WBI ENERGY TRANSMISSION, INC.

Valley Expansion Project

FERC Docket No. CP17-   -000

Resource Report No. 7

Soils

FINAL

Volume II – Public

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RESOURCE REPORT NO. 7 – SOILS

SUMMARY OF FILING INFORMATION

Minimum Requirement	Location Addressed
Identify, describe, and group by milepost the soils affected by the proposed pipeline and aboveground facilities. (§ 380.12(I)(1)) • List the soil associations by milepost and describe their characteristics.	Section 7.1.1 and Appendix 7C
For aboveground facilities that would occupy sites over 5 acres, determine the acreage of prime farmland soils that would be affected by construction and operation. (§ 380.12(I)(2)) • List the soil series, describe their characteristics and percentages within the site. • Indicate the onsite percentage of each series that would be permanently affected. Indicate which series are considered "prime or unique farmland".	Sections 7.1.2.1 and 7.2.2 and Appendix 7C
Describe by milepost potential impacts on soils. (§ 380.12(I)(3,4))	Section 7.1, Appendix 7B and Appendix 7C
Identify proposed mitigation to minimize impact on soils and compare with the staff's Upland Erosion Control, Revegetation, and Maintenance Plan. (§380.12(I)(5)) • Identify any measures of the Plan that are deemed unnecessary, technically infeasible, or unsuitable and describe alternative measures that will ensure an equal or greater level of protection.	Sections 7.2 and 7.3

FERC Comments on Draft Resource Report 7 - Soils	**Location Addressed, and/or Response to Comment**
MARCH 15, 2017 COMMENTS	
1. Provide a plan for testing/monitoring of backfill materials removed during triple lift segregation to ensure that poor-quality subsoils are not mixed with or become backfilled to the crop root depth, and indicate who would be responsible for this testing.	Section 7.3.1.1

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Abbreviations and Acronyms

CFR	Code of Federal Regulations
Commission	Federal Energy Regulatory Commission
dS/m	deciSiemens per meter
EC	Electrical Conductivity
EI	Environmental Inspector
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
LUST	leaking underground storage tanks
mS/m	milliSiemens per meter
MP	milepost
NRCS	Natural Resource Conservation Service
Plan	FERC's Current *Upland Erosion Control, Revegetation, and Maintenance Plan*
Procedures	FERC's Current *Wetland and Waterbody Construction and Mitigation Procedures*
Project	Valley Expansion Project
SPCC Plan	Spill Prevention, Control and Countermeasure Plan
SSURGO	U.S. Department of Agriculture Soil Survey Geographic Database
TBS	town border station
TWS	temporary workspace
USDA	U.S. Department of Agriculture
UST	underground storage tanks
Viking	Viking Gas Transmission Company
WBI Energy	WBI Energy Transmission, Inc.
WEG	wind erodibility group

7.0 SOILS

WBI Energy Transmission, Inc. (WBI Energy) owns and operates a natural gas transmission pipeline system and associated aboveground facilities in the states of North Dakota, South Dakota, Montana, and Wyoming. WBI Energy is filing an abbreviated application with the Federal Energy Regulatory Commission (FERC or Commission) pursuant to Section 7(c) of the Natural Gas Act, as amended, and Title 18 Code of Federal Regulations (CFR), Part 157 of the Commission's regulations requesting approval to construct, install, operate, and maintain the proposed facilities described below.

WBI Energy is proposing to construct, install, operate, and maintain the Valley Expansion Project (Project), which will consist of approximately 37.3 miles of 16-inch diameter natural gas pipeline from a proposed interconnect with the existing Viking Gas Transmission Company (Viking) pipeline near Felton, Minnesota (milepost [MP] 0.0) to a new electric-driven compressor station near Mapleton, North Dakota (MP 37.3) that will be tied into WBI Energy's Line Section 24. The pipeline will transport natural gas with bi-directional flow capabilities and will span across the state border from Clay County, Minnesota into Cass County, North Dakota. Associated auxiliary facilities will also be constructed with the Project. In order to provide the volumes of natural gas requested through the open season process, WBI Energy will also replace two existing town border stations (TBS) and construct a regulator station in Barnes, Stutsman, and Burleigh counties, North Dakota, respectively. Construction of each facility will involve a new footprint; therefore, these facilities are evaluated in this environmental report. A complete description of the Project facilities is provided in section 1.1 of Resource Report 1.

Resource Report 7 identifies, describes, lists by milepost, and quantifies by acreage the soils traversed by the Project and activities to manage and mitigate soil impacts during and after construction. Soil characterization information provided is based on review and analysis of the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service's (NRCS) Soil Survey Geographic Database (SSURGO), which was obtained from the NRCS Web Soil Survey (USDA, NRCS, n.d.-a).

7.1 SOIL RESOURCES

Soil characteristics along the pipeline route and at the associated aboveground facility sites were identified and assessed using the SSURGO database (USDA, NRCS, n.d.-a) and by a limited field survey effort. The SSURGO database is a digital version of the original county soil surveys developed by the NRCS for use with geographic information systems. It provides the most detailed level of soils information for natural resource planning and management. SSURGO is linked to an attribute database that gives the proportionate extent of the component soils and their properties for each soil map unit.

SSURGO attribute data consist of physical and chemical soil properties, and interpretive groupings. Some generalized attribute data apply to the whole soil map unit (e.g. prime farmland), whereas more specific data apply to major components (e.g., land capability classification, hydric soil status, or slope class) or layer data for soil horizons (e.g., organic matter, texture or permeability). The soil attribute data can be used in conjunction with spatial data to describe soil characteristics and limitations for use in a particular area.

Soil map units within the Project area were identified from the NRCS soil surveys of Clay County, Minnesota and Cass, Barnes, Stutsman, and Burleigh counties, North Dakota that have been digitized and included in the Web Soil Survey and the SSURGO database (USDA, NRCS, n.d.-a).

Soil series, as established by the NRCS, are soils that are grouped together based on similar soil chemistry and physical properties. One or more dominant soil series compromise a single map unit and represent dominant soil patterns or characteristics that can be mapped on the landscape. Map units can be further differentiated into consociations, complexes, and associations, or undifferentiated groups. In a consociation, delineated areas use a single name from the dominant component in the map unit. Complexes and associations consist of two or more dissimilar components that occur in a regularly repeating pattern. Undifferentiated groups consist of two or more components that are not consistently associated geographically and, therefore, do not always occur together in the same map delineation. These components are included in the same named map unit because their use and management are the same or very similar for common uses. Generally, they are grouped together because some common feature, such as steepness, stoniness, or flooding, determines their use and management (USDA, NRCS, n.d.-b). The Project crosses both consociations and complexes as outlined in table 7.1.1-1.

For purposes of the analyses in this resource report, the dominant soil series within each soil complex was used to infer the overall soil characteristics discussed throughout this report. In all soil surveys, virtually every delineation of a map unit includes areas of soil components or miscellaneous areas that are not identified in the name of the map unit. These areas are called inclusions and are too small to be delineated separately.

Geographically referenced map unit polygons obtained from the NRCS were merged with the digitized Project footprint to provide crossing lengths and acreages of specific soil map units within the project boundary. The SSURGO database was then queried for attribute data pertaining to prime farmland and hydric soils, water and wind erodible soils, compaction prone soils, rutting potential, soils with revegetation concerns, stony/rocky soils, shallow bedrock, corrosion prone soils, topsoil depth, slope class, and soil chemistry (salinity and pH), as described below.

In most cases, SSURGO soil data are of sufficient accuracy to generally evaluate soil properties, characteristics, and use limitations applicable to pipeline construction. However, SSURGO data are based on averages that may not represent values found at specific locations along the pipeline. SSURGO data also do not include soils of minor extent that may be found in anomalous but significant amounts at specific locations along the Project route.

Based on an initial review of SSURGO data, WBI Energy identified that some soils crossed by the Project in the Red River Valley may have salinity (salty), sodicity (excess sodium), and calcium carbonate concentrations in subsoils at levels that could adversely affect crop growth when mixed with soil horizons that lack these features. Salinity is common in the area, and consists of salinity in saline variants of Bearden and Fargo soils and sodicity in Ryan soils. Subsoil salinity is possible throughout the area, depending on the soil setting. Most of the soils in the area have calcium carbonate (commonly called limy) accumulations in the subsoil. Salinity, sodicity, and calcium carbonate are not uniformly distributed within the soils and are typically higher in the subsoil.

In order to better understand soil characteristics along the pipeline, WBI Energy conducted a scoping level soil survey along the pipeline centerline to document topsoil depths and salinity soil characteristics prior to construction. The soil survey evaluated topsoil depths by probing and salinity characteristics using an Electromagnetic Induction Salinity Meter, called an EM-38 meter, which evaluated the relative electrical conductivity, or salinity, of the surface soil and subsoils crossed. In particular, topsoil thickness[1] and apparent soil salinity[2] were determined at 165 and 179 locations, respectively (depending on access and crop status at

[1] "Topsoil" is defined as the dark colored surface soil horizon with the most favorable characteristics favoring plant growth, including high organic matter and nutrient levels, good soil structure. Topsoil is typically considered the A-horizons; however in Red River Valley soils, the dark colored soil can and frequently does extend into the B-horizons. In some situations, dark colored horizons may not be good topsoil because of elevated levels of calcium carbonate or salinity, clay, the presence of restrictive layers due to poor soil structure, including massive soils that limit root penetration.

[2] The EM-38 provides an estimate of "Apparent Soil Conductivity (ECa)" at a shallow and deep depths within the soil depending on the orientation of the magnetic coils. Soil electrical conductivity is affected by several parameters including moisture content, texture, mineralogy, and salt content. In soils of relatively uniform moisture, mineralogy and texture, salinity is by far the most significant contributor to ECa values and is an accurate predictor of salinity presence.

the time of the survey), approximately every 1,000 feet along the Project centerline. Soil salinity has been shown to be accurately estimated in North Dakota using the EM-38 meter (Wollenhaupt et al., 1986). Sample locations were georeferenced using a Global Positioning System navigational system (GPS). Sample cores of the top 18 to 36 inches of soil at each sampling location were obtained utilizing a hand-held soil push probe. The soil cores were collected and contained in the probe and evaluated for depth of topsoil and the presence/absence of calcium carbonate for construction planning purposes (e.g., to evaluate appropriate topsoil stripping depths.)

The soil cores were visually evaluated by Certified Professional Soil Scientists under the supervision of a Professional Soil Classifier licensed to practice in North Dakota. The soil profiles were photographed for data reference. Photographs, soil descriptions, EM-38 readings, sampling locations, and topsoil depths for each soil sample were summarized. Representative samples of the dominant soils were also collected for laboratory analysis to assist with future reclamation efforts. The results of WBI Energy's scoping-level Soil Survey are provided in appendix 7A and are summarized in sections 7.1.3.1 and 7.1.3.3. Results were used to identify locations along the Project route that may require special soil handling procedures that augment standard procedures in the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) (FERC, 2013a) designed to maintain soil productivity in agricultural land. Consistency with the Plan and recommended enhancements are discussed in sections 7.3.1 and 7.3.4.

7.1.1 Existing Soil Resources and Descriptions

A majority of the Project is contained within the Red River Valley of the North, an intensively agricultural region that was formerly the bed of Glacial Lake Agassiz. The area is extremely flat, with relief being approximately 6 inches to the mile in the area of Fargo. Relief is similarly limited to the east; however, the land surface gradually rises eastward to a series of ascending beach ridges representing various levels of Glacial Lake Agassiz. The eastern terminus of the Project is just west of the beach ridge area.

The land surface is young, and was exposed approximately 9,200 years ago when Lake Agassiz drained. The lacustrine sediments in which the soils formed are fine textured, 2:1 expanding clays (smectites) that range from silty clay and clay loams to heavy silt loams. Because the soils have low relief and are fine textured, both surface and groundwater are not removed rapidly. Soils are typically wet unless artificially drained, with the majority of soil crossed by the Project in somewhat poorly drained to very poorly drained drainage classes. Natural surface drainage is very poorly integrated, with meandering streams eventually draining to the Red River of the North. Artificial drainage consisting initially of shallow surface drains leading to a network of county drainage ditches resulted in the region becoming one of the best agricultural areas in the United States. Subsurface tile drainage is becoming extensive in response to wetter conditions during the growing season, affecting planting and tillage operations if such drainage is not used. Most of the soils are considered by the NRCS to be Prime Farmland if drained.

Table 7.1.1-1 summarizes the soil map unit types within the construction footprint for the Project, including the total acreage and relative percentage for each Project facility. A detailed listing of soil map unit types by milepost crossed or in each facility site is provided as appendix 7B. Based on review of this data, approximately 57 percent of the soils crossed by the Project are silty clays, 23 percent are silty clay loams, 10 percent are silt loams, and 8 percent are loams. In addition, all of the soils have relatively little relief and have slopes less than 4 percent.

