BAKKENLINK PIPELINE PROJECT

PLAN OF DEVELOPMENT

BakkenLink Pipeline Project
Dry Creek Terminal to Beaver Lodge
McKenzie and Williams Counties, North Dakota

BakkenLink Pipeline LLC

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1. Introduction

1.1) General Introduction

The Project is a crude oil pipeline system consisting of approximately 37 miles of 16-inch steel crude oil pipeline extending from the Beaver Lodge receipt point in Williams County, North Dakota to the Dry Creek Terminal in McKenzie County, North Dakota (Figure 2-1). The connect to the Dry Creek Terminal will establish a connection with the existing BakkenLink Pipeline that is transporting crude oil to a rail facility operated by Great Northern Midstream LLC at Fryburg, North Dakota. BakkenLink is developing and intends to construct, own, and operate the Project.

This Plan of Development (POD) describes procedures that would be taken by BakkenLink Pipeline LLC (BakkenLink) and its contractors (Contractor) during the construction, operation, and maintenance of the BakkenLink Beaver Lodge to Dry Creek Terminal Pipeline Project (Project). This POD summarizes current proposed actions as presented by BakkenLink for this project and outlines mitigation or protection measures that would be implemented on the Project. The proposed action as described in the POD is the preferred route/alternative based on the analysis conducted by BakkenLink. The alternative analysis and preferred route selection was done in coordination with the BLM, USACE and the USFS. Updates and modifications would be incorporated into this POD as necessary.

Proposed actions and measures in this POD apply to actions within the project area, defined as the construction right-of-way (ROW), access roads, and all additional temporary workspace (ATWS) utilized during the construction and staging of material for this project. BakkenLink and Contractor personnel would be aware of and familiar with this POD and its content prior to any project related construction.

1.2) Purpose of Plan

The purpose of this POD is to provide an overview of the proposed project, each construction phase, construction methods, potential pipeline impacts and mitigation measures, operation and maintenance, and reclamation procedures. The POD incorporates site specific drawings and schematics for contractors and construction crews to ensure safe and appropriate construction. The POD would be used in conjunction with other site specific plans.

Throughout this POD, maps and alignment sheets containing details regarding the Project ROWs are referenced and are included in the appendices. This includes crossings of roadways, utilities, waterbodies, and detailed information on required ATWS.

2. Purpose and Need

2.1) Description of Proposed Construction

The purpose of the project is to transport light sweet crude, typical of middle Bakken and upper Three Forks formations ("Bakken") production. The preferred route of the proposed pipeline will consist of approximately 37 miles of 16-inch crude oil pipeline which would commence near Johnsons Corner, North Dakota at the existing Dry Creek Terminal receipt point, traverse Lake Sakakawea, and terminate at the Beaver Lodge receipt point near Tioga, North Dakota. The anticipated in-service date for the Lake Sakakawea portion of the Project is Q3/Q4 2016 and the anticipated in-service date for the Dry Creek Terminal to Beaver Lodge portion of the Project is Q3/Q4 2016. BakkenLink would transport crude oil at

an initial capacity of 100,000 barrels per day (BPD) from three proposed receipt points, including one existing and two new proposed crude oil truck receipt locations and pipeline gathering receipt stations. Via connection to the Great Northern Midstream LLC rail facility, the crude oil collected by the Project would have improved access to key markets across the United States.

The Project would consist of the following pipeline assets and associated receipt points:

Table 2-1. Pipeline Assets

Diameter	Approx. Mileage	Description
16-inch	37.1	Bi-directional steel pipeline that would transport crude oil between Beaver Lodge Receipt Point on the north end of the system and the Dry Creek Terminal on the south end.

Table 2-2. Pipeline Associated Receipt Points

Receipt Point	County	Facility Status
Beaver Lodge	Williams, ND	Proposed
Keene	McKenzie, ND	Proposed
Dry Creek Terminal	McKenzie, ND	Existing

2.2) Project Need

BakkenLink would provide a number of producers in western North Dakota with a much needed alternative means of transporting their crude oil. BakkenLink shippers would be able to access new markets via an existing rail facility operated by Great Northern Midstream LLC near Fryburg, North Dakota and potential pipeline interconnects in the Beaver Lodge area. It is anticipated that the Project would encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The Project would address regional pipeline and outlet constraints as development of the Bakken Formation continues. Based on current rig activity, BakkenLink estimates that oil production and development associated with the Bakken and Three Forks formations has and will continue to increase beyond existing pipeline capacity in the geographic market area to be served by BakkenLink in the region. The expansion of the BakkenLink Pipeline from the Dry Creek Terminal to the Beaver Lodge receipt point is expected to reduce truck traffic in the project area. The reduction in truck traffic is expected to increase human health and safety over the long term by decreasing impacts to air quality and reducing traffic. In addition the reduction in traffic associated with the proposed project will reduce the strain on roads and related infrastructure.

The route design for the Project would provide various origination points (i.e., receipt points) in the most prolific and active parts of the middle Bakken and upper Three Forks development, as well as provide much needed access to pipeline service in the project area. The 16-inch-diameter pipeline allows for economic expansion opportunities.

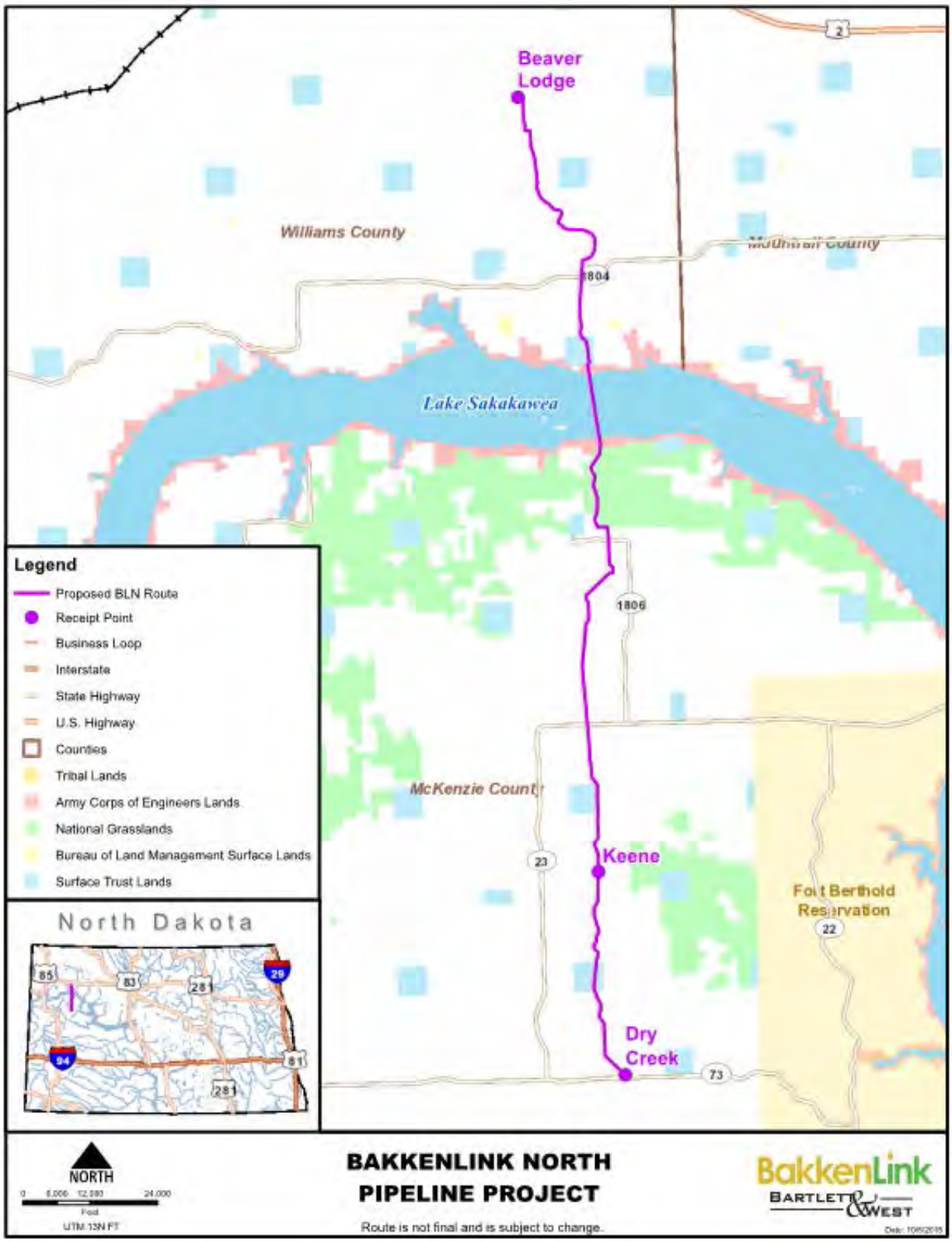

Figure 2-1. Project Overview Map

2.3)Commodity and Purpose

The Project would transport crude oil, specifically, light sweet crude, typical of middle Bakken and upper Three Forks formations ("Bakken") production. The Project would provide much-needed pipeline capacity to transport the increasing supplies of crude oil produced in portions of Williams and McKenzie Counties in North Dakota.

2.4) Pipeline Type

The Project would consist of a pipeline for the transportation of crude oil from three receipt points listed in Table 2-2 as well as connect the existing BakkenLink line to areas and outlets on the north side of Lake Sakakawea.

2.5) Alternative Routes

BakkenLink evaluated several options for the proposed route with the participation of the U.S. Army Corps of Engineers (USACE) and the U.S. Forest Service (USFS), Bureau of Land Management (BLM) and various other state and federal agencies. Each option was considered in light of study of underserved Bakken development areas, economics, engineering design, feasibility to construct, and environmental impacts. The location of the proposed route was selected to have minimal effects on resources and residents. Key routing considerations included the location and number of receipt points in relation to the existing and proposed oil field production facilities as well as the crossing of the Missouri River at Lake Sakakawea.

The Missouri River crossing at Lake Sakakawea is a key logistical consideration. Several crossing locations were evaluated during preliminary design and planning of the Project. Crossing locations west of Williston, at New Town, and at a location approximately 6 miles west of the proposed location, have been evaluated. BakkenLink presented the different crossing location options for discussion at meetings with the USACE and USFS on November 2, December 9, 2010, and on February 9, 2011 (subsequent meetings held – see Addendum to Lake Sakakawea Crossing Reports, Appendix X.A). As a result of the meetings with the federal agencies and evaluation of the engineering, construction and commercial drivers for the project, the current crossing location north of Keene was preferred over other crossing locations. There are currently pipelines installed in this area across the Missouri River thus creating a quasi-corridor for pipelines.

3. Right-of-Way Location

3.1) Description and Dimensions

The temporary construction ROW for the Project would generally be 100 feet wide. ATWS will be acquired at certain locations (e.g., staging for road, railroad, and river crossings) as found in **Appendix I**; however, the temporary construction ROW may also be reduced in some locations as necessary to avoid/reduce impacts to environmentally sensitive areas such as wetlands. In these locations, the temporary ROW would be reduced to 75 feet or less to minimize impacts. Temporary ROW across USFS land would be reduced to 50 feet.

The permanent easements generally would be 50 feet wide for the length of the pipeline (i.e., 37 miles). The location of the pipeline within the permanent ROW may vary depending on terrain, the presence of

other existing facilities, landowner concerns, and environmentally sensitive resources. The Project would follow existing pipeline and utility easements where feasible. The permanent ROW would be reduced in environmentally sensitive areas to 30 feet or less. Across USFS lands, permanent ROW would be reduced to 20 feet.

For additional Project-related needs, a total of 51.6 acres of temporary area serving as ATWS would be required for construction-related activities. The proposed Beaver Lodge receipt point, proposed Keene receipt point, and the existing facility located near the Dry Creek Terminal would be utilized as temporary pipe storage yard locations. Any additional pipe storage yards, equipment staging areas, or Contractor offices would be at designated pipe yards or existing Contractor facilities. Equipment wash stations would be located on the temporary workspace in areas to facilitate equipment cleaning to preclude the spreading of noxious weeds per the *Noxious Weed Plan* (**Appendix XXVII**). ATWS would be designated near wetlands, at HDD and bored crossings, and other areas where special construction techniques are necessary. BakkenLink would not utilize ATWS in any wetland and would use a minimum setback of 50 feet. In addition, hazardous materials, chemicals, fuels, etc., would not be stored within 100 feet of wetlands or waters of the U.S.; however, construction equipment may be staged within the ATWS. Other setbacks associated with wetlands/waterbody edges would include 50 feet for all equipment staging areas and 10 feet for temporary storage of spoil material. Refueling of stationary equipment associated with the project would be done on USACE lands only with the equipment located within a secondary containment system. Refueling of non-stationary equipment other than marine equipment used on USACE land would be refueled off USACE lands where practicable, otherwise would take place in a single central location within a secondary containment area.

Table 3-1. Temporary Pipe Storage Yards

Yard	Approx. MP	Footprint * (Acres)	Location Description
Dry Creek Pipe Yard	0	15	Adjacent to route, near the Dry Creek Terminal
Keene Pipe Yard	7.5	30	At Keene Receipt Point
Beaver Lodge Pipe Yard	37	25	At Beaver Lodge Receipt Point

* No additional acreage will be disturbed for temporary pipe storage yards

In addition to these temporary areas, there would be three receipt points associated with the Project, one of which is an existing facility. The existing facility is the Dry Creek Terminal on the very southernmost terminus of this project. The two new receipt points would be constructed (and the lands purchased) by others. In relation to the project; however, they are related actions and therefore, will be included in the project design and operation analyses. The Keene and Beaver Lodge receipt points are estimated to have a footprint of 30 and 25 acres, respectively, resulting in a total of 55 acres committed to these sites.

At the three receipt point locations, all facilities, above-ground appurtenances, and pipeline inspection gauge (Pig) launcher assemblies would be within the fence lines of the receipt point, with the exception of mainline valves (MLVs), which would have impacts as noted in the typical MLV layout shown in **Appendix VII**. Additional permanent acreage impacts directly associated with the pipeline would be required MLVs located along the length of the pipeline. Three MLVs would be located along the length of the pipeline. Dimensions and acreage of the MLV sites can be seen below in Table 3.2, with locations

along the pipeline shown in Table 5-1. All sites would require gravel, which is further described in section 5.3.

Table 3-2. Pipeline Appurtenance Acreage

Location	Description	Site Size (feet)	Footprint (Acres)
MLV 1	MLV North of Lake	100 x 100	0.23
MLV 2	MLV South of Lake	100 x 100	0.23
MLV 3	MLV South of USFS	30 x 40	0.03
		TOTAL ACRES	0.49

The Contractor would be responsible for logistics and securing lodging for the construction personnel. It is anticipated the existing man camps available commercially would be utilized for housing of personnel. These sites would have the requisite permitting and authorization from state, local and federal agencies. Additional information pertaining to construction personnel can be found in section 7.9.

3.2) Site-Specific Engineering Surveys for Critical Areas

Aerial LiDAR (Light Detection and Ranging) data was collected and processed at a width of 500 feet along the entire route to identify critical areas for site-specific surveys (i.e., wetlands). With this approach, the only additional survey work required was to locate the "entry and exit" points for the horizontal directional drills and to capture all of the above and below ground facilities crossed, such as roads, powerlines, pipelines, telephone lines, fiber optic cables, etc.

3.3) Waterbody Crossings

"Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes. Waterbody crossings would be constructed in accordance with applicable permits. Waterbody crossings will generally be constructed using various methodologies including open-cut trenching and/or Horizontal Directional Drilling (HDD) technology. The Lake Sakakawea crossing will be installed via a pipeline pull method into pre-installation shoreline crossing trenches at both shorelines supplemented with post-installation lowering through the intervening route segment. The methodology for each waterbody location would be determined by the crossing size and sensitivity. Waterbody crossings and methods are listed in **Appendix IX**. Specific methodologies for waterbody crossings have been determined at this time, and will also be evaluated by the Contractor based on construction site-specific circumstances as well as recommended mitigation based on input from the agencies. Additional HDD crossing information is included in Table 10-2.

The Route traverses the Lake Sakakawea (HUC 10110101) watershed. The route crosses one perennial stream (one total crossing): the Missouri River (Lake Sakakawea). Stream crossing locations and crossing methods are summarized in **Appendix IX**. A list of total stream crossings by county can be seen in the following Table 3-3. The crossing of the Missouri River (i.e., Lake Sakakawea) is included as a perennial stream crossing.

Table 3-3. Stream Crossing Totals by County

County	Intermittent	Perennial	Total
McKenzie	17	1	18
Williams	10	1	11
Total	27	2	29

Except for Lake Sakakawea, all water bodies that would be crossed by the BakkenLink Pipeline Project would have a minimum of five (5) feet of cover from the top of the pipe to the bed of the waterbody. Due to its size and installation methodology, Lake Sakakawea, the minimum depth of cover would be four (4) feet as shown below in Table 3-4.

Table 3-4. Exceptions to General Depth of Cover

Waterbody	Crossing Method	Depth of Cover
Lake Sakakawea	Trench/Pull	4 feet minimum cover below the lake bed

Pertaining to the crossings of Lake Sakakawea, specific crossing details, plans, and maps can be found in **Appendix X**. This appendix includes a detailed lake crossing work plan, which contains updates to permit requirements and design considerations as well as inputs from potential installation contractors regarding construction approaches. Four feet minimum depth of cover for the lake crossing meets and exceeds both federal requirements for pipeline cover and standard industry practices for marine pipelay techniques. In addition to the minimum cover, extra measures were taken in the design to protect the pipeline crossing the lake.

Additional protective measures for Lake Sakakawea pipeline crossing include:

- Increased 0.500” wall thickness will be used for pipe crossing lake as compared to standard line pipe of 0.312” wall thickness
- Reinforced concrete weight coating for enhanced mechanical protection and buoyancy control
- Increased depth of cover at the shorelines with additional rock cap
- Remote controlled isolation double block valves as close as practical to the shorelines
- Remote line pressure monitors/transmitters at the valve locations

An alternative crossing method for Lake Sakakawea was also considered, Horizontal Direction Drilling, and details are included in **Appendix X**. As a result of this alternative’s evaluation, bore hole samples were collected to examine the subsurface conditions of Lake Sakakawea. **Appendix X** does not indicate whether the borings were abandoned or not, but it should be noted that they were abandoned by grouting them with bentonite prior to pulling the casing.

BakkenLink evaluated both the proposed and alternative lake crossing methodologies. The determination that the alternative HDD method was not a viable method and will be discussed more in **Appendix X**.

3.4) Land Status Right-of-Way Acreage

The proposed pipeline route would traverse private, state, and federal lands. Approximately 28.78 miles (77.6 percent) of the proposed route would be on private lands, 3.13 miles (8.4 percent) on state lands, and 5.18 miles (14 percent) on federal lands. A breakdown of the pipeline length and acreage for the permanent easements (i.e., 50 ft wide typical, except 20 ft wide for USFS) and temporary construction ROW (i.e., 100 ft wide, except 50 ft wide for USFS) can be seen below in Table 3-5**.**

Table 3-5. Pipeline Right-of-Way by Land Status

Land Status	Percentage (%)	Pipe Length (Miles)	Pipe Length (Feet)	Permanent Easement (Acres)	Temporary Construction ROW (Acres)	Total (Acres)
Federal (USFS)	6.6	2.43	12,844	5.9	15.7	22
Federal (USACE)	7.4	2.75	14,514	11.3	12.7	24
State	8.4	3.13	16,536	11.7	31.2	43
Private	77.6	28.78	151,974	162.9	154.9	318
Total	100	37.09	195,868	191.8	214.5	406

3.5) Identification and Map Notation of Temporary Construction Workspace

In addition to the pipeline acreage used for both the permanent easements and temporary construction ROW specific to the pipeline, ATWS would be required along the route and would amount to a total of 51.6 acres as previously mentioned. The 214.5 acres of Temporary Construction ROW listed in Table 3-5 includes the 51.6 acres of ATWS. Specific Project ATWS locations and acreage can be found in **Appendix I**. A total of three temporary pipe storage yards would be required during the project [one 15-acre, one 30-acre, and one 25-acre yard (Table 3-1)]. The 15-acre pipe yard will be located at the existing Dry Creek Receipt Point. The 30 and 25-acre pipe yards will both be located at the two new receipt points, Keene and Beaver Lodge, respectively. Three MLV sites along the proposed pipeline would account for an additional 0.49 acres (Table 3.2).

In sum, a total of 476.3 acres of land would be required for construction-related activities for the project [i.e., 406.3 acres for combined temporary construction ROW and permanent easements (Table 3-5), 70 acres for temporary pipe storage yards and purchased project-related land (Table 3-1)]. Typical Project ROW and ATWS construction drawings can be found in **Appendix II.**

4. Facility Design Factors

4.1) Pipeline Specifications (Pressure/ Temperatures)

The BakkenLink Pipeline is designed to be a 16-inch-diameter steel pipeline for the transportation of crude oil. The system would only accept for transport light sweet crude, generally low in sulfur content and typical of production from the Bakken pools in North Dakota. The specifications of the pipeline segments are described below:

- 16-inch Trunkline -- 16.00” OD X 0.312” WT, API 5L-X65
- 16-inch Drilled/Bored Crossings -- 16.00” OD X 0.375” WT, API 5L-X65
- 16-inch Lake Sakakawea Crossing -- 16.00” OD X 0.500” WT, API 5L-X65

The pipeline is designed for a maximum temperature rating of 120 degrees Fahrenheit and a maximum operating pressure of 1,480 pounds-force per square inch gauge (psig). The Project would typically operate at 60 degrees Fahrenheit and between 200 to 1,000 psig. The 16-inch-diameter trunkline is designed for an initial flow rate of 100,000 BPD and could be expanded to 135,000 BPD with projected associated facilities.

4.2) Pipeline Lowering

US DOT regulation (49 CFR §195.248) specifies the minimum depths of cover for various locations. This pipeline will exceed minimum regulation requirements and have a minimum cover of 4 feet from natural ground to top of pipe. For 16-inch-diameter pipe, the trench is typically about five and a half feet deep to allow for four feet of cover. The trench would be approximately two feet wide in stable soils and up to 11 feet wide in saturated or otherwise unstable soils. Additional trench width may be required to maintain stability of trench walls for the safety of pipeline workers and equipment. As an added protective measure, the pipeline would be installed to a minimum depth of 5 feet below the bottom of waterbodies including rivers, creeks, streams, ditches, and drains. This depth would normally be maintained over a distance of 15 feet on each side of the waterbody measured from the top of the defined stream channel. The following table indicates BakkenLink proposed depths that meet or exceed standard depths that would apply to pipeline construction.

Table 4-1. Pipeline Depth

Location	Excavation (inches)
Undeveloped Section Line crossing	72
Rangeland and cultivated lands	48
Industrial, commercial, and residential areas	48
Crossings of inland bodies of water with a width of at least 100 ft from high water mark to high water mark (with the exception of Lake Sakakawea)	60
Drainage ditches at public roads and railroads	48

Depth of cover requirements may be modified by BakkenLink based on site-specific conditions. Lake Sakakawea is an example of modifications to the general depth of cover requirements due to site-specific conditions. Information about these crossings is provided in Section 3.3. All depths, however, would be in compliance with all established codes.

5. Additional Components of Right-of-Way

5.1) Location of Facilities and Connections to Existing Facilities

Three receipt points, described in Table 2-2, would be used for input of product. Receipt points would consist of an interconnection installed in the pipeline to allow connection to a truck terminal or other third-party facilities.

Due to the sufficient pressure to be provided from existing input sources, no separate pumping stations would be built as part of the Project. The pressure provided by inputs at the receipt locations through delivery pumps would be adequate for operation of the pipeline at the current projected flow rates. Truck unloading facilities, Lease Automatic Custody Transfer (LACT) units, and delivery pumps would be provided by others at the receipt points. Surface facilities included in the Project would be limited to pipeline markers, cathodic protection test stations and deep well sites, communications equipment, and MLVs. Fenced-in enclosures may be installed to house power, control systems, and communications equipment, allowing valves to be operated remotely. All pig launchers/receivers will be located within receipt point sites. Site footprints and layouts for pig launchers/ receivers and MLVs can be observed in **Appendices IV, V, VI, and VII**.

Table 5-1 summarizes the approximate milepost (Approx. MP) designations between receipt points and lateral interconnections of the trunkline and MLV locations.

Table 5-1. Pipeline Mileposts

Location	Approx. MP
Dry Creek Terminal (includes pig launcher)	Trunkline - 0
Keene Receipt Point	Trunkline - 7.5
MLV 1	Trunkline – 25.9
MLV 2	Trunkline – 23.2
MLV 3	Trunkline – 20.1
Beaver Lodge Receipt Point (includes pig receiver)	Trunkline – 37.1

5.2) Possible Future Components

New pumping stations or additional equipment may be added at planned receipt point locations in the future to boost the Project's capacity from 100,000 BPD to approximately 135,000 BPD. Aboveground storage tanks (AST) also may be installed in the future at strategic locations to allow for storage and other operational considerations. The location for new pumping station and future ASTs would be determined based on future demand and needs.

5.3) Need for Gravel and Sand

Gravel and/or sand are expected to be required for construction. The gravel type is assumed to be dry gravel ranging from ¼ to 2 inches. Approximately 3,016 tons would be used for improving access roads. Locations where gravel or matting will be needed are provided in **Appendix XI** and specific gravel estimates are noted as well. Approximately 419 tons of gravel would be used for HDD staging areas for the HDDs described in Table 10-2. While the pig launchers and receivers and the majority of valves would be located within the receipt point facility footprints, the three MLV sites however would require gravel within their respective footprints. The three MLV sites would require 588 tons of gravel combined. The total expected need for gravel for road improvements, HDD staging sites and, MLV sites is approximately 4,023 tons. No blasting is expected as part of the construction process, so no gravel would be needed to replace rock areas. Should additional gravel or sand be required during the course of construction, the Contractor would be responsible for providing the materials and finding a local site or vendor approved by BakkenLink for procurement. Any potential additional sand or gravel source

would be inventoried for noxious weeds by an environmental inspector prior to approval for use on the ROW.

