakakawea. The tops of the cliffs are vegetated, with little to no exposures along rolling hills. Elevation within the survey area ranges from 1,880 to 1,838 feet above mean sea level.					
Bedrock Exposure Status	80%: weathered exposed in small nobs and cuts in drainages lacking vegetation, and in blowouts on the flat surface					
Geological Description (in approximate stratigraphic ascending order from bottom to top)	**Unit**	**Lithology**	**Geologic Abbreviation**	**Description**	**Estimated Thickness (meters)**	**New Localities**
	1	Topsoil, sand dunes, and alluvial floodplain	QTou/SD, Qct	Medium-brown, mostly covered by vegetation; transported cobbles and gravels eroding out on the surface	1.0-3.0	-
	0	Silty mudstones with lignite	Tb (or possibly Sentinel Butte)	Light-gray to light-tan weathered, observed in small nobs and cuts in drainages lacking vegetation	14.5	-
Nearest Previously Documented Fossil Locality	L1136/ USGS 10103: snail (Viviparus sp.), located less than 1 mile from survey area; exact location is unknown, only the legal description to the nearest section was readily available					
Previously Documented Fossil Localities within Survey Area	N/A					
Fossil Localities Discovered During the Survey	NFOs: 0 SFLs: 0					
Status of New Specimens	No collection; as no scientifically important specimens			**Repository of New Specimens**	N/A	

* PLSS = Public Land Survey System.

Figure 7. Fort Union Formation exposed along the southern shoreline of Lake Sakakawea on USACE land. Light gray to buff silty mudstones with some small woody coal horizons (P04-191023-04). Direction: west.

Figure 8. Fort Union Formation sediments and glacial till reworked talus deposits along northern shoreline of Lake Sakakawea on USACE land (P04-191023-05). Direction: north.

Figure 9. Unidentifiable Fort Union Formation fossilized plant material in a light-gray mudstone block, which, before undergoing erosion, originated near a woody coal horizon along the southern shoreline of Lake Sakakawea on USACE land (Section 36, T. 154 N., R. 97 W.). Scale in centimeters.

Figure 10. Charcoaled wood and plant material from dark-purplish brown woody coal horizon in the Fort Union Formation exposure shown in Figure 6. Scale in centimeters.

Figure 11. Isolated weathered ex-situ silicified wood fragment found along southern shoreline of Lake Sakakawea on USACE land (Section 36, T. 154 N., R. 97 W.). Scale in centimeters.

Figure 12. Isolated ex-situ mollusk internal cast found along northern shoreline of Lake Sakakawea on USACE land (Section 18, T. 154 N., R. 96 W.). Scale in centimeters.

5 RECOMMENDATIONS

SWCA documented no localities during the field survey; however, thick vegetation covered much of the survey area at the time of the survey, and personnel found isolated weathered fossils where good exposure existed. It is understood that some monitoring may be required by the USFS paleontologists due to the potential for scientifically important paleontological resources in the geologic units underlying portions of the project area. SWCA recommends paleontological clearance for activity on the ground surface throughout the paleontological study area, including the driving of vehicles through and around the proposed disturbance areas. While, pipeline trench depth is anticipated to be five to six feet below current ground surface, SWCA also recommends subsurface clearance for the paleontological study area. No scientifically significant paleontological resources were documented within the survey areas and the anticipated depth to unweathered Union Formation (=Sentinel Bute and/or Bullion Creek) is anticipated to be a couple feet or more for much of the area; therefore planned construction is anticipated to result in limited subsurface disturbance of these units within the survey areas.

WBI should instruct all project personnel that if crews discover any mineralized bones or other potential fossils during construction activities and a paleontological monitor is not present, the fossils should be left in place untouched, and the Environmental Inspector or Construction Foreman and a qualified and appropriately permitted (e.g., USFS, USACE, and/or State of North Dakota) paleontologist should be contacted immediately to assess the discovery and make further recommendations.

Generally, SWCA recommends that for future surface- and subsurface-disturbing actions that disturb paleontologically sensitive geological units, potential effects to significant paleontological resources should be evaluated and mitigated as appropriate before and during construction.