TABLE 7.1.1-1

Soil Associations in the Project Areas

Project Facility	County, State	Map Unit Symbol	Map Unit Name	Map Unit Type	Acres	Percent of Project Area
Pipeline						
	Clay County, MN	I130A	Hegne-Fargo silty clays, 0 to 1 percent slopes	Complex	4.2	1%
		I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	45.7	9%
		I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	Consociation	6.5	1%
		I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	Consociation	1.9	0%
		I376A	Colvin silty clay loam, 0 to 1 percent slopes	Consociation	43.9	8%
		I377A	Wheatville silt loam, 0 to 2 percent slopes	Consociation	16.5	3%
		I467A	Bearden silt loam, 0 to 2 percent slopes	Consociation	27.9	5%
		I507A	Glyndon loam, 0 to 2 percent slopes	Consociation	30.5	6%
		I5A	Borup loam, 0 to 1 percent slopes	Consociation	5.1	1%
		I627A	Bearden-Fargo complex, 0 to 2 percent slopes	Complex	29.9	6%
		I634A	Augsburg silt loam, 0 to 1 percent slopes	Consociation	6.8	1%
		I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	Consociation	5.4	1%
		I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	Consociation	5.3	1%
	Cass County, ND	I119A	Bearden silty clay loam, 0 to 2 percent slopes	Consociation	3.0	1%
		I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	122.3	23%
		I231A	Dovray silty clay, 0 to 1 percent slopes	Consociation	2.5	0%
		I233A	Fargo silty clay loam, 0 to 1 percent slopes	Consociation	12.7	2%
		I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	Complex	2.2	0%
		I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	Consociation	30.6	6%
		I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	Complex	24.8	5%
		I241A	Fargo-Ryan silty clays, 0 to 1 percents slopes	Complex	4.5	1%
		I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	Consociation	3.2	1%
		I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	Consociation	4.5	1%
		I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	Complex	7.6	1%
		I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	Consociation	12.7	2%
		I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	Complex	7.8	1%
		I475B	Sinai silty clay, levees, 0 to 6 percent slopes	Consociation	8.0	2%
		I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	Complex	0.1	0%
			Pipeline Subtotal		**475.8**	**91%**
Access Roads						
	Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	1.1	0%
		I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	Consociation	0.2	0%
		I376A	Colvin silty clay loam, 0 to 1 percent slopes	Consociation	0.4	0%
		I507A	Glyndon loam, 0 to 2 percent slopes	Consociation	0.3	0%
		I627A	Bearden-Fargo complex, 0 to 2 percent slopes	Complex	0.2	0%
		I634A	Augsburg silt loam, 0 to 1 percent slopes	Consociation	0.6	0%

TABLE 7.1.1-1

Soil Associations in the Project Areas

Project Facility	County, State	Map Unit Symbol	Map Unit Name	Map Unit Type	Acres	Percent of Project Area
	Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	2.9	1%
		I231A	Dovray silty clay, 0 to 1 percent slopes	Consociation	0.2	0%
		I233A	Fargo silty clay loam, 0 to 1 percent slopes	Consociation	0.3	0%
		I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	Consociation	1.5	0%
		I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	Complex	0.3	0%
		I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	Consociation	0.6	0%
		I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	Consociation	0.9	0%
		I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	Consociation	0.2	0%
		I475B	Sinai silty clay, levees, 0 to 6 percent slopes	Consociation	0.7	0%
		I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	Complex	0.4	0%
			Access Road Subtotal		**10.8**	**2%**
Laydown Yards						
	Clay County, MN	I15A	Hecla loamy fine sand, 0 to 2 percent slopes	Consociation	6.5	1%
		I356A	Ulen fine sandy loam, 0 to 2 percent slopes	Consociation	0.5	0%
		I762A	Vallers loam, lake plain, 0 to 1 percent slopes	Consociation	0.7	0%
	Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	7.4	1%
		I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	Complex	2.5	0%
		I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	Complex	3.3	1%
			Laydown Yard Subtotal		**20.7**	**4%**
Aboveground Facilities						
Viking Interconnect	Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	Consociation	0.1	0%
		I5A	Borup loam, 0 to 1 percent slopes	Consociation	4.9	1%
Block Valve 14.4	Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	Consociation	0.4	0%
Mapleton Compressor Station	Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	Consociation	10.4	2%
		I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	Consociation	0.0	0%
Block Valve 24.4	Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	Consociation	0.2	0%
Sanborn Regulator Station	Barnes County, ND	G101A	Hamerly-Wyard loams, 0 to 3 percent slopes	Complex	0.6	0%
		G118A	Vallers loam, saline, 0 to 1 percent slopes	Consociation	0.5	0%
Jamestown TBS	Stutsman County, ND	G101A	Hamerly-Wyard loams, 0 to 3 percent slopes	Complex	0.4	0%
Apple Valley TBS	Burleigh County, ND	C210B	Williams-Bowbells loams, 3 to 6 percent slopes	Complex	0.7	0%
		C740A	Temvik silt loam, 0 to 3 percent slopes	Consociation	0.1	0%
			Aboveground Facility Subtotal		**18.3**	**3%**
			Project Total		**525.6**	**100%**

Note: Sum of addends may not equal total due to rounding.

Source: USDA, NRCS, n.d.-a. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed December 2016.

7.1.2 Standard Soil Limitations

The following subsections discuss the existing soil classifications and potential limitations based on review of the SSURGO data, which specifies soil characteristics related to designations as prime farmland and farmland of statewide importance; and for hydric, water and wind erodibility, compaction prone, revegetation concerns, stony-rocky soils, shallow bedrock, and corrosion prone characteristics. Topsoil depth, slope class, soil salinity, soil pH, and contaminated soils are further discussed in section 7.1.3. Soils within the Project construction footprint may have more than one limitation associated within a given map unit. The existing soil limitations identified for the pipeline, access roads, laydown yards, and aboveground facilities are summarized in table 7.1.2-1, and a detailed listing of selected physical, chemical, and interpretative characteristics is provided in appendix 7C.

7.1.2.1 Prime Farmland and Farmland of Statewide Importance

Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding (USDA, NRCS, n.d.-b).

Farmland of statewide importance is land other than prime or unique farmland that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops. The appropriate state or local government determines statewide important farmland with concurrence from the state conservationist. Generally, these farmlands produce high yields of crops when treated and managed according to acceptable farming methods. In some states or localities, farmlands of statewide importance may include tracts of land that have been designated for agriculture by state law or local ordinance.

Prime farmland designation is a direct attribute in SSURGO and based on a query of the SSURGO database, a total of 458.5 acres (87.3 percent of total Project footprint) of the soils crossed by the pipeline construction footprint are classified as prime farmland. Access roads, laydown yards, and aboveground facilities will impact an additional 40.6 acres (7.7 percent of total Project footprint) of prime farmland soils. None of the soils crossed by the pipeline construction footprint or access roads are classified as farmland of statewide importance; however, the laydown yards and aboveground facilities will impact 1.2 acres (less than 1 percent) of farmland of statewide importance soils.

7.1.2.2 Hydric Soils

A hydric soil is a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils along with hydrophytic vegetation and wetland hydrology are used to define wetlands (USDA, NRCS, n.d.-b).

Hydric soil designation is a direct attribute in SSURGO and based on a query of the SSURGO database, a total of 342.7 acres (65.2 percent of total Project footprint) of the soils crossed by the pipeline construction footprint are classified as hydric. Access roads, laydown yards, and aboveground facilities will impact an additional 37.8 acres (7.2 percent of total Project footprint) of hydric soils.

TABLE 7.1.2-1

Summary of Soil Characteristics in the Project Areas [a]

Project Area	Total Acres	Prime Farmland [b]	Farmland of Statewide Importance [c]	Hydric [d]	Water Erodible [e]	Wind Erodible [f]	Compaction Prone [g]	Rutting Hazard [h]	Revegetation Concerns [i]	Stony-Rocky [j]	Shallow Bedrock [k]	Corrosion Prone [l]
Pipeline	475.8	458.5	0.0	342.7	0.0	0.0	427.1	466.3	57.6	0.0	0.0	473.4
Access Roads	10.8	10.1	0.0	7.6	0.0	0.0	8.7	4.1	2.0	0.0	0.0	10.5
Laydown Yard	20.7	13.8	0.5	13.8	6.5	6.5	13.1	14.9	6.9	0.0	0.0	14.3
Aboveground Facilities	18.2	16.7	0.7	16.4	0.0	0.0	11.0	16.7	0.8	0.0	0.0	17.5
Total	**525.5**	**499.1**	**1.2**	**380.5**	**6.5**	**6.5**	**459.9**	**502.0**	**67.4**	**0.0**	**0.0**	**515.6**

[a] Soil map units analyzed have multiple characteristics. As a result, the sum of the rows will not equal the total acreages presented in this table.

[b] Includes soils classified in the U.S. Department of Agriculture Soil Survey Geographic Database (SSURGO) database as prime farmland, or prime farmland if a limiting factor is mitigated

[c] Includes soils classified in the SSURGO database as farmland of statewide importance

[d] Includes soils that are classified in the SSURGO database as hydric

[e] Includes soils with a non-irrigated land capability classification of 4e through 8e or a slope class of >8-15 percent or greater

[f] Includes soils in wind erodibility groups 1 and 2

[g] Includes soils that have a clay loam or finer surface texture and somewhat poor, poor, or very poor drainage class

[h] Soil with a severe rutting hazard are in low strength Unified Engineering soil classification (CL, CH, CL-ML, ML, MH, OL, OH, or PT), poorly drained or very poorly drained drainage classes and in low relief slope classes (e.g. 0-5%). Hazard rating of 3 (severe) through 1 (slight) were determined for each category and summed. Maximum severity – 6, with a severe rating being between 5 and 6, inclusive.

[i] Includes soils with a land capability classification of 4 or greater

[j] Includes soils with a cobbly, stony, bouldery, shaly, channery, very gravelly, or extremely gravelly modifier to the textural class of the surface layer and/or that have a surface layer that contains greater than 5 percent by weight rock fragments larger than 3 inches

[k] Includes soils that have lithic or paralithic bedrock within 60 inches of the soil surface

[l] Includes soils classified in the SSURGO database as “high” for the risk of corrosion for uncoated steel.

Source: U.S. Department of Agriculture, Natural Resource Conservation Service. n.d.-a. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed December 2016.

7.1.2.3 Erosion Hazards

Soil erosion is the removal of material from the surface soils, which is the part of the soil having an abundance of nutrients and organic matter vital to plant growth. The most common forces causing soil erosion are water (e.g., rainfall, runoff) and wind. Water and wind erosion can be very slow and even hard to detect, or it can be rapid and very apparent. Left without protection such as vegetation or temporary mulch, soil surfaces can be exposed to the full force of wind and water and can be eroded in a short time (Muckel, 2004). Additional details about the soils crossed can be found in appendix 7C.

Water Erodibility

Map units with a land capability subclass designation of 4e through 8e, which are considered to have severe to extreme erosion limitations for agricultural use and/or an average slope greater than 8 percent, are considered susceptible to water erosion.

None of the soils crossed by the pipeline construction footprint, access roads, or aboveground facilities are classified as highly water erodible. Laydown yards will impact 6.5 acres (1.2 percent of total Project footprint) of water erodible soils.

Wind Erodibility

A wind erodibility group (WEG) is a grouping of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to blowing. Soils are placed into wind erodibility groups ranging from 1 to 8 on the basis of the properties of the soil surface layer, which correlate to an estimate of potential soil loss ranging from 310 to 38 tons per acre per year, respectively. Wind erodible soils were identified by querying the SSURGO database for soils that have a WEG rating of 1 or 2, or which are highly wind erodible.

None of the soils crossed by the pipeline construction footprint, access roads or aboveground facilities are classified as highly wind erodible. Laydown yards will impact 6.5 acres (1.2 percent of total Project footprint) of wind erodible soils.

7.1.2.4 Compaction Potential and Rutting Hazard

Compaction occurs when moist or wet soil particles are pressed together and the pore spaces between them are reduced. Adequate pore space is essential for the movement of water, air, and soil fauna through the soil. Restricted infiltration results in excessive runoff, erosion, nutrient loss, and potential water-quality problems. Compaction restricts penetration by plant roots and thus inhibits plant growth. Also, it can significantly reduce the rate of rainwater infiltration in urban areas, thus increasing the volume of storm water runoff (Muckel, 2004).

Compaction-prone soils were identified by querying the SSURGO database for component soil series that have: 1) a surface texture of sandy clay loam or finer; and 2) a drainage class of somewhat poorly, poorly, or very poorly drained. A total of 427.1 acres (81.3 percent of total Project footprint) of the soils crossed by the pipeline construction footprint are classified as compaction prone. Access roads, laydown yards, and aboveground facilities will impact an additional 32.8 acres (6.2 percent of total Project footprint) of compaction prone soils.

Rutting is the plastic or fluid deformation of soils when loads, such as that from construction equipment, are applied to wet to moist, finer grained soils (i.e., soils containing high amounts of silts or clays) having a high water holding capacity. Hydric soils, organic soils, and poorly drained non-hydric soils may also be susceptible to rutting. These disturbances typically alter surface hydrology by diverting/holding stormwater runoff, minimizing surface water infiltration, and restricting root growth (USDA NRCS, 1998).

The chief characteristics and conditions considered in the rutting potential ratings are depth to a water table, rock fragments on or below the surface, the Unified classification of the soil, depth to a restrictive layer, and slope. Based on these criteria, ratings were extrapolated for use in this report and include the following:

- Severe: a severe rating indicates that ruts form readily and that equipment use is severely restricted either by the type of equipment or season of use;
- Moderate: a moderate rating indicates that rutting is likely and that equipment use is moderately restricted because of one or more soil factors; and
- Slight: a slight rating indicates that the soil is subject to little or no rutting and that equipment use normally is not restricted either by type of equipment that can be used or time of year because of soil factors.

Because the majority of soils along the pipeline route (466.3 acres or 89.5 percent of total Project footprint) are low strength and fine textured with a high available water holding capacity, have low relief (slope), and are poorly drained, the soils are susceptible to rutting. Access roads, laydown yards, and aboveground facilities will impact an additional 35.7 acres (6.7 percent of total Project footprint) of soils prone to rutting. Rutting may be moderated somewhat in areas that are artificially tile drained and/or during extremely dry periods where the surface soil horizons are dry. Rutting on unprotected soil will be especially problematic when constructing during spring or during wet periods when the soil is moist and unfrozen.

7.1.2.5 Revegetation Concerns

Successful restoration and revegetation is important for maintaining agricultural productivity and to protect the underlying soil from potential damage, such as erosion. Droughty soils which have a coarse surface texture and are somewhat excessively or excessively drained could prove difficult to revegetate. Drier soils have less water to aid in the germination and eventual establishment of new vegetation. Coarse-textured soils also have a lower water holding capacity following precipitation, which can result in moisture deficiencies in the root zone creating unfavorable conditions for many plants. Additionally, steep slopes and highly acidic or highly alkaline soils could make the establishment of vegetation difficult. A discussion of soil pH is included in section 7.1.3.4.

Some saline soil that have salinity >4 deciSiemens per meter in the soil surface will require salt-tolerant plant species during restoration; however, since surface salinity is a preconstruction characteristic of the affected topsoil, pipeline construction is not anticipated to have an effect on these soils.

Soils with revegetation concerns were identified by querying the SSURGO database for component soil series that have: 1) a surface texture of sandy loam or coarser and are moderately well to excessively drained; and/or 2) have an average slope greater than 8 percent. A total of 57.6 acres (11.0 percent of total Project footprint) of the soils crossed by the pipeline construction footprint are classified as having revegetation concerns. Access roads, laydown yards, and aboveground facilities will impact an additional 9.7 acres (1.9 percent of total Project footprint) of soils with revegetation concerns.