6. Government Agencies

6.1) Permit Stipulation and Federal, State, and Local Agencies Involved

Federal agencies involved in the Project and which BakkenLink has been working directly with include the U.S. Fish and Wildlife Service, Natural Resources Conservation Service, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, U.S. Forest Service (McKenzie Ranger Districts), U.S. Department of Transportation Federal Highway Administration, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration, U.S. Bureau of Land Management, and National Park Service.

State agencies with which BakkenLink has been working include the North Dakota Department of Transportation, North Dakota Game and Fish Department, Parks and Recreation Department, Department of Health (Air and Water Quality Divisions), State Historical Society, State Public Service Commission (PSC), and State Water Commission. BakkenLink also has been working with McKenzie and Williams Counties, and Pleasant Valley and Dry Fork Townships.

A list of required state and federal permits and stipulations can be found in Table 6-1. BakkenLink would also work with all other local entities (i.e., gas, oil, public utilities, etc.) and adhere to all crossing standards required as necessary. In addition, BakkenLink would treat all private landowners fairly and honor commitments and agreed upon requirements as applicable.

Table 6-1. State and Federal Permitting

Agency	Type of Approval	Need
Federal Permits		
Army Corps of Engineers	Outgrant Application Permit to Construct (Consulting Agency on BLM led Environmental Assessment)	Required for Lake Sakakawea Crossing
	Section 10/404 Permit to Construct	Required for Lake Sakakawea Crossing
	Section 408 Permit to Construct	Required for Lake Sakakawea Crossing
	Nationwide Permit 12	Will obtain if required
Bureau of Land Management	Lead Federal Agency	Coordinate federal review
	Decision Document for Environmental Assessment	Required to allow construction of the project to begin
	Federal ROW Grant	Required to allow construction of the project to begin

Agency	Type of Approval	Need
Department of Transportation, Federal Highway Administration	Permit	Required to cross federal-aid highways
U.S. Forest Service	Right of Way granted via BLM as lead agency on Environmental Assessment (USFS Cooperating Agency)	Required on U.S. Forest Service Land
U.S. Fish and Wildlife	Section 7 Consultation	Biological Opinion
State of North Dakota and County Permits		
ND State Land Department	Easement	Before Individual landowner consultations
ND Department of Transportation	Utility Occupancy Permit	ROW occupancy permit for state roadway crossings
ND State Water Commission	Sovereign Land Permit	ROW access across Missouri River
	Water Use Permit	Prior to use of water from State regulated source
ND State Historical Society	Cultural Resource Review	Compliance with NDCC 55-03 to assess the potential project impacts to cultural resources
ND Game and Fish Department	Consultation	Suggested timing restrictions for construction in waterways.
ND Department of Health, Air Quality Division	Permit to Construct	Required for construction of receipt points
ND Department of Health, Water Quality Division	401 Water Quality Certification	ND Department of Health is cooperating agency with the USACE and would determine impacts to water quality
	North Dakota Pollutant Discharge Elimination System SWPPP	Required for construction projects disturbing 1 or more acres, must have either individual storm water permit or coverage under one of North Dakota's general permits
	Discharge of Hydrostatic Test Water	Permit to discharge hydrostatic test water
ND Public Service Commission	Certificate of Corridor Compatibility and Route Permit	Required to construct a transmission facility
	Certificate of Public Convenience and Necessity	Required for a public utility to construct or operate a public utility
McKenzie County, ND	Permit	Required for road crossings
Williams County, ND	Permit	Required for road crossings
Other Entities	Permit	For all other utility crossing

6.2) Existing Plans of the State, Local Government, and Private Entities

BakkenLink has identified several energy infrastructure projects near the Project but has not identified any potential conflicts. BakkenLink has consulted with various federal, state, and local governments, as well as local businesses and residents, and has not identified any conflicts with proposed developments in the vicinity of the Project.

7. Construction of the Facilities

7.1) General Construction Description

BakkenLink's facilities would be designed, constructed, tested, operated, and maintained in accordance with applicable requirements of the USDOT regulations in 49 CFR §195, United States Department of Labor regulations, Occupational Safety and Health Administration (OSHA) requirements, and other applicable federal and state regulations. These regulations are intended to ensure adequate protection for the public and to prevent crude oil pipeline accidents and failures. Among other design standards, 49 CFR §195 specifies pipeline material selection; minimum design requirements; protection from internal, external and atmospheric corrosion; and qualification procedures for welding and operations personnel.

Pipeline construction is much like a moving assembly line. Construction of the pipeline involves several procedures that are summarized in the following Sections. These operations include:

- Survey and staking;
- Clearing and grading;
- Trenching;
- Pipe stringing;
- Bending;
- Welding;
- Lowering the pipeline;
- Backfilling;
- Hydrostatic testing; and
- ROW cleanup and restoration.

Construction would proceed along the pipeline in one continuous operation. As construction proceeds along a segment, as described in Table 7-1 and depicted in **Appendix XII**, construction at any single point along the pipeline, from initial surveying and clearing, to backfilling and finish grading, is anticipated to last about six to ten weeks. Multiple segments may be constructed at the same time. The entire process would be coordinated in such a manner as to minimize the total time an individual tract of land is disturbed, exposed to erosion, or temporarily precluded from its normal use. Typical construction ROW drawings can be found in **Appendix II** and typical construction drawings for the Project can be found in **Appendix III**.

Table 7-1. Construction Segments

Segment No.	Start Location	End Location	Approximate Length* (Miles)	Approx. MP	
1	Dry Creek Terminal	South of Lake Sakakawea	22.8	0	23
2	South of Lake Sakakawea	North of Lake Sakakawea	2.8	23	26
3	North of Lake Sakakawea	Beaver Lodge Receipt Point	11.5	26	37

*Segment lengths are approximate and the exact location for each segment beginning and end points will be provided in Issue for Construction (IFC) drawings.

7.2) Survey and Staking

The first step of construction would involve marking the limits of the approved work area (the construction ROW and ATWS), the pipeline centerline, access roads, existing utility lines, and other special areas. Sensitive areas such as wetland boundaries and cultural resource sites would be marked and flagged for implementing protective measures. Markers will be labeled "Environmental Sensitive Area" and won't specifically identify the resource. BakkenLink would notify landowners in advance of construction activities that could affect their property, business, or operations.

7.3) Clearing and Grading

The construction ROW would be cleared and graded (where necessary) to provide a relatively level surface for construction equipment, a sufficiently wide workspace for the passage of heavy construction equipment, and safety for the pipeline workers. Vegetation would be mowed and cleared to the edge of the work area in grassland areas where grading is not required.

To avoid soil mixing, topsoil would be removed and segregated from the underlying subsoil. Topsoil would be removed from the entire width of the ROW (i.e., over the trench, spoil side, and on the working side of the temporary construction ROW) for the entire length of the pipeline. Topsoil would be segregated and stored on the temporary construction ROW on the opposite side of the trench from the "working side" where construction activity would take place. After pipeline installation is complete, the subsoil would then be replaced in the pipeline trench and adjacent areas to restore the land's natural contours. Only then would the topsoil be replaced in the locations from where it was initially removed. Special, site-warranted cases, however, may require the storage of topsoil on the "working side" of the trench (e.g., construction on an upward facing side slope), however, topsoil would still be removed from the entire width of the ROW. In these instances the topsoil would be stored outside of the actual work area and would be located on the adjacent ATWS. Typical construction schematics depicting topsoil and subsoil storage locations in relation to the Project ROW for these special site-warranted cases, in addition to most other field cases which will be encountered during construction, can be found in **Appendix II**.

The depth of topsoil stripping would vary according to the ROW landscape position. Construction activities would be suspended during abnormally wet conditions to prevent excessive rutting or mixing of topsoil with subsurface soils.

Fences and gates would be constructed during the clearing and grading operations to allow continuous use of pastures, grazing units, and livestock facilities. Silt fence would be installed along the ROW adjacent to wetlands and streams. When crossing small water features such as small ponds, streams, and creeks, approved temporary flumed structures will be constructed to minimize impacts to the water feature. Specific methodologies for waterbody crossings have not been determined at this time, but would be determined by the Contractor based on construction site-specific circumstances as well as recommended mitigation based on input from the agencies. Temporary erosion controls will be installed after initial disturbance of soils, where necessary, to minimize erosion. Erosion controls would be maintained throughout construction. Typical schematics for the temporary structures mentioned above can be found in **Appendix III**.

7.4) Pipe Stringing, Bending, and Welding

After clearing and grading, the Contractor would string the pipe along the ROW. Pipe would either be stored at storage yards or transported directly to the pipeline ROW. The pipe lengths are typically 40 to 80 feet long. A stringing crew using special trailers would move the pipe along the ROW.

A pipe-bending machine would be used to make slight bends in the pipe to account for changes in the pipeline route and to conform to the topography. The bending machine uses a series of clamps and hydraulic pressure to make a smooth, controlled bend in the pipe. All bending is performed in strict accordance with federally prescribed standards to ensure integrity of the bend.

Pipe would be bent at the mill when necessary for sharp bends or segmentable fittings would be used. The pipe would be pre-coated at the mill with a fusion-bonded epoxy external coating (or other coating technique) to provide corrosion protection.

A welding process would be utilized to join the sections of pipe into one continuous length. Each welder would be required to pass an approved qualification test to work on a particular pipeline aspect. The qualification tests would be conducted using project specific weld procedure(s) that would be developed in accordance with federally adopted welding standards (API 1104).

Welds would be nondestructively tested to ensure structural integrity and compliance with the applicable USDOT regulations. Those welds not meeting established specifications would be repaired or removed. Once the welds are approved, the welded joints would be externally coated and the entire pipeline would be visually and electronically inspected for coating defects, scratches or other damage. Any damage or defects would be repaired before lowering into the trench.

7.5) Trenching

Trenches would be excavated using a wheel trencher or backhoe. Special excavation equipment or techniques may be used if large quantities of solid rock are encountered.

Trenches would be excavated to a depth sufficient to provide the minimum cover required by federal, state and local municipalities as well as landowner requirements. USDOT specifies a minimum cover of 3

feet from natural ground to top of pipe however the ND PSC Corridor Certificate calls out 4 feet depth of cover. Specific trench dimensions and depths of cover are discussed in Section 3.3 and 4.1.

The amount of open trench permitted at any time during the project will be governed by the stability of the trench and the prevailing weather conditions. The open trench will be restricted so as not extend more than three miles ahead of the "firing line" unless approved by Company. When the trench is excavated through lands where livestock is confined or through cultivated fields where it is desirable for the landowner to have a passageway across the trench, temporary fences, gates and/or bridges will be installed to provide appropriate restriction or safe access across the open trench.

7.6) Lowering-in, Padding, and Backfilling

A series of side-boom tractors would simultaneously lift welded sections of the pipe and carefully lower the sections into the trench. Non-metallic slings protect the pipe and coating as it is raised and moved into position. In rocky areas, the Contractor may place sandbags or foam blocks at the bottom of the trench prior to lowering-in to protect the pipe and coating from damage. Trench breakers or water stops will be installed, as necessary, adjacent to wetlands and stream crossings to eliminate groundwater migration along the trench. Construction schematic drawings can be found in **Appendix III**.

The trench would be dewatered, as necessary, prior to lowering in. Dewatering effluent would pass through sediment filters (hay bale structures and/or filter bags), to ensure compliance with applicable water quality requirements. Construction schematic drawings can be found in **Appendix III**.

The trench would be backfilled after the pipe has been installed. Soil would be returned to the trench in the reverse order of excavation. Where topsoil was segregated, subsoil would be backfilled first followed by the topsoil. The trench line (subsoil) would be compacted with a wheeled-roller or other suitable construction equipment. A crown would be left over the trench line to allow for natural subsidence. If the excavated material (rock) can damage the pipe and/or coating, the pipeline would be protected with a rock shield and/or covered with select fill, obtained from commercial borrow areas or by separating suitable material from nearby trench spoil. Topsoil would not be used for padding.

7.7) Hydrostatic Testing

The entire length of the pipeline would be hydrostatically tested before being placed into service. Requirements for this test are prescribed in the USDOT's federal regulations. Depending on the varying elevation of the terrain and the location of available water sources, the pipeline may be divided into sections to facilitate the test. The pipeline section breakdowns are provided in Table 10-1 and 10-2. The exact water source has not been selected yet; however, the source of the hydrostatic test water will be from a local rural water cooperative or a municipal water system.

Each pipe section would be filled with water and pressured to a level higher than the operating pressure. The test pressure would be held for a specific period to confirm that it meets the design strength requirements and if any leaks are present. BakkenLink would require a minimum hydrostatic test pressure of 1850 psig. The maximum pressure would be limited to 95% of the SMYS (Specified Minimum Yield Strength) of the steel pipe, which is 2408 psig.

Hydrostatic test water would be discharged in accordance with applicable permits. It is anticipated that hydrostatic test water would be discharged overland within or along the edges of the construction ROW

using energy dissipation devices to minimize erosion and sedimentation. Test water will not be discharged onto USACE land nor into Lake Sakakawea. Test water would contact only new pipe and BakkenLink does not plan to add chemicals to the test water. Once a test section successfully passes the hydrostatic test, the water is emptied from the pipeline in accordance with federal and state requirements. The pipeline would then be dried to assure it has no free water in it before oil is put into the pipeline. A *Hydrostatic Test Plan* can be found in **Appendix XIV**.

7.8)Cleanup

The final step in the construction process is restoring the ROW as closely as possible to its original condition. Depending on the Project requirements, this typically involves decompacting construction work areas, replacing the topsoil, and seeding non-cultivated land. Decompaction would occur in areas where the topsoil was not stripped but would have experienced sufficient construction traffic to cause soil compaction. As discussed in section 7.3, since topsoil would be stripped across the width of the entire construction ROW, it is anticipated that decompaction measures would only be necessary for specific, site-warranted circumstances. Decompaction measures are further described in **Appendix XIII**. Final grading is anticipated to occur within 20 days of backfilling the trench. Permanent erosion control measures including, but not limited to trench plugs, permanent slope breakers, erosion control matting, and riprap would be installed as necessary and shown in construction drawings within the ROW during this phase. Additional information pertaining to permanent erosion and sediment control can be found in the *Construction Mitigation and Reclamation Plan* (CMRP) in **Appendix XIII.**

Rocks greater than 6” across would not be placed within one foot of the surface on tilled land. Rocks would be collected and disposed of off the ROW or at a location designated by the landowner.

Pipeline markers and/or warning signs would be placed along the pipeline centerline at specified intervals to identify the location of the pipe. Access roads would be restored to pre-construction conditions, unless otherwise specified by the property owner and approved by regulatory agencies. Private and public property (fences, gates, driveways, roads, etc.) that were disturbed by construction would be restored to their original or better conditions, consistent with agreements with individual landowners, counties and/or townships, and any applicable permit requirements.

The schematic diagram below in Figure 7-1 shows the above described typical construction sequence for pipeline installation.

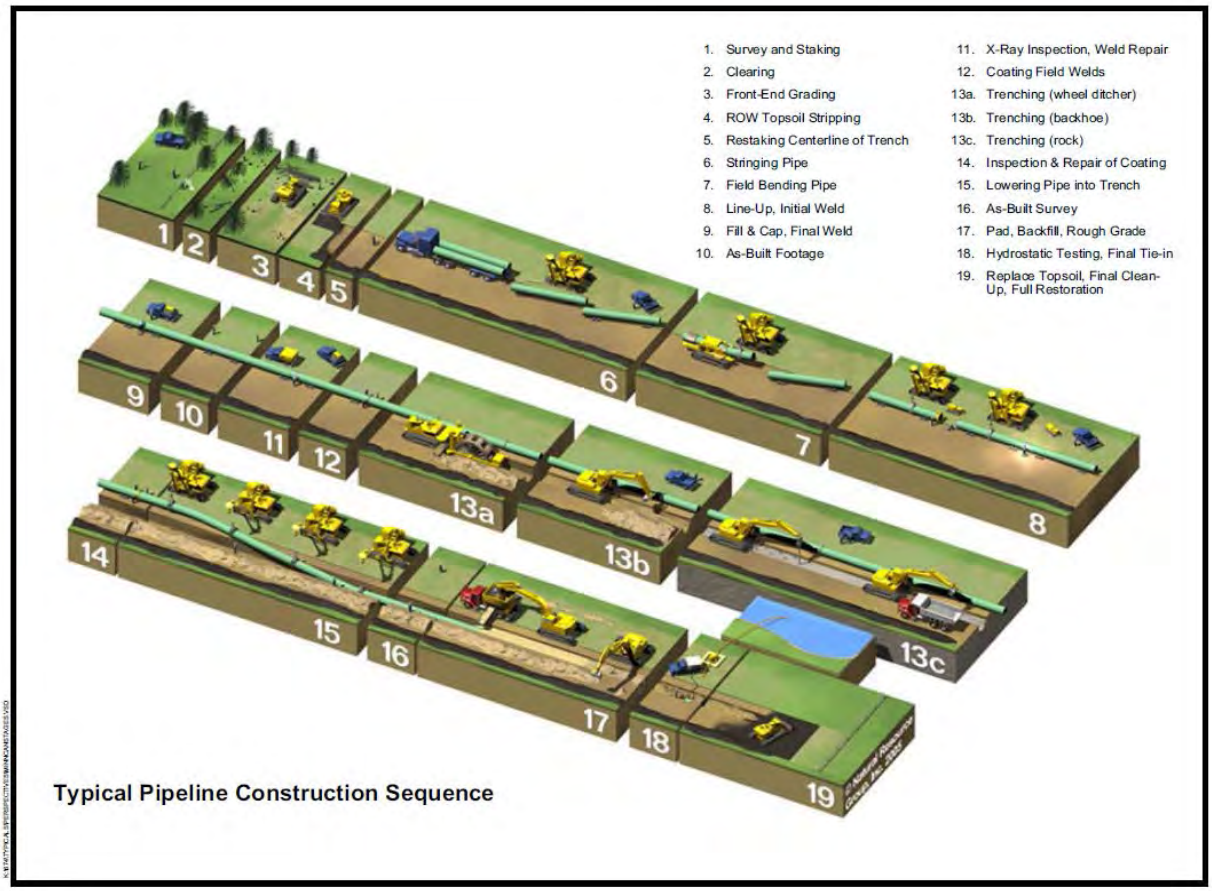

Figure 7-1. Typical Construction Sequence

7.9)Typical Workforce and Equipment

The workforce for this Project is estimated to be approximately 100 personnel per construction spread. This includes managers, laborers, foremen, inspectors, equipment operators, welders, etc. Table 7-2 below provides an estimated list of typical equipment that would be used per spread during construction activities. Further specifics about the number of construction spreads and their composition will be determined after contractor selection and negotiations.

Table 7-2. Typical Equipment List per Spread

Typical Equipment List for each Spread	
Description	Units
1 1/2 yd Trackhoe BH-33	5
1 1/4 yd Trackhoe	7
1 Ton Crew Cab w/Radio	3
2 Ton Flatbed Truck	2
250-375- CFM Air Compressor	5
3/4 Ton Pickup w/Radio	13
4 inch pump	5
Pipe Layers	10

Typical Equipment List for each Spread	
6-20" Bending Machine	1
Construction Office	1
Dozers	4
Enviro Carrier - IC100 EC-22	5
Farm Tractor w/Implements	3
Float Trailer	4
Forklift	3
Fuel Truck	2
Longreach Trackhoe	1
Lowboy Trailer	4
Mechanic Rig	2
Operator Truck	35
Rolligon	5
Rolligon Tow Tractor	4
Rubber Tire Backhoe	1
Sandblasting pot w/hoses	3
Streetsweeper	1
Tac Rig VW-01	1
Tack Rig	1
Tandem Truck	6
Tool Box	10
Utility Trailer	2
Welding Rig	10
Vacuum Excavator	1
EQUIPMENT TOTALS	125
Drill Rigs	
1 million pound rig	1
300,000 pound rig	2
100, 000 pound rig	2
Drill Shack	3
Frac Tank	5
Mud Mixer	3
EQUIPMENT TOTALS	16

Special equipment includes the need for HDD drill rigs. These rigs vary in size depending on the installation and drill requirements. The rigs are described by their thrust/pull-back capacities. So a one-million pound rig has a thrust/pull-back capacity of approximately 1 million pounds. Rigs for this Project are expected to be one-million, 300,000 and 100,000 pound rigs with approximate 765-, 486-, and 225-horse power engines, respectively.

BakkenLink has divided the Project into three distinct construction segments, as shown in Table 7-1. The construction spreads that would be mobilized to install the pipeline would be determined during contractor selection, negotiation and planning phases.

Similarly, specific information about man camps would be determined during contractor negotiations and planning. BakkenLink does not anticipate the creation and/or use of a project specific man camp as commercial camps in the area are expected to be available for use. Pending contractor selection and labor resources, it is expected that a majority of the labor force would come from the local area and will not result in an influx of new, non-local labor and personnel. Oil and gas projects in the Bakken and Three Forks region of North Dakota generally maintain a level of established, local labor, and resources. As projects ramp up and draw down, a phasing of resources occurs where labor no longer needed at one project site could move to another project where additional resources are needed. Because of this mobility of established, local resources, BakkenLink does not foresee an influx of outside labor to the area.

7.10) Workforce Labor/Installation Costs

The estimated construction cost for the BakkenLink Pipeline is approximately $31,806,160 for combined labor and installation costs. Of this total, the approximate combined labor and installation costs by North Dakota Counties are summarized in Table 7-3 below.

Table 7-3. Labor and Installation Costs

County	Combined Labor and Installation Costs
Williams	$11,175,160
McKenzie	$20,631,000
Total	$31,806,160

7.11) Facility Construction

The receipt points provided in Table 2-2 are facilities that are not part of this Project, but are associated with the pipeline system. Two of the three receipt points would be “green field” construction and would require approximately 55 acres of land. **Appendix VIII** provides preliminary process flow diagrams (PFDs). The pipeline scope does include the construction of above ground appurtenances including pig launchers/receivers and MLVs. All facilities and above ground appurtenances will be within the fence lines of the receipt points, except for the mainline valves, which will have impacts as noted in MLV layout typical drawings shown in **Appendix VII**. MLV locations are identified in Table 5-1. In general, the appurtenance facilities for MLVs would be enclosed with chain link fence and have proper egress for operations and maintenance vehicles.

7.12) Access to Right-of-Way

All construction vehicles and equipment traffic would be confined to the public roads, private roads acquired for use by BakkenLink, and the construction ROW. If private access roads are required, BakkenLink and the landowner would reach a mutually acceptable agreement on the route that would be utilized by the Contractor for entering and exiting the pipeline construction ROW should access to the construction ROW not be practicable or feasible from adjacent segments of the pipeline

construction ROW, public road, or railroad ROW. If temporary private access roads are constructed, they would be approximately 12-feet wide, will be designed to maintain proper drainage, and would be built to minimize soil erosion.

All construction-related access roads to the ROW would be marked with signs. Any private roads not to be utilized during construction would also be marked.

BakkenLink would offer landowners or managers of forested lands to install and maintain measures to control unauthorized vehicle access to the construction ROW where appropriate. On federal lands, all travel management will be in accordance with applicable travel management plans, and reviewed/approved by the authorized officer. Measures may include the following unless otherwise approved or directed by BakkenLink and relevant government authority based on site specific conditions or circumstances:

- signs;
- fences with locking gates;
- slash and timber barriers, pipe barriers, or boulders lined across the construction ROW; and
- conifers or other appropriate trees or shrubs across the construction ROW.

7.13) Site Specific Plans and Mitigation

Routing the Project to avoid cultural resources should negate any adverse effects. In the event that an adverse impact may occur, the nature of the impact would be determined and the North Dakota State Historic Preservation Office (SHPO) would be consulted to determine eligibility for listing on the NRHP. If the site is determined eligible, mitigation could include an effort to minimize Project impacts on the resource and/or collection of additional documentation.

BakkenLink has developed an *Unanticipated Discovery Plan* to guide procedures if an unknown cultural resource or human remains are inadvertently encountered during construction. The *Unanticipated Discovery Plan* outlines the framework for handling such discoveries in an efficient and legally compliant manner, and can be found in **Appendix XV**.

In order to minimize the risk of accidental damage from trenching, drilling, or other excavation activities, BakkenLink is currently a subscriber to the state One Call system. Because pipelines are normally buried underground, markers are used to show the approximate, not exact, location of the pipeline.

The Corridor includes crossings of highways, railroads, utility facilities, rivers, woodlands, and wetlands. BakkenLink would implement trenchless technology methods in some of these crossing areas to minimize impacts to sensitive areas. Waterbody and Road Crossing locations, lengths and methodologies are described in **Appendices IX and XX**, respectively. Cropland areas, hay fields and native grasslands would be temporarily disturbed but permanent impacts to the Corridor are not anticipated.

BakkenLink's *Spill Prevention Control and Countermeasure Plan* (SPCC) and *Stormwater Pollution Prevention Plan* (SWPPP) (**Appendices XVI and XVII**) address preventive and mitigation measures that would be used to avoid or minimize the potential impact of hazardous material spills during construction. The Project would be monitored through use of a SCADA system, which would alert

operations personnel to any potential leaks. Additionally, redundant communications methods and equipment would be installed allowing valves to be operated remotely to minimize any potential impacts of a spill. Actuation locations have been determined, and consultation with the Pipeline and Hazardous Materials Safety Administration (PHMSA) has occurred. Dual actuated valves will be installed on either side of the Lake Sakakawea Crossing.

7.14) Safety Requirements

Experienced, well-trained personnel are essential for the successful implementation of this Project. BakkenLink and its Contractors would undergo prevention and response, as well as safety training. The program would be designed to improve awareness of safety requirements, pollution control laws and procedures, and proper operation and maintenance of equipment. The Contractor would provide a minimum one (1) qualified and experienced safety personnel and a minimum one (1) emergency personnel to each construction spread. All work would be conducted in compliance with the Contractor's Safety Plan and Procedures as approved by BakkenLink.

The construction Contractor and all of his subcontractors would ensure that persons engaged in Project construction are informed of the construction requirements and that they attend and receive training regarding these requirements as well as all laws, rules and regulations applicable to the work. Prior to construction, all Project personnel would be trained on environmental permit requirements and environmental specifications, including fuel handling and storage, cultural resource protection methods, stream and wetland crossing requirements, and sensitive species protection measures.