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APPENDIX A

Copy of USFS Authorization to Conduct Paleontological Resources Research or Collection No. R1-DPG-MGM-FY19-01

Office Use Only
Authorization Number:
R1-DPG-MGM-FY19-01

FS-2800-22B (REV-02/17)
OMB 0596-0082

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Authorization to Conduct Paleontological Resources Research or Collection

Authorities: 16 U.S.C. §470aaa through 16 U.S.C. §470aaa-11; Organic Administration Act June 4, 1897; 36 CFR 291.13-291.23

Georgia Knauss of SWCA Environmental Consultants , hereinafter called the permittee, is hereby authorized to use, subject to the terms and conditions of this permit, National Forest System land identified within the: Dakota Prairie Grasslands . The permittee is authorized to conduct activities as specified below in the permitted area described as: SWCA paleontology crew will conduct a pedestrian survey for paleontological resources. This authorization allows for emergency surface paleontological collection when determined by the permittee is needed.

The permittee is authorized to conduct the following activities in the permitted area as described above: **Sections 12, 13, and 14 T153N; R97W located on the McKenzie Ranger District.**

Permit Terms and Conditions

1. This permit expires on December 31, 2019 , unless the Agency extends it in writing before that date.
2. The permittee must notify the Agency not less than 30 days, but not more than 60 days, prior to starting the project and entering on Forest Service lands.
3. All paleontological resources that are collected from National Forest System lands under permit will remain the property of the United States.
4. The collection will be preserved in an approved repository, to be made available for scientific research and public education.
5. Specific locality data will not be released by the permittee or repository unless authorized in accordance with 36 CFR 291.6, or as otherwise agreed to in another agreement.
6. The permittee recognizes that the area within the scope of the permit may be subject to other authorized uses.
7. The permittee must conform to all applicable Federal, State, and local laws.
8. The permittee must assume responsibility for all work conducted under the permit and the actions of all persons conducting this work.
9. The permit cannot be transferred.
10. The permittee cannot modify the permit without the approval of the authorized officer.
11. The permittee must comply with all timelines established in the permit, and must request modification of the permit if those timelines cannot be met.
12. The permittee or other persons named on the permit must be on site at all times when field work is in progress and will have a copy of the signed permit on hand.
13. The permittee will comply with any vehicle or access restrictions, safety or environmental restrictions, or local safety conditions or restrictions.
14. The permittee will report suspected resource damage or theft of paleontological or other resources to the authorized officer in a timely manner after learning of such damage or theft.
15. The permittee will acknowledge the Forest Service in any report, publication, paper, news article, film, television program or other media resulting from work performed under the permit.

16. The permittee will comply with the timeline established in the permit for providing a complete list to the authorized officer of specimens collected and the current location of the specimens[1].

17. The permittee will provide scheduled reports to the authorized officer within the timeline established in the permit[2].

18. The permittee will be responsible for all costs for the proposed activity, including fieldwork, preparation, identification, cataloging, and storage of collections, unless otherwise arranged through a specific agreement.

19. The permittee will comply with the tasks required by the authorized officer, even in the event of permit expiration, suspension, or revocation.

20. Additional stipulations, terms, and conditions as required by the authorized officer and/or the agency may be appended.

21. The permittee must provide the final report by December 31, 2019 to Cale E. Bickerdyke (cale.bickerdyke@usda.gov) and Barb Beasley (barbara.beasley@usda.gov).
22. Permitte will check in at the McKenzie RD Office prior to beginning field work to provide vehicle ID and receive any safety or other info deemed necessary by the District Ranger.
23. Report any Heritage resources according to the district archeologist instructions.
24. Report suspected unauthorized fossil collection immediately to the District Ranger.
25. Images destined for social media taken by the field crew should have the GPS locator turned off or GPS info removed before posting on social media; only if social media posting is allowed by the Georgis Knauss, Principal Field Leader.
26. North Dakota Geological Survey, North Dakota Heritage Museum, Bismarck, North Dakota, is the official repository for paleontological specimens collected during this authorization.

A copy of this permit must be carried in the field whenever field work is in progress and an individual named in line 8 of the *Application for Authorization* is responsible in the field for compliance with all permit terms and conditions.

Georgia Knauss, Paleontology Lead Project Manager, SWCA Environmental Consultants	Nancy Veres, MRD, DPG McKenzie District Ranger
7/26/2019	7-29-19
(Signature of Permittee) (Date)	(Signature of Agency Signing Officer) (Date)

[1] The attached Paleontological Specimen Data Form may facilitate transmittal of required specimen and repository information. Use of this form by the applicant/permit holder is optional.
[2] The attached Paleontological Investigation Report Form may facilitate the applicant/permit holder's transmittal of required documentation pertaining to the authorized paleontological study. Use of this form by the applicant/permit holder is optional.

BURDEN & NON-DISCRIMINATION STATEMENT

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0082. The time required to complete this information collection is estimated to average 1 minute per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative

means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (800) 975-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service.