7.1.2.6 Rocky and Shallow-to-Bedrock Soils

Introducing rocks to the surface soil horizon could reduce soil moisture-holding capacity, resulting in a reduction of soil productivity. Additionally, some agricultural equipment could be damaged by contact with large rocks. Rocks at the surface and in the surface soil horizon could be encountered during grading, trenching, and backfilling. Additionally, construction through soils with shallow bedrock could result in the incorporation of bedrock fragments into surface soils.

Soils containing significant quantities of rock were identified by querying the SSURGO database for component soil series with one or more soil horizons that: 1) have a cobbly, stony, bouldery, channery, flaggy, very gravelly, or extremely gravelly modifier to the textural class; and/or 2) contain greater than 5 percent (by weight) of rocks larger than 3 inches. None of the soils crossed by the pipeline construction footprint, access roads, laydown yards, or aboveground facilities are classified as rocky.

Shallow-to-bedrock soils were identified by querying the SSURGO database for component soil series that have a bedrock contact within 60 inches of the soil surface. The analysis also identified whether the near surface bedrock is lithic (unweathered) and could require blasting to excavate, or is paralithic (weathered) and could likely be ripped and dug without blasting. Based on SSURGO data, none of the soils crossed by the pipeline construction footprint, access roads, laydown yards, or aboveground facilities are classified as having shallow bedrock. As stated in section 6.1.5 of Resource Report 6, there is potential for shallow bedrock near the Apple Valley TBS; however, this information was not reflected in NRCS soils data.

7.1.2.7 Corrosion Potential

Corrosion potential is based on the corrosion of steel rating class. Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, pH, and electrical conductivity of the soil. The risk of corrosion for uncoated steel, expressed as low, moderate, or high, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract. Corrosion potential for each soil association within the Project area is summarized in appendix 7C. A total of 473.4 acres (90.1 percent of total Project footprint) of the soils crossed by the pipeline construction footprint are classified as prone to corrosion. Access roads, laydown yards, and aboveground facilities will impact an additional 42.3 acres (8.0 percent of total Project footprint) of corrosion prone soils.

7.1.3 Other Soil Limitations

In addition to the limitations discussed above and identified in table 7.1.2-1, additional limitations related to topsoil depth, slope class, soil salinity, soil pH, and contaminated soils were analyzed as described below.

7.1.3.1 Topsoil Depth

Topsoil depths along the pipeline route were quantified using SSURGO data by examining the organic matter content of the surface horizons. Near-surface soils considered “A-Horizons” or underlying subsoil with 2 percent or more organic matter were considered topsoil. Topsoil thicknesses were then assigned to one of four classes: 0 to 6 inches, greater than 6 to 12 inches, greater than 12 to 18 inches, and greater than 18 inches. Based on NRCS SSURGO data, the majority of topsoil (84.1 percent) along the Project route is between 12 and 18 inches in thickness, with 2 percent and 12 percent between 0 to 6 and 6 to 12 inches in thickness, respectively. Less than 2 percent of the soils will have topsoil greater than 18 inches in thickness based on SSURGO data.

These data were generally confirmed by WBI Energy’s Scoping Soil Survey results; however, topsoil depth, as determined in the field, was shallower than predicted by the SSURGO data. Of 165 sample locations examined, 21 samples (13 percent), 92 samples (56 percent), 37 samples (22 percent), and 15 samples (9 percent) had topsoil in the 0-6, 6-12, 12-18, and >18 inch classes, respectively. A summary of topsoil depths identified by the SSURGO data and field surveys is provided in table 7.1.3-1. The differences between the

SSURGO and the field topsoil data could be an artifact of inherent inaccuracies in the parent SSURGO data, the limited field observations (i.e., samples approximately every 1,000 feet), or simply reflect the natural variations that are known exist throughout the Red River Valley.

More soils observed during WBI Energy's soil survey were placed by field examination into in the 0-6 and 6-12 inch categories based on a large number of disturbed soils that were sampled and the fact that soil specialists placed several of the Fargo soils that are listed in the SSURGO database as having an average of 13 inches of topsoil as having only between 7 and 12 inches of topsoil. However, a substantial portion (30 percent) of the soils crossed were documented to be greater than 12 inches thick and, considering the SSURGO data, it is possible that the amount is much greater than was observed by the field survey.

TABLE 7.1.3-1

Summary of SSURGO-determined Topsoil Depths and Slope Classes within the Project Area (in acres)

		Topsoil Depth (inches) [a]				Slope Class (percent) [b]	
Project Component	Total Acres	0-6 inches	>6-12 inches	>12-18 inches	>18 inches	0-5	>5
Pipeline	475.8	4.9	57.0	416.5	9.2	475.8	0.0
Access Roads	10.8	1.0	1.1	2.0	0.0	10.8	0.0
Laydown yards	20.7	0.0	4.8	11.5	9.0	20.7	0.0
Aboveground Facilities	18.2	0.9	6.4	10.7	0.0	18.2	0.0
Total	**525.5**	**6.7**	**68.8**	**440.4**	**18.2**	**525.5**	**0.0**

[a] Topsoil depths were calculated as the thickness of all A-horizons and B-horizons that have >2% Organic Matter as outlined in the U.S. Department of Agriculture Soil Survey Geographic Database (SSURGO) databases.

[b] Slope classes were assigned using the representative slope value of the dominant soil within each map unit as outlined in the SSURGO databases.

Note: Sum of addends may not equal total due to rounding.

Source: U.S. Department of Agriculture, Natural Resource Conservation Service. n.d.-a. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed December 2016.

7.1.3.2 Slope Class

The slope gradient of a soil influences several characteristics such as the ability of a soil to retain water and the potential for accelerated erosion or subsidence (USDA, NRCS, 2016). The slope gradient of a soil is used to assess soils with high water erosion potential and is a factor used to identify soils that may have revegetation concerns. Due to the importance of slope in assessing erosion hazards and revegetation potential, a query was developed to evaluate the slope of soils along the right-of-way. The query reduced the large number of slope classes used by the NRCS by averaging slopes for component soils and placing them into more useable groupings: 0 to 5 percent, greater than 5 to 8 percent, greater than 8 to 15 percent, greater than 15 to 30 percent, and greater than 30 percent slopes. For example, a component soil with 6 to 12 percent slopes has an average slope of 9 percent and will be placed in the greater than 8 to 15 percent slope category.

Steep slopes are lacking along the proposed WBI Energy pipeline route, access roads, laydown yards, and aboveground facilities, and are not anticipated to be a soil limitation for the Project.

7.1.3.3 Soil Salinity

Because of low gradients in the Red River Valley, removal of surface runoff and drain tile discharge through area surface ditches is slow, frequently resulting in persistent ponding of water that acts to maintain elevated watertables in areas adjacent to the ditch. If the water is saline, evapotranspiration in the crop rooting zone can affect crop yields. Research on salinity in the Red River Valley has associated accumulations of soil salinity sufficient to reduce crop yields with these artificially elevated water tables near roadside drainage ditches (Skarie et al., 1986). This "secondary" or man-caused salinization is not generally recognized in the SSURGO soil map unit, but may significantly reduce restoration success near the pipeline trench if saline subsoils are brought to near the surface during backfilling of the trench. Complicating the estimation of soil salinity is the presence of saline soils as minor inclusions within soil map units that typically occur as saline areas of only a few hundred feet in crossing length.

Surface and subsurface salinity is difficult for growers to remediate without subsurface tile drainage. Because salinity at the soil surface includes the A-horizons, pipeline construction that segregates and replaces topsoil to the area from which it was removed generally will not affect post-construction crop yields. However, where salinity is associated with the lower subsoils, the mixing of saline and non-saline subsoil layers may result in reduced crop yields if the salinity is brought closer to the surface by mixing these layers during excavation and backfill. Areas within the Project footprint that have saline soil will frequently have saline groundwater sufficiently close to the soil surface that the water will discharge and pond within the pipeline trench.

As described in section 7.1, WBI Energy evaluated the distribution of potential soil salinity along the pipeline centerline by using an EM-38 meter, and the results indicate that salinity is variable both along the centerline and by depth in the subsoils. Table 7.1.3-2 summarizes the locations where subsoil salinity may be encountered. Areas with high potential subsoil salinity were observed at 30 of 179 locations (17 percent) and generally include areas of both salinity adjacent to surface drainage and roadside ditches, as well as sporadic inclusions of natural saline subsoils. Of those 30 locations, 16 have salinity ratios greater than 2 (subsurface to surface conductivity), indicating saline subsoils are probable, and the remaining 14 have ratios less than 2, indicating saline subsoils are possible. These areas are depicted as environmental sensitive areas on the environmental bar of the alignment sheets provided as appendix 1B of Resource Report 1.

TABLE 7.1.3-2

Summary of Locations where Subsoil Salinity May Exist

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
Deep Salinity Probable									
013_VEP	2.46	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	86.42	346.26	4.01	Probable
019_VEP	3.60	I377A	Wheatville silt loam, 0 to 2 percent slopes	9.0	>6-12	96.15	226.81	2.36	Probable
020_VEP	3.79	I377A	Wheatville silt loam, 0 to 2 percent slopes	12.0	>6-12	104.08	420.29	4.04	Probable
023_VEP	4.36	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	94.00	215.68	2.29	Probable
028_VEP	5.30	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.0	>6-12	115.91	292.16	2.52	Probable
034_VEP	6.44	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.0	>6-12	114.62	456.50	3.98	Probable
035_VEP	6.63	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.0	>6-12	95.13	203.29	2.14	Probable
052_VEP	9.85	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	7.5	>6-12	94.74	335.01	3.54	Probable
071_VEP	13.45	I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	16.0	>12-18	145.17	329.31	2.27	Probable
082_VEP	15.53	I229A	Fargo silty clay, 0 to 1 percent slopes	18.0	>12-18	100.22	274.27	2.74	Probable
085_VEP	16.10	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	196.82	418.29	2.13	Probable
087_VEP	16.48	I229A	Fargo silty clay, 0 to 1 percent slopes	14.0	>12-18	102.92	264.78	2.57	Probable
088_VEP	16.67	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	24.0	>18	103.70	434.82	4.19	Probable
096_VEP	18.33	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	119.36	272.43	2.28	Probable
119_VEP	22.61	I229A	Fargo silty clay, 0 to 1 percent slopes	24.0	>18	125.07	266.95	2.13	Probable
108_VEP	20.60	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	106.48	247.65	2.33	Probable
Deep Salinity Possible									
021_VEP	3.98	I377A	Wheatville silt loam, 0 to 2 percent slopes	8.0	>6-12	219.55	390.05	1.78	Possible
032_VEP	6.06	I467A	Bearden silt loam, 0 to 2 percent slopes	10.0	>6-12	201.77	379.43	1.88	Possible
045_VEP	8.52	I467A	Bearden silt loam, 0 to 2 percent slopes	7.0	>6-12	206.81	318.57	1.54	Possible
047_VEP	8.90	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	8.0	>6-12	104.16	200.48	1.92	Possible
058_VEP	10.98	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	11.0	>6-12	156.27	242.63	1.55	Possible
064_VEP	12.12	I376A	Colvin silty clay loam, 0 to 1 percent slopes	12.0	>6-12	125.45	232.59	1.85	Possible
065_VEP	12.31	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	20.0	>18	128.02	245.60	1.92	Possible
067_VEP	12.69	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	2.0	0-6	207.01	372.94	1.80	Possible
070_VEP	13.26	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	16.0	>12-18	155.72	236.69	1.52	Possible
084_VEP	15.91	I229A	Fargo silty clay, 0 to 1 percent slopes	23.0	>18	144.13	239.62	1.66	Possible
095_VEP	18.14	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	152.64	288.65	1.89	Possible

TABLE 7.1.3-2

Summary of Locations where Subsoil Salinity May Exist

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
102_VEP	19.47	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	132.38	229.88	1.74	Possible
104_VEP	19.84	I229A	Fargo silty clay, 0 to 1 percent slopes	13.0	>12-18	120.97	224.96	1.86	Possible
107_VEP	20.41	I229A	Fargo silty clay, 0 to 1 percent slopes	NS	NS	127.57	200.62	1.57	Possible

[a] Samples ID and data provided by Duraroot (Duraroot Environmental Consulting, 4626 WCR 65 Keenesburg Colorado 80643) at approximate 1,000-foot intervals along the pipeline centerline.

[b] Mileposts were determined using spatial queries of the Project GIS in ArcMap Ver 10.4.1

[c] Map Unit Symbols and names from the SSURGO database at the locations sampled.

[d] Topsoil depth as determined in cores collected in the field by Duraroot soil scientists.

[e] Apparent soil conductivity readings for the shallow soil (< 0.5 meter) as determined by the EM38 in the vertical reading position.

[f] Apparent soil conductivity readings for the deep soil (1.5 meters) as determined by the EM38 in the horizontal reading position.

[g] Ratio of deep to shallow apparent conductivity.

[h] For the purposes of evaluating potential salinity, saline subsoil under less saline subsoil requiring triple lift is probable when the ratio is > 2.0 and is possible when the ratio is > 1.5 and < 2.0, and the deep reading is > 200 mS/m.

mS/m = milliSiemens per meter

7.1.3.4 Soil pH

Soil pH is the numerical designation of acidity or alkalinity in soil. Soil pH is measured on a scale of 0.0 to 10.0 with a pH 7.0 described as neutral in reaction because it is neither acidic nor alkaline (see table 7.1.3-3). Soils with a pH of 3.5 or less are considered ultra-acidic and soils with a pH of 9.1 or higher are considered very strongly alkaline. Soil pH is an important factor to consider when selecting crops and other plants, evaluating soil amendments for fertility and stabilization and determining the risk of corrosion. In general, soils that are either highly alkaline or highly acid are likely to be very corrosive to steel. Soils within the Project area are neutral to slightly alkaline and range from pH 6.3 to over 8.0, with most pH values between 7.0 and 8.0 as detailed in table 7.1.3-3 and in appendix 7C. Based on this information, soil pH is not anticipated to be a significant consideration for construction or reclamation.

TABLE 7.1.3-3

Soil pH Ranges and Reaction Classes

Reaction Class	Range in pH
Ultra-acid	1.8-3.4
Extremely acid	3.5-4.4
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Moderately acid	5.6-6.0
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Slightly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	9.1-11.0

7.1.3.5 Contaminated Soils

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination typically are minor, because of the low frequency and volumes of equipment spills and leaks. Soil contamination could also occur if hazardous waste is encountered during construction. This could involve septic systems from prior residences, underground storage tanks, buried trash, unidentified oil or gas lines, etc.