All visitors and any other personnel without specific work assignments would be required to attend a safety and environmental awareness orientation prior to being granted access to any construction sites.

Construction activities would be carried out during daylight hours unless approved by BakkenLink. Burning along the ROW would be controlled and be in accordance with local permits and requirements. Spill prevention measures would be undertaken to maintain the safety of the construction personnel and protect the environment. Access to the ROW would be controlled to allow only authorized vehicles and maintain the safety of the construction crews.

7.15) Emergency Response Plan

After contracts are awarded, a unified Project Safety Plan and Procedures would be developed with the Contractor that will include emergency response protocols. All work would be conducted in compliance with the Safety Plan and Procedures. A copy of the Safety Plan would be maintained on site at all times during work. During construction planning, emergency egress and nearest urgent care facilities would be identified and included in emergency response protocols.

7.16) Fire Control Measures

The Contractor would comply with all federal, state, county, and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following mitigation measures would be implemented to prevent fire hazards and control fires:

- A list of local fire authorities and their designated representative to contact would be maintained on site by construction personnel.

- Adequate firefighting equipment would be available on site in accordance with the applicable regulatory requirements.
- The level of fire hazard would be posted at the construction office (where visible for workers) and workers would be made aware of the hazard level and related implications.
- The Contractor would provide equipment to handle any possible fire emergency. This would include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed.
- Specifically, the Contractor would supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, grinding, and burning of brush or vegetative debris.
- In the event of a fire, the Contractor would immediately use resources necessary to contain the fire. The Contractor would simultaneously notify local emergency response personnel.
- All tree clearing activities would be completed in accordance with local rules and regulations for the prevention of forest fires.
- Burning would be done in compliance with applicable state, county, or local regulations.
- Any burning would be done within the ROW. Only small piles would be burned to avoid overheating or damage to trees or other structures along the ROW.
- Flammable wastes would be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking would be prohibited around flammable materials.
- Smoking would be prohibited on the entire construction site when the fire hazard level is high.

7.17) Hazardous Materials

The Contractor would ensure that all hazardous and potentially hazardous materials are transported, stored, and handled in accordance with all applicable regulations. Workers exposed to or required to handle dangerous materials would be trained in accordance with the applicable regulations and the manufacturer's recommendations.

The Contractor would dispose of all hazardous materials at licensed waste disposal facilities. Hazardous wastes would not be disposed of in any other fashion such as un-permitted burying or burning.

All hazardous wastes being transported off-site would be manifested. The manifest would conform to requirements of the appropriate state agency. The transporter would be licensed and certified to handle hazardous wastes on the public highways. Incidents on public highways would be reported to the appropriate agencies. The vehicles as well as the drivers must conform to all applicable vehicle codes for transporting hazardous wastes. The manifest would conform to 49 CFR Parts 172.101, 172.202, and 172.203.

If toxic or hazardous waste materials or containers are encountered during construction, the Contractor would stop work immediately to prevent disturbing or further disturbing the waste material and would immediately notify BakkenLink. The Contractor would not restart work until clearance is granted by BakkenLink or the appropriate agency.

8. Resource Values and Environmental Concerns

8.1) Introduction

BakkenLink has committed to specific environmental protection measures as part of the Project design to minimize potential impacts to natural and human resources during construction and operation. These protection measures are summarized by resource in **Appendix XVIII**. The temporary construction ROW may be reduced in some areas as necessary to avoid impacts to environmentally sensitive areas. In addition, a high consequence area location study would be conducted during the initial design phase of the Project to determine appropriate placement of the valves to minimize environmental impact. For the purpose of this Chapter 8, "Corridor" refers to a one-mile-wide corridor for the entire length of the pipeline, and "Route" refers to the proposed pipeline alignment. Legal descriptions for the Corridor can be found in **Appendix XIX**.

8.2) Public Health and Safety

The Project would be designed, constructed, and operated in compliance with applicable portions of the U.S. Department of Transportation (USDOT) regulations as set forth in 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations encompass general requirements, accident reporting and safety related condition reporting, design requirements, construction, pressure testing, operation and maintenance, qualification of pipeline personnel, and corrosion control. Relevant industry standards are incorporated into these regulations by reference, including those of the American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), and the American Standard for Testing and Materials (ASTM) and others.

8.3) Transportation

Construction operations for the Project would temporarily impact public transportation. Increased truck traffic on adjacent roadways can temporarily be expected and has a documented negative, but manageable, impact on road conditions. The total traffic load on these roadways is expected to be negligible as transportation of oil from wells adjacent to the Project would continue using heavy trucks and truck traffic would increase over time as more wells are installed. Appropriate measures and construction plans (i.e., road signing and warning measures) would be developed by BakkenLink to ensure the safety of all local traffic during construction activities adjacent to public roadways. In addition, all required county and state utility crossing permits would be obtained. All roadways which are paved or comprised of stabilization material would be crossed using HDD as required and to the extent possible, which should serve to greatly reduce impacts to traffic. BakkenLink would also require all contractors to obtain appropriate oversize/overweight permits and follow all state and federal regulations for the transportation of all construction material related to the Project. All road crossing locations, type, and method for crossing are listed in **Appendix XX.**

In addition, construction of the Project would require the construction of temporary access roads along the Route. A list of current roads which would be used for access as well as respective planned improvement for those needing improvement can be found in **Appendix XI**. Landowners would be contacted in advance to obtain approval if temporary access on private roads is necessary. Placement of temporary accesses would be designed to avoid sensitive features such as wetlands. Areas used for temporary roads or working areas during construction would be restored to their original condition to the extent practicable. All necessary construction road signing and warning measures would also be utilized to ensure the safety of traffic.

8.4) Noise

Noise levels would be greater closer to the Route. The Route is located a minimum distance of 500 feet from existing residences. This would help minimize noise heard along the Route. At 500 feet or greater from the Route, pipeline construction noise would generally be below background noise levels and would be temporary. Post-construction activities would be periodic and noise associated with them would be temporary. Additionally, these activities are similar in nature to operation activities that take place for any existing facilities in the area. Lastly, no noise would be generated as a result of the operation of the MLVs.

8.5) Visual Impacts

The majority of the Route would be visible to travelers along nearby county roads, as well as local residents. These impacts would be temporary. Impacts to aesthetics are minimized by the placement of the Route along existing road and utility line corridors. Visual impacts along the reclaimed Route would be dependent on the land use in the area. Areas across croplands and hay fields would be rapid in re-establishment, whereas areas on native grasslands would be visible longer following reclamation.

Visual impacts to the Route would diminish in time. Impacts to annual cropland and perennial hay fields are anticipated to have little visibility after the first year. Impacts to native grassland areas would take longer to recovery and may be visible for a significantly longer time following construction, and would be dependent on the reclamation and seasonal conditions following reclamation (**Appendix XIII**). The only long-term visual impacts would be those associated with the two new receipt points, Emergency Response Equipment Storage Areas and MLV sites as attributed to the permanent facilities which would be constructed (**Appendices IV, V, VI, and VII**). Most permanent facilities (i.e., MLV sites) would likely blend in with the existing character of the landscape over time. Mitigation practices would continue through pipeline maintenance and repairs.

8.6) Recreational Areas

Recreational impacts would be primarily visual and limited to individuals using public or private property for hiking, hunting, fishing or nature observation. Public access to the temporary construction ROW would be restricted during construction. Impacts to recreational activities are not anticipated within the Route. Once installed, recreational activities would resume on private and public properties. No designated recreational areas would be converted to non-recreational properties. Mitigation is not anticipated to be necessary.

8.7) Cultural Resources

A Class III Cultural Resource Inventory was performed prior to construction. Cultural resource sites that are unevaluated or have been determined to be eligible for the National Register of Historic Places (NRHP) have been avoided.

BakkenLink has developed an *Unanticipated Discovery Plan* (**Appendix XV**) to guide procedures if unknown cultural resources or human remains are inadvertently encountered during construction. This plan outlines specific procedures for appropriately handling such discoveries in an efficient and legally compliant manner.

8.8)Surface Water

Construction of the Project could affect surface water in several ways. Clearing, grading, trenching and soil stockpiling activities could temporarily alter overland flow. Surface soil compaction caused by the operation of heavy equipment could reduce the soil's ability to absorb water, which could increase surface runoff and the potential for ponding. These impacts would be localized and temporary following proper and sufficient de-compaction during reclamation (**Appendix XIII**).

Environmentally sensitive areas such as wetlands and waterbodies, if necessary and warranted, can be by-passed underground with trenchless methods. When HDD is employed, as listed in Table 10-2, inadvertent releases of drilling fluids and lubricants through seepage may occur, which sometimes can reach surface water(s). BakkenLink has developed an *Inadvertent Returns Contingency Plan* and *Hydrostatic Test Plan*, provided in **Appendices XXI and XIV**, respectively. The Project would be designed and constructed so it would not impede the flow of any waterway. The pipeline would be installed below the bed of the waterway, at a level so the channel bed gradient does not change.

Pipeline crossings would be scheduled at times when there is as little rainfall as possible to minimize the risks of debris, stockpiled soil, and other sources of sediment from being washed into water bodies or wetlands. Temporary erosion and sediment control mitigation or protection measures would be installed across the entire width of the construction ROW, upslope of and on both sides of each waterbody crossing, after clearing and before ground surface disturbance. No silt/turbid discharge water from the trench dewatering operations would be allowed to enter any waterbody or wetland.

If temporary dewatering of groundwater is required during construction activities, water would be discharged in compliance with a National Pollutant Discharge Elimination System (NPDES) permit and the SWPPP. The SWPPP would provide guidance on the location of dewatering structures, resulting in no deposition of sediments into wetlands and water bodies, and no impacts on cultural resources or habitat for sensitive species. The discharge of water from dewatering and hydrostatic testing operations would comply with relevant state discharge guidelines, and would follow the *Hydrostatic Test Plan* in **Appendix XIV**. Effects from dewatering would be localized, temporary, and generally insignificant. The SWPPP is included in **Appendix XVII.**

8.9) Groundwater

Construction activities could temporarily alter overland flow and groundwater recharge. Surface soil compaction caused by the operation of heavy equipment could reduce the soil's ability to absorb water, which could increase surface runoff and the potential for erosion. These impacts would be temporary and localized following proper and sufficient de-compaction during reclamation (**Appendix XIII**).
Some dewatering of construction areas and the pipeline trench may occur; however, relatively small volumes are expected and effects on the overall groundwater system would be small and temporary. Potential impacts on the groundwater would include minor fluctuations in groundwater levels and/or increased turbidity within the aquifer adjacent to the activity. Because of the relatively small amount of water removed, the short duration of the activity, and the local discharge of the water, groundwater levels would quickly recover after pumping stops.

The greatest risk for impacts to groundwater would result from the accidental release of a hazardous substance during construction or from a release during operations of the pipeline. BakkenLink has

developed a SPCC and SWPPP to address preventive and mitigative measures that would be used to avoid or minimize the potential impact of hazardous material spills during construction. The Project would be monitored through a SCADA system, which would alert operations personnel to any potential leaks. Additionally, communications equipment would be installed allowing valves to be operated remotely to minimize any potential impacts of a spill. Expected actuator locations include on both sides of the Lake Sakakawea Crossing, however, additional locations are pending consultation with the PHMSA, with further discussion found in section 7.12. The SPCC is included in **Appendix XVI**.

8.10) Wetlands

The pipeline would be routed to avoid most wetland crossings. Wetlands that cannot be avoided would be crossed using open cut methods and mitigation measures. Standard wetland construction mitigation measures would include reducing construction ROW to 75 feet and limiting equipment working in wetlands to that essential for clearing the ROW, excavating the trench, fabricating and installing the pipeline, backfilling the trench, and restoring the ROW. In areas where access to the ROW is only available through the wetland area, non-essential equipment would be allowed to travel through wetlands only if the ground is firm enough, or has been stabilized, to avoid rutting. If rutting is anticipated, non-essential equipment would be allowed to travel through the wetlands only once, and essential equipment would need to be stabilized with prefabricated mats or terra mats. Areas that would be disturbed by excavation, grading, and construction traffic may increase sedimentation into a wetland area. Reasonable efforts would be employed to limit any sediment movement within the Corridor. Following completion of pipeline installation, it is anticipated that there would be no additional impacts on surface wetlands or water quality. Permanent impacts are not anticipated.

Erosion and sediment control mitigation or protection measures would be used during construction, operation, and maintenance of the pipeline to protect topsoil and minimize soil erosion into adjacent wetlands. Vegetation clearing would be limited to trees and shrubs, and excavation would be limited to the pipeline trench only. During clearing activities, sediment barriers would be installed and maintained adjacent to wetland areas and within temporary extra workspaces, as necessary to minimize the potential for sediment runoff.

8.11) Geology

Construction and operation of the Project would not materially alter the geologic conditions of the Project Area. Similarly, the geologic conditions of the area are not expected to affect the installation or operation of the pipeline. Seismic events, such as earthquakes, shocks and tremors have been felt in North Dakota, but have not reached an intensity V or above (Modified Mercalli Scale) in The State's recorded history, according to the USGS. Such events would not be expected to have sufficient forces to damage the pipeline during operation. Should a seismic event occur, pipeline operators generally take precautionary measures to ensure the condition of the system before returning to normal operation.

Landslide data obtained from the North Dakota state geologist's office shows historical landslide fields within the pipeline corridor concentrated in the areas north of Lake Sakakawea, shown in **Appendix XXII**. Due to the topography of these areas and the potential for future landslides, BakkenLink plans to cross these areas via HDD technology. This method would allow installation of the pipe with minimal impact to the surface geology and provide sufficient depth of cover to prevent the operation of the pipeline to be affected by potential landslides.

Any effects from construction could include disturbances to the natural topography along the ROW, due to trenching and grading activities. Alteration of topographic contours would consist of grading the construction ROW and modification to steeper topographic formations to provide a safe, level working surface for construction equipment. Construction and operation of the Project is not anticipated to have any effect on future mining production, including loss of revenue or diminished mineral land values. No geological hazards are expected to be created.

8.12) Soils

No permanent impacts to the soils in the Corridor are anticipated as a result of pipeline installation or operation, except at those locations where new receipt point facilities are constructed, MLV sites are located, or pig receivers are placed. The location and footprint for all permanent facilities can be found in sections 3.1 and 5.1. The majority of the soil disturbance in the Corridor would be limited to the route but temporary access, staging areas, and temporary workspaces may be needed at select locations.

In order to prevent effects on the soil due to compaction by construction operations, topsoil stripping, and/or soil decompaction techniques would be used during clearing, grading, and restoration activities. Topsoil stripping would occur in the Project ROW above the trench and on both working side and the spoil side of the trench (i.e., the entire width of the construction ROW) along the entire length of the pipeline. In locations where topsoil was not stripped due to specific site-warranted cases, but significant compaction occurred, decompaction measures would be taken, with decompaction measures further described in **Appendix XIII**.

Soil impacts may occur due to wind and water erosion on areas that are disturbed during construction. Wind erosion would be more of a hazard in those portions with coarse-textured soils. Erosion potential can be influenced by the size of area being disturbed at any given time. Because the length of the pipeline would be disturbed in segments during the construction phase, erosion potential would be minimized.

Soils crossed by the Route would be susceptible to contamination from spills or leaks of liquids used during construction. BakkenLink has developed a SPCC Plan (**Appendix XVI**) that would outline methods to reduce spills or leaks. Any contaminated soils would be excavated and removed from the Project area, and the appropriate agencies would be notified as required.

Other impacts may include the mixing of topsoil and subsoil, the potential loss of topsoil due to wind and/or water erosion, and compaction/rutting. The impacts would primarily result from trench excavation and backfilling, and equipment and vehicle traffic along the ROW. Grading may be required in some places to ensure safe working platforms for equipment, as well as to improve access roads (**Appendix XI)**. Generally, these areas would be on steep slopes which are not agriculturally productive.

8.13) Vegetation

Temporary impacts would occur within the Route and where access is needed for Project construction activities. Wooded or forest areas within the Corridor are primarily associated with streams and wind breaks found near current or former homesteads. Loss of vegetation will occur within the footprint of truck receipt points, MLV sites, and pig receiving sites as discussed in sections 3.1 and 5.1. Any trees along the route would be protected to the extent practicable and in a manner compatible with safe operation, maintenance, and inspection of the pipeline. The construction ROW would be reduced to 50

feet through areas where trees are established, which would help reduce the overall impact to forested areas. Trees would be allowed to re-grow within the permanent easement; however, not within 15 feet of either side of the pipeline.

Existing agricultural and grazing practices along the Route have substantially altered the original vegetative landscape. Minimal impacts are expected to occur to native plant communities. Permanent vegetative impacts from pipeline construction are not anticipated. Temporarily disturbed areas that are normally cultivated would be available after Project construction. Areas not currently in agricultural use would be seeded with native seed mixes per USACE, USFS, USFWS, and NRCS recommendations, or as otherwise negotiated with private landowners.

BakkenLink would work closely with landowners to minimize adverse impacts to vegetation associated with construction of the pipeline. A survey would be conducted to document tree species and numbers that would be impacted by Project construction. Trees and shrubs would be replaced in accordance with the ND PSC's tree and shrub mitigation specifications; and as required by other governing agencies (USFS and USACE). Generally, BakkenLink would conduct an inventory of trees and shrubs that would be removed during construction of the pipeline. Trees and shrubs would be replaced by the same species or similar species suitable for North Dakota growing conditions at a 2:1 replacement ratio. The replacement location(s) would be coordinated with the landowner(s). Documentation identifying the number, variety, type, location, and date of the replacement plantings would be filed with the ND PSC or other governing agency. Monitoring of the survival rate and overall condition of the plantings would be conducted for three years. If the survival rate is 75% or less, the PSC may require additional plantings. A copy of the PSC *Tree and Shrub Mitigation Specifications*, the BakkenLink *Tree and Shrub Inventory Sampling Plan*, and *USACE SOP #14 –Garrison Project Tree/Vegetation Mitigation* are included as **Appendix XXIII, XXIV, and XXV**, respectively.

8.14) Wildlife

Impacts to wildlife would include modifications to habitat, and an increase of human activity in the area. Activities may result in temporary displacement of wildlife in the area and the disturbance of avian nest locations. The Migratory Bird Treaty Act of 1918, 16 U.S.C. §§ 703-712) protects bird species, including, but not limited to, cranes, ducks, geese, shorebirds, hawks, and songbirds and their nests. These impacts would be temporary and permanent impacts are not anticipated. Activities closer to the construction would be more concentrated, and may temporarily displace nesting birds and wildlife, or destroy nests. The impact on terrestrial wildlife would be short-term and minimal, and permanent impacts are not anticipated.

To protect species protected under Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, a presence/absence survey for active nests would be conducted prior to construction. To minimize impacts, migratory birds and nests would be avoided during construction and operation of the pipeline. Any wildlife encountered during work activities would be avoided to the extent possible. Clearing and grubbing of the Project ROW would occur in the fall or early spring to discourage bird nesting. In the event clearing and grubbing of the ROW is not possible prior to the nesting season, nesting surveys for migratory birds would be conducted where suitable nesting habitat exists prior to construction. If active nests are encountered on the ROW, the USFWS would be consulted for instructions on avoidance and/or mitigation measures. Consultation with the USFWS regarding nesting avian species would be continued during construction activities.

Surveys for raptor nests and sharp-tail grouse lek locations were conducted along the Corridor in the spring of 2012, 2013, and 2014. The methods and results of the surveys are discussed in the *Raptor and Prairie Grouse Survey Spring 2012-2013* and *Raptor and Prairie Grouse Survey Spring 2014* reports included in **Appendix XXVI**. A raptor and migratory bird survey will be conducted five days prior to construction, if construction occurs during the nesting season (February 1 and July 15). However, if the ROW is mowed or cleared of vegetation outside of the nesting season (July 16 and January 31) and vegetative growth is inhibited until commencement of construction activities, then pre-construction migratory bird surveys would not be required.

8.15) Rare and Unique Natural Resources

Adverse impacts to threatened and endangered species are not anticipated. Seven USFS-sensitive plant species populations have been identified within the construction ROW. Consultation with the Forest Service is on-going regarding avoidance measures. If during construction, additional threatened and endangered species and/or their nests are encountered, construction would be halted and the USFS and USFWS would be notified and consulted for additional information on how to proceed. The proposed Corridor does not include any areas designated as Wildlife Management Areas (NDGF 1999) or USFWS Waterfowl Production Areas.

8.16) Noxious Weeds and Aquatic Nuisance Species

Noxious weeds are opportunistic and often exotic (non-indigenous) plant species that readily invade disturbed areas, often producing monocultures and preventing native plant species from establishing communities. Noxious weeds also degrade agricultural productivity, soil and water, wildlife habitat, and recreational and wilderness values.

The North Dakota Century Code (NDCC) §4.1-47-01(6) defines noxious weeds as any plant propagated by either seed or vegetative parts which is determined by the commissioner, a county weed board, or a city weed board, after consulting with the North Dakota State University Extension Service, to be injurious to public health, crops, livestock, land, or other property. Currently, there are eleven species or species groups (some include more than one species and/or cultivars) in North Dakota (North Dakota Administrative Code §7-06-01-02). Pursuant to NDCC 4.1-47 the control and the spread of noxious and invasive weeds is mandatory, and dissemination of noxious weeds must be prevented.

Biological surveys for noxious weeds were conducted during 2011 to determine their occurrence along the proposed ROW. A survey for these species was completed in the 2014 field season. The surveys focused on a 200-ft wide corridor centered on the Project centerline. Noxious weed locations and the extent of localized populations were delineated and recorded using global positioning system (GPS) equipment. Resulting maps showing the current, known locations of noxious weeds along the ROW are depicted in **Appendix XXVII**.
Aquatic nuisance species (ANS) have not been identified in any of the waterbodies or wetlands crossed by the Project. However, BakkenLink will ensure that proper mitigation measures be implemented during construction to prevent the spread of ANS.

Monitoring of noxious weeds would be conducted as part of on-going O&M inspections. BakkenLink would maintain ongoing communication with individual landowners, counties, and land management agencies regarding noxious weeds. These parties would also be supplied with BakkenLink contact information to report noxious weeds along the ROW. BakkenLink would maintain operations personnel

trained in the identification of noxious weeds, who would contribute to monitoring reports by documenting noxious weeds observed during the normal course of O&M.

Monitoring would continue for a period of three (3) years after any ground disturbance takes place. Monitoring would be conducted on an annual basis, or as needed following a report of an infestation. Known infestation sites would be monitored on an ongoing basis or until noxious weeds at the site are controlled. BakkenLink shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must control weeds on their land that can be reasonably determined to have spread from land occupied by BakkenLink's aboveground facilities.

BakkenLink would comply with State of North Dakota, County, and federal agency requirements implemented to prevent the spread of noxious weeds and ANS. BakkenLink would implement weed control measures in areas of the Project right-of-way (ROW) where noxious weeds have been identified. Monitoring during construction and O&M would include the identification of areas along the ROW where noxious weeds are present. Monitoring would also include an evaluation of the prescribed control measures in their effectiveness of control. A *Noxious Weed Control Plan* was developed and can be found in attached **Appendix XXVII**.

9. Interim and Final Reclamation

9.1) Reclamation

During construction activities, the Contractor would limit ground disturbance wherever possible and use appropriate erosion and sediment control measures. Disturbed areas would be restored to their original contours and condition to the extent practical, unless landowner consent is obtained to do otherwise. Post-construction reclamation activities include, but are not limited to; removing and disposing of construction debris; dismantling temporary facilities; leveling or filling tire ruts; relieving compaction, rock removal, soil additives, seeding and mulching; erosion control measures including trench breakers, slope breakers, matting and riprap; installing fences, farm terraces, and ROW and pipeline markers , and reseeding non-cultivated areas. The CMRP can be found in **Appendix XIII.**

9.2) Waterbody Crossing Stabilization Plan

Sediment barriers would be installed before initial disturbance of the waterbody or adjacent upland. Sediment barriers would be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Erosion control matting would be placed on the banks for flowing streams where vegetation has been removed. Matting would extend three feet past the upper edge of the high water mark. If an interceptor dike is present on the approach slope, the matting would begin on the uphill side of the interceptor dike. Matting would be installed across the slope in the direction of the water flow. Double six inch staples would be used every twelve inches before the trench is backfilled and compacted. The matting would be trenched and rolled down the hill with double staples every twelve inches before the trench is backfilled and compacted. The edges of parallel matting would be overlapped at a minimum of six inches. The upper matting would be placed over the lower matting shingle style and stapled every twelve inches along the length of the edge. Staples would be placed down the center of the matting with three staples in every square yard. In livestock areas, fencing would be used to exclude livestock, with permission of the landowner. Washouts, staple integrity and mat movement would be monitored and replaced as necessary.

9.3) Revegetation

The final seed mix(s) would be based on input from the local NRCS office or managing agency and the availability of seed at the time of reclamation. The landowner may request specific seeding requirements during easement negotiations. All seed would be State of ND Certified or Registered seed (or certified/registered by the state of origin), with certification tags shall be made available to the authorized officer or environmental inspector before seed is planted to limit the introduction of noxious weeds. Seed would be applied at the rate recommended by the managing agency or NRCS. Seeding rates would be based on pure live seed. The Contractor would plant seed at depths consistent with the local or regional agricultural practices.

Post-construction monitoring inspections would be conducted annually for 5 years on USFS and USACE unless successful revegetation occurs sooner. Reclamation monitoring on private land would occur annually for 3 years. Additional information pertaining specifically to tree and shrub revegetation can be found in section 8.13. Areas which have not been successfully re-established would be revegetated by BakkenLink or by compensation of the landowner to reseed the area. If revegetation is successful, additional vegetation monitoring along the Project ROW would consist only of monitoring for noxious weeds and trees and shrubs as described in section 8.13 and 8.16, respectively.

10. Operation and Maintenance

10.1) Operation and Maintenance

After pipeline construction has been completed, BakkenLink would be responsible for monitoring and inspecting the operation of the pipeline as well as maintenance and repair in accordance with the *Integrity Management Plan* (IMP). Leak detection and monitoring systems compliant with API 1130 would be employed utilizing the measuring equipment at the inlet and outlet to the pipeline, which would be interconnected with a SCADA system connected to a central operations center (control room).