APPENDIX B

Copy of Department of The Army
Antiquities Act Permit
No. DACW45-3-20-8008

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

REPLY TO
ATTENTION OF
REAL ESTATE DIVISION

FILE: 405-80a, DACW45-3-20-8008, Garrison Project, North Dakota SWCA Environmental Consultants

September 15, 2019

Georgia Knauss
SWCA Environmental Consultants
116 N. 4th Street, Suite 200
Bismarck, ND 58501

Dear Ms. Knauss:

Enclosed is a fully executed copy of Permit No. DACW45-3-20-8008. The permit authorizes SWCA Environmental Consultants to conduct the examination of ruins, the excavation of archeological sites, and the gathering of objects of antiquity on certain lands within the Garrison Project, North Dakota. This area is more specifically described in the enclosed permit.

In accordance with Special Conditions h. and j. of the Permit, it is required that the Garrison Operations Project Manager, Mr. Todd Lindquist, and the Garrison Project Archeologist, Mr. Richard Rogers, be contacted prior to commencement of any fieldwork being conducted. You may contact them in writing at the Garrison Project Office, P.O. Box 527, Riverdale, North Dakota 58565, or call or email them at (701) 654-7702, todd.j.lindquist@usace.army.mil and (701) 654-7744, Richard.r.rogers@usace.army.mil. Please ensure that individuals conducting the field work carry a copy of the permit, a copy of this letter and any subsequent amendments to the permit while working on Garrison Project lands.

If you have any questions, please write to me at the above address or telephone Taryn Kjelstrup of my staff at (701) 654-7709

Sincerely,

ORIGINAL SIGNED

Rick L. Noel
Chief, Civil Branch, Real Estate Division
Real Estate Contracting Officer

Enclosures

Copies Furnished (w/encl):

CENWO-PMA (Barnum)
CENWO-ODT-N (Kruger)
CENWO-REC (Kjelstrup)
CENWO-ODG-A (Rogers)

DEPARTMENT OF THE ARMY

ANTIQUITIES ACT PERMIT

NAME OF PROJECT OR INSTALLATION: North Bakken Expansion Project, Garrison Project, North Dakota

(Please use this number when referring to this permit.)
NO. DACW45-3-20-8008

To conduct monitoring work upon public lands owned or controlled by the Department of the Army under the United States Code Annotated 54 U.S.C.A § 320302, effective December 19, 2014.

1. PERMIT ISSUED TO: SWCA Environmental Consultants

   DATE: September 15, 2019

2. NAME, ADDRESS AND OFFICIAL STATUS OF PERSON:

   a. In general charge: Georgia Knauss
   SWCA Environmental Consultants
   116 N. 4th Street, Suite 200
   Bismarck, ND 58501

   b. In actual charge: Andrew Gerwitz, Daigo Yamamura, Vicki Meyers, Shawna Johnson

3. USER APPLICATION DATE: June 24, 2019

4. AUTHORIZES: Surveys and limited testing of lands described below in No. 5 and shown on the attached map. To excavate, collect, and make extensive collections on specific sites described below in No. 5. Mitigation paleontology, surveys, limited collection/salvage of fossils discovered during construction.

5. ON LANDS DESCRIBED AS FOLLOWS: Those portions of Sections 13, 24, and 36, Township 154 North, Range 97 West, and Sections 18, 19, 30, and 31, Township 154 North, Range 96 West of the 5th Principle Meridian, Williams and McKenzie Counties, North Dakota, situated within the Garrison Project Boundary (shown on Exhibit "A").

6. FOR PERIOD: September 15, 2019 - December 31, 2021

7. MATERIALS COLLECTED UNDER THIS PERMIT WILL BE DEPOSITED FOR PERMANENT PRESERVATION IN THE: Any collection of specimens will follow standard accepted practices for conservation and preservation of vertebrate fossils including use of consolidants, protective barriers and field jackets of plaster/burlap, or casting bandages. All fossil recovered will be transferred to an accredited state or federal repository designated by SWCA Environmental Consultants and approved by the USACE for additional conservation, curation, and indefinite storage. All documentation will be provided to the USACE.

OR IN OTHER ACCREDITED INSTITUTIONS UNDER SUITABLE LOAN AGREEMENTS. A COPY OF CURRENT, VALID CURATION AGREEMENT MUST BE KEPT ON FILE WITH DISTRICT COMMANDER.