According to Minnesota Pollution Control Agency’s (MPCA) *What’s In My Neighborhood* website, the Project will not cross any hazardous waste sites or brownfields (MPCA, 2016). A review of the North Dakota Department of Health, Waste Management website identified two underground storage tanks (USTs) and one reported leaking UST (LUST) within 0.25 mile of the Project (NDDH, 2016). A review of the Environmental Protection Agency’s (EPA) listing of contaminated sites identified two regulated sites within 0.25 mile of the Minnkota Laydown Yard in Harwood, North Dakota and one regulated site near MP 11.2 along the pipeline route near the town of Felton in Clay County, Minnesota. As discussed in section 2.1.5 in Resource Report 2, the regulated sites identified within 0.25 mile of the Project are not, by definition, contaminated sites.

The USTs, LUSTs, and EPA-listed contaminated sites identified within 0.25 mile of the Project are not located within the area that will be disturbed by construction of the Project. For this reason, direct or indirect impacts on these features are not anticipated as a result of construction or operation of the Project. Additional discussion of potential contamination sources can be found in section 2.1.5 of Resource Report 2 and section 8.5.3 of Resource Report 8.

7.2 GENERAL CONSTRUCTION AND OPERATIONAL IMPACTS

Typical soil impacts that may occur during construction include mixing of layers within the soil profile, compaction, rutting, erosion, and alteration of drainage characteristics. Impacts on soil resources will depend on several factors including: the types of soil present, topsoil stripping and segregation from subsoils, and implementation of the restoration procedures, soil compaction mitigation, and revegetation guidelines referenced in the Plan.

7.2.1 Pipeline Construction and Operation Impacts

Construction activities such as clearing, grading, trench excavation, backfilling, heavy equipment traffic, and restoration along the construction right-of-way have the potential to adversely affect natural soil characteristics (i.e., infiltration, water storage and routing, and nutrient levels), thus reducing soil productivity. Clearing of vegetative cover exposes soil to the effects of wind, sun, and precipitation, which potentially increases soil erosion and the transport of sediment to sensitive resource areas.

During construction, temporary compaction of soils can occur by grading and heavy equipment traffic over the soil surface. Compaction reduces porosity and percolation rates, which can increase runoff potential. Additionally, grading has the potential to mix topsoil with subsoil, potentially resulting in long-term reduction of agricultural productivity. Trench excavation and backfilling also have the potential to cause the mixing of topsoil and subsoil, and to bring rock and/or gravel into the soil surface (where present in the subsoil). These potential impacts can result in an increase in operating and labor costs, decreased agricultural productivity, and potential damage to agricultural field equipment.

Areas of active cropland are present within the Project area and will be affected by Project construction. Potential impacts on cropland may include the following:

- Mixing of topsoil with subsoil, resulting in loss of fertility and productivity
- Rutting and compaction caused by movement of construction equipment
- Interfering with or damaging agricultural drainage or irrigation systems
- Introducing noxious weeds from construction equipment

7.2.2 Aboveground Facility Construction and Operation Impacts

Project construction and operation of the aboveground facilities will result in temporary and permanent impacts on soils. As indicated in section 7.1.1, construction of the Mapleton Compressor Station and Viking Interconnect will temporarily impact 15.4 acres of soils and permanently impact 6.6 acres (see appendix 7C). Construction activities at these sites may result in the loss of soil due to water or wind erosion; however, soils mapped at the proposed sites are not particularly susceptible to erosion when properly vegetated or stabilized.

Operation of the Mapleton Compressor Station will result in the permanent conversion of approximately 6.0 acres of prime farmland soil to commercial/industrial uses. Operation of the Viking Interconnect will result in the permanent conversion of approximately 0.7 acre of prime farmland soil to commercial/industrial uses.

Construction and operation of the two mainline valve settings will permanently convert a total of 0.6 acre of soils (0.25 acre at Block Valve 24.4 and 0.35 acre at Block Valve 14.4), which will be unavailable for other uses. The soils at the Block Valve 14.4 are considered prime farmland.

7.2.3 Access Road Construction/Operation Impacts

Use of the temporary access roads and travel lanes described in section 1.4.1 of Resource Report 1 will affect approximately 10.8 acres. WBI Energy will construct six new permanent roads or approaches off existing roads to provide access to the Mapleton Compressor Station, Viking Interconnect, Apple Valley TBS, Sanborn Regulator Station, and two mainline block valves. Construction and use of the permanent access roads to these facilities will affect a total of 0.6 acre. The soils crossed by the permanent access roads are identified in appendix 7C as part of the impacts associated with the aboveground facilities.

7.3 SPECIFIC SOIL IMPACTS AND MITIGATION MEASURES

Mitigation measures to protect soil resources will be implemented during and after construction. WBI Energy is proposing to use a 100-foot-wide temporary working space (TWS) corridor for conventional construction procedures in upland areas along the pipeline. WBI Energy anticipates needing workspace greater than the standard 75-foot width outlined in the Plan to accommodate topsoil stripping, specialized soil handling, and drain tile mitigation in agricultural lands. Refer to section 7.3.1 for additional details on specialized construction requirements related to special soil handling and agricultural land considerations.

In general, WBI Energy will implement measures in the Plan to avoid, minimize, or mitigate potential effects of pipeline construction on soils. The Plan specifies best management practices that will be used to protect soil productivity and water quality by controlling soil erosion and the loss of topsoil and surface organic matter. This includes stripping topsoil and keeping it segregated from subsoil for use in restoration of the TWS. No topsoil segregation will occur in areas used for additional TWS outside of agricultural areas, unless requested by the land management agency or landowner. Further, WBI Energy will decompact soils, as necessary, upon conclusion of construction to ensure vegetation can be re-established and to protect agricultural productivity.

The Plan outlines the measures WBI Energy will implement to revegetate portions of the right-of-way that are not actively cultivated to a condition that supports the preconstruction land use. A description of specific mitigation measures that will be implemented to address specific soil limitations are provided in the following subsections. WBI Energy is proposing modifications to the Plan to further minimize impacts to agricultural land and the justification for such modifications are provided in section 7.3.4.

7.3.1 Agricultural Land

Construction in agricultural areas will disrupt ongoing agricultural activities and eliminate use of the land for the duration of construction. Agricultural land and pasture areas will be unavailable within the construction footprint during construction; however, following construction, agricultural activities will be allowed to resume without restrictions. Potential impacts on agricultural soils will be minimized and mitigated in accordance with the Plan and the special construction procedures described in section 1.5.4.6 of Resource Report 1. These include measures to conserve and segregate topsoil, alleviate soil compaction, protect existing drainage tile and irrigation systems, prevent the introduction of weeds, retain existing soil productivity, and replace fencing that is damaged.

7.3.1.1 Topsoil Stripping, Salinity, and Special Soil Handling

Topsoil mixing with subsoil during construction, backfill, and restoration can affect soil productivity because the mixed topsoil and subsoil can result in lower soil nutrient value, organic matter, and unfavorable soil structure and moisture characteristics. In most locations along the Project route, stripping and preserving topsoil separately from the underlying subsoil layers and mixing underlying subsoil layers during excavation and backfill will not have an adverse effect on post-construction soil productivity because the subsoil layers do not differ substantially in soil quality.

In areas where good quality subsoil overlies poor quality subsoil, soil lift management during topsoil stripping and trench excavation may be necessary to ensure that subsoil soil layers with poor plant growth characteristics (elevated levels of salinity/sodicity/calcium carbonate) are not mixed with subsoil layers that have better plant growth characteristics. In particular, there is a possibility that subsoil salinity may require three lift, or "triple lift" segregation, i.e., segregating topsoil (0-12 inches or to bottom of A-horizon if required by landowner), non-saline subsoil (Bt or Bw soil horizons), and saline parent material (Bkz, or Bz horizons) into separate piles during trenching (see figure 7.3.1-1). Not doing this in locations where poor quality subsoil exists could result in bringing subsoil salts to the surface, where they could affect crop growth. If poor subsoils are brought nearer to the surface within the rooting zone, plant germination and growth could also be adversely affected and crops could become chloritic (yellowed). These symptoms will be evident as persistent linear features associated with the pipeline construction footprint. This effect could be long lasting, and obvious.

In highly productive soils with thick topsoil and variable quality subsoils, it is important to identify the correct depth of topsoil to strip to: (1) avoid diluting productive remaining topsoil with subsoil; (2) identify areas where mixing subsoil layers during the excavation and backfill process could bring poor quality soil closer to the surface and affect post construction soil productivity; and (3) identify areas of potentially poor quality trench water that can salinize land if applied to cropland during dewatering; potential issues may occur at these locations if saline subsoils are mixed with less saline, shallower subsoils during trench excavation and storage of backfill.

Based on review of the SSURGO data, 84 percent of the pipeline route may have topsoil depths that exceed 12 inches in depth (see table 7.1.3-1); however, WBI Energy documented only 32 percent of topsoil may exceed 12 inches in its field cores. WBI Energy is proposing to segregate up to 12 inches of topsoil in order to minimize the potential for impacts to agricultural lands. At a minimum, WBI Energy will strip topsoil from the trench and spoil side along the pipeline alignment, but may also strip topsoil from the working side of the trench line in areas where the potential for mixing surface and subsoils or compaction of topsoil could occur. Implementation of these topsoil segregation measures will help ensure post-construction soil productivity, thereby minimizing the potential for long-term impacts on agricultural lands. As requested in section 7.3.4, WBI Energy is requesting to modify the requirements of the Plan to use up to 100 feet of TWS to accommodate the additional space needed to store the additional topsoil.

Topsoil stripping protocols will be adjusted as appropriate to minimize potential impacts on agricultural productivity. The topsoil stripping and special subsoil handling protocols utilized generally require additional width of right-of-way to accommodate soil storage and safe pipeline construction, as described in the following sections. The following subsections describe the topsoil stripping and specialized soil handling measures that will or may be used by WBI Energy during construction depending on existing, known soil conditions and/or conditions at the time of construction.

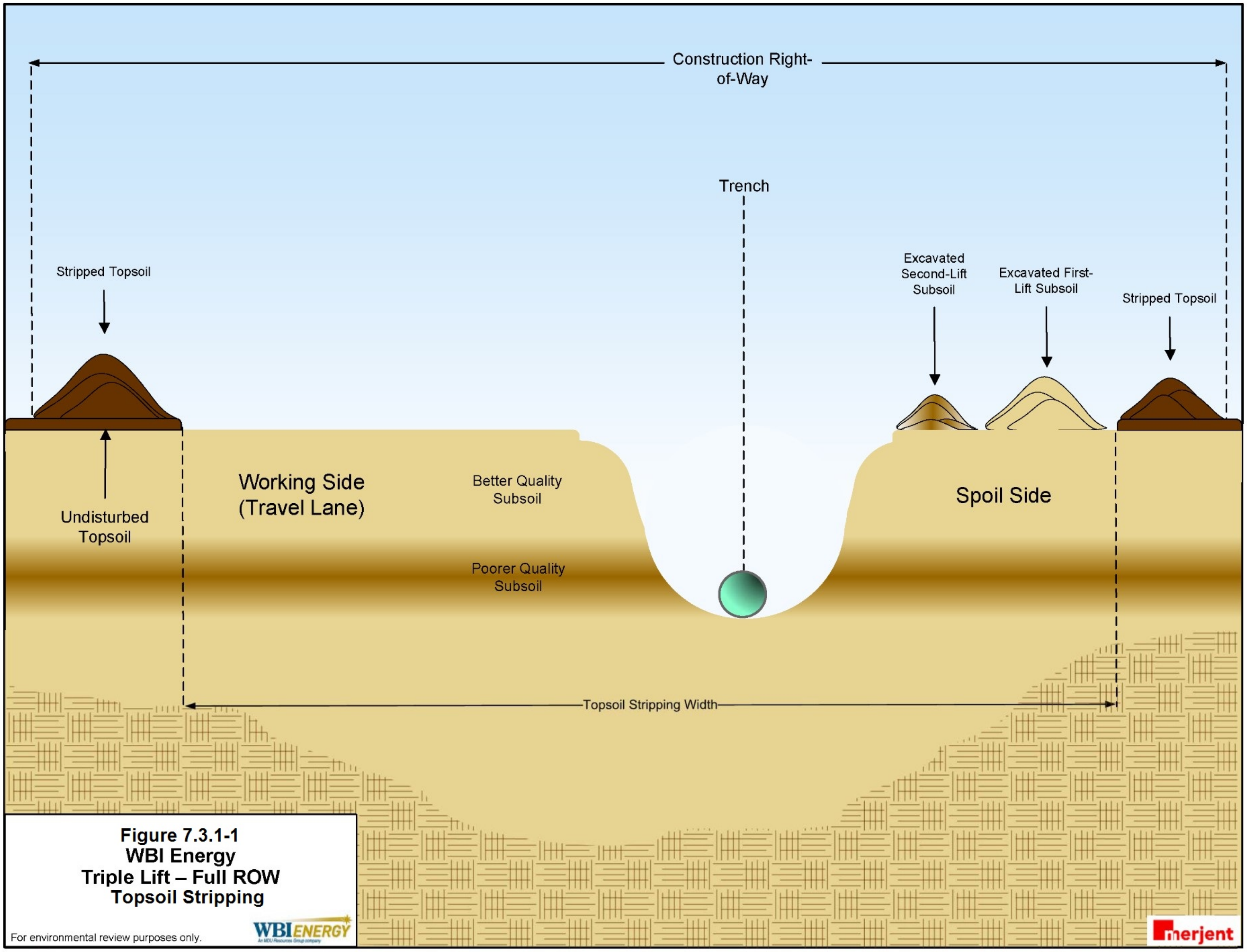

Figure 7.3.1-1
WBI Energy
Triple Lift – Full ROW
Topsoil Stripping

Full Right-of-Way Topsoil Stripping

- Full right-of-way topsoil stripping may be used in areas where topsoil is thin and there is a potential for mixing topsoil and subsoil due to construction traffic and grading activities.
- Full right of way topsoil may also be used where the potential exists for mixing of topsoil and subsoil when constructing under wet conditions.[3] The potential for soil mixing is much greater during wet periods, particularly when the soil is susceptible to rutting, which is most of the soils in the Project footprint (see table 7.1.2-1).
- Where full right-of-way topsoil stripping is used, additional right-of-way width to accommodate the volume of topsoil striped from the entire construction right-of-way would be required (see section 7.3.4.)