Specialized coating for underground pipelines and a cathodic protection system would be utilized to prevent external corrosion. An impressed current style cathodic protection system would be installed on the pipeline. Rectifiers and deep well anode beds are anticipated to be installed at approximately 15 mile intervals. The exact locations would be confirmed with geotechnical testing and availability of commercial electrical power. The deep well anodes would have a minimum 20 year life and the assembly would be designed to allow the anodes to be replaced at the end of the design life to extend the operational life of the pipeline. The rectifiers would be sized to allow sufficient adjustment to compensate for varying conditions. In accordance with 49 CFR, Part 195 the rectifiers would be inspected at least 6 times per calendar year. The pipeline potential would be recorded at every test station (approximately 1 mile intervals) every calendar year. A close interval survey, providing a pipeline potential measurement every 3 ft, would occur every 7 years or more frequently in critical areas identified in the IMP.

Because pipelines are normally buried underground, markers are used to show the approximate – not exact – location of the pipeline. The markers also display the name of the pipeline operator, the product transported in the line, and a toll free telephone number where the operator can be reached in an emergency. Appropriate markers and security fencing will be installed in accordance with USDOT regulations in 49 CFR §195.

The following measures would be implemented to prevent or mitigate any adverse effects resulting from the Project operations:

- BakkenLink would follow a written manual of procedures for conducting normal operations and maintenance activities and for handling abnormal operations and emergencies. The manual would delineate the responsibilities of both management and operating personnel and would be reviewed each calendar year to insure it remains effective. The manual would include provisions that address the following:
    - Retention of important construction, operation and maintenance records, including records of pipeline and equipment inspections.
    - Procedures for reporting spills, accidents, and safety related conditions.
    - Identification of sensitive areas along the Project route that would require an immediate response to prevent hazards to the public if the facilities failed or malfunctioned.
    - Procedures for receiving, identifying and classifying notices of events which need immediate response by Project personnel or notice to fire, police or other appropriate public officials.
    - Establishing and maintaining liaison with fire, police and other appropriate public officials. Procedures would be included for notifying these officials of pipeline emergencies and coordinating with them pre-planned and actual responses during such emergency.
    - Maintaining a list and contact information of area contractors that may be used to respond to a spill or emergency.
- A SCADA system would be installed on the pipeline system. Pressures and flow rates would be monitored at a central location 24 hours a day and 7 days a week. The SCADA system would allow abnormal operating conditions to be discussed immediately and addressed promptly, including shutdown of the system in the event of a leak or other appropriate circumstance.
- A continuing training program would be implemented to instruct personnel in safely carrying out the operations, maintenance and emergency procedures related to their assignments. This would include instruction on the characteristics and hazards of the crude oil being transported, the recognition of conditions that are likely to cause emergencies, and the steps necessary to control or minimize the impacts of an accidental release.
- In addition to observation by operating personnel, aerial (or ground) patrols would be used to inspect the surface conditions on or adjacent to the Project ROW. The frequency of inspection would be a minimum of 26 times per year not to exceed three week interval.
- A damage prevention program would be established to prevent damage to the pipeline from excavation activities or other encroachments on the ROW. The damage prevention program would include membership in one or more “One-Call” systems in North Dakota that provide prior notification when excavation by third parties is to occur near the Project.

ROW and access roads are to be inspected at intervals and with methods in accordance with the operator’s protocols. Access to the ROW would be controlled so that only authorized vehicles are allowed access and only for authorized purposes, including inspection and maintenance operations.

Under Title 49 CFR, Part 195, BakkenLink is required to submit and maintain an Operations and Maintenance Plan and Integrity Management Plan to PHMSA. These documents expand on the type and frequency of indirect and direct assessments to be implemented for the pipeline. These documents are

mandatory and subject to periodic audit by PHMSA. Specific to this comment, the details noted can be found in 49 CFR, Part 195, paragraphs 195.412, 195.442, 195.452 and Appendix C.

10.2) Hydrostatic Testing and Water Management

BakkenLink is responsible for acquiring all permits required by federal, state, and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation. Appropriate withdrawal/discharge permits for hydrostatic test water will be kept on site at all times during testing operations. Additional volumes of water may be required for dust control during construction activities. Dust control measures will be maintained by construction contractors and guided by best management practices in accordance with landowner agreements. Water volumes and sources would be determined based on site-specific requirements but water use and sourcing would be pursuant to government regulations and relevant permits.

Any water obtained or discharged would be in compliance with permit notice requirements and with sufficient notice for BakkenLink's Testing Inspector to make water sample arrangements prior to obtaining or discharging water. BakkenLink would obtain water samples for analysis from each source before filling the pipeline. In addition, water samples would be taken prior to discharge of the water, as required by state and federal permits.

Currently, the exact source has not been selected yet; however, the source of the hydrostatic test water will be from a local rural water cooperative or a municipal water system and the relevant agencies would be notified. Similarly, discharge locations would be determined by site-specific conditions. Environmentally sensitive areas would be avoided for water discharge. Water discharge would be in upland areas and no water discharge would occur within 500 feet of waterbodies. Appropriate erosion mitigation measures and energy dissipating devices would be employed where discharge occurs. Water sources and discharge locations would comply with regulation and permitting requirements and would be disclosed to the relevant agencies.

In some instances sufficient quantities of water may not be available from the permitted water sources at the time of testing. Withdrawal rates may be limited as stated by the permit. Under no circumstances would an alternate water source be used without prior authorization.

The tables below describe the estimated water volume required for hydrostatic testing activities. The tables are broken down into volumes necessary for the pipeline hydrostatic test based on construction spreads of the entire line and additional HDD testing volumes.

Table 10-1. Hydrostatic Test Segments and Estimated Water Volumes

Seg. #	Pipeline Sections	Approx. MP		Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
1	Dry Creek to South Lake	0	22.8	120,384	1,161,217	Local rural water cooperative or a municipal water system	MP 0
2	Lake Sakakawea	22.8	25.6	14,784	140,278	Local rural water cooperative or a municipal water system	MP 25.6

Seg. #	Pipeline Sections	Approx. MP		Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
3	North Lake to Beaver Lodge	25.6	37.1	60,720	585,702	Local rural water cooperative or a municipal water system	MP 37.1
	Total			**195,888**	**1,887,201**		

Table 10-2. HDD Segments and Estimated Hydrostatic Test Water Volumes

HDD Sections	Approx. MP	Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
Lake Sakakawea – North Bluff	25.6	3,050	28,940	Local rural water cooperative or a municipal water system	26.17
Lake Sakakawea – South Bluff	22.01	3,767	35,743	Local rural water cooperative or a municipal water system	22.01
United States Forest Service	20.24	4,183	39,690	Local rural water cooperative or a municipal water system	20.24
Totals		**11,000**	**104,373**		

The total water use for the hydrotesting and drilling operations is estimated in Table 10-3 below. The estimate reflects water volumes needed for the Trunkline hydrostatic test, HDD pre-installation hydrostatic tests and drilling operations independently. It is possible the water amounts can be reduced if the water is reused between tasks. For example, water used during HDD pre-installation hydrostatic test could be stored, filtered and reused for mixing in the drilling mud. However, the table below does not account for any reuse of water.

Table 10-3. Total Water Usage

Water Usage	Water (gallons)
Hydrostatic Test Total	1,887,197
HDD Pre-installation Hydrostatic Test Total	104,373
Water for Drilling Operations Total*	775,521
Water Totals	2,767,091

*Water use in drilling operations provided in BakkenLink *Inadvertent Returns Contingency Plan*

10.3) ATMOS Monitoring Technology

ATMOS Pipe Leak Detection System is a statistical volume balance leak detection system. It uses the powerful Sequential Probability Ratio Test (SPRT) and pressure and flow analysis to optimize the leak detection. Atmos Pipe has the ability to identify operational changes in the pipeline and can detect leaks during transient operations. Data validation algorithms and filtering techniques are employed

to improve data quality. Flow measurement errors are also learned to assist in the provision of This allows the system to accurately detect true leak events from the pressure changes caused by transient operation. If a leak occurs, the system generates an alarm within minutes and allows location of the leak within approximately ½ to 1 mile.

11. Termination and Restoration

11.1) Removal of Structures

BakkenLink has consulted with various federal, state, and local governments, several energy infrastructure projects near the Project area, as well as local businesses and residents, and has not identified any conflicts with proposed developments in the vicinity of the Project. Where above ground structures such as fences and roadways are affected by pipeline installation activities, the Contractor would mitigate damages where possible and restore any removed structures to a state acceptable to BakkenLink and the landowner.

Prior to the completion of construction activities, BakkenLink would ensure that the BLM authorized officer has access to review and inspect vegetation and restoration activities along the ROW. BakkenLink and its contractors would be responsible for the removal of temporary construction facilities, structures or surface materials, reclamation of the original grade contours and restoration of disturbed areas to a state similar to pre-construction conditions.

12. Appendices

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Appendix I

Additional Temporary Construction Workspace Locations/Acreage

Appendix I. Additional Temporary Construction Workspace Locations/Acreage

Additional Temporary Workspace			
Side	Approx. MP	Area (ft^2)	Acres
Right	0.2	2690	0.061
Right	0.3	2465	0.056
Right	1.7	2534	0.058
Right	1.7	2481	0.057
Left	2.2	2503	0.057
Left	2.2	2595	0.060
Right	2.6	2500	0.057
Right	2.7	2393	0.055
Right	2.7	2393	0.055
Right	2.8	2350	0.054
Right	3	2500	0.057
Right	3.1	2500	0.057
Right	3.2	1762	0.040
Right	3.3	2523	0.058
Left	4.6	2691	0.062
Right	4.7	2636	0.061
Right	4.7	2249	0.052
Right	4.8	2690	0.062
Right	4.9	2588	0.059
Left	4.9	1635	0.038
Right	5.1	2621	0.060
Right	5.2	2621	0.060
Right	5.3	2621	0.060
Left	5.4	4145	0.100
Left	6.4	3546	0.081
Left	6.5	4187	0.096
Left	7.3	2648	0.061
Left	7.4	2731	0.063
Left	7.5	2554	0.059
Left	7.6	2492	0.057
Right	7.6	2492	0.057
Left	7.6	2492	0.057
Left	7.7	2495	0.057
Left	7.7	2935	0.067
Left	7.8	2536	0.058
Left	7.8	2584	0.059
Left	7.9	2514	0.058
Left	8	2481	0.057
Left	8.4	2481	0.057
Left	8.4	2593	0.060
Left	8.7	2742	0.063
Right	8.9	4987	0.114

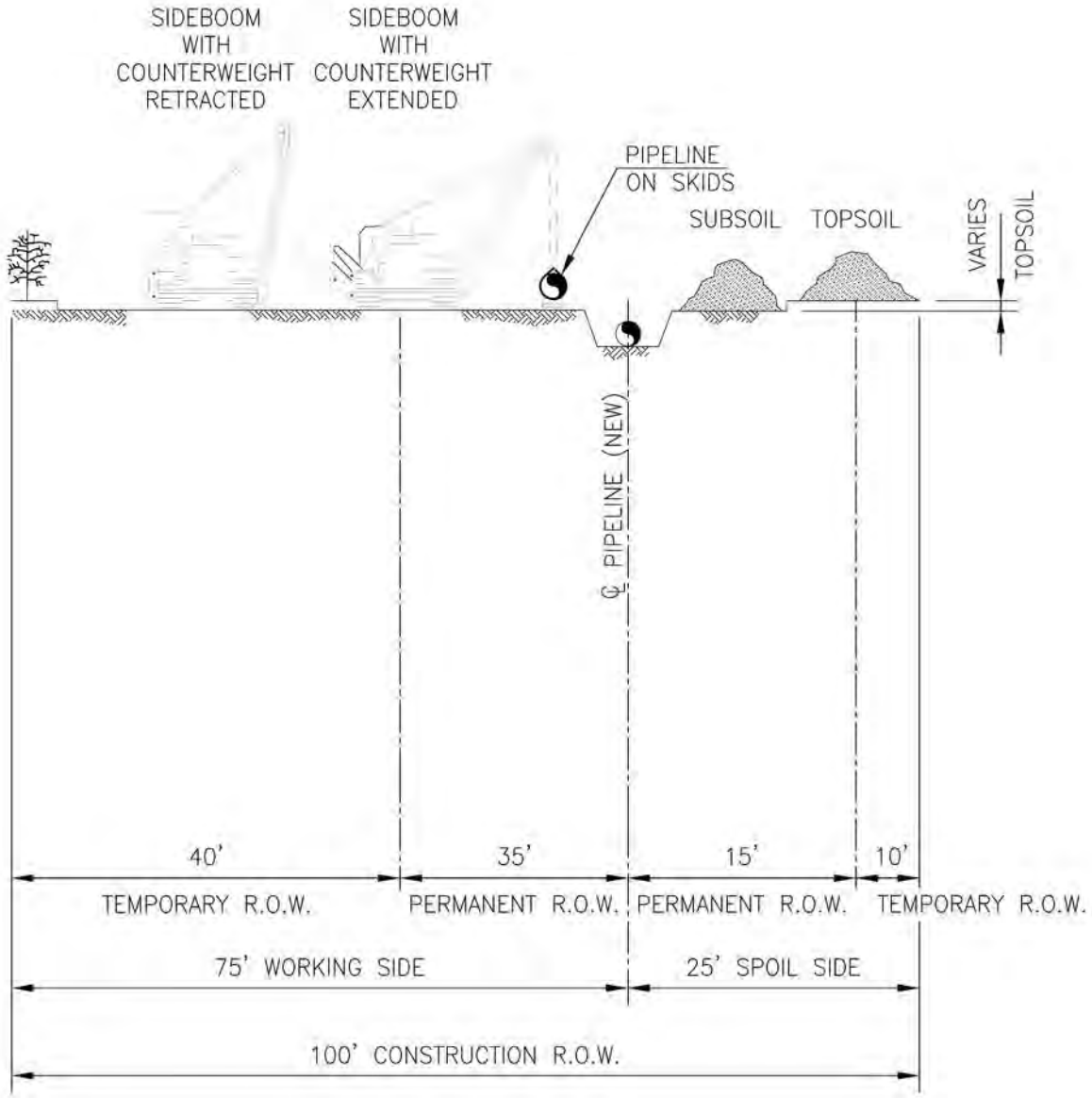
Left	9.2	2500	0.057
Left	10.2	2500	0.057
Left	10.3	2279	0.052
Left	10.4	2279	0.052
Left	10.5	2279	0.052
Right	11.4	25920	0.595
Right	11.5	24377	0.560
Left	11.6	2485	0.057
Left	11.6	2609	0.060
Left	12.4	2486	0.057
Left	12.5	2488	0.057
Left	12.5	2497	0.057
Left	12.6	2480	0.057
Left	13.4	2542	0.058
Left	13.4	2235	0.051
Left	13.6	2574	0.059
Left	13.6	2524	0.058
Left	14.1	2536	0.058
Left	14.2	2392	0.055
Left	14.4	2722	0.062
Left	14.5	2914	0.067
Left	14.9	2656	0.061
Left	14.9	2627	0.060
Left	15.7	2591	0.060
Left	15.8	2667	0.061
Left	16	1881	0.043
Left	16.1	2460	0.056
Left	16.5	2553	0.059
Left	16.6	2544	0.058
Right	16.8	2270	0.052
Right	16.9	1988	0.046
Right	17.1	2522	0.058
Right	17.5	2504	0.057
Right	17.6	2501	0.057
Right	17.6	2210	0.051
Right	17.7	2425	0.056
Right	18.2	2563	0.059
Right	18.2	2533	0.058
Right	18.7	2525	0.058
Right	18.7	2502	0.057
Left	19.1	2493	0.057
Left	19.2	2500	0.057
Right	19.3	2447	0.056
Right	19.3	2363	0.054
Right	19.4	2324	0.053
Right	19.4	2411	0.055
Right	19.5	2289	0.053

Right	19.6	2453	0.056
Left	20	2325	0.053
Left	20	2328	0.053
Left	20.2	127800	2.934
Right	20.3	57028	1.309
Left	20.5	8137	0.187
Right	20.5	3139	0.072
Right	21	50187	1.152
Left	21	37709	0.866
Right	21.2	2820	0.065
Right	21.6	2531	0.058
Right	21.7	2541	0.058
Right	22.2	100703	2.312
Left	22.2	254937	5.853
Right	22.6	21563	0.495
Left	22.6	22744	0.522
Right	23	995	0.023
Right	23	1450	0.033
Right	23.2	88801	2.039
Left	23.2	82112	1.885
Left	25.5	13583	0.312
Right	25.6	83727	1.922
Left	25.6	557191	12.791
Right	25.8	103543	2.377
Left	26.5	56284	1.292
Right	26.5	135173	3.103
Right	26.6	2459	0.056
Right	26.8	2486	0.057
Right	26.9	4226	0.106
Left	26.9	4852	0.111
Right	27.2	2489	0.057
Right	27.3	2462	0.057
Right	27.5	2461	0.057
Right	27.5	2461	0.057
Left	27.9	2100	0.048
Left	27.9	2524	0.058
Right	28.1	2500	0.057
Right	28.2	2531	0.058
Right	28.9	2390	0.055
Right	28.9	2406	0.055
Left	29.4	2635	0.060
Left	29.4	2252	0.052
Right	29.9	2638	0.061
Right	29.9	2415	0.055
Right	30.3	2387	0.055
Right	30.4	2453	0.056
Right	30.5	2400	0.055

Right	31.6	2456	0.056
Right	31.7	2543	0.058
Right	31.8	2643	0.061
Right	31.9	2595	0.060
Right	31.9	2576	0.059
Right	31.9	2595	0.060
Right	32.1	2586	0.059
Right	32.1	2586	0.059
Right	32.5	1846	0.042
Right	32.7	2455	0.056
Right	32.9	2329	0.053
Right	33	2360	0.054
Right	33.4	2013	0.046
Right	33.5	2210	0.051
Right	33.7	2197	0.050
Right	33.8	2199	0.050
Right	33.9	2638	0.061
Right	34	2636	0.061
Right	34.2	2634	0.060
Right	34.4	2569	0.059
Right	34.5	2470	0.057
Right	34.5	2439	0.056
Right	34.6	2471	0.057
Right	34.6	2679	0.062
Right	34.8	2482	0.057
Right	34.9	2482	0.057
Right	34.9	2482	0.057
Right	34.9	1514	0.035
Right	35.4	2458	0.056
Right	35.4	2418	0.056
Right	35.5	2465	0.057
Right	35.5	2483	0.057
Left	35.6	2458	0.056
Left	35.7	2542	0.058
Right	36.6	2468	0.057
Right	36.7	2515	0.058
Right	36.7	2515	0.058
Right	36.8	2473	0.057
Right	36.9	2535	0.058
Right	36.9	2484	0.057
		Total =	51.55

Appendix II

Typical Right-of-Way and Temporary Construction Workspace Drawings



NOTES:

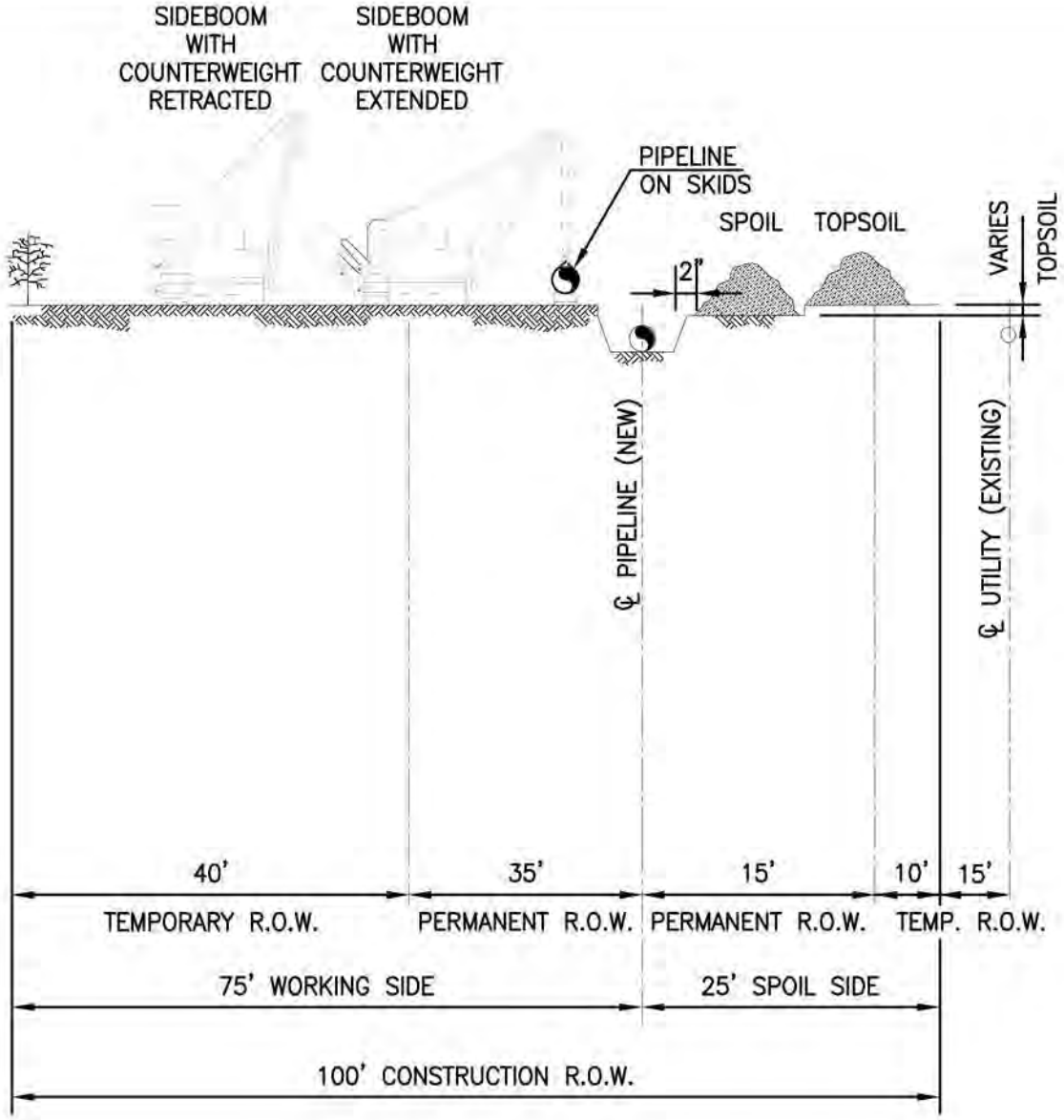
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 30	REV A



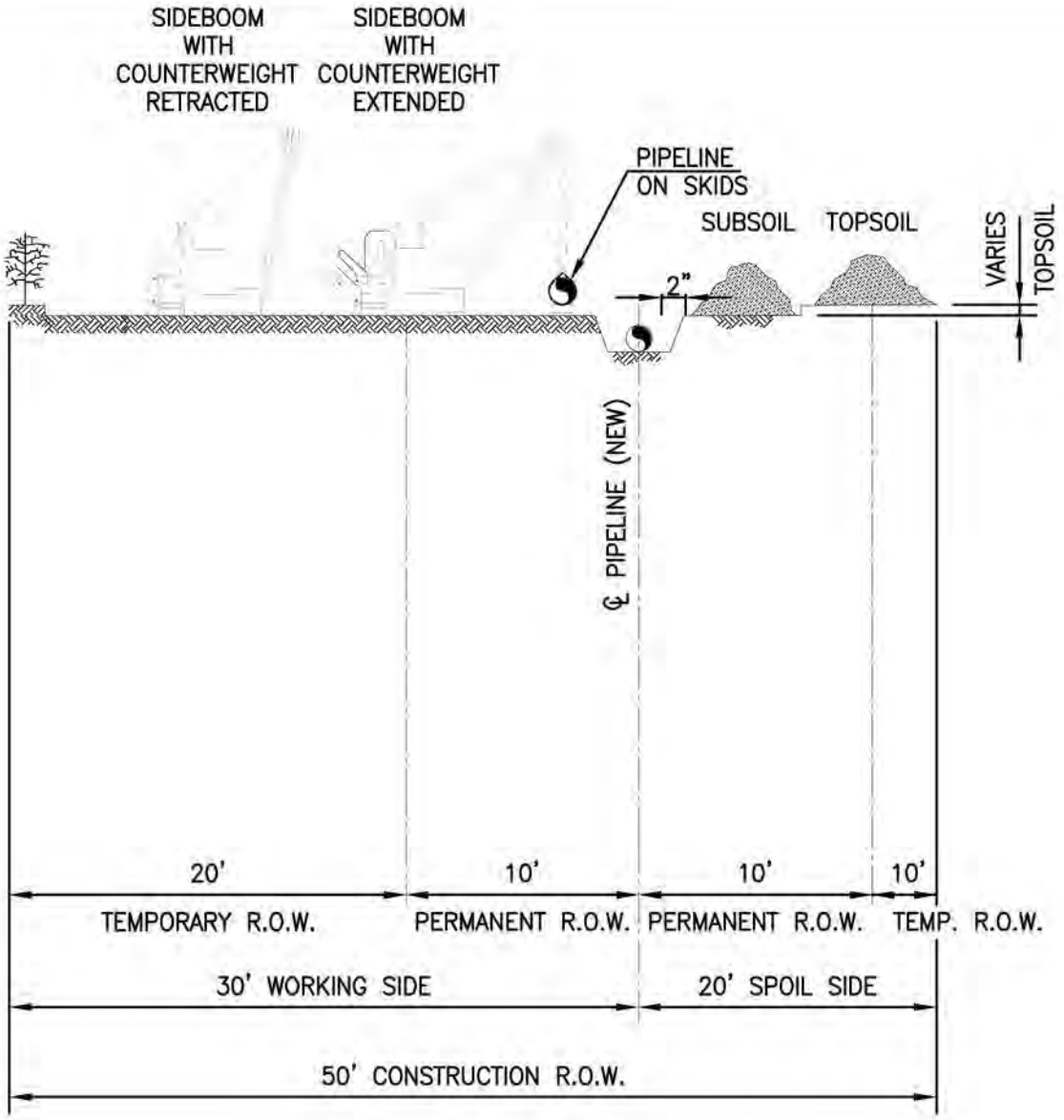
NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
PARALLEL TO EXISTING UTILITIES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 31	REV A