8. CONDITIONS

This permit is subject to the provisions of the United States Code Annotated 54 U.S.C.A § 320302, effective December 19, 2014, and the following conditions:

a. Archaeological resources shall be analyzed and recorded in the field. Collection and laboratory analysis of cultural resource material is prohibited, except where as authorized by the Omaha District Commander in consultation with affected parties. In such a case, the permittee will specify in the application when laboratory analysis is anticipated.

b. Collections of archaeological resources, artifacts and other material removed from public lands under the provisions of this permit remain the property of the United States Government and may be recalled at any time for use of the Department of the Army or other agencies of the Federal Government.

c. The following individual(s) are authorized to be in direct charge of field work conducted under this permit:

(1) Andrew Gerwitz, Daigo Yamamura, Vicki Meyers, Shawna Johnson

d. The person(s) in direct charge of field work shall be on-site at all times when work is in progress. Failure to comply with all permit stipulations will result in the removal of a subject's name(s) from the approved list of persons-in-direct charge.

e. During the course of the activities conducted under this permit, the District Commander, or his representative and/or affected tribes shall have access to the study area of this permit, and during or after completion of this work shall have the right to inspect all data that is recovered.

f. The use of any information (not limited to: press releases, videotaping, articles, reports) obtained as a result of this permit must be coordinated with, and approved by, the Omaha District Commander in advance, after consultation with affected parties. This restriction is in effect both during and after this permit expires. Any invitations to the public to participate in activities happening on USACE lands are prohibited.

g. All field notes, records, photographs, and other data related to this permit will be made accessible to the USACE Archaeologist for review.

h. Temporary stakes and/or flagging used to identify sites shall be removed upon completion of the project unless otherwise authorized.

i. Vehicular activity shall be restricted to existing roads and trails unless otherwise authorized by the appropriate land manager(s) and/or affected tribes.

j. Disturbed areas shall be kept to a minimum size consistent with the purpose of the scope of work and/or work plan.

k. Permittee shall take adequate precautions to prevent livestock, wildlife, and the public from injury in any pit or trench.

l. All test holes shall be backfilled.

SPECIAL CONDITIONS

a. This permit shall not be exclusive in character, and there is hereby reserved unto the Government the right to use, lease or permit the use of said land or any part thereof for any purpose.

b. All costs to obtain this permit shall be borne by the permittee.

c. Under no circumstances will Indian grave(s) or burial ground(s) under the jurisdiction of the Omaha District be investigated. In the event that an inadvertent discovery is made, all fieldwork shall cease immediately, the site shall be secured and the remains protected. The notification procedures found in the attached contact list shall be followed immediately.

d. All excavated areas shall be restored by filling in the excavation and otherwise leaving the area in a near to original condition as practicable.

e. The permittee shall conduct all operations in such a manner as to prevent the erosion of the land, pollution of the water resources, and damage to the watershed, and to do all things necessary to prevent or reduce to the fullest extent the scarring of the lands.

f. Any findings of mined or processed precious metals or other treasure trove in the area covered by this permit are the exclusive property of the Government, and shall not be removed from the site without specific written permission from the Department of the Army.

g. Copies of the final report will be submitted to the District Commander.

h. Before undertaking any work on lands administered by the Department of Army, clearances should be obtained from the official in charge of the area. Clearance requirements for any future work shall include a work plan or research design. At a minimum, clearance will require the permittee to notify the local project manager and the appropriate land manager(s) in writing or email of any activity that will be performed, obtain prior approval for any excavation that will be done, and identification of times and dates that personnel will be on-site.

i. Before undertaking any work on Omaha District lands within the exterior boundaries of any Indian reservation, clearance shall be obtained first from the respective tribe, THPO (Tribal Historical Preservation Office)/CPO (Cultural Preservation Office) offices, tribal cultural resource office and then from the Bureau of Indian Affairs official having immediate jurisdiction over the property.

j. The permittee is responsible for notifying all affected parties of any activity that will be performed, obtaining prior approval for any fieldwork that will be performed, and identification of times and dates that personnel will be on-site via email.

k. The permittee is required to have on-site at all times, a copy of their permit and scope of work or work plan.

l. Non-compliance of any conditions of this permit, subject the permittee to prosecution under the United States Code Annotated 54 U.S.C.A § 320302.