Trench Plus Spoil-side Topsoil Stripping

- Trench plus spoil-side topsoil stripping strips and reserves the topsoil over the trench and the area used for trench subsoil storage when topsoils are thick, grading of the construction right-of-way is minimal, and moisture conditions are favorable for construction.
- Where trench plus spoil side topsoil stripping is used in conjunction with triple-lift soil segregation (see below), additional right-of-way width would be required to accommodate space needed to store the separate soil piles (see section 7.3.4.)

Triple-Lift Soil Segregation

- In some locations, the subsoils may vary greatly in soil quality, with the first subsoil layer being of higher quality than the layers underneath. In those locations, three lift (or triple lift) soil handling may be used to avoid mixing between soil layers. Triple lift involves stripping the topsoil from the trench and spoil storage area, and storing it separately from the two separate subsoil layers that are excavated from the trench (see figure 7.3.1-1, which demonstrates triple-lift soil segregation in conjunction with full right-of-way topsoil stripping). The high quality and underlying subsoil layers that are excavated are stored separately, and then returned to the trench in the order they were removed.
- As discussed in section 7.1.3.3 and summarized in table 7.1.3-2, WBI Energy has identified 30 locations where subsoil salinity may be expected based on an EM-38 salinity assessment, and these locations are identified on the environmental bar of the alignment sheets provided in appendix 1B of Resource Report 1. Due to the typical 1,000-foot spacing of soil samples used to identify areas of potential salinity, WBI Energy is conservatively flagging a 500-foot buffer on each side of these locations as potentially saline areas. Therefore, these locations correspond to areas where triple-lift soil handling procedures may be appropriate to avoid and minimize impacts to soil productivity and crop yields. In addition, as discussed in section 2.1.6.1 of Resource Report 2, the discharge of saline trench water to surrounding cropland in these areas may result in salinization of surface soils and reduce crop yields well after pipeline construction has concluded.
- WBI energy will train its Environmental Inspector(s) (EI) to evaluate topsoil and subsoil characteristics, provide recommendations for topsoil stripping depths, and determine where soil and

[3] Wet Weather Shutdown. Environmental Inspector (EI) will be trained to observe construction before, during, and after constructing in wet conditions to ensure that impacts to the soils are minimal. When conditions become wet such that safety and soil integrity are compromised, the EI will be able to recommend that construction cease until conditions improve.

water salinity exist at levels sufficient to apply triple lift soil segregation procedures and/or specialized siting for trench water discharge locations. Soil and trench water salinity levels will be evaluated in areas that have a potential for saline conditions, as identified on the alignment sheets, using a hand-held Electrical Conductivity (EC) meter (salinity probe) designed for use in both soil and water.[4] Where the subsoil EC is >4 deciSiemens per meter (dS/m) and is more than twice the EC of the overlying soil, then triple lift soil segregation procedures will be implemented and the EI will ensure that poor-quality subsoils are adequately separated so that they do not become mixed with or become backfilled to the crop root depth. In addition, dewatering discharge to adjacent cropland will be avoided when the ditch-water salinity is found to be >4 dS/m. Further discussion of trench dewatering of is provided in section 2.1.6.1 in Resource Report 2.

- Triple lift soil handling typically requires additional construction workspace to accommodate the need for additional soil storage space (see section 7.3.4).

7.3.2 Erosion

WBI Energy will utilize erosion and sedimentation control devices in accordance with the Plan. Temporary erosion controls (e.g., silt fences, straw bales, or straw logs) will be installed, where appropriate, during clearing to prevent the movement of disturbed soils off the right-of-way or other work areas. As necessary, trench breakers (e.g., stacked sand bags or foam) will be installed in the trench around the pipe to prevent movement of subsurface water along the pipeline. Additionally, temporary slope breakers consisting of mounded and compacted soil will be installed across the right-of-way in areas required by the Plan and the FERC *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) (FERC, 2013b).

Sedimentation and erosion control devices will be inspected on a regular basis by WBI Energy's EI as specified in the Plan and Procedures. As indicated in section 7.1.2.3, wind erosion of topsoil storage piles is not expected to be a concern during construction due to the lack of wind-erodible soils in the Project area; however, if necessary, WBI Energy will prevent dry topsoil from eroding by installing mulch or tackifier over the piles or by implementing other methods of topsoil conservation.

During construction and restoration, the effectiveness of temporary erosion control devices will be monitored by WBI Energy's EI. The effectiveness of revegetation and permanent erosion control devices will be monitored by WBI Energy operating personnel during the long-term operation and maintenance of the pipeline system. Erosion control devices will be maintained in areas that are not actively cultivated until revegetation is successful. Following successful revegetation, the temporary erosion control devices will be removed.

The Plan includes restoration and revegetation measures that include seedbed preparation, fertilization, and seeding to actively promote revegetation. While no seeding of actively cultivated agricultural land is planned, in those locations where seeding is required (e.g., pastureland), WBI Energy will use seed mixes and soil amendments requested by the landowner or the NRCS, and will monitor revegetation after the first and second growing seasons. In agricultural areas, revegetation will be considered successful if crop yields are similar to adjacent undisturbed portions of the cropland. If necessary, WBI Energy will compensate landowners for damaged crops and lost soil productivity. Based on these measures, WBI Energy believes agricultural soils will be restored to agricultural production (where not permanently impacted by aboveground facilities) after construction is complete.

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4 Several dual-purpose soil and water conductivity meters are available. A representative salinity meter and probe is Spectrum Technologies Field Scout Soil EC Meter (http://www.specmeters.com/assets/1/22/2265FS_Meter_(w_CE)1.pdf) or equivalent.

7.3.3 Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination are typically minor because of the low frequency and small volumes of spills and leaks. WBI Energy's Spill Prevention, Control and Countermeasure Plan (SPCC Plan) specifies cleanup procedures in the event of soil contamination from spills or leaks of fuel, lubricants, coolants, or solvents. The SPCC Plan is provided as appendix 1E-1 of Resource Report 1. WBI Energy and its contractor will follow the SPCC Plan to prevent and contain, if necessary, accidental spills of any material that may contaminate soils, and to ensure that inadvertent spills of fuels, lubricants, or solvents are contained, cleaned up, and disposed of in an appropriate manner.

WBI Energy reviewed several sources for information regarding the potential for encountering soil and groundwater contamination within or near the Project area (see section 2.1.5 of Resource Report 2 and section 8.5.3 of Resource Report 8). Based on this review, there are no landfills, quarries, or mines within 0.25 mile of the Project; there are two USTs and one reported LUST within 0.25 mile of the Project; there are two regulated sites within 0.25 mile of the Minnkota Laydown Yard in Harwood, North Dakota; and one regulated site was identified near MP 11.2 along the pipeline route near the town of Felton in Clay County, Minnesota. As discussed in section 2.1.5 in Resource Report 2, the regulated sites identified within 0.25 mile of the Project are not, by definition, contaminated sites.

Neither of the USTs or the LUST sites identified within 0.25 mile of the Project are located within the area that will be disturbed by construction of the Project. For this reason, direct or indirect impacts on these features are not anticipated as a result of construction or operation of the Project.

It is possible that unknown sites could be encountered along the pipeline route during construction. If contaminated soils or groundwater are encountered, WBI Energy will implement measures identified in its SPCC Plan. This plan describes measures for containing and characterizing contaminated media, notifying the landowner and appropriate regulatory agencies of the contamination, and responding to the contaminated media.

7.3.4 Consistency with the FERC Upland Erosion Control, Revegetation, and Maintenance Plan

WBI Energy proposes to follow the requirements in the current Plan but is requesting one modification to section IV.A.2 of the Plan relating to limiting the construction right-of-way to 75 feet in width. This modification is needed due to a variety of project- and site-specific considerations in the Red River Valley, and will allow WBI Energy to provide a safe work environment and facilitate restoration, maintain soil productivity, and minimize potential for impacts on crop yields. The justifications for this request are outlined in the following bullets:

- In agricultural land, the Plan requires stripping, segregation, and replacement of the full depth of topsoil, up to 12 inches deep. Much of the Project area contains high-quality topsoil that may be at least 12 inches thick or thicker, and the majority of the land crossed is cultivated or rotated crop land where full right-of-way topsoil stripping may be necessary to protect soil productivity. Therefore, WBI Energy is requesting additional workspace to segregate and store the topsoil separate from subsoil(s) in these areas to facilitate safe movement of construction equipment along the construction right-of-way.
- In areas where deeper subsoil salinity is high, special soil handling may include separate stripping and segregation of topsoil and two subsoil lifts, which is commonly known as triple lift soil handling. WBI Energy has identified locations where subsoil salinity may be anticipated (see section 7.1.3.3, table 7.1.3-2, and the environmental bar on the alignment sheets provided in appendix 1B of Resource

Report 1), and may use triple lift procedures in those areas where the presence of excessive subsoil salinity is confirmed during construction. There is also a potential for encountering saline conditions in other areas, as identified by landowners or by the EI during trenching operations. Use of the triple lift method in addition to full- or trench and spoil side topsoil stripping methods, will require additional workspace to maintain the separate spoil piles.

- The Project centerline also crosses soils that are thin or otherwise have a high susceptibility to rutting and compaction where full right-of-way topsoil stripping may occur to prevent topsoil compaction and potential mixing of topsoil and subsoil. Stripping topsoil across the full right-of-way will require additional workspace.
- Some locations exist where drain tile will be crossed by a deeper trench to go under the tile and/or tile header systems. A deeper trench will generate more spoil and require additional workspace.

Because topsoil depths greater than 12 inches may occur in many locations, saline subsoils may exist requiring triple lift soil handling procedures, thin or ruttable soils exist that may require full right-of-way topsoil stripping, and there may be additional trench depth needed to accommodate drain tile avoidance, WBI Energy is requesting an additional 25 feet of construction right-of-way for a total TWS of 100 feet along the entire length of the pipeline. The proposed increase in the nominal TWS will not impact or prevent the implementation of other measures to provide for upland erosion control and protection of waterbodies and wetlands. The proposed TWS will allow WBI Energy to implement the FERC construction measures of the Plan while addressing site-specific conditions during construction and meeting OSHA regulations (29 CFR Part 1926.650-.652, Subpart P).

7.4 CUMULATIVE IMPACTS

WBI Energy reviewed the Project area for earth-disturbing projects that, when considered collectively with the Project, could lead to greater impacts than those caused by an individual project. WBI Energy is proposing to co-locate the pipeline with existing utility rights-of-way and the Mapleton Compressor Station will be installed adjacent to WBI Energy's existing Mapleton TBS. The Viking Interconnect, Sanborn Regulator Station, Jamestown TBS, and Apple Valley TBS will be installed directly adjacent to existing roadways in predominantly rural agricultural settings.

While the past and ongoing agricultural use of land within the Project region of influence has likely had, and continues to have, a significant and lasting impact on soils, WBI Energy's ground disturbing activities on these same lands is expected to have a negligible cumulative impact due to WBI Energy's compliance with the Plan, which is not implemented for ongoing agricultural activities. In addition, none of the past, present, or reasonably foreseeable projects that have been identified in the Project region of influence (see table 1.11-1 in Resource Report 1) occur sufficiently close to the Project facilities to create cumulative impacts on existing soil resources, with the exception of the Fargo-Moorhead Area Diversion Project and the Viking Meter Station, which will both result in some permanent impacts to agricultural lands. The Otter Tail Power Line Project will be constructed concurrently with the Project, but installation of the power line will occur along roadways and no impacts to agricultural lands are anticipated.

The majority of areas affected by construction occur on actively cultivated and previously disturbed lands, and most lands will revert to their previous uses and contours following construction. Approximately 7.5 acres of prime farmland soils will be permanently converted to another use due to the Project's aboveground facilities, which adds to the cumulative loss of tillable agricultural lands caused by the existing Mapleton TBS, the existing Jamestown TBS, and the Viking Meter Station that will be installed near the Viking Interconnect, the FMADP, and the Harmony Solar Project. However, the amount is negligible considering the large amount of tillable land adjacent to the aboveground facilities and surrounding areas. For these reasons, cumulative impacts on agricultural land, including prime farmland, will not be significant.

7.5 REFERENCES

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Valley Expansion Project

Resource Report 7

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
000_VEP	0.00	I5A	Borup loam, 0 to 1 percent slopes	10.0	>6-12	150.72	154.90	1.03	
001_VEP	0.19	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	150.64	133.65	0.89	
002_VEP	0.38	I507A	Glyndon loam, 0 to 2 percent slopes	6.0	0-6	160.05	166.97	1.04	
003_VEP	0.57	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	82.98	123.45	1.49	
004_VEP	0.76	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	62.20	77.28	1.24	
005_VEP	0.95	I507A	Glyndon loam, 0 to 2 percent slopes	10.5	>6-12	76.15	132.79	1.74	
006_VEP	1.14	I5A	Borup loam, 0 to 1 percent slopes	7.0	>6-12	107.20	143.72	1.34	
007_VEP	1.33	I507A	Glyndon loam, 0 to 2 percent slopes	7.0	>6-12	146.81	162.63	1.11	
008_VEP	1.52	I507A	Glyndon loam, 0 to 2 percent slopes	20.0	>18	77.67	94.54	1.22	
009_VEP	1.70	I507A	Glyndon loam, 0 to 2 percent slopes	6.5	>6-12	57.16	69.74	1.22	
010_VEP	1.89	I507A	Glyndon loam, 0 to 2 percent slopes	9.0	>6-12	65.52	116.77	1.78	
011_VEP	2.08	I507A	Glyndon loam, 0 to 2 percent slopes	15.0	>12-18	61.27	190.17	3.10	
012_VEP	2.27	I507A	Glyndon loam, 0 to 2 percent slopes	7.0	>6-12	61.73	93.61	1.52	
013_VEP	2.46	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	86.42	346.26	4.01	Yes
014_VEP	2.65	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	84.31	153.37	1.82	
015_VEP	2.84	I507A	Glyndon loam, 0 to 2 percent slopes	8.0	>6-12	92.05	92.00	1.00	
016_VEP	3.03	I634A	Augsburg silt loam, 0 to 1 percent slopes	9.0	>6-12	175.52	217.86	1.24	
017_VEP	3.22	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	182.12	158.76	0.87	
018_VEP	3.41	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	105.68	145.13	1.37	
019_VEP	3.60	I377A	Wheatville silt loam, 0 to 2 percent slopes	9.0	>6-12	96.15	226.81	2.36	Yes
020_VEP	3.79	I377A	Wheatville silt loam, 0 to 2 percent slopes	12.0	>6-12	104.08	420.29	4.04	Yes
021_VEP	3.98	I377A	Wheatville silt loam, 0 to 2 percent slopes	8.0	>6-12	219.55	390.05	1.78	Yes
022_VEP	4.17	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	238.61	217.83	0.91	
023_VEP	4.36	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	94.00	215.68	2.29	Yes
024_VEP	4.55	I377A	Wheatville silt loam, 0 to 2 percent slopes	NS	NS	105.72	161.42	1.53	
025_VEP	4.73	I377A	Wheatville silt loam, 0 to 2 percent slopes	8.0	>6-12	178.37	180.79	1.01	
026_VEP	4.92	I467A	Bearden silt loam, 0 to 2 percent slopes	9.0	>6-12	97.44	115.05	1.18	
027_VEP	5.11	I467A	Bearden silt loam, 0 to 2 percent slopes	8.0	>6-12	94.78	90.56	0.96	
028_VEP	5.30	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.0	>6-12	115.91	292.16	2.52	Yes
029_VEP	5.49	I467A	Bearden silt loam, 0 to 2 percent slopes	9.0	>6-12	96.15	177.59	1.85	
030_VEP	5.68	I467A	Bearden silt loam, 0 to 2 percent slopes	8.0	>6-12	119.98	134.62	1.12	
031_VEP	5.87	I467A	Bearden silt loam, 0 to 2 percent slopes	10.0	>6-12	91.93	133.06	1.45	