NOTES:

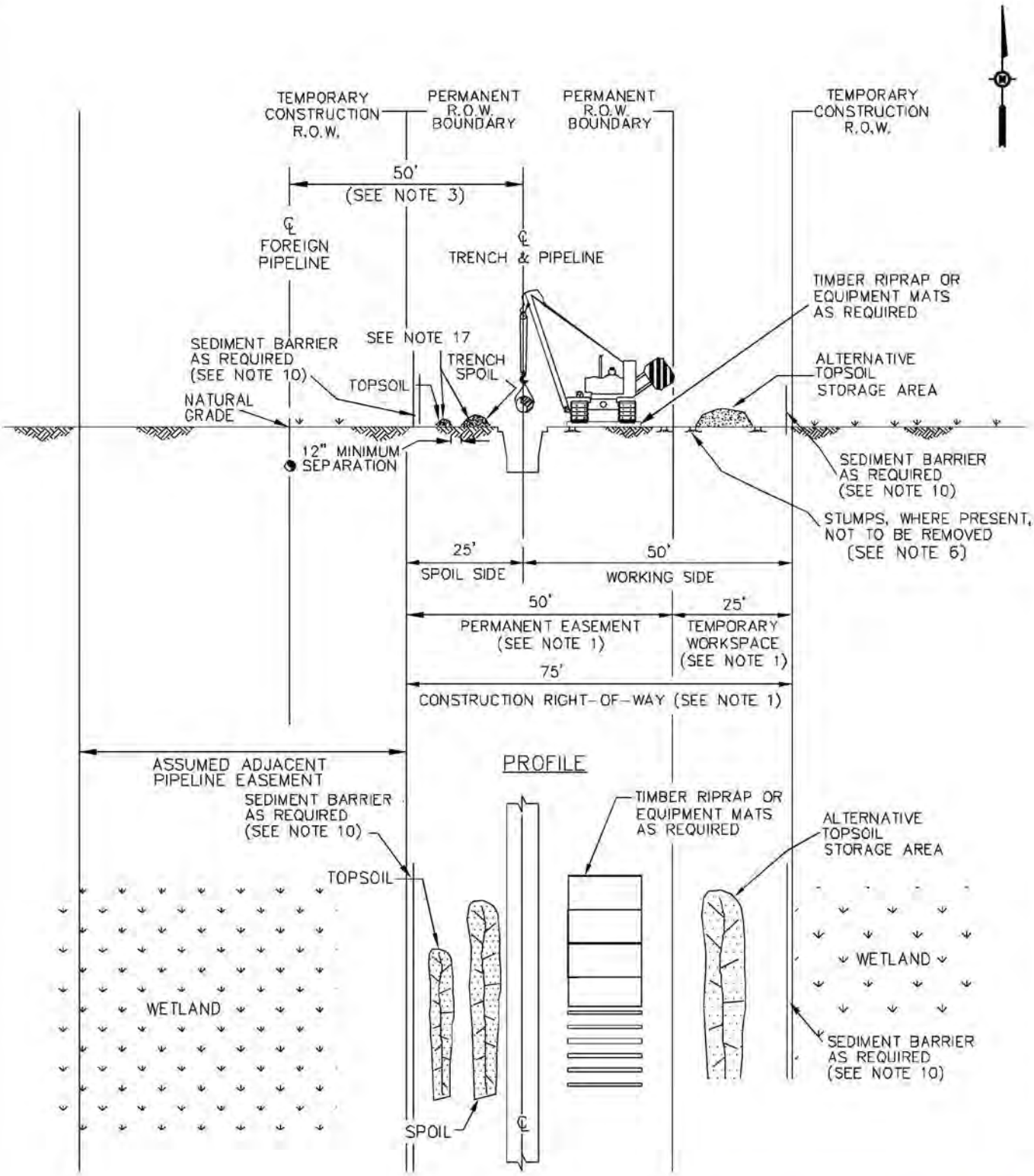
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE ENTIRE 50 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN FOREST SERVICE GRASSLANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 32	REV A



PLAN VIEW

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN WETLANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A

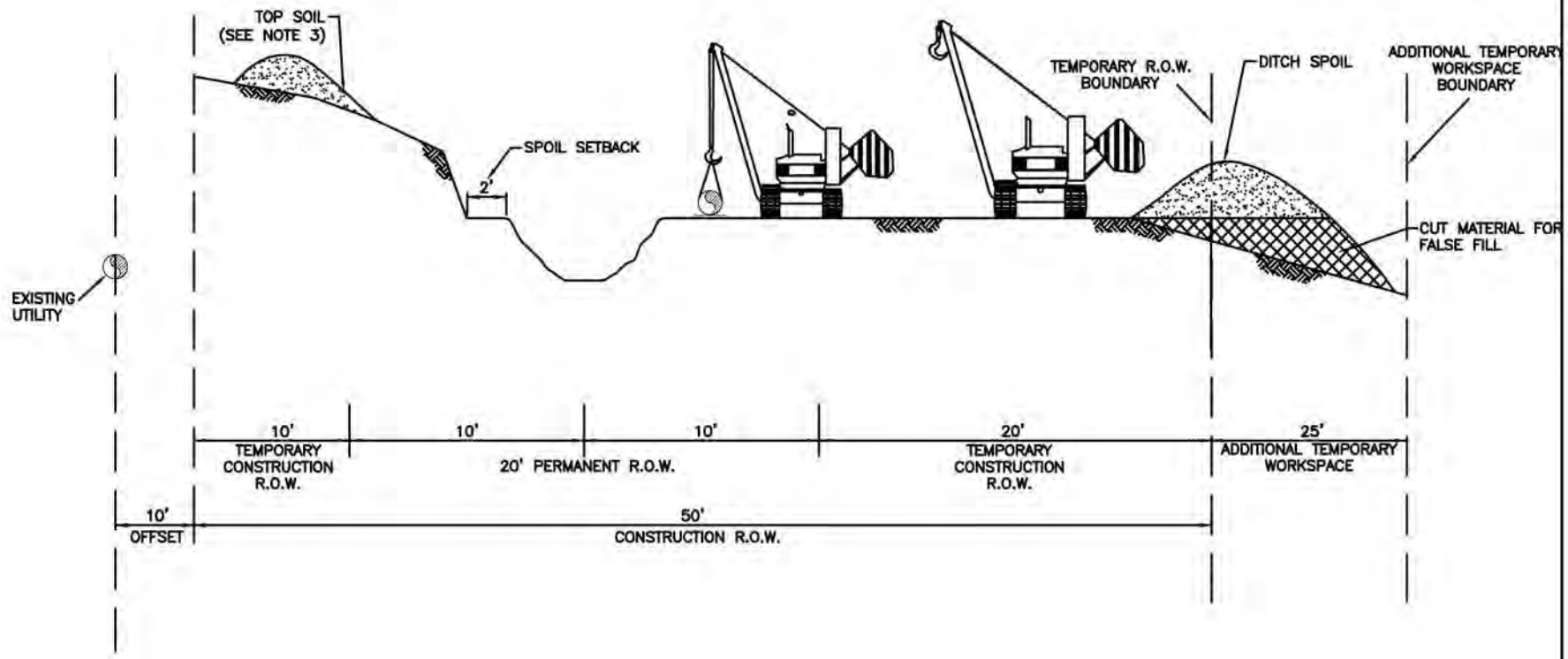
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT AND 25 FEET OF TEMPORARY WORKSPACE.
2. THE SAME LAYOUT APPLIES WHETHER CONSTRUCTION R.O.W. DOES OR DOES NOT ABUT A FOREIGN R.O.W.
3. IF OFFSET FROM A FOREIGN PIPELINE, THE OFFSET WILL BE 50 FEET FOR MOST WETLANDS, BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.
4. LOCATE ANY EXTRA TEMPORARY WORK SPACE AREAS AT LEAST 50 FEET FROM EDGE OF WETLAND UNLESS OTHERWISE SPECIFIED IN A SITE-SPECIFIC PLAN.
5. CLEARING OF VEGETATION AND TREES IS PROHIBITED BETWEEN TEMPORARY EXTRA WORK SPACE AND THE EDGE OF THE WETLAND.
6. CUT VEGETATION AND TREES OFF AT GROUND LEVEL, LEAVING EXISTING ROOT SYSTEMS IN PLACE AND REMOVE CUTTINGS FROM THE WETLAND FOR DISPOSAL.
7. LIMIT CONSTRUCTION EQUIPMENT TO ONE PASS THROUGH WETLANDS TO THE EXTENT PRACTICABLE.
8. NO REFUELING OF EQUIPMENT OR CONCRETE COATING ACTIVITIES WITHIN 300 FEET OF WETLAND EXCEPT IN ACCORDANCE WITH THE SPCC PLAN. NO STORAGE OF HAZARDOUS MATERIALS WITHIN 100 FEET OF ANY WETLAND.
9. IF SATURATED AT TIME OF CONSTRUCTION, REDUCE SOIL COMPACTION BY UTILIZING WIDE-TRACK OR BALLOON TIRE CONSTRUCTION EQUIPMENT OR NORMAL EQUIPMENT OPERATED ON TIMBER RIPRAP OR EQUIPMENT MATS.
10. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS IMMEDIATELY AFTER INITIAL GROUND DISTURBANCE ACROSS THE ENTIRE CONSTRUCTION R.O.W. IMMEDIATELY UPSLOPE OF THE WETLAND BOUNDARY AND AT THE EDGE OF THE CONSTRUCTION R.O.W. ALONG THE WETLAND AS DIRECTED BY THE COMPANY INSPECTOR.
11. SEGREGATE THE TOP 1 FOOT OF TOPSOIL FROM THE AREA DISTURBED BY TRENCHING, EXCEPT IN AREAS WHERE STANDING WATER OR SATURATED SOILS ARE PRESENT. MAINTAIN 12" SEPARATION BETWEEN TOPSOIL AND TRENCH SPOIL.
12. LEAVE GAPS IN TOPSOIL AND SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS. DO NOT USE TOPSOIL FOR PADDING. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING SPOIL PILE.
13. IF SATURATED AT TIME OF CONSTRUCTION, LEAVE HARD PLUGS AT THE EDGE OF WETLAND UNTIL JUST PRIOR TO LOWERING IN.
14. LOWER-IN PIPE, INSTALL TRENCH BREAKERS AT WETLAND EDGES AS DIRECTED BY THE COMPANY INSPECTOR. BACKFILL IMMEDIATELY ON COMPLETION OF CONSTRUCTION.
15. REMOVE ANY TIMBER RIPRAP OR EQUIPMENT MATS FROM WETLANDS UPON COMPLETION OF CONSTRUCTION.
16. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND REPLACE TOPSOIL, WHERE SALVAGED, WITHOUT A CROWN OVER THE TRENCH.
17. TOPSOIL AND TRENCH SPOIL RELATIVE POSITIONS CAN, AS DIRECTED BY THE COMPANY INSPECTOR, BE ADJUSTED TO FIT SITE CONDITIONS.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
WITHIN WETLANDS (2 OF 2)

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

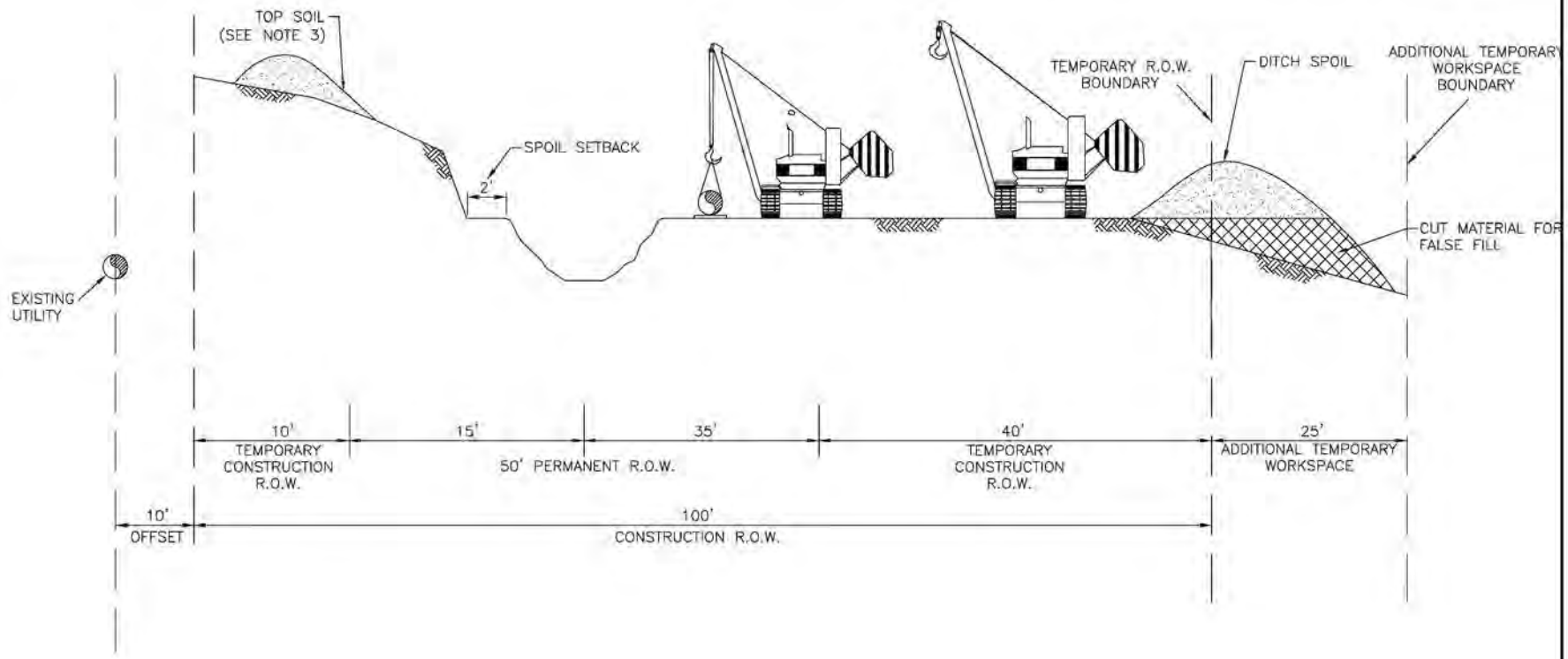
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W.(TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE
WORKSPACE WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 34	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

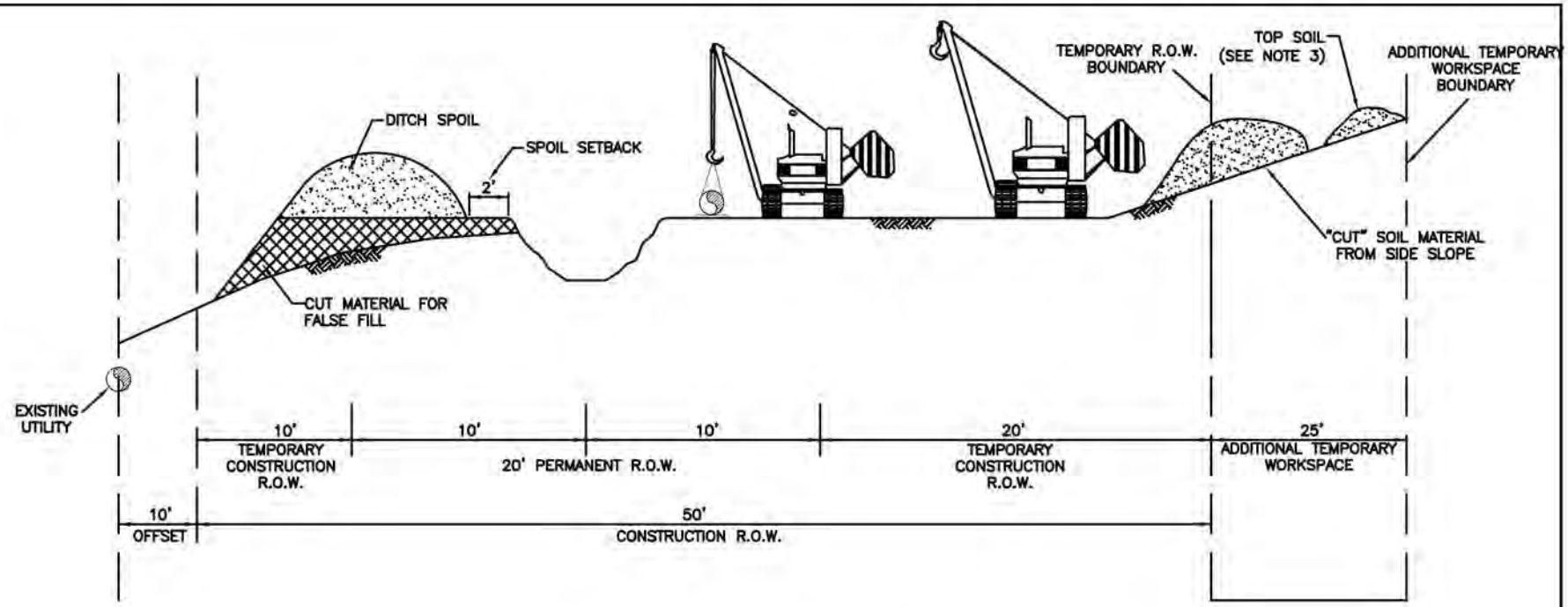
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 35	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

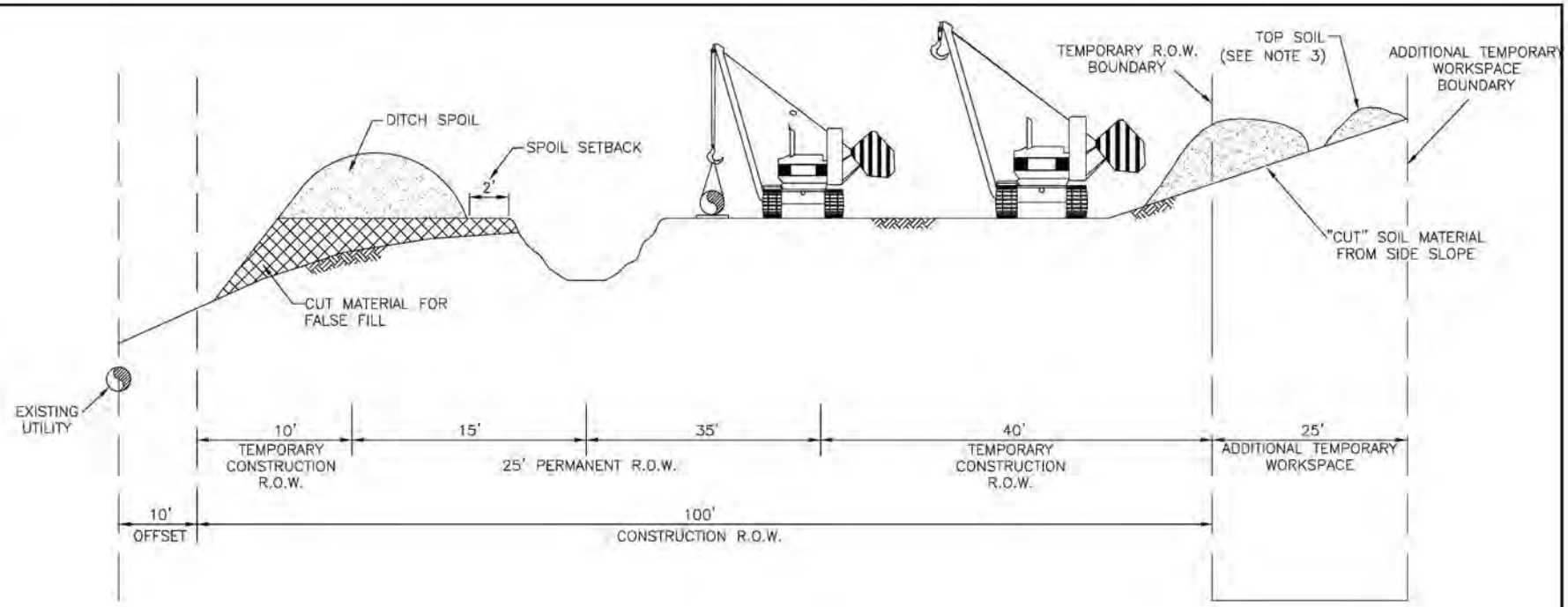
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE
WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 36	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

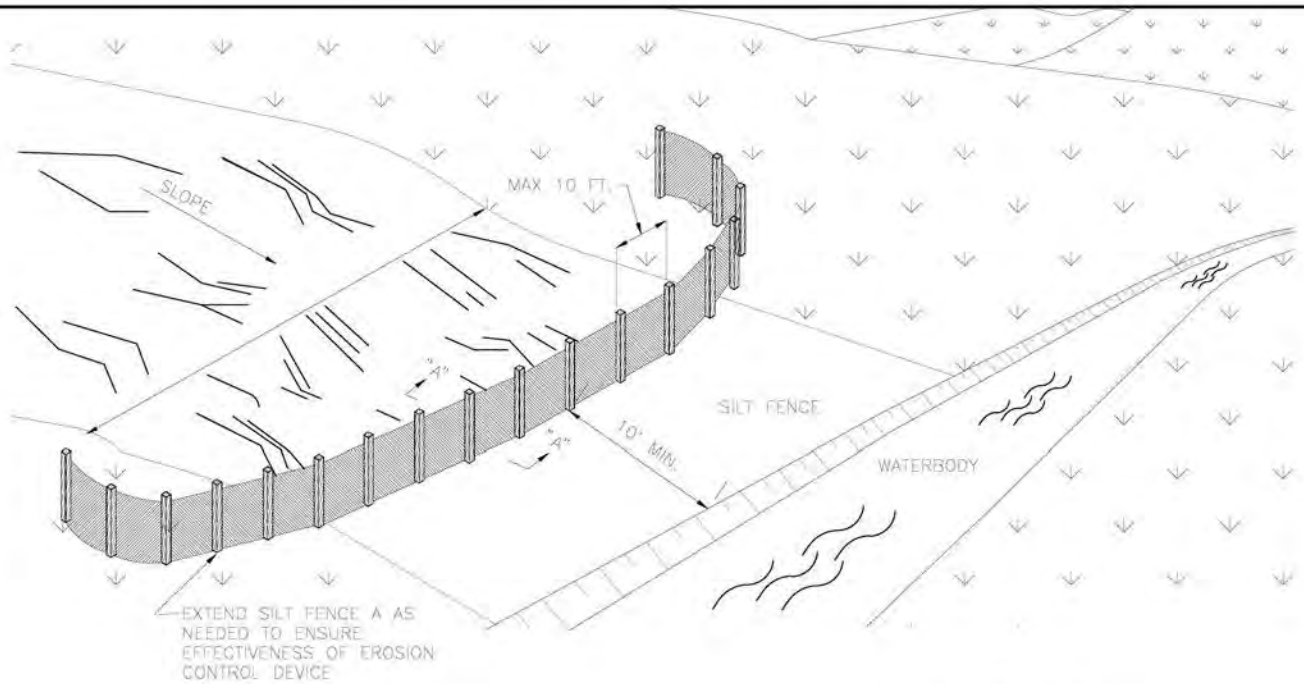
BakkenLink

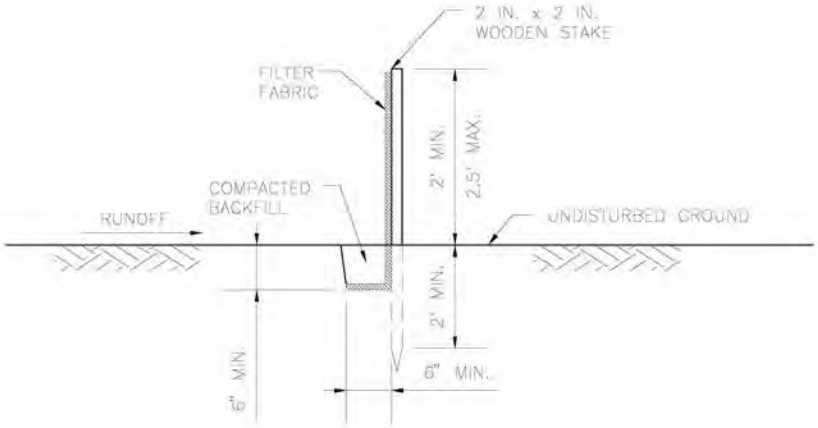
TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 37	REV A

Appendix III

Typical Construction Drawings





SECTION–"A"–"A"

SCALE: NOT TO SCALE

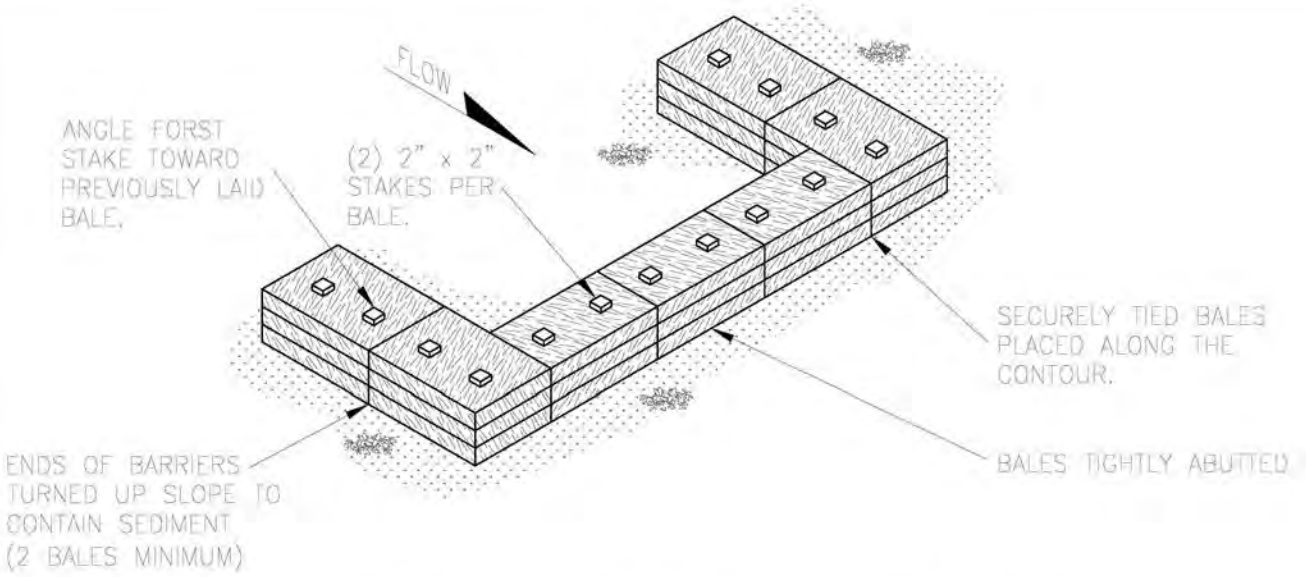
NOTES:

1. SILT FENCES ARE TO BE USED IN AREAS WHERE SHEET FLOW OR RELATIVELY SMALL VOLUMES OF WATER CAN BE EXPECTED TO OCCUR. FOR LARGER VOLUMES SUCH AS WITHIN A DEFINED CHANNEL, A CHECK DAM WILL BE REQUIRED.
2. STAKES ARE TO BE PLACED A MAXIMUM OF TEN (10) FT. OR CLOSER AS CONDITIONS REQUIRE.
3. ATTACH FILTER FABRIC AT EACH POST AT A MINIMUM OF THREE (3) LOCATIONS.
4. THE FILTER FABRIC (MIN. OF 1 FT.) IS TO BE ANCHORED IN A 6 INCH X 6 INCH TRENCH WITH WELL COMPACTED BACKFILL OVER THE FABRIC TO PREVENT UNDERMINING.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE SILT FENCE SHALL BE TURNED AND EXTENDED UPSLOPE.
6. SILT FENCES ARE TO BE CHECKED AND MAINTAINED ON A REGULAR BASIS. REMOVE ANY BUILD UP OF SEDIMENT WHEN THE HEIGHT OF SEDIMENT EXCEEDS APPROXIMATELY 20% OF THE HEIGHT OF THE BARRIER.
7. MATERIAL SHOULD BE WOVEN GEOTEXTILE FABRIC SUCH AS EXXON GTF 180 OR MOBILE 600X, OR AN APPROVED EQUIVALENT. SECONDARY REINFORCEMENT SUCH AS A CONSTRUCTION BARRIER FENCE OR WIRE MESH CAN ALSO BE USED BEHIND THE FILTER FABRIC.
8. WHERE ANCHORING CONDITIONS FOR THE SILT FENCE ARE POOR, PLACE ANCHORED STRAW BALES ON DOWNSTREAM SIDE OF THE SILT FENCE
9. MAITAINANCE REQUIREMENTS:
   INSPECT SILT FENCE:
   - DAILY IN AREAS OF ACTIVE CONSTRUCTION
   - WEEKLY IN AREAS OF NO CONSTRUCTION
   - WITHIN 24 HOURS FOLLOWING MAJOR RAIN EVENT
   - REPAIR OR REPLACE SILT FENCE AS NEEDED
   - REMOVE ACCUMILATED SEDIMENTS TO AN UPLAND AREA AS NEEDED

BakkenLink

TYPICAL CONSTRUCTION
SILT FENCE
BARRIER INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–1	REV A



PERSPECTIVE VIEW

NOT TO SCALE

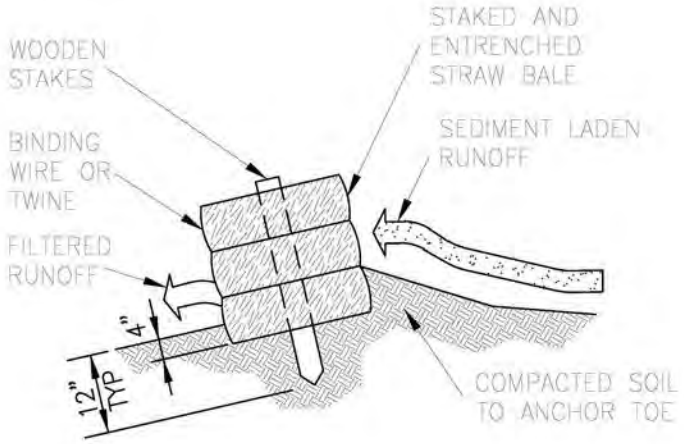
INSTALLATION REQUIREMENTS:

WHEN USING STRAW BALES, PLACE THEM:

- WITH THEIR ENDS TIGHTLY ABUTTING AND EMBEDDED IN THE SOIL A TYPICAL OF 4".
- BETWEEN DISTURBED AREAS AND DOWN-SLOPE ENVIRONMENTAL RESOURCE AREAS.
- AT THE BASE OF ALL SLOPES NEXT TO WETLANDS, WATERBODIES, AND ROAD CROSSINGS.
- AT THE INLET AND OUTLET OF OPEN DRAINAGE STRUCTURES.
- APPROXIMATELY 6 FEET BEYOND THE TOE OF THE SLOPE TO GIVE THE SEDIMENT ROOM TO COLLECT.

KEY IN THE BOTTOM OF THE BALE. IN AREAS WHERE IT IS NOT FEASIBLE TO TRENCH IT IN (LEDGES, ROCKY SOIL,LARGE TREE ROOTS, ETC), USE NATIVE SOIL AS BACKFILL UP-SLOPE OF THE BALE.

IF USED IN CONJUNCTIION WITH SILT FENCE, BALES ARE PLACED UP-SLOPE OF THE SILT FENCE AND DO NOT NEED TO BE TRENCHED IN.



CROSS-SECTION

NOT TO SCALE

MAINTENANCE REQUIREMENTS:

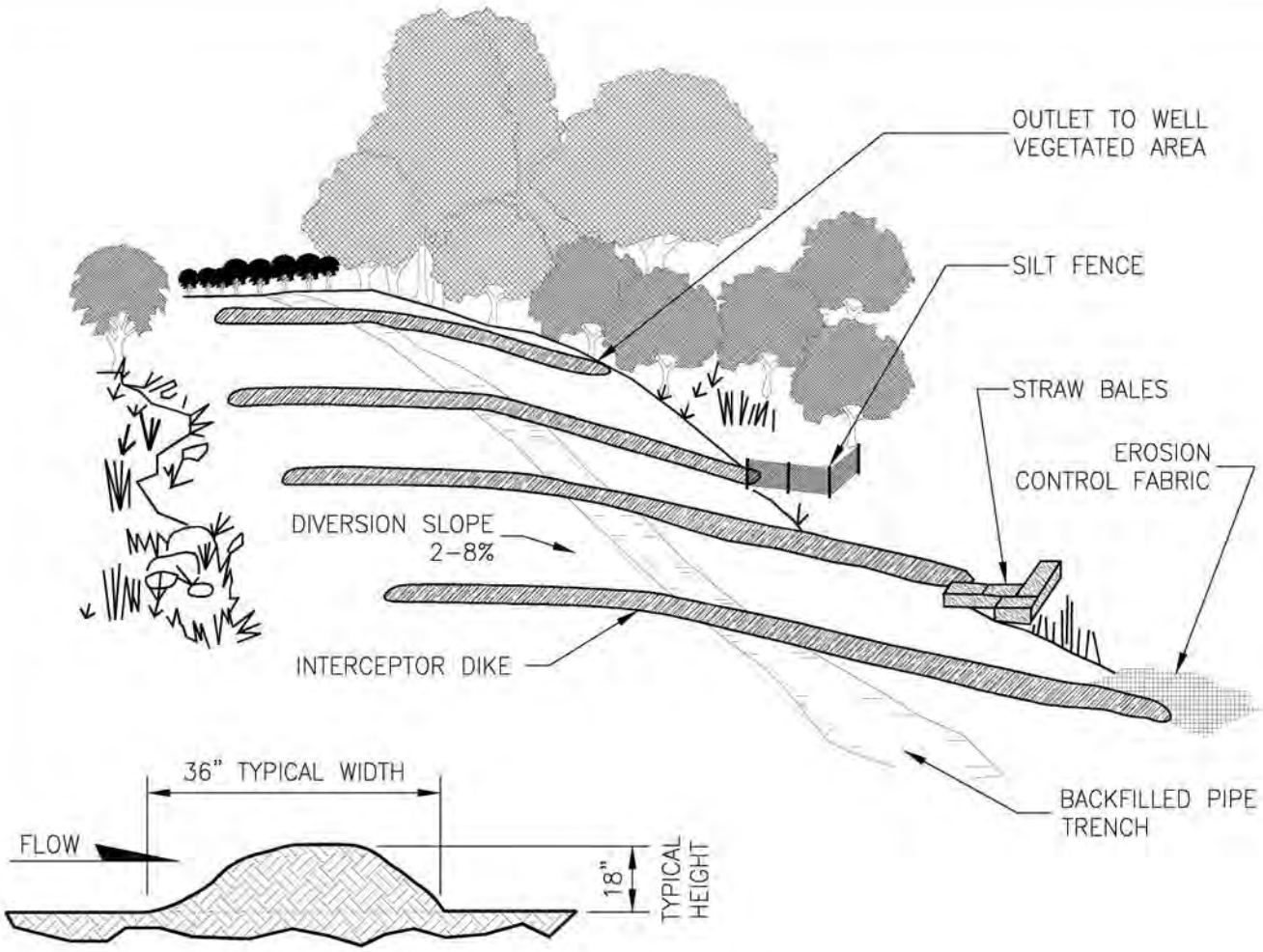
INSPECT BALES:

- DAILY IN AREAS OF ACTIVE CONSTRUCTION.
- WEEKLY IN AREAS WITH NO CONSTRUCTION.
- WITHIN 24 HOURS FOLLOWING EACH MAJOR STORM EVENT.
- REPAIR OR REPLACE BALES AS NEEDED.
- REMOVE ACUMULATED SEDIMENTS TO AN UPLAND AREA AS NEEDED.

BakkenLink

TYPICAL CONSTRUCTION
STRAW BALE INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-2	REV A



CROSS SECTION

NOT TO SCALE

INSTALLATION REQUIREMENTS:

- INSTALL PERMANENT INTERCEPTOR DIKES IN ALL AREAS EXCEPT RESIDENTIAL OR AGRICULTURAL AS NECESSARY TO AVOID EXCESSIVE EROSION (UNLESS AUTHORIZED BY LANDOWNER OR LAND MANAGING AGENCY IN AGRICULTURAL OR RESIDENTIAL AREA).
- MUST BEINSTALLED ON SLOPES GREATER THAT 5% WHERE THE BASE OIF THE SLOPE IS LESS THAN 50 FEET FROM A WATERBODY, WETLAND OR ROAD CROSSING AT THE FOLLOWING MINIMUM SPACING:

SLOPE (%)	SPACING (FT)
5-15	300
>15-30	200
>30	100

- CONSTRUCT USING EARTH FILLED SACKS, STAKED STRAW BALES, SILT FENCE, OR SOIL FOR TEMPORARY OR COMPACTED EARTH AND ROCK TO PERMANENT.
- INSTALL WITH A 2 - 8% OUTFALL ANGLE.
- POSITION OUTFALL TO PREVENT SEDIMENT DISCHARGE INTO WETLADS, WATERBODIES, OR OTHER SENSITIVE RESOURCES.
- FILTER RUN-OFF WATER BY CONASTRUCTIONG THE OUTLET IN A WELL VEGETATED STABLE AREA, OR BY USING AN ENERGY DISSIPATING DEVICE (SILT FENCE, STRAW BALES, EROSION CONTROL FABRIC), AS DIRECTED BY THE ENVIRONMENTAL INSPECTOE.

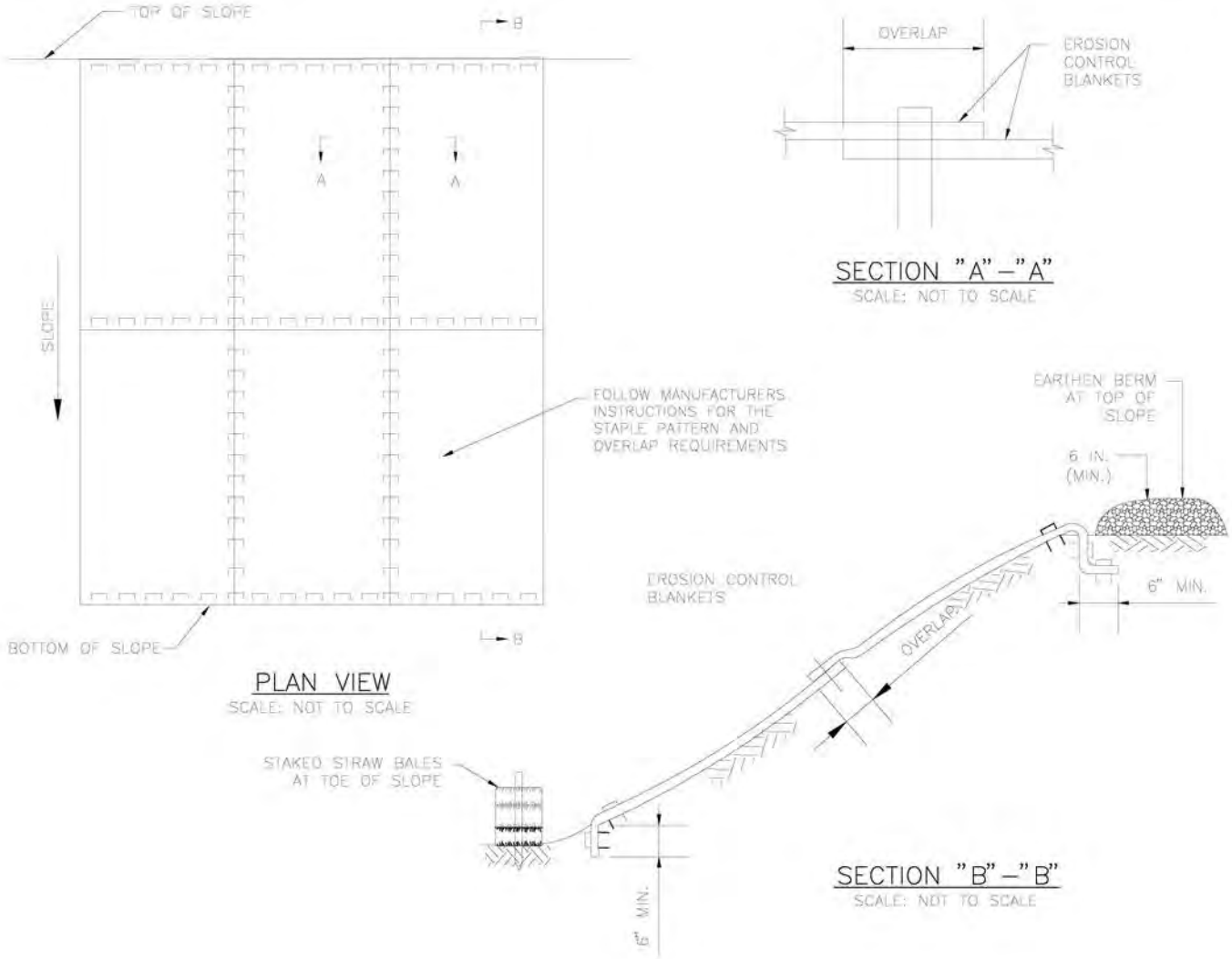
MAINTENANCE REQUIREMENTS:

- INSPECT DURING AND FOLLOWING CONSTRUCTION AND MAKE REPAIRS AS NEEDED.
- KEEP THE CHANNEL FREE OF DEBRIS AND OBSTRUCTIONS.
- SEED AND MULCH PERMANENT INTERCEPTOR DIKES FOLLOWING CONSTRUCTION.

BakkenLink

TYPICAL CONSTRUCTION
INTERCEPTOR DIKE INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-3	REV A



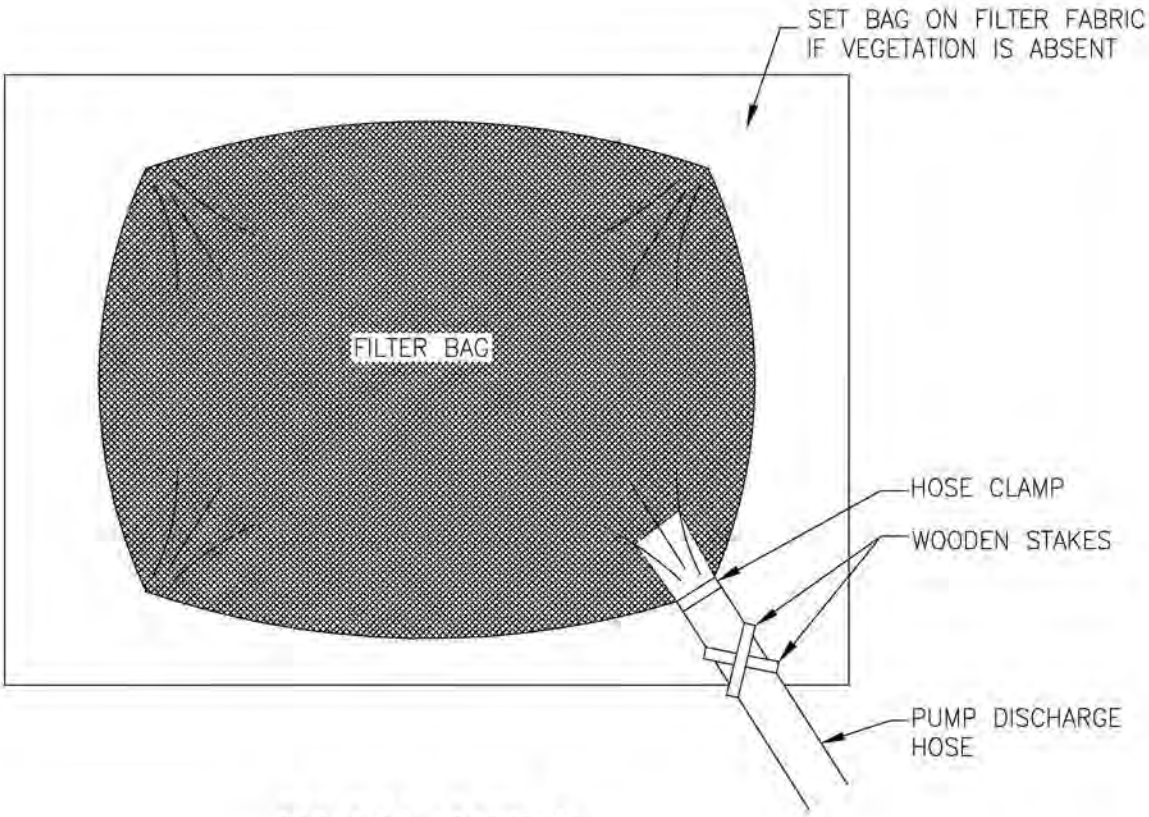
NOTES:

1. EROSION CONTROL BLANKETS SHALL BE NORTH AMERICAN GREEN S 150 FOR SLOPES 3 TO 1 AND SC 150 FOR SLOPES 2 TO 1 OR APPROVED EQUALS.
2. INSTALL BLANKETS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
3. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING GRADING, REMOVAL OF LARGE ROCKS AND DEBRIS, AND THE APPLICATION OF SEED AND FERTILIZER.
4. EROSION CONTROL BLANKETS SHALL EXTEND COMPLETELY ACROSS DISTURBED AREAS TO PROTECT ERODIBLE SURFACES.
5. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A MINIMUM SIX (6) INCHES WIDE AND SIX (6) INCHES DEEP TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ROLL THE BLANKETS DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
7. AS AN ALTERNATIVE TO STAPLES, WOODEN STAKES CAN BE USED.
8. ENSURE COMPLETE CONTACT BETWEEN THE BLANKETS AND THE SLOPE FACE. ADDITIONAL STAPLES CAN BE USED TO ELIMINATE GAPS.
9. EROSION CONTROL BLANKETS WILL BE INSTALLED AS REQUIRED BY LAND OWNER OR APPLICABLE PERMIT.

BakkenLink

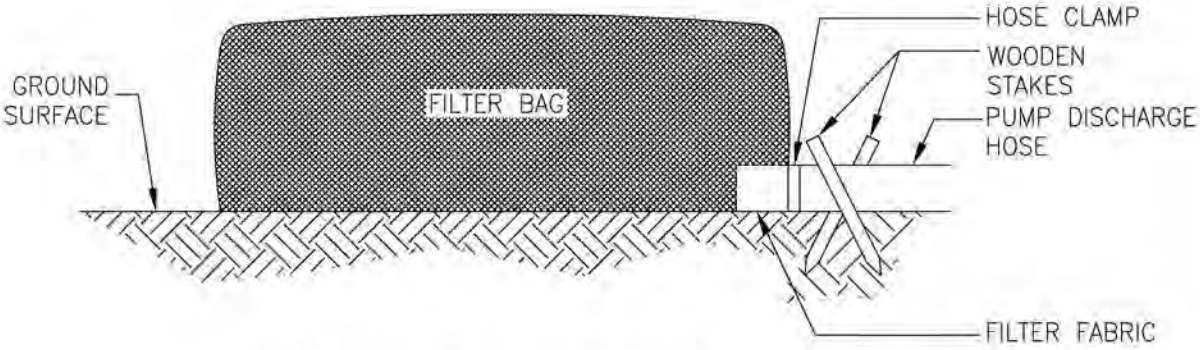
TYPICAL CONSTRUCTION
EROSION CONTROL
BLANKET INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–4	REV A



PLAN VIEW

N.T.S.



CROSS-SECTION

N.T.S.

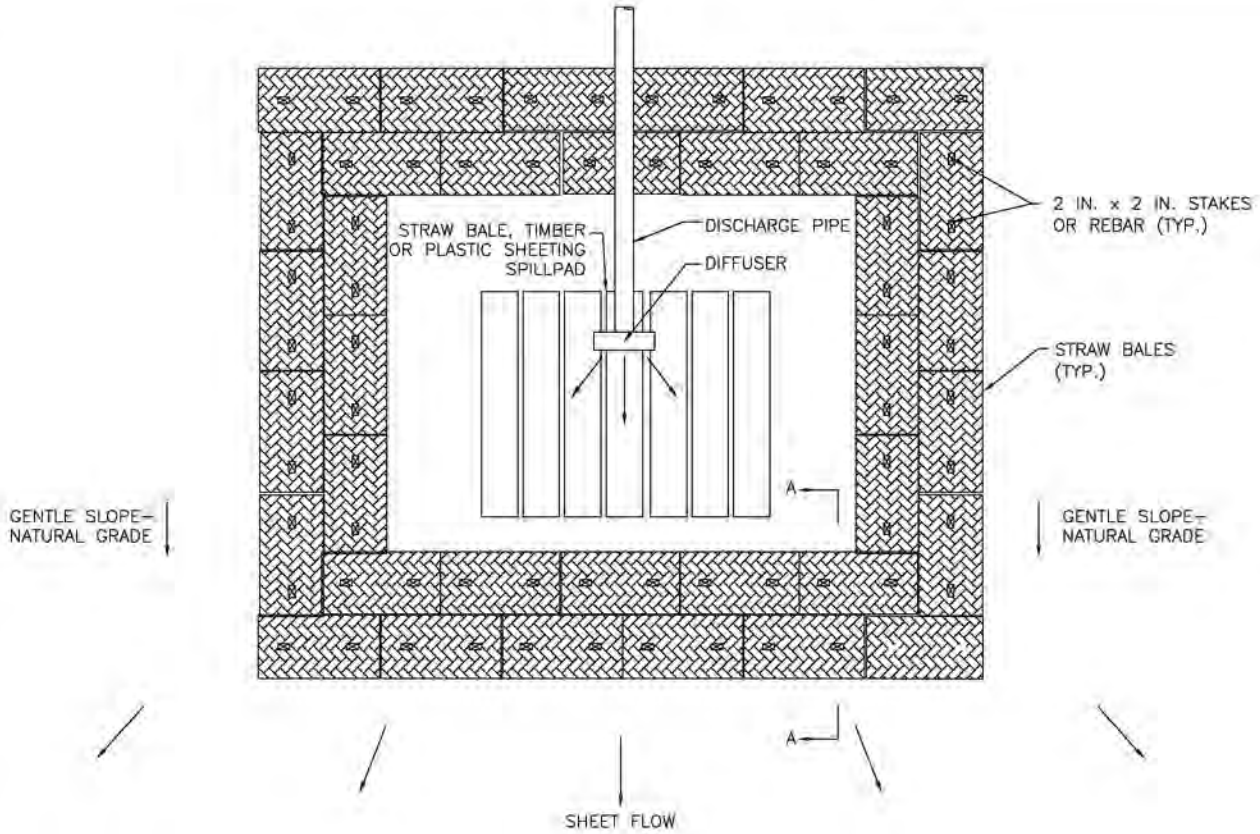
NOTES:

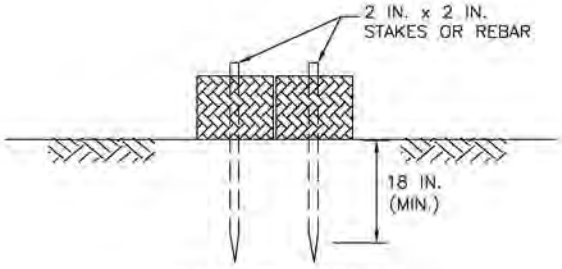
1. LIMIT ONE (1) DISCHARGE HOSE PER BAG.
2. REMOVE DEWATERING STRUCTURE AS SOON AS POSSIBLE AFTER COMPLETION OF DEWATERING ACTIVITIES.