Immediately Cease Work & Secure Site
Contact the Corps EOC
(402) 995-2674

Contact Operations Project Manager

Garrison Project Office

Todd Lindquist, (701) 654-7702

Contact Appropriate Archeologist

Garrison Project Office

Richard Rogers
Office: (701) 654-7744
Cell: (701) 301-0018

SWCA Antiquities Act Permit WBI Energy North Bakken
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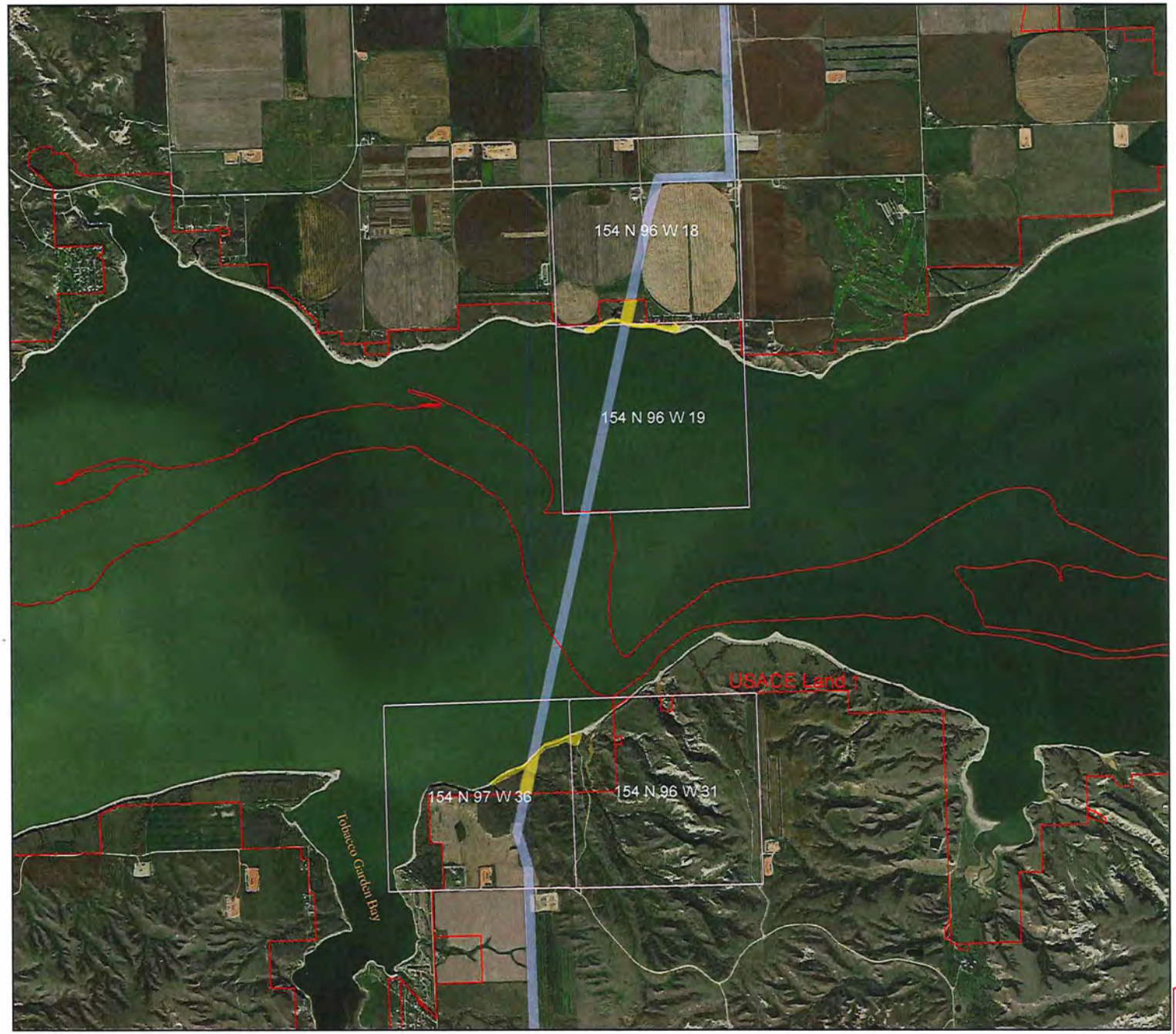

Legend

- USACE Boundary
- Additional Survey Area
- Survey Corridor

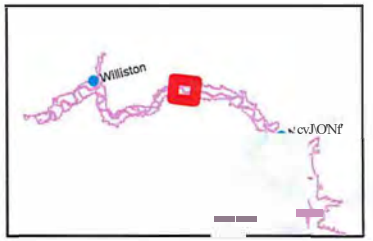

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EXHIBIT "A" MADE A PART OF AND ATTACHED TO LICENSE NO. DACW45-3-20-8008