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Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
032_VEP	6.06	I467A	Bearden silt loam, 0 to 2 percent slopes	10.0	>6-12	201.77	379.43	1.88	Yes
033_VEP	6.25	I467A	Bearden silt loam, 0 to 2 percent slopes	7.0	>6-12	140.48	159.31	1.13	
034_VEP	6.44	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.0	>6-12	114.62	456.50	3.98	Yes
035_VEP	6.63	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.0	>6-12	95.13	203.29	2.14	Yes
036_VEP	6.82	I376A	Colvin silty clay loam, 0 to 1 percent slopes	14.0	>12-18	117.87	176.46	1.50	
037_VEP	7.01	I467A	Bearden silt loam, 0 to 2 percent slopes	15.0	>12-18	225.33	199.97	0.89	
038_VEP	7.20	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.0	>6-12	115.17	184.04	1.60	
039_VEP	7.39	I467A	Bearden silt loam, 0 to 2 percent slopes	10.0	>6-12	117.05	142.36	1.22	
040_VEP	7.58	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.0	>6-12	143.26	175.40	1.22	
041_VEP	7.77	I376A	Colvin silty clay loam, 0 to 1 percent slopes	14.0	>12-18	79.00	98.33	1.24	
042_VEP	7.95	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.0	0-6	95.64	114.00	1.19	
043_VEP	8.14	I467A	Bearden silt loam, 0 to 2 percent slopes	9.0	>6-12	102.59	111.50	1.09	
044_VEP	8.33	I467A	Bearden silt loam, 0 to 2 percent slopes	7.0	>6-12	96.03	121.77	1.27	
045_VEP	8.52	I467A	Bearden silt loam, 0 to 2 percent slopes	7.0	>6-12	206.81	318.57	1.54	Yes
046_VEP	8.71	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.0	>6-12	92.48	96.15	1.04	
047_VEP	8.90	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	8.0	>6-12	104.16	200.48	1.92	Yes
048_VEP	9.09	I467A	Bearden silt loam, 0 to 2 percent slopes	10.0	>6-12	162.01	203.22	1.25	
049_VEP	9.28	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	8.0	>6-12	107.52	97.51	0.91	
050_VEP	9.47	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	7.0	>6-12	198.53	193.72	0.98	
051_VEP	9.66	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	9.0	>6-12	111.34	124.39	1.12	
052_VEP	9.85	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	7.5	>6-12	94.74	335.01	3.54	Yes
053_VEP	10.04	I376A	Colvin silty clay loam, 0 to 1 percent slopes	12.0	>6-12	157.59	226.07	1.43	
054_VEP	10.23	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	16.0	>12-18	99.27	144.93	1.46	
055_VEP	10.42	I376A	Colvin silty clay loam, 0 to 1 percent slopes	26.0	>18	97.59	156.54	1.60	
056_VEP	10.61	I376A	Colvin silty clay loam, 0 to 1 percent slopes	5.0	0-6	136.62	187.43	1.37	
057_VEP	10.80	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.0	>6-12	161.97	201.54	1.24	

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				Inches		mS/m			
058_VEP	10.98	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	11.0	>6-12	156.27	242.63	1.55	Yes
059_VEP	11.17	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	26.0	>18	160.99	235.79	1.46	
060_VEP	11.36	I376A	Colvin silty clay loam, 0 to 1 percent slopes	13.0	>12-18	148.84	203.68	1.37	
061_VEP	11.55	I376A	Colvin silty clay loam, 0 to 1 percent slopes	16.0	>12-18	205.91	286.85	1.39	
062_VEP	11.74	I467A	Bearden silt loam, 0 to 2 percent slopes	11.0	>6-12	116.42	172.79	1.48	
063_VEP	11.93	I376A	Colvin silty clay loam, 0 to 1 percent slopes	24.0	>18	118.18	120.17	1.02	
064_VEP	12.12	I376A	Colvin silty clay loam, 0 to 1 percent slopes	12.0	>6-12	125.45	232.59	1.85	Yes
065_VEP	12.31	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	20.0	>18	128.02	245.60	1.92	Yes
066_VEP	12.50	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	12.0	>6-12	217.44	256.38	1.18	
067_VEP	12.69	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	2.0	0-6	207.01	372.94	1.80	Yes
068_VEP	12.88	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	18.0	>12-18	159.70	132.94	0.83	
069_VEP	13.07	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	18.0	>12-18	176.66	144.04	0.82	
070_VEP	13.26	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	16.0	>12-18	155.72	236.69	1.52	Yes
071_VEP	13.45	I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	16.0	>12-18	145.17	329.31	2.27	Yes
072_VEP	13.64	I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	24.0	>18	177.16	228.41	1.29	
073_VEP	13.83	I229A	Fargo silty clay, 0 to 1 percent slopes	24.0	>18	187.83	197.00	1.05	
074_VEP	14.02	I229A	Fargo silty clay, 0 to 1 percent slopes	30.0	>18	134.94	188.41	1.40	
075_VEP	14.20	I229A	Fargo silty clay, 0 to 1 percent slopes	NS	NS	145.91	149.54	1.02	
076_VEP	14.39	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	24.0	>18	117.64	119.39	1.01	
077_VEP	14.58	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	170.14	227.67	1.34	
078_VEP	14.77	I130A	Hegne-Fargo silty clays, 0 to 1 percent slopes	8.0	>6-12	188.85	199.66	1.06	
079_VEP	14.96	I130A	Hegne-Fargo silty clays, 0 to 1 percent slopes	8.0	>6-12	161.04	241.11	1.50	

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
080_VEP	15.15	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	101.55	118.92	1.17	
081_VEP	15.34	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	22.0	>18	100.14	146.93	1.47	
082_VEP	15.53	I229A	Fargo silty clay, 0 to 1 percent slopes	18.0	>12-18	100.22	274.27	2.74	Yes
083_VEP	15.72	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	95.88	124.11	1.29	
084_VEP	15.91	I229A	Fargo silty clay, 0 to 1 percent slopes	23.0	>18	144.13	239.62	1.66	Yes
085_VEP	16.10	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	196.82	418.29	2.13	Yes
086_VEP	16.29	I229A	Fargo silty clay, 0 to 1 percent slopes	27.0	>18	87.92	116.93	1.33	
087_VEP	16.48	I229A	Fargo silty clay, 0 to 1 percent slopes	14.0	>12-18	102.92	264.78	2.57	Yes
088_VEP	16.67	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	24.0	>18	103.70	434.82	4.19	Yes
089_VEP	16.86	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	133.19	161.69	1.21	
090_VEP	17.05	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	15.0	>12-18	133.34	145.09	1.09	
091_VEP	17.23	I229A	Fargo silty clay, 0 to 1 percent slopes	14.0	>12-18	119.63	160.68	1.34	
092_VEP	17.38	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	170.30	132.20	0.78	
093_VEP	17.51	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	126.43	173.72	1.37	
094_VEP	18.02	I229A	Fargo silty clay, 0 to 1 percent slopes	8.0	>6-12	147.13	147.82	1.00	
095_VEP	18.14	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	152.64	288.65	1.89	Yes
096_VEP	18.33	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	119.36	272.43	2.28	Yes
097_VEP	18.52	I16F	Fluvaquents, frequently flooded-Hapludolls complex, 0 to 30 percent slopes	NS	NS	NS	NS	NS	NS
098_VEP	18.71	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	13.0	>12-18	77.26	95.39	1.23	
099_VEP	18.90	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	12.0	>6-12	113.59	162.18	1.43	
100_VEP	19.09	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	180.93	143.82	0.79	
101_VEP	19.28	I229A	Fargo silty clay, 0 to 1 percent slopes	8.0	>6-12	149.48	122.81	0.82	
102_VEP	19.47	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	132.38	229.88	1.74	Yes
103_VEP	19.66	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	124.33	183.63	1.48	
104_VEP	19.84	I229A	Fargo silty clay, 0 to 1 percent slopes	13.0	>12-18	120.97	224.96	1.86	Yes
105_VEP	20.03	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	12.0	>6-12	114.25	127.93	1.12	
106_VEP	20.22	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	122.88	173.12	1.41	

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
107_VEP	20.41	I229A	Fargo silty clay, 0 to 1 percent slopes	NS	NS	127.57	200.62	1.57	Yes
108_VEP	20.60	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	106.48	247.65	2.33	Yes
109_VEP	20.79	I229A	Fargo silty clay, 0 to 1 percent slopes	7.0	>6-12	111.52	135.66	1.22	
110_VEP	20.81	I229A	Fargo silty clay, 0 to 1 percent slopes	11.0	>6-12	97.88	244.92	2.50	Yes
111_VEP	20.83	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	111.36	164.06	1.47	
112_VEP	21.00	I229A	Fargo silty clay, 0 to 1 percent slopes	7.5	>6-12	97.73	86.52	0.89	
113_VEP	21.70	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	7.0	>6-12	84.64	20.35	0.24	
114_VEP	21.84	I229A	Fargo silty clay, 0 to 1 percent slopes	8.0	>6-12	101.28	195.03	1.93	
115_VEP	NS	NS	NS	NS	NS	NS	NS	NS	NS
116_VEP	NS	NS	NS	NS	NS	NS	NS	NS	NS
117_VEP	NS	NS	NS	NS	NS	NS	NS	NS	NS
118_VEP	22.44	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	137.80	130.70	0.95	
119_VEP	22.61	I229A	Fargo silty clay, 0 to 1 percent slopes	24.0	>18	125.07	266.95	2.13	Yes
120_VEP	22.78	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	6.0	0-6	122.88	157.73	1.28	
121_VEP	22.95	I229A	Fargo silty clay, 0 to 1 percent slopes	9.0	>6-12	156.91	150.86	0.96	
122_VEP	23.13	I229A	Fargo silty clay, 0 to 1 percent slopes	8.0	>6-12	204.37	287.46	1.41	
123_VEP	23.32	I229A	Fargo silty clay, 0 to 1 percent slopes			110.38	158.39	1.43	
124_VEP	23.51	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	181.20	215.97	1.19	
125_VEP	23.70	I229A	Fargo silty clay, 0 to 1 percent slopes	7.0	>6-12	65.80	49.84	0.76	
126_VEP	23.89	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	10.0	>6-12	70.22	49.68	0.71	
127_VEP	24.08	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	10.0	>6-12	62.17	47.42	0.76	
128_VEP	24.27	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	13.0	>12-18	87.83	61.79	0.70	
129_VEP	24.46	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	9.0	>6-12	82.29	57.53	0.70	
130_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
131_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
132_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
133_VEP	NS	NS	NS	NS	NS	NS	NS	NS	

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
134_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
135_VEP	25.59	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	5.0	0-6	68.58	51.01	0.74	
136_VEP	25.78	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	5.0	0-6	81.47	58.63	0.72	
137_VEP	25.97	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes			58.89	46.05	0.78	
138_VEP	26.16	I229A	Fargo silty clay, 0 to 1 percent slopes	5.0	0-6	84.79	59.80	0.71	
139_VEP	26.35	I229A	Fargo silty clay, 0 to 1 percent slopes			88.89	63.43	0.71	
140_VEP	26.54	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	78.81	55.35	0.70	
141_VEP	26.73	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	4.0	0-6	106.04	71.09	0.67	
142_VEP	26.92	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	98.81	68.47	0.69	
143_VEP	27.11	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	71.70	52.38	0.73	
144_VEP	27.30	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	80.84	55.11	0.68	
145_VEP	27.49	I229A	Fargo silty clay, 0 to 1 percent slopes	7.0	>6-12	60.84	46.32	0.76	
146_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
147_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
148_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
149_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
150_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
151_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
152_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
153_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
154_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
155_VEP	29.41	I229A	Fargo silty clay, 0 to 1 percent slopes	14.0	>12-18	104.90	71.28	0.68	
156_VEP	29.60	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	67.44	36.48	0.54	
157_VEP	29.61	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	20.0	>18	87.91	48.39	0.55	
158_VEP	29.61	I229A	Fargo silty clay, 0 to 1 percent slopes	3.0	0-6	87.83	49.49	0.56	
159_VEP	30.66	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	93.77	51.48	0.55	
160_VEP	30.85	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	81.04	45.46	0.56	
161_VEP	31.04	I229A	Fargo silty clay, 0 to 1 percent slopes	15.0	>12-18	101.04	55.15	0.55	