BakkenLink

TYPICAL CONSTRUCTION
FILTER BAG INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-5	REV A





SECTION–"A"–"A"
SCALE: NOT TO SCALE

NOTES:

1. INSTALL A STRAW BALE DEWATERING STRUCTURE WHEREVER IT IS NECESSARY AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR TO PREVENT THE FLOW OF HEAVILY SILT LADEN WATER INTO WATER BODIES OR WETLANDS. ALL DEWATERING ACTIVITIES SHALL BE IN ACCORDANCE WITH ENVIRONMENTAL SPECIFICATION AND RELEVANT PERMITS.

2. DISCHARGE SITE SHOULD BE WELL VEGETATED AND LOCATED AT LEAST 50 FEET FROM ANY WATERCOURSE. THE TOPOGRAPHY OF THE SITE SHOULD BE SUCH THAT WATER WILL FLOW INTO THE DEWATERING STRUCTURE AND AWAY FROM ANY WORK AREAS. THE AREA DOWN SLOPE FROM THE DEWATERING SITE MUST BE REASONABLY FLAT OR STABILIZED BY VEGETATION OR OTHER MEANS TO ALLOW THE FILTERED WATER TO CONTINUE AS SHEET FLOW.

3. DIRECT THE PUMPED WATER ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, WEIGHTED TIMBERS, OR A WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE, SUCH AS MIRAGI 600X, TERRAFIX 400W, OR A COMPANY APPROVED EQUIVALENT.

4. DISCHARGE RATES SHOULD BE SUCH THAT THE CAPACITY OF THE STRUCTURE WILL NOT BE EXCEEDED.

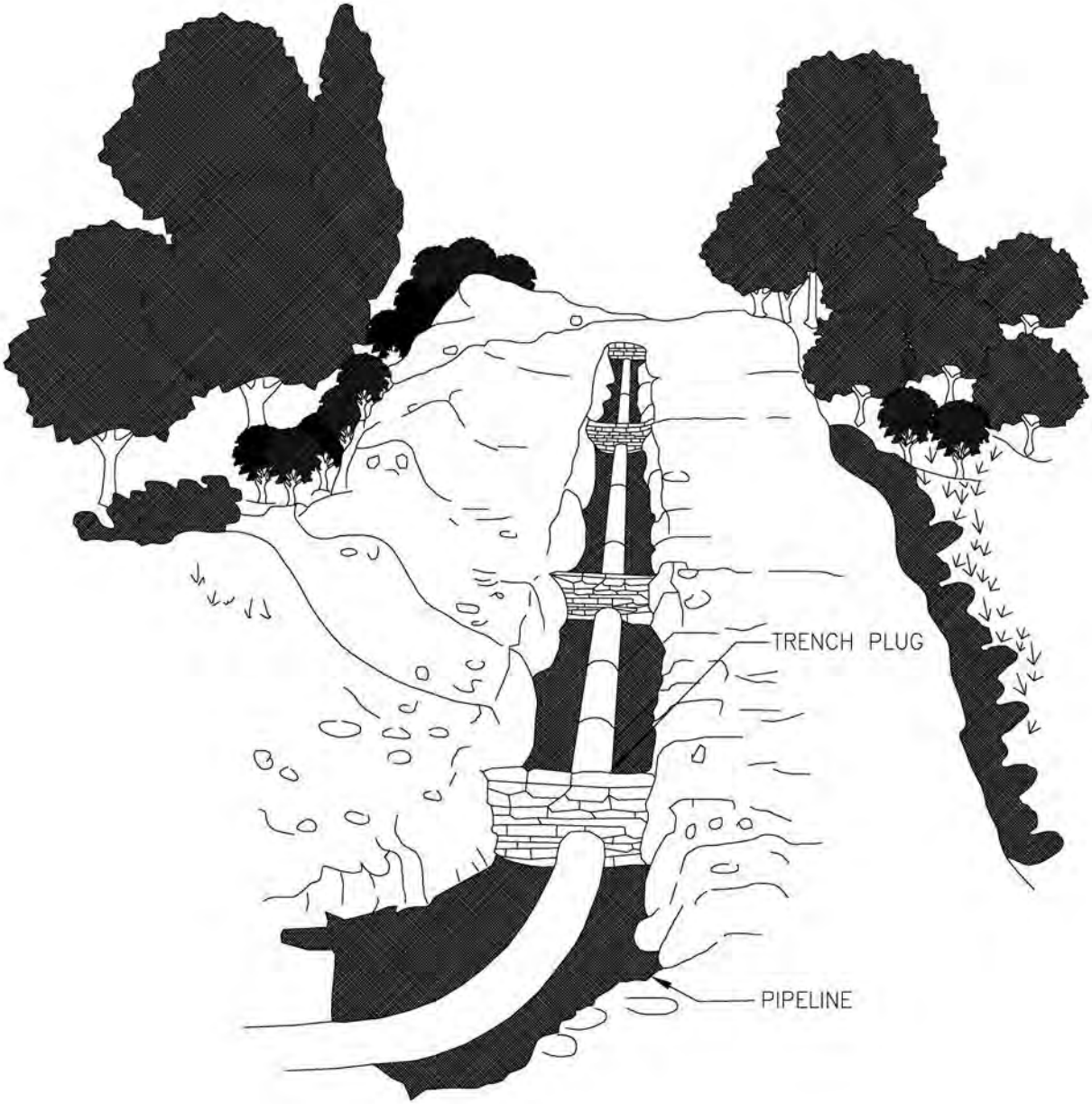
5. DISCHARGE WATER SHALL BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD USING A COMBINATION OF STRAW BALES AND THE NATURAL TOPOGRAPHY. DRIVE TWO (2) STAKES OR REBAR INTO EACH BALE TO ANCHOR THEM IN PLACE.

6. MANUFACTURED FILTER BAGS ARE A SUITABLE ALTERNATIVE TO STRAW BALE STRUCTURES FOR TRENCH DEWATERING. FILTER BAGS SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER. DISPOSE OF FULL FILTER BAGS AT AN APPROVED OFF-SITE FACILITY.

BakkenLink

TYPICAL CONSTRUCTION
STRAW BALE
DEWATERING STRUCTURE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–6	REV A



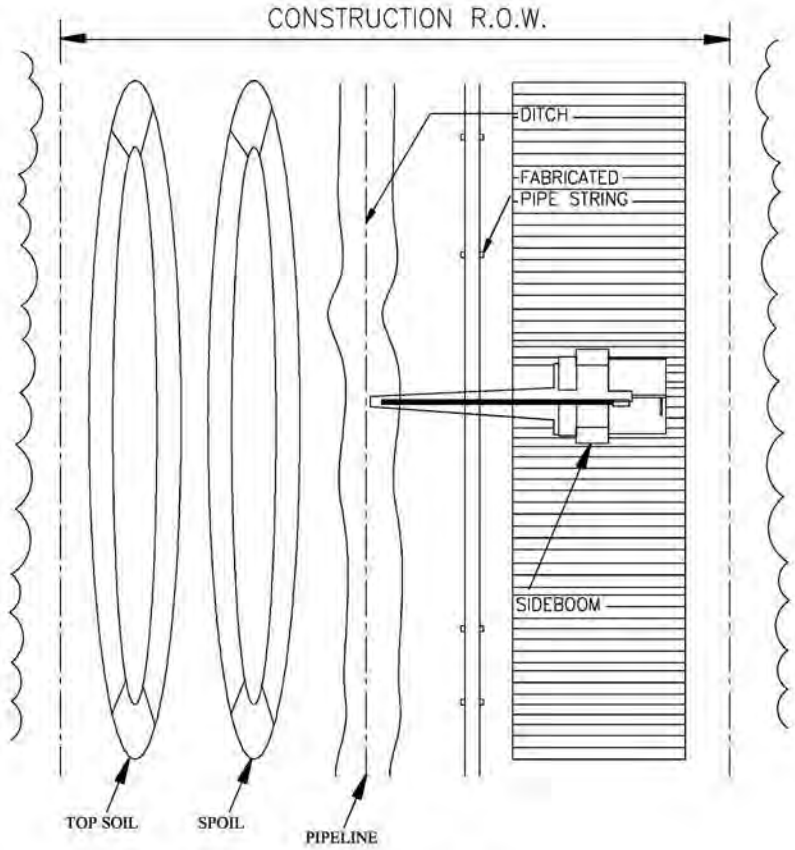
NOTES:

SLOPE (%)	SPACING (FT)
5–15	300
>15–30	200
>30	100

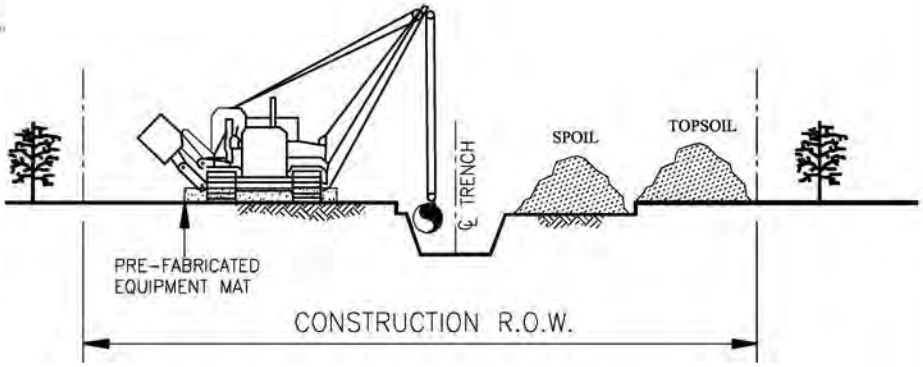
BakkenLink

TYPICAL CONSTRUCTION
PERMANENT
TRENCH PLUGS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–7	REV A



PLAN VIEW



SECTION A-A

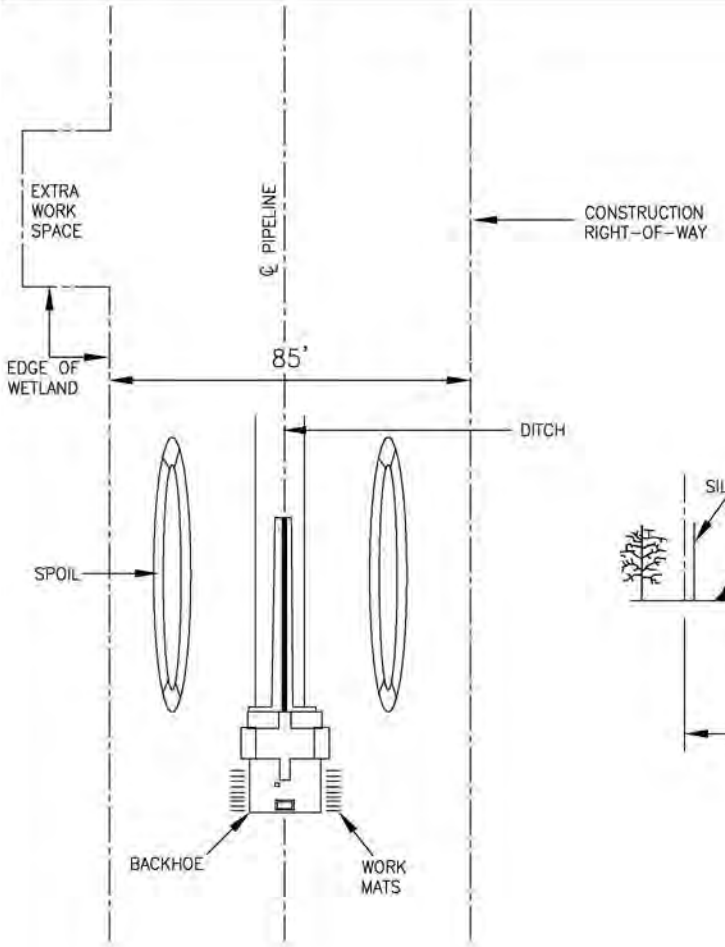
CONSTUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
4. INSTALL TIMBER MATS/RIPAP THROUGH ENTIRE WETLAND AREA. EQUIPMENT NECESSARY FOR RIGHT-OF-WAY CLEARING MAY MAKE ONE (1) PASS THROUGH THE WETLAND BEFORE MATS ARE INSTALLED.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BLAES AND/OR SILT FENCE) AT DOWNSLOPE EDGE OF RIGHT-OF-WAY AND ALONG WETLAND EDGE AS REQUIRED.
6. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND DITCH SPOIL AREAS AND REMOVED FROM WETLAND FOR DISPOSAL.
7. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
8. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STRING STAGING TRENCH THROUGH WETLANDS.
9. LOWER-IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES AS REQUIRED AND BACKFILL IMMEDIATELY.
10. REMOVE TIMBER MATS OR PRE-FABRICATED MATS FROM WETLAND UPON COMPLETION.
11. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.

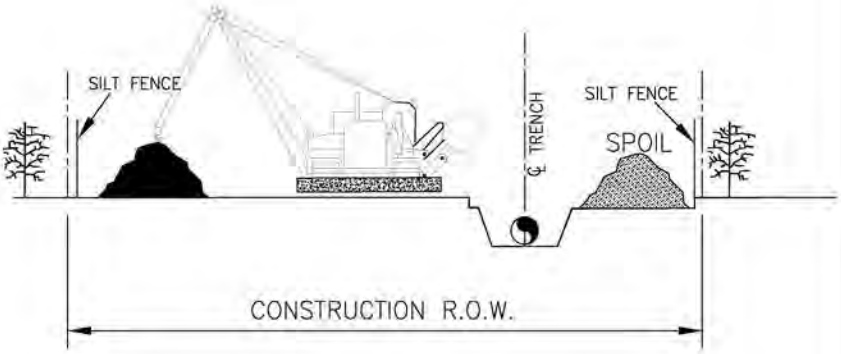
BakkenLink

TYPICAL CONSTRUCTION
STANDARD WETLAND
CROSSING METHOD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-8	REV A



PLAN VIEW



SECTION A-A

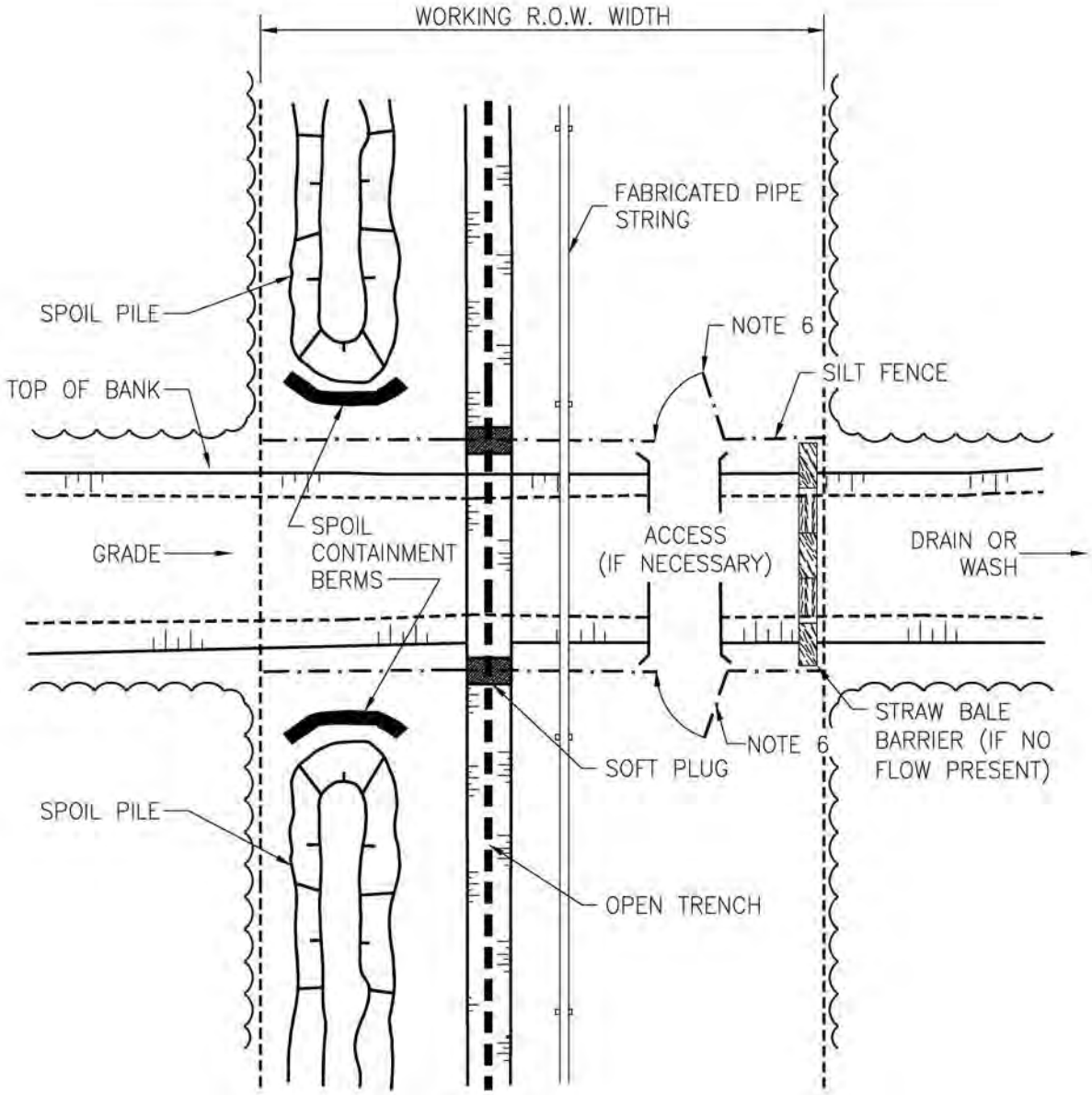
CONSTUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
4. RESTRICT ROOM GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
6. UTILIZE AMPHIBIOUS EXCAVATORS (PONTOON MOUNTED BACKHOES) OR TRACKED BACKHOES SUPPORTED BY FABRICATED TIMBER MATS OR FLOATS TO EXCAVATE TRENCH. IF FABRICATED TIMBER MATS ARE USED FOR STABILIZATION. THE BACKHOE SHALL GRADUALLY MOVE ACROSS THE WETLAND BY MOVING THE MAT FROM IMMEDIATELY BEHIND TO IMMEDIATELY IN FRONT OF THE BACKHOE'S PATH.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/ OR SILT FENCE) AT EDGE OF RIGHT-OF WAY AND ALONG WETLAND EDGE IF PRACTICAL.
8. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
9. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR PLACEMENT.
10. FLOAT PIPE IN PLACE, LOWER-IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY
11. REMOVE TIMBER MATS OR PRE-FABRICATED MATS OF NON-NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
13. THE CONSTRUCTION RIGHT-OF-WAY FOR THIS TYPE OF CONSTRUCTION SHALL BE 85 FEET.

BakkenLink

TYPICAL CONSTRUCTION
PUSH/PULL WETLAND
CROSSING METHOD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-9	REV A



PLAN VIEW

NOT TO SCALE

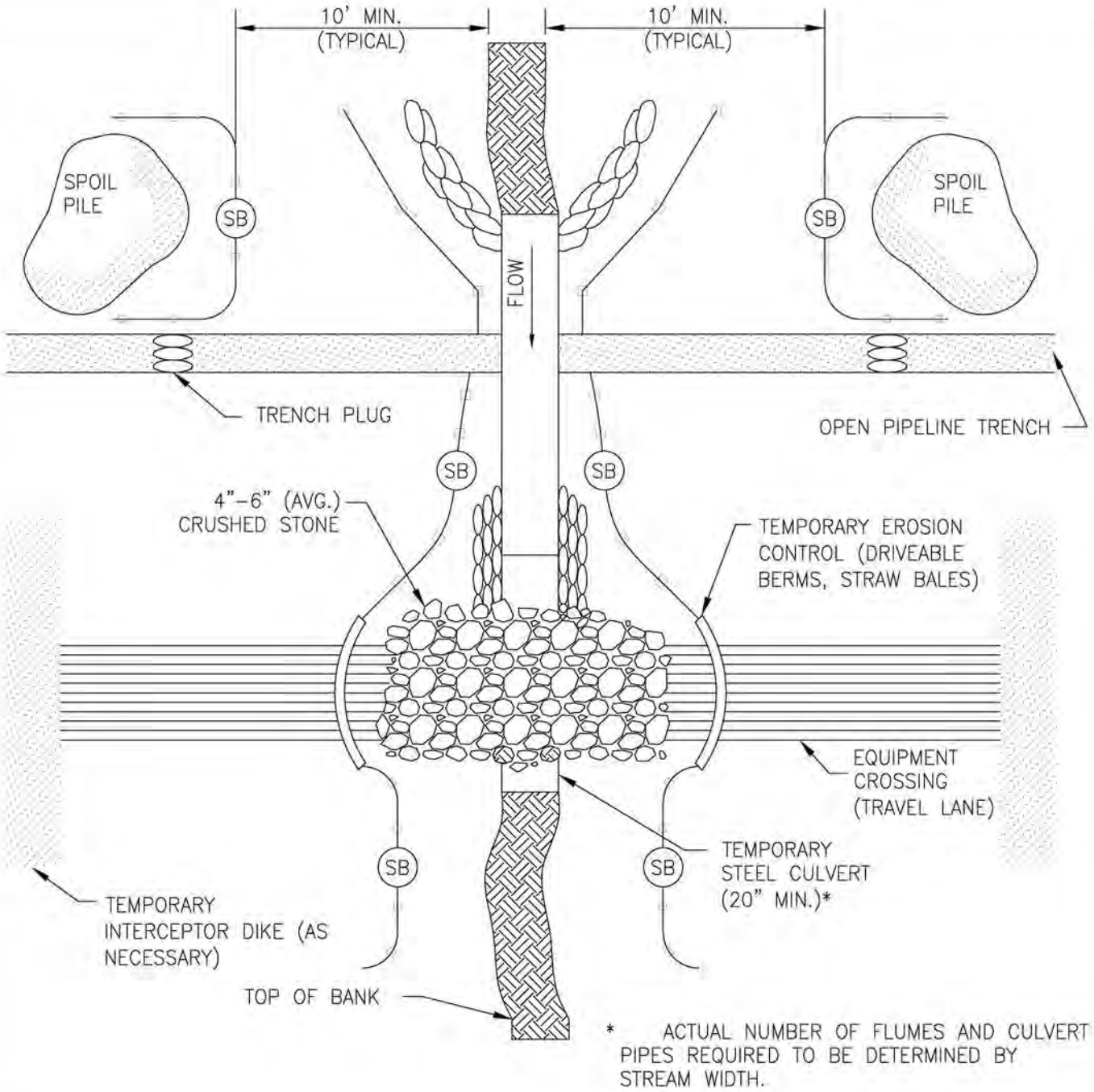
NOTE:

1. APPLICABLE TO MINOR (<10') WATERBODIES THAT ARE NOT FLOWING AT THE TIME OF CONSTRUCTION, OR DO NOT SUPPORT A SIGNIFICANT FISHERY.
2. WEHICLE ACCESS IS ONLY REQUIRED WHERE NECESSARY TO FACILITATE EQUIPMENT MOVEMENT AND MAY CONSIST OF TIMBER MATS, TEMPORARY BRIDGES, RAIL FLATARS OR FLUME CROSSING.
3. INSTALL SOFT PLUGS FOLLWOING EXCAVATION OF MAINLINE DITCH THROUGH CROSSING.
4. INSTALL SEDIMENT BARRIERS AS INDICATED. PROTECT ACCESS WITH SILT FENCE GATES OR STRAW BALE BARRIERS.
5. MAINLINE PIPE SECTION MAY SPAN CROSSING IN PREPARATION FOR LOWER IN.
6. SILT FENCE OR STRAW BALE "GATE" TO BE CLOSED AT NIGHT OR DURING RAINFALL.

BakkenLink

TYPICAL CONSTRUCTION
NON-FLOWING
OPEN CUT CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-10	REV A



NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR APPROPRIATE MATERIALS.

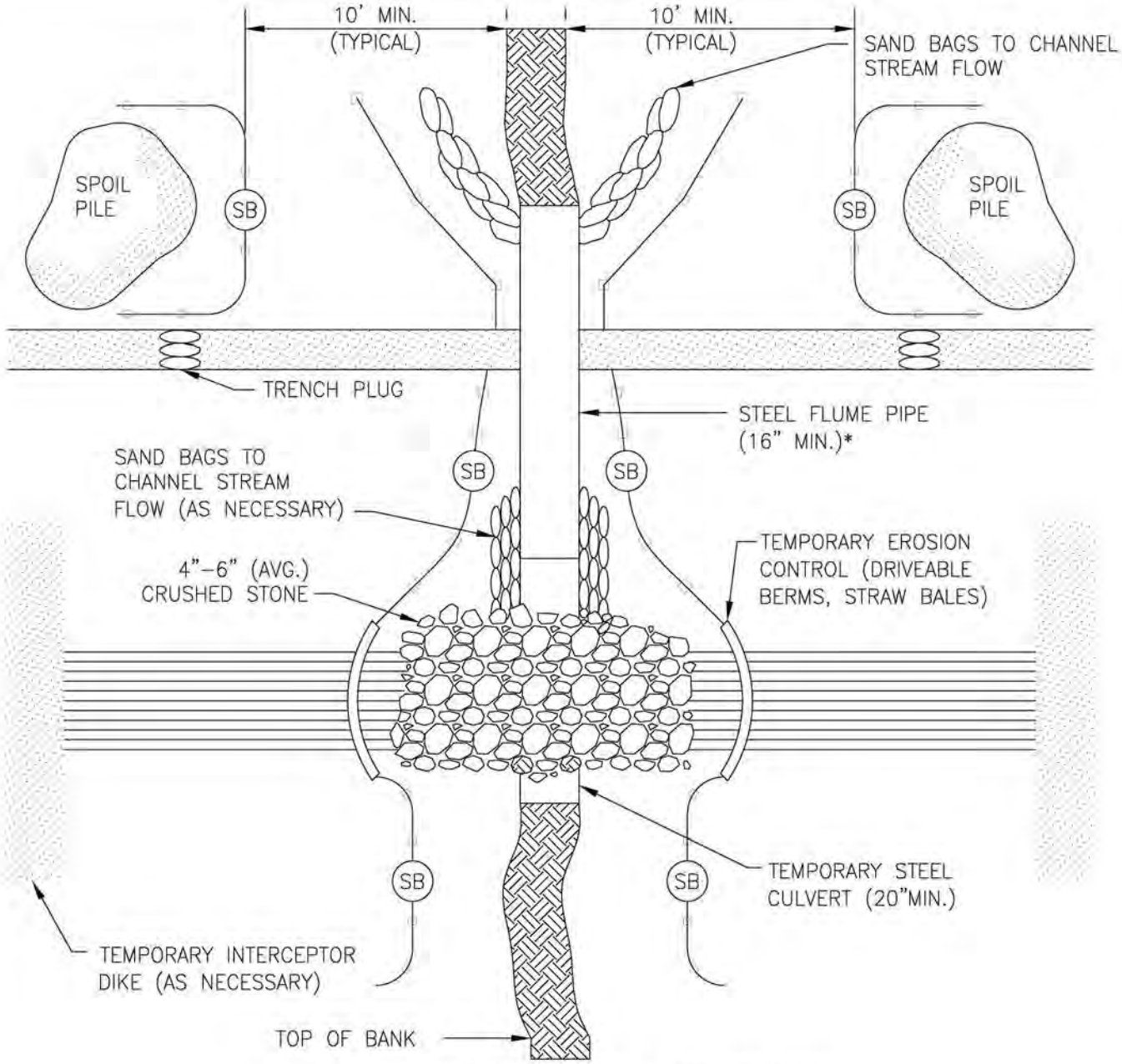
2. FOR MINOR WATERBODIES, COMPLETE TRENCHING AND BACKFILLING IN THE WATERBODY (NOT INCLUDING BLASTING OR OTHER ROCK BREAKING MEASURES) WITHIN 24 HOURS. IF A FLUME IS INSTALLED WITHIN THE WATERBODY DURING MAINLINE ACTIVITIES, IT CAN BE REMOVED JUST PRIOR TO LOWERING IN THE PIPELINE. THE 24-HOUR TIMEFRAME STARTS AS SOON AS THE FLUME IS REMOVED.