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Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
162_VEP	31.05	I229A	Fargo silty clay, 0 to 1 percent slopes	9.0	>6-12	103.81	59.10	0.57	
163_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
164_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
165_VEP	NS	NS	NS	NS	NS	NS	NS	NS	
166_VEP	31.64	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	14.0	>12-18	87.66	91.05	1.04	
167_VEP	31.83	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	105.63	107.10	1.01	
168_VEP	32.02	I229A	Fargo silty clay, 0 to 1 percent slopes	9.0	>6-12	111.96	108.15	0.97	
169_VEP	32.21	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	NS	NS	74.07	88.94	1.20	
170_VEP	32.40	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	14.0	>12-18	117.27	113.31	0.97	
171_VEP	32.59	I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	5.0	0-6	70.20	83.15	1.18	
172_VEP	32.78	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	NS	NS	85.28	92.53	1.09	
173_VEP	32.97	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	18.0	>12-18	66.18	81.44	1.23	
174_VEP	33.16	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	7.0	>6-12	94.18	98.31	1.04	
175_VEP	33.35	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	12.0	>6-12	93.87	99.52	1.06	
176_VEP	33.54	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	14.0	>12-18	96.37	100.26	1.04	
177_VEP	33.73	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	NS	NS	102.07	104.37	1.02	
178_VEP	33.92	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	5.0	0-6	96.25	100.15	1.04	
179_VEP	34.10	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	NS	NS	88.44	90.34	1.02	
180_VEP	34.29	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	16.0	>12-18	90.51	94.64	1.05	
181_VEP	34.48	I233A	Fargo silty clay loam, 0 to 1 percent slopes	8.0	>6-12	91.76	93.62	1.02	
182_VEP	34.67	I233A	Fargo silty clay loam, 0 to 1 percent slopes	10.0	>6-12	87.89	93.66	1.07	
183_VEP	34.86	I233A	Fargo silty clay loam, 0 to 1 percent slopes	12.0	>6-12	79.85	88.08	1.10	

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Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			
184_VEP	35.05	I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	12.0	>6-12	68.17	84.17	1.23	
185_VEP	35.24	I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	14.0	>12-18	74.50	82.72	1.11	
186_VEP	35.43	I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	5.0	0-6	70.78	83.08	1.17	
187_VEP	35.62	I119A	Bearden silty clay loam, 0 to 2 percent slopes	18.0	>12-18	78.64	86.28	1.10	
188_VEP	35.81	I119A	Bearden silty clay loam, 0 to 2 percent slopes	17.0	>12-18	74.38	87.30	1.17	
189_VEP	36.00	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	14.0	>12-18	62.00	79.44	1.28	
190_VEP	36.19	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	NS	NS	63.32	81.12	1.28	
191_VEP	36.38	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	10.0	>6-12	76.37	86.12	1.13	
192_VEP	TBD	I233A	Fargo silty clay loam, 0 to 1 percent slopes	9.0	>6-12	73.91	93.97	1.27	
193_VEP	TBD	I233A	Fargo silty clay loam, 0 to 1 percent slopes	8.0	>6-12	88.01	92.18	1.05	
194_VEP	TBD	I233A	Fargo silty clay loam, 0 to 1 percent slopes	9.0	>6-12	98.28	144.44	1.47	
195_VEP	TBD	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	6.0	0-6	73.99	71.90	0.97	
196_VEP	29.22	I241A	Fargo-Ryan silty clays, 0 to 1 percent slopes	8.0	>6-12	96.23	66.24	0.69	
197_VEP	29.03	I241A	Fargo-Ryan silty clays, 0 to 1 percent slopes	9.0	>6-12	108.15	69.84	0.65	
198_VEP	28.84	I229A	Fargo silty clay, 0 to 1 percent slopes	7.0	>6-12	103.65	68.78	0.66	
199_VEP	28.65	I229A	Fargo silty clay, 0 to 1 percent slopes	12.0	>6-12	109.55	72.65	0.66	
200_VEP	28.46	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	90.45	60.38	0.67	
201_VEP	28.27	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	14.0	>12-18	67.25	48.20	0.72	
202_VEP	28.08	I229A	Fargo silty clay, 0 to 1 percent slopes	6.0	0-6	75.65	52.42	0.69	
203_VEP	27.89	I229A	Fargo silty clay, 0 to 1 percent slopes	7.0	>6-12	103.03	69.25	0.67	
204_VEP	27.71	I229A	Fargo silty clay, 0 to 1 percent slopes	10.0	>6-12	86.93	58.43	0.67	

[a] Samples ID provided Duraroot (Duraroot Environmental Consulting, 4626 WCR 65 Keenesburg Colorado 80643) at approximate 1000 foot intervals along the pipeline centerline.
[b] Mileposts were determined using spatial queries of the Project GIS in ArcMap Ver 10.4.1
[c] Map Unit Symbols and names from the SSURGO database at the locations sampled.

APPENDIX 7A

Results of the Scoping Soil Survey for Topsoil Depth and Salinity as Apparent Electrical Conductivity

Sample ID [a]	Milepost [b]	Map Unit Symbol [c]	Map unit Name [c]	Topsoil Depth [d]	Topsoil Depth Class	Shallow Apparent Conductivity [e]	Deep Apparent Conductivity [f]	Conductivity Ratio [g]	Potential Salinity [h]
				Inches		mS/m			

[d] Topsoil depth as determined in cores collected in the field by Duraroot soil scientists.
[e] Apparent soil conductivity readings for the shallow soil (< 0.5 meters) as determined by the EM38 in the vertical reading position.
[f] Apparent soil conductivity readings for the deep soil (1.5 meters) as determined by the EM38 in the horizontal reading position.
[g] Ratio of deep to shallow apparent conductivity.
[h] For the purposes of evaluating potential salinity, saline subsoil may be anticipated when the ratio is > 1.5 and the deep reading is > 200 mS/m.

NS = Not sampled

mS/m = milliSiemens per meter

Valley Expansion Project

Resource Report 7

APPENDIX 7B

Soil Map Units Crossed by Milepost

APPENDIX 7B

Soil Map Units Crossed by Milepost

County, State	Map Unit Symbol	Map Unit Name	MP Start	MP End	Crossing Length (mi)
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	0.00	0.11	0.11
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	0.11	0.63	0.52
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	0.63	0.74	0.11
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	0.74	1.13	0.39
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	1.13	1.27	0.14
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	1.27	1.39	0.12
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	1.39	1.44	0.05
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	1.44	1.53	0.09
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	1.53	1.56	0.03
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	1.56	2.14	0.57
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	2.14	2.18	0.04
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	2.18	2.96	0.78
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	2.96	3.02	0.06
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	3.02	3.13	0.11
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	3.13	3.58	0.45
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	3.58	3.59	0.02
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	3.59	3.73	0.13
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	3.73	3.75	0.03
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	3.75	4.00	0.25
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.00	4.11	0.10
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.11	4.33	0.23
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.33	4.35	0.02
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.35	4.36	0.01
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.36	4.38	0.02
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.38	4.39	0.01
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.39	4.45	0.06
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.45	4.47	0.02
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.47	4.52	0.05
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.52	4.59	0.07
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.59	4.64	0.05
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.64	4.67	0.04
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.67	4.69	0.01
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	4.69	4.75	0.06
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	4.75	4.87	0.13
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	4.87	5.05	0.18
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	5.05	5.09	0.04
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	5.09	5.18	0.09
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	5.18	5.33	0.16
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	5.33	5.69	0.36
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	5.69	5.83	0.14
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	5.83	5.94	0.11
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	5.94	6.01	0.07
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.01	6.12	0.11
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.12	6.17	0.05
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.17	6.22	0.05
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.22	6.24	0.02
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.24	6.27	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.27	6.32	0.05

APPENDIX 7B

Soil Map Units Crossed by Milepost

County, State	Map Unit Symbol	Map Unit Name	MP Start	MP End	Crossing Length (mi)
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.32	6.42	0.10
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.42	6.45	0.04
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.45	6.51	0.06
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.51	6.53	0.02
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.53	6.56	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.56	6.58	0.02
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.58	6.61	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.61	6.66	0.05
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.66	6.68	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	6.68	6.89	0.21
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	6.89	7.12	0.23
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.12	7.25	0.13
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	7.25	7.31	0.06
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.31	7.33	0.03
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	7.33	7.40	0.07
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.40	7.58	0.18
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	7.58	7.61	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.61	7.85	0.24
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	7.85	7.89	0.04
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	7.89	8.03	0.14
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	8.03	8.05	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.05	8.14	0.09
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	8.14	8.17	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.17	8.27	0.10
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	8.27	8.34	0.07
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.34	8.40	0.06
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	8.40	8.65	0.26
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	8.65	8.73	0.08
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	8.73	8.86	0.12
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	8.86	9.08	0.23
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	9.08	9.14	0.06
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	9.14	9.17	0.03
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.17	9.25	0.08
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	9.25	9.98	0.74
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	9.98	10.06	0.08
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	10.06	10.41	0.36
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	10.41	10.45	0.04
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	10.45	10.48	0.02
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	10.48	10.89	0.41
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	10.89	11.08	0.19
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	11.08	11.11	0.03
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	11.11	11.25	0.14
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	11.25	11.74	0.49
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	11.74	11.81	0.07
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	11.81	12.24	0.43
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	12.24	12.99	0.76
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	12.99	13.12	0.13
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	13.12	13.20	0.08

APPENDIX 7B

Soil Map Units Crossed by Milepost

County, State	Map Unit Symbol	Map Unit Name	MP Start	MP End	Crossing Length (mi)
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	13.20	13.24	0.04
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	13.24	13.32	0.08
Clay County, MN	I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	13.32	13.76	0.44
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	13.76	14.33	0.57
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	14.33	14.45	0.11
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	14.45	14.63	0.19
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	14.63	14.68	0.04
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	14.68	14.72	0.04
Clay County, MN	I130A	Hegne-Fargo silty clays, 0 to 1 percent slopes	14.72	15.06	0.34
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	15.06	15.21	0.15
Clay County, MN	I16F	Fluvaquents,frequently flooded-Hapludolls complex, 0 to 30 percent slopes	15.21	15.27	0.05
Clay County, MN	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	15.27	15.35	0.08
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	15.35	15.48	0.13
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	15.48	15.52	0.04
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	15.52	15.75	0.23
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	15.75	15.78	0.03
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	15.78	15.94	0.16
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	15.94	15.97	0.03
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	15.97	16.22	0.25
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	16.22	16.26	0.04
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	16.26	16.66	0.40
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	16.66	16.68	0.02
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	16.68	16.72	0.04
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	16.72	16.74	0.02
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	16.74	16.80	0.07
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	16.80	16.88	0.07
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	16.88	16.91	0.03
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	16.91	16.95	0.04
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	16.95	16.99	0.04
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	16.99	17.05	0.06
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	17.05	17.09	0.04
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	17.09	17.17	0.08
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	17.17	18.07	0.90
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	18.07	18.10	0.03
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	18.10	18.14	0.04
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	18.14	18.19	0.04
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	18.19	18.44	0.25
Clay County, MN	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	18.44	18.51	0.08
Clay County, MN	I16F	Fluvaquents,frequently flooded-Hapludolls complex, 0 to 30 percent slopes	18.51	18.53	0.01
Clay County, MN	IWa	Water	18.53	18.54	0.01
Cass County, ND	IWa	Water	18.54	18.55	0.01
Cass County, ND	I149E	Cashel-Fluvaquents, channeled complex, 0 to 25 percent slopes, frequently flooded	18.55	18.61	0.06
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	18.61	18.85	0.25

APPENDIX 7B

Soil Map Units Crossed by Milepost

County, State	Map Unit Symbol	Map Unit Name	MP Start	MP End	Crossing Length (mi)
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	18.85	19.08	0.22
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	19.08	19.99	0.92
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	19.99	20.05	0.06
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	20.05	20.97	0.92
Cass County, ND	I231A	Dovray silty clay, 0 to 1 percent slopes	20.97	21.08	0.11
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	21.08	21.11	0.03
Cass County, ND	I231A	Dovray silty clay, 0 to 1 percent slopes	21.11	21.11	0.01
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	21.11	21.15	0.04
Cass County, ND	IWa	Water	21.15	21.17	0.02
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	21.17	21.22	0.05
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	21.22	21.30	0.08
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	21.30	21.32	0.02
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	21.32	21.61	0.29
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	21.61	21.65	0.04
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	21.65	21.70	0.05
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	21.70	21.74	0.04
Cass County, ND	IWa	Water	21.74	21.76	0.02
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	21.76	21.77	0.02
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	21.77	21.85	0.08
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	21.85	21.90	0.05
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	21.90	21.96	0.06
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	21.96	22.14	0.18
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	22.14	22.87	0.73
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	22.87	23.01	0.14
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	23.01	23.39	0.38
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	23.39	23.45	0.06
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	23.45	23.51	0.06
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	23.51	23.55	0.03
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	23.55	23.58	0.03
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	23.58	23.62	0.04
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	23.62	23.70	0.09
Cass County, ND	I906F	Orthents-Aquents-Urban Land, highway complex, 0 to 35 percent slopes	23.70	23.78	0.07
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	23.78	23.98	0.20
Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	23.98	24.60	0.62
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	24.60	25.00	0.40
Cass County, ND	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	25.00	25.11	0.11
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	25.11	25.60	0.49
Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	25.60	26.01	0.41
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	26.01	26.13	0.13
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	26.13	26.74	0.61
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	26.74	27.03	0.29

APPENDIX 7B

Soil Map Units Crossed by Milepost

County, State	Map Unit Symbol	Map Unit Name	MP Start	MP End	Crossing Length (mi)
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	27.03	27.36	0.32
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	27.36	27.40	0.04
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	27.40	27.48	0.08
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	27.48	27.52	0.04
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	27.52	27.66	0.15
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	27.66	27.69	0.03
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	27.69	28.28	0.59
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	28.28	28.46	0.17
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	28.46	28.52	0.06
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	28.52	28.55	0.03
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	28.55	29.13	0.58
Cass County, ND	I241A	Fargo-Ryan silty clays, 0 to 1 percents slopes	29.13	29.47	0.33
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	29.47	31.13	1.67
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	31.13	31.57	0.43
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	31.57	31.69	0.12
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	31.69	31.74	0.04
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	31.74	31.76	0.02
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	31.76	31.83	0.07
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	31.83	32.17	0.34
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	32.17	32.25	0.08
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	32.25	32.63	0.39
Cass County, ND	I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	32.63	32.81	0.18
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	32.81	33.06	0.25
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	33.06	33.08	0.02
Cass County, ND	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	33.08	33.11	0.03
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	33.11	34.27	1.16
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	34.27	34.33	0.06
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	34.33	34.52	0.19
Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	34.52	35.09	0.56
Cass County, ND	I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	35.09	35.72	0.63
Cass County, ND	I119A	Bearden silty clay loam, 0 to 2 percent slopes	35.72	35.94	0.22
Cass County, ND	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	35.94	36.20	0.26
Cass County, ND	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	36.20	36.41	0.21
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	36.41	36.47	0.06
Cass County, ND	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	36.47	36.79	0.32
Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	36.79	37.23	0.43

MP = milepost

Valley Expansion Project

Resource Report 7

APPENDIX 7C

Soil Characteristics Affected by the Project (in Acres)

APPENDIX 7C

Soil Characteristics Affected by Project (in Acres)

County, State	Map Unit	Map Unit Name	Temporary ROW Area [a] (acres)	Permanent ROW Area (acres)	Farmland Designation [b]	Hydric [c]	Non-Irrigated Land Capability Classification [d]	Wind Erodibility Group [e]	Slope Class (Percent) [f]	K_w	Topsoil Depth (inches)	Drainage Class [g]	Surface Texture [h]	Depth to Bedrock (inches) [i]	Soil pH [j]	Corrosion Potential [k]
PIPELINE																
Clay County, MN	I130A	Hegne-Fargo silty clays, 0 to 1 percent slopes	4.2		Prime farmland if drained	Yes	4	2w	1	.24	20	Poorly drained	Silty clay		7.9	High
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	45.7		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	6.5		Prime farmland if drained	Yes	4	3w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Clay County, MN	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	1.9		All areas are prime farmland	No	4	2e	1	.17	58	Moderately well drained	Silty clay		7	High
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	43.9		Prime farmland if drained	Yes	4L	2w	0.5	.37	23	Poorly drained	Silty clay loam		7.5	High
Clay County, MN	I377A	Wheatville silt loam, 0 to 2 percent slopes	16.5		All areas are prime farmland	No	4L	2e	1	.32	23	Somewhat poorly drained	Silt loam		7.8	High
Clay County, MN	I467A	Bearden silt loam, 0 to 2 percent slopes	27.9		All areas are prime farmland	No	4L	2e	1	.37	21	Somewhat poorly drained	Silt loam		7.6	High
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	30.5		All areas are prime farmland	No	4L	2e	1	.32	20	Somewhat poorly drained	Loam		7.9	High
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	5.1		Prime farmland if drained	Yes	4L	2w	0.5	.37	18	Poorly drained	Loam		7.9	High
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	29.9		Prime farmland if drained	No	4L	2e	1	.32	21	Somewhat poorly drained	Silty clay loam		7.6	High
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	6.8		Prime farmland if drained	Yes	4L	2w	0.5	.32	18	Poorly drained	Silt loam		7.9	High
Clay County, MN	I641A	Fargo silty clay, silty substratum, 0 to 1 percent slopes	5.4		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Clay County, MN	I642A	Fargo silty clay, silty substratum, depressional, 0 to 1 percent slopes	5.3		Prime farmland if drained	Yes	4	3w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I119A	Bearden silty clay loam, 0 to 2 percent slopes	3.0		All areas are prime farmland	No	4L	2e	1	.28	21	Somewhat poorly drained	Silty clay loam		7.6	High
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	122.3		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I231A	Dovray silty clay, 0 to 1 percent slopes	2.5		Prime farmland if drained	Yes	4	3w	0	.20	20	Very poorly drained	Silty clay		7	Moderate
Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	12.7		Prime farmland if drained	Yes	6	2w	0.5	.28	20	Poorly drained	Silty clay loam		7.2	High
Cass County, ND	I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	2.2		Prime farmland if drained	Yes	4	2w	1	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	30.6		Prime farmland if drained	Yes	4	3w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	24.8		Prime farmland if drained	Yes	4	2w	0.5	.24	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I241A	Fargo-Ryan silty clays, 0 to 1 percents slopes	4.5		Not prime farmland	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	3.2		All areas are prime farmland	No	4	2e	1	.17	58	Moderately well drained	Silty clay		7	High
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	4.5		All areas are prime farmland	No	4	2e	3	.17	18	Somewhat poorly drained	Silty clay		7.9	High
Cass County, ND	I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	7.6		All areas are prime farmland	No	4L	2e	1	.32	21	Somewhat poorly drained	Silty clay loam		7.6	High
Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	12.7		Not prime farmland	Yes	4	3s	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	7.8		Prime farmland if drained	Yes	4L	2w	0.5	.32	20	Poorly drained	Silty clay loam		7.9	High
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	8.0		All areas are prime farmland	No	4	2e	3	.20	30	Well drained	Silty clay		6.3	High
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	0.1		Not prime farmland	No	4L	2c	2	.28	18	Moderately well drained	Silt loam		7.6	High
		Pipeline Total	**475.8**	**0.0**												
ACCESS ROADS																
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	1.1		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Clay County, MN	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	0.2		Prime farmland if drained	Yes	4	3w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Clay County, MN	I376A	Colvin silty clay loam, 0 to 1 percent slopes	0.4		Prime farmland if drained	Yes	4L	2w	0.5	.37	23	Poorly drained	Silty clay loam		7.5	High

APPENDIX 7C

Soil Characteristics Affected by Project (in Acres)

County, State	Map Unit	Map Unit Name	Temporary ROW Area [a] (acres)	Permanent ROW Area (acres)	Farmland Designation [b]	Hydric [c]	Non-Irrigated Land Capability Classification [d]	Wind Erodibility Group [e]	Slope Class (Percent) [f]	K_w	Topsoil Depth (inches)	Drainage Class [g]	Surface Texture [h]	Depth to Bedrock (inches) [i]	Soil pH [j]	Corrosion Potential [k]
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	0.3		All areas are prime farmland	No	4L	2e	1	.32	20	Somewhat poorly drained	Loam		7.9	High
Clay County, MN	I627A	Bearden-Fargo complex, 0 to 2 percent slopes	0.2		Prime farmland if drained	No	4L	2e	1	.32	21	Somewhat poorly drained	Silty clay loam		7.6	High
Clay County, MN	I634A	Augsburg silt loam, 0 to 1 percent slopes	0.6		Prime farmland if drained	Yes	4L	2w	0.5	.32	18	Poorly drained	Silt loam		7.9	High
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	2.9		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I231A	Dovray silty clay, 0 to 1 percent slopes	0.2		Prime farmland if drained	Yes	4	3w	0	.20	20	Very poorly drained	Silty clay		7	Moderate
Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	0.3		Prime farmland if drained	Yes	6	2w	0.5	.28	20	Poorly drained	Silty clay loam		7.2	High
Cass County, ND	I235A	Fargo silty clay, depressional, 0 to 1 percent slopes	1.5		Prime farmland if drained	Yes	4	3w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I238A	Fargo-Hegne silty clays, 0 to 1 percent slopes	0.3		Prime farmland if drained	Yes	4	2w	0.5	.24	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	0.6		All areas are prime farmland	No	4	2e	1	.17	58	Moderately well drained	Silty clay		7	High
Cass County, ND	I293B	Cashel silty clay, 0 to 6 percent slopes, occasionally flooded	0.9		All areas are prime farmland	No	4	2e	3	.17	18	Somewhat poorly drained	Silty clay		7.9	High
Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	0.2		Not prime farmland	Yes	4	3s	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I475B	Sinai silty clay, levees, 0 to 6 percent slopes	0.7		All areas are prime farmland	No	4	2e	3	.20	30	Well drained	Silty clay		6.3	High
Cass County, ND	I479B	Fairdale-Fluvaquents, channeled complex, 0 to 6 percent slopes, frequently flooded	0.4		Not prime farmland	No	4L	2c	2	.28	18	Moderately well drained	Silt loam		7.6	High
		Access Roads Total	**10.8**	**0.0**												
LAYDOWN YARDS																
Clay County, MN	I15A	Hecla loamy fine sand, 0 to 2 percent slopes	6.5		Not prime farmland	No	2	4e	2	.24	41	Moderately well drained	Loamy fine sand		7	Low
Clay County, MN	I356A	Ulen fine sandy loam, 0 to 2 percent slopes	0.5		Farmland of statewide importance	No	3	3e	1	.10	23	Somewhat poorly drained	Fine sandy loam		7.9	High
Clay County, MN	I762A	Vallers loam, lake plain, 0 to 1 percent slopes	0.7		Prime farmland if drained	Yes	4L	2w	1	.28	23	Poorly drained	Loam		7.5	High
Cass County, ND	I229A	Fargo silty clay, 0 to 1 percent slopes	7.4		Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I234A	Fargo-Nutley silty clays, 0 to 2 percent slopes	2.5		Prime farmland if drained	Yes	4	2w	1	.17	20	Poorly drained	Silty clay		7.2	High
Cass County, ND	I473A	Hegne-Fargo silty clay loams, 0 to 1 percent slopes	3.3		Prime farmland if drained	Yes	4L	2w	0.5	.32	20	Poorly drained	Silty clay loam		7.9	High
		Laydown Yards Total	**20.7**	**0.0**												
ABOVEGROUND FACILITIES																
Apple Valley TBS																
Burleigh County, ND	C210B	Williams-Bowbells loams, 3 to 6 percent slopes	0.7	0.5	Farmland of statewide importance	No	6	2e	4	.24	15	Well drained	Loam		7.2	Moderate
Burleigh County, ND	C740A	Temvik silt loam, 0 to 3 percent slopes	0.1	0.0	Farmland of statewide importance	No	6	2c	1	.32	18	Well drained	Silt loam		7	Moderate
		Apple Valley TBS Subtotal	**0.7**	**0.5**												
Jamestown TBS																
Stutsman County, ND	G101A	Hamerly-Wyard loams, 0 to 3 percent slopes	0.4	0.3	All areas are prime farmland	No	4L	2e	2	.20	20	Somewhat poorly drained	Loam		7.5	High
		Jamestown TBS Subtotal	**0.4**	**0.3**												
Mapleton Compressor Station																
Cass County, ND	I233A	Fargo silty clay loam, 0 to 1 percent slopes	10.4	6.0	Prime farmland if drained	Yes	6	2w	0.5	.28	20	Poorly drained	Silty clay loam		7.2	High
Cass County, ND	I248A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	0.0	0.0	All areas are prime farmland	No	4	2e	1	.17	58	Moderately well drained	Silty clay		7	High
		Mapleton Compressor Station Subtotal	**10.4**	**6.0**												

APPENDIX 7C

Soil Characteristics Affected by Project (in Acres)

County, State	Map Unit	Map Unit Name	Temporary ROW Area [a] (acres)	Permanent ROW Area (acres)	Farmland Designation [b]	Hydric [c]	Non-Irrigated Land Capability Classification [d]	Wind Erodibility Group [e]	Slope Class (Percent) [f]	K_w	Topsoil Depth (inches)	Drainage Class [g]	Surface Texture [h]	Depth to Bedrock (inches) [i]	Soil pH [j]	Corrosion Potential [k]
Block Valve 24.4																
Cass County, ND	I469A	Fargo silty clay, moderately saline, 0 to 1 percent slopes	0.2	0.2	Not prime farmland	Yes	4	3s	0.5	.17	20	Poorly drained	Silty clay		7.2	High
		Block Valve 24.4 Subtotal	**0.2**	**0.2**												
Sanborn Regulator Station																
Barnes County, ND	G101A	Hamerly-Wyard loams, 0 to 3 percent slopes	0.6	0.3	All areas are prime farmland	No	4L	2e	2	.20	20	Somewhat poorly drained	Loam		7.5	High
Barnes County, ND	G118A	Vallers loam, saline, 0 to 1 percent slopes	0.5	0.4	Not prime farmland	Yes	4L	4w	0	.28	23	Poorly drained	Loam		7.9	High
		Sanborn Regulator Station Subtotal	**1.1**	**0.6**												
Viking Interconnect																
Clay County, MN	I507A	Glyndon loam, 0 to 2 percent slopes	0.1		All areas are prime farmland	No	4L	2e	1	.32	20	Somewhat poorly drained	Loam		7.9	High
Clay County, MN	I5A	Borup loam, 0 to 1 percent slopes	4.9	0.6	Prime farmland if drained	Yes	4L	2w	0.5	.37	18	Poorly drained	Loam		7.9	High
		Viking Interconnect Subtotal	**5.0**	**0.6**												
Block Valve 14.4																
Clay County, MN	I229A	Fargo silty clay, 0 to 1 percent slopes	0.4	0.4	Prime farmland if drained	Yes	4	2w	0.5	.17	20	Poorly drained	Silty clay		7.2	High
		Block Valve 14.4 Subtotal	**0.4**	**0.4**												
		Aboveground Facilities Total	**18.2**	**8.6**												
		Project Total	**525.5**	**8.6**												

[a] Temporary right-of-way areas include TWS and additional TWS.

[b] Farmland designations as noted in the Soil Survey Geographic (SSURGO) databases for each county within the Project footprint. The farmland classification designates map units as one of the following categories: prime farmland, prime farmland if a limiting factor is mitigated, farmland of statewide importance, farmland of local importance, or farmland of unique importance.

[c] Hydric status as noted in the SSURGO databases for each county within the Project footprint.

[d] Non-irrigated land capability class and subclass as noted in the SSURGO databases for each county within the Project footprint. Capability class is the broadest category in the land capability classification system and values range from 1 to 8 which indicate soils with slight limitations that restrict their use to soils with very severe limitations that make them unsuited to cultivation respectively. Capability subclass is the second category in the land capability classification system and values indicate the dominant problem or hazard affecting their use. Values are “e” (erosion susceptibility), “w” (poor soil drainage, wetness, a high water table, or overflow), “s” (limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content), and “c” (climate; the temperature or lack of moisture).

[e] The wind erodibility group is a grouping of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. Values range from 1-8. A rating of 1 is the most susceptible and a rating of 8 is least susceptible to wind erosion.

[f] Slope class of the dominant soil component as noted in the SSURGO databases for each county within the Project footprint.

[g] Drainage class identifies the natural drainage condition of the soil. The eight natural drainage classes are: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, very poorly drained, and subaqueous.

[h] Soil texture of the surface layer of soil as noted in the SSURGO databases for each county within the Project footprint.

[i] The vertical distance from the soil surface to the upper boundary of bedrock.

[j] Soil pH is a numerical expression of the relative acidity or alkalinity of a soil. Values range from 1.8 (ultra-acidic) -11.0 (very strongly alkaline)

[k] Corrosion potential using SSURGO values for the risk of corrosion for uncoated steel. Values include low, moderate, and high.

ROW = right-of-way

NOTE: Due to rounding, some addends may be off by 0.1 place.

Source: U.S. Department of Agriculture, Natural Resources Conservation Service. n.d-a. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed December 2016.