3. FOR INTERMEDIATE WATERBODIES, COMPLETE TRENCHING AND BACKFILLING IN THE WATERBODY (NOT INCLUDING BLASTING OR OTHER ROCK BREAKING MEASURES) WITHIN 48 CONTINUOUS HOURS, IF FEASIBLE.

BakkenLink

TYPICAL CONSTRUCTION
WET CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-11	REV A



- ACTUAL NUMBER OF FLUMES AND CULVERT PIPES REQUIRED TO BE CONTINUED BY STREAM WIDTH.

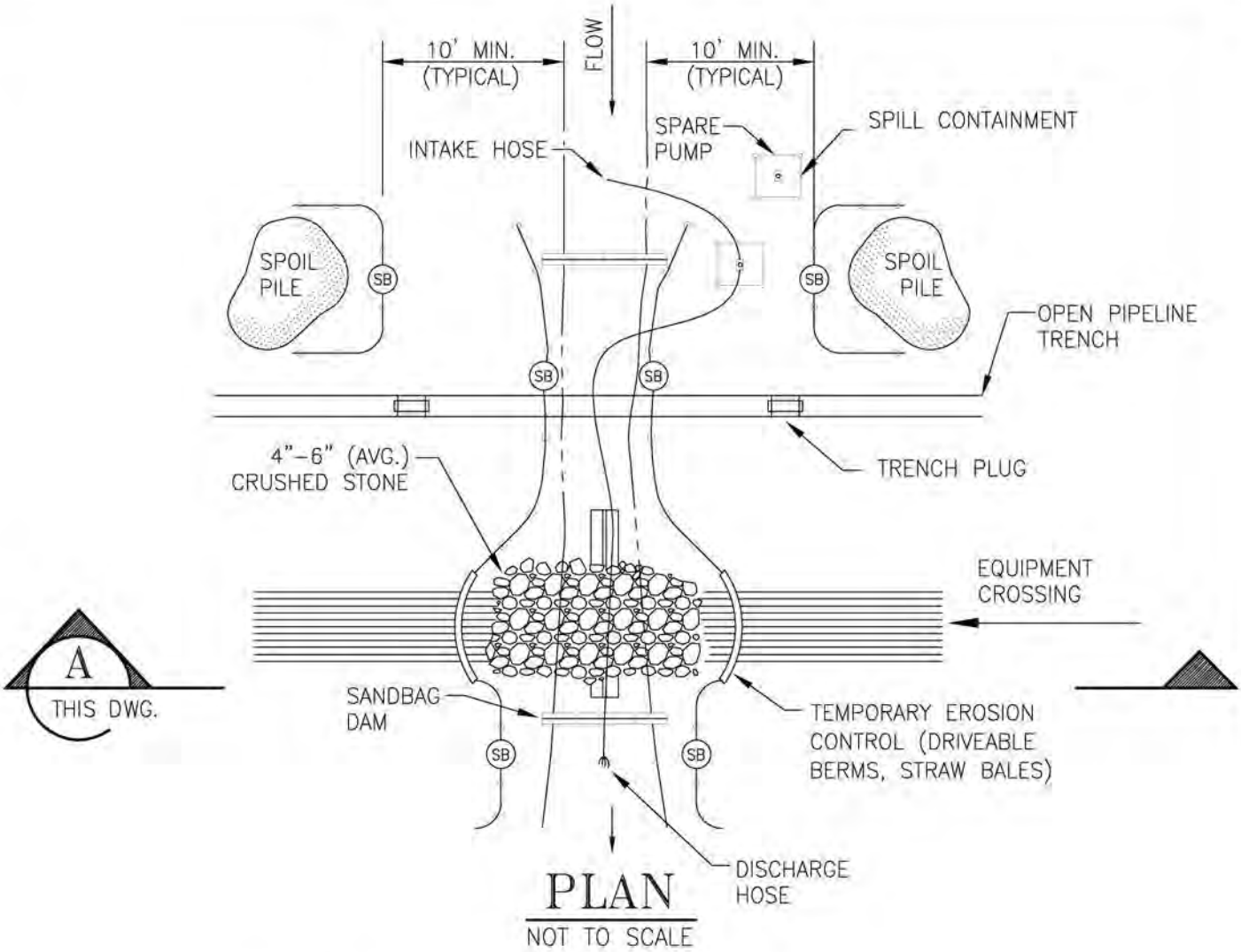
NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.
2. SAND BAGS MUST BE FILLED WITH SAND FREE OF SILT, ORGANICS, AND OTHER MATERIAL.
3. ALIGN FLUME(S) TO PREVENT BANK EROSION AND STREAM SCOUR.
4. CONDUCT ALL IN-STREAM ACTIVITY (EXCEPT BLASTING OR OTHER ROCK BREAKING MEASURES) WITH THE FLUME(S) IN PLACE. FLUME PIPE(S) MAY NOT BE REMOVED FOR LOWERING IN OR INITIAL STREAMBED RESTORATION EFFORTS.
5. THE ENDS OF THE FLUME AND CULVERT MUST EXTEND TO AND UNDISTURBED AREA.

BakkenLink

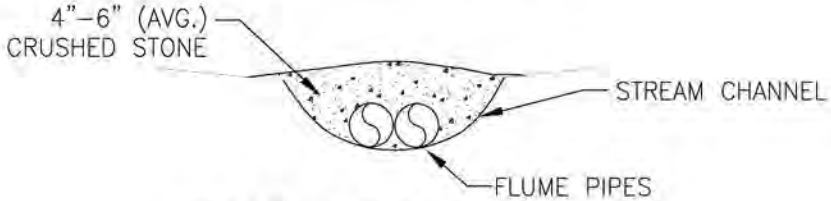
TYPICAL CONSTRUCTION FLUMED CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-12	REV A



PLAN

NOT TO SCALE



SECTION A

SCALE: NOT TO SCALE

THIS DWG.

NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR APPROPRIATE MATERIALS.
2. INSTALL AND SEAL SANDBAGS UPSTREAM AND DOWNSTREAM OF THE CROSSING.
3. CREATE AN UPSTREAM SUMP USING SANDBAGS IF NATURAL SUMP IS UNAVAILABLE FOR THE INTAKE HOSE.
4. EXCAVATE ACROSS STREAM CHANNEL FOLLOWING WATER REROUTING.
5. DO NOT REFUEL OR STORE FUEL WITHIN 100 FEET OF THE WATERBODY, WHERE FEASIBLE.
6. MONITOR PUMPS AT ALL TIMES DURING STREAM CROSSING PROCEDURE.
7. USE SUFFICIENT PUMPS, INCLUDING ONSITE BACKUP PUMPS, TO MAINTAIN DOWNSTREAM FLOW.
8. SCREEN PUMP INTAKES.
9. NUMBER OF FLUME PIPES FOR EQUIPMENT BRIDGE WILL VARY DEPENDING ON SITE CONDITIONS.

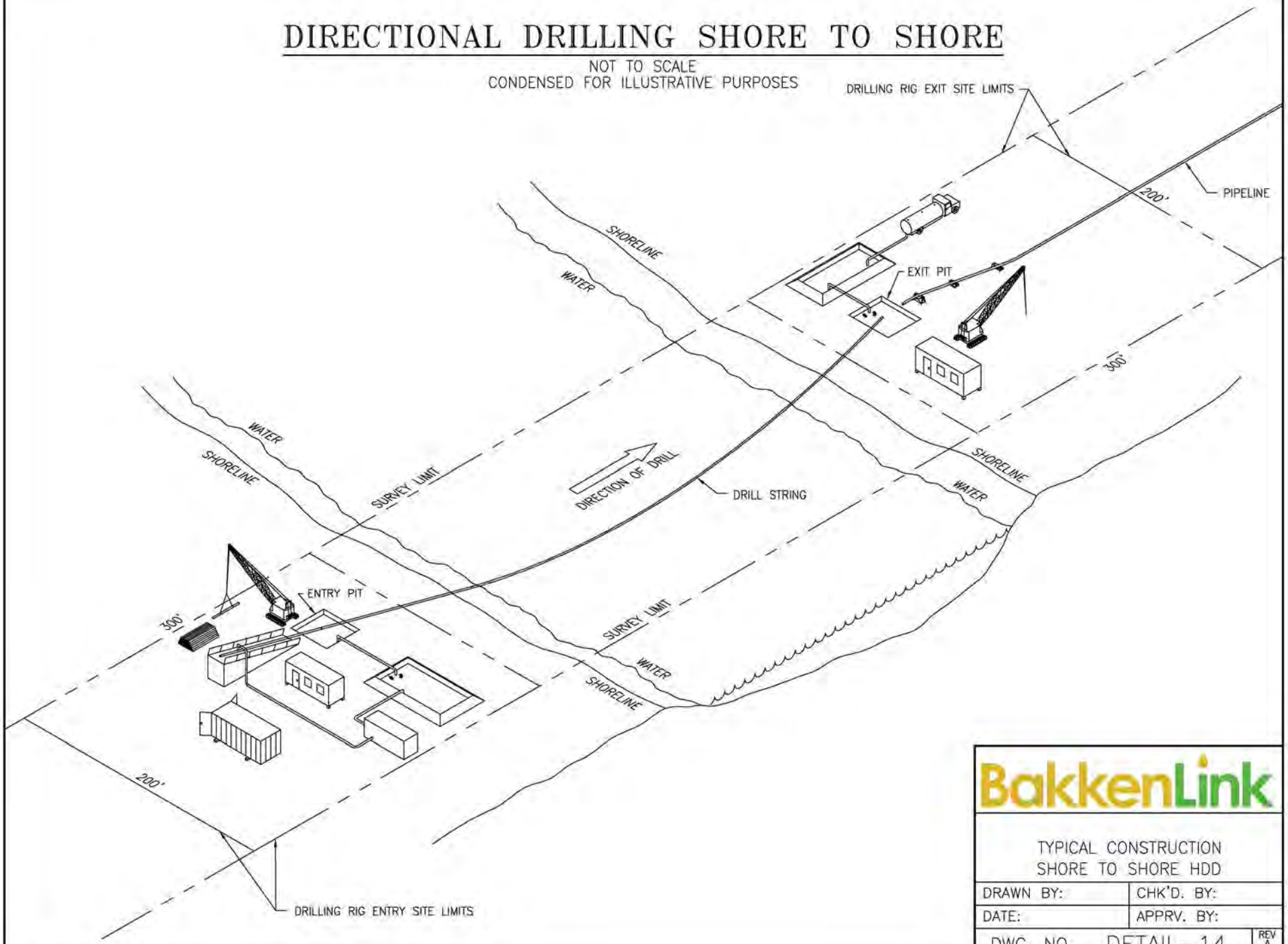
BakkenLink

TYPICAL CONSTRUCTION
DAM AND PUMP CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-13	REV A

DIRECTIONAL DRILLING SHORE TO SHORE

NOT TO SCALE
CONDENSED FOR ILLUSTRATIVE PURPOSES



BakkenLink

TYPICAL CONSTRUCTION
SHORE TO SHORE HDD

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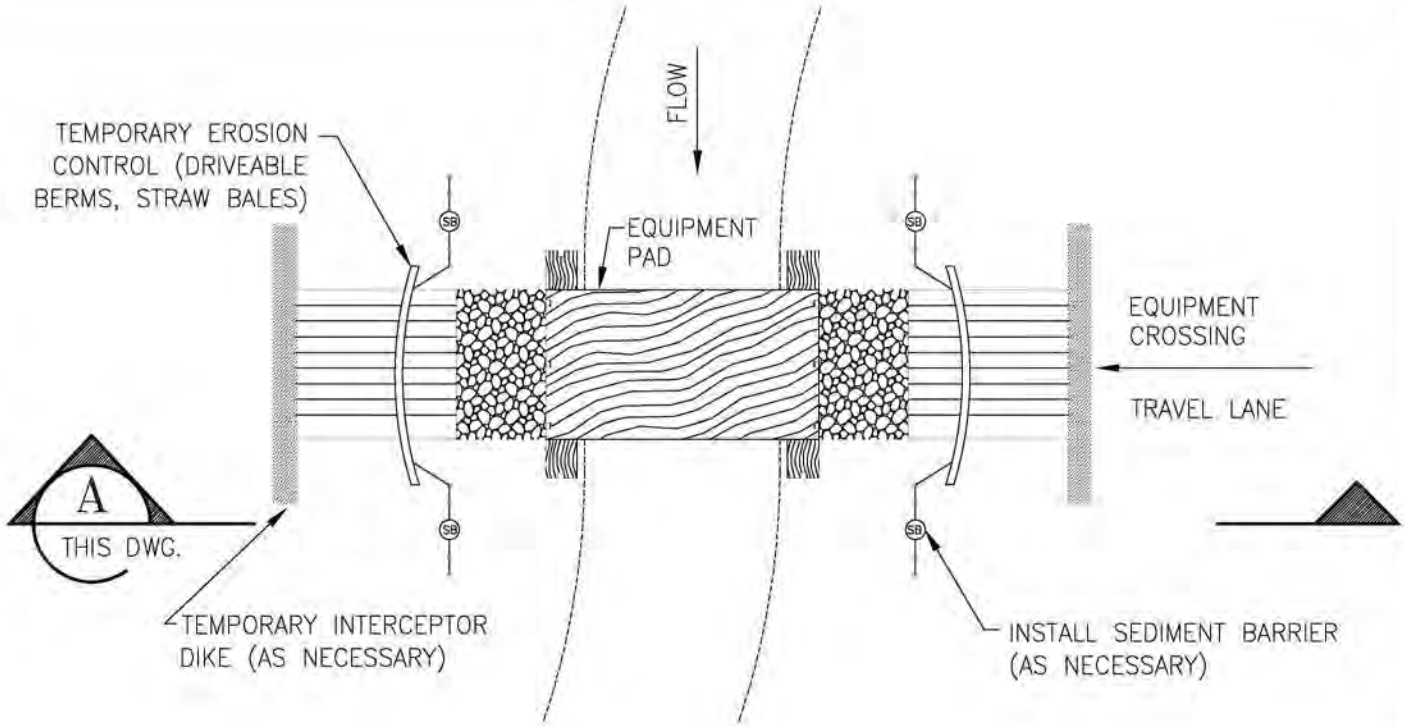
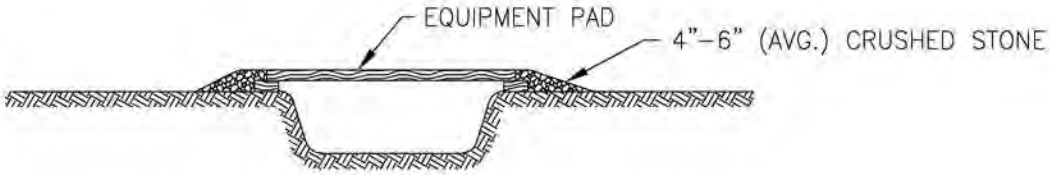
DATE:	APPRV. BY:
DWG. NO. DETAIL–14	REV A



PLAN

NOT TO SCALE



SECTION A

SCALE: NOT TO SCALE

THIS DWG.

NOTES:

1. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.
2. ADDITIONAL EQUIPMENT PADS CAN BE PUT SIDE BY SIDE IF EXTRA WIDTH IS REQUIRED.
3. EQUIPMENT PAD TYPICALLY CONSTRUCTED OF HARDWOOD; MUST ACCOMODATE THE LARGEST EQUIPMENT USED.
4. CRUSHED STONE MUST EXTEND A MINIMUM OF 10 FEET FROM THE TOP OF THE BANK.
5. CONSTRUCT BRIDGE TO PREVENT SOIL FROM ENTERING WATERBODY.

BakkenLink

TYPICAL CONSTRUCTION
EQUIPMENT BRIDGE (PADS & CULVERTS)

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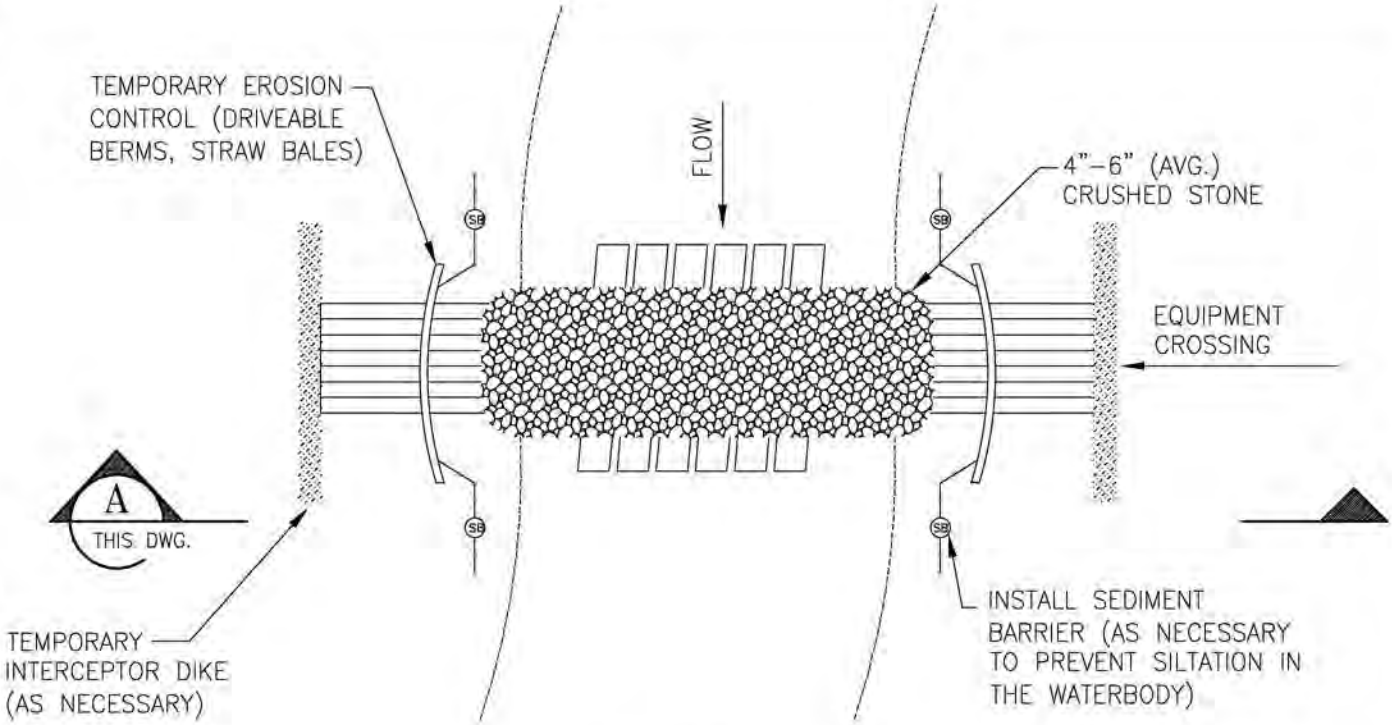
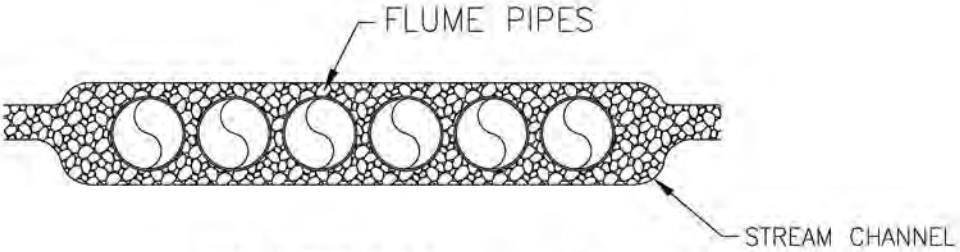
DATE:	APPRV. BY:
DWG. NO. DETAIL-15	REV A



PLAN

NOT TO SCALE



SECTION A

SCALE: NOT TO SCALE THIS DWG.

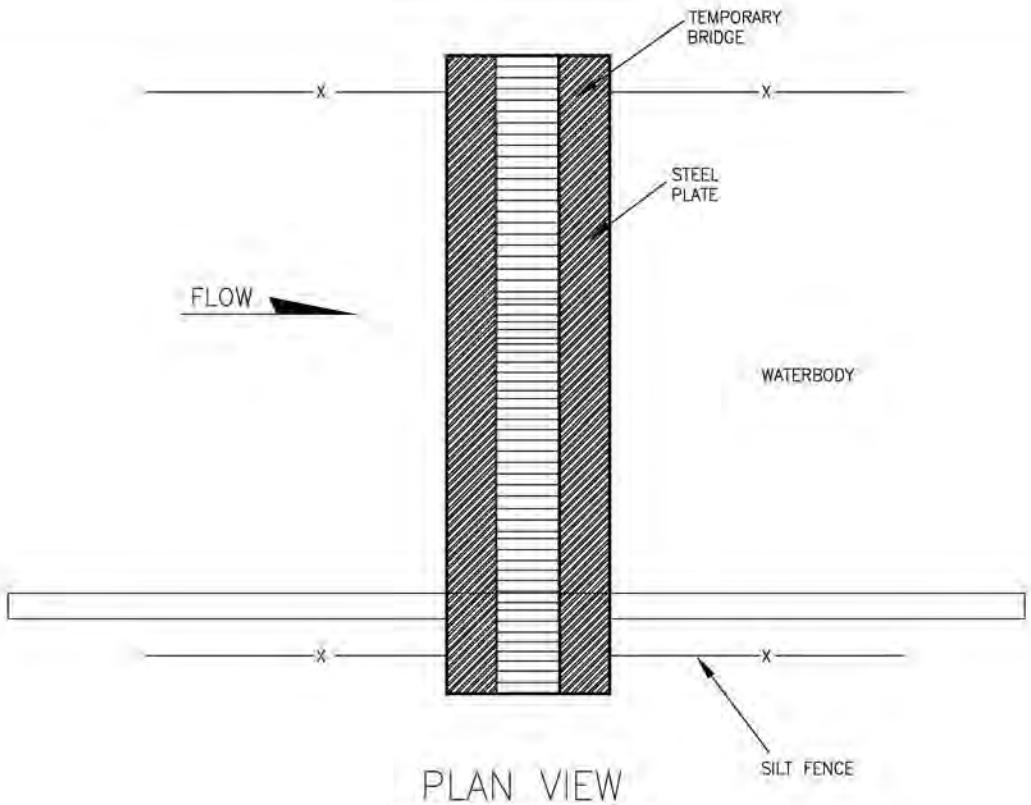
NOTES:

1. ALIGN FLUME PIPES TO PREVENT EROSION AND STREAMBED SCOUR.
2. (SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCES AND/OR STRAW BALES, OR OTHER APPROPRIATE MATERIALS.

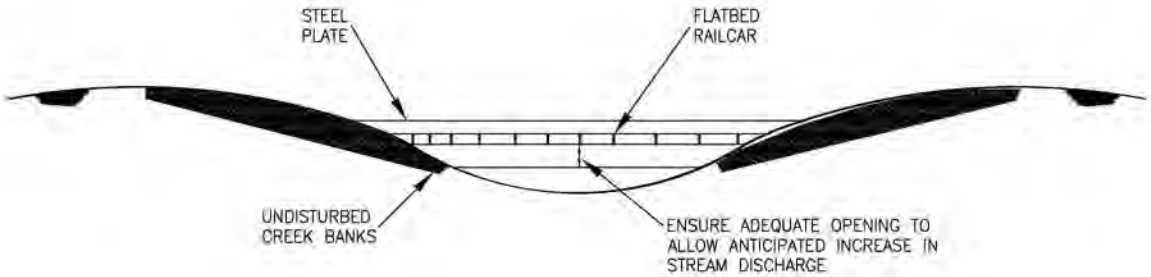
BakkenLink

TYPICAL CONSTRUCTION EQUIPMENT BRIDGE (STONE & CULVERTS)

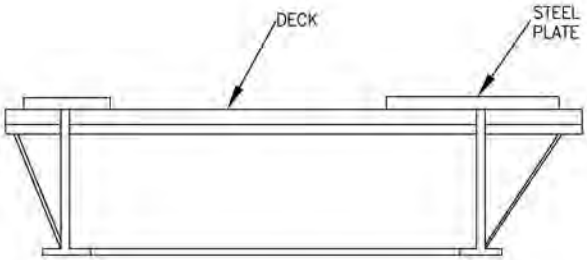
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–16	REV A



PLAN VIEW



SECTION A–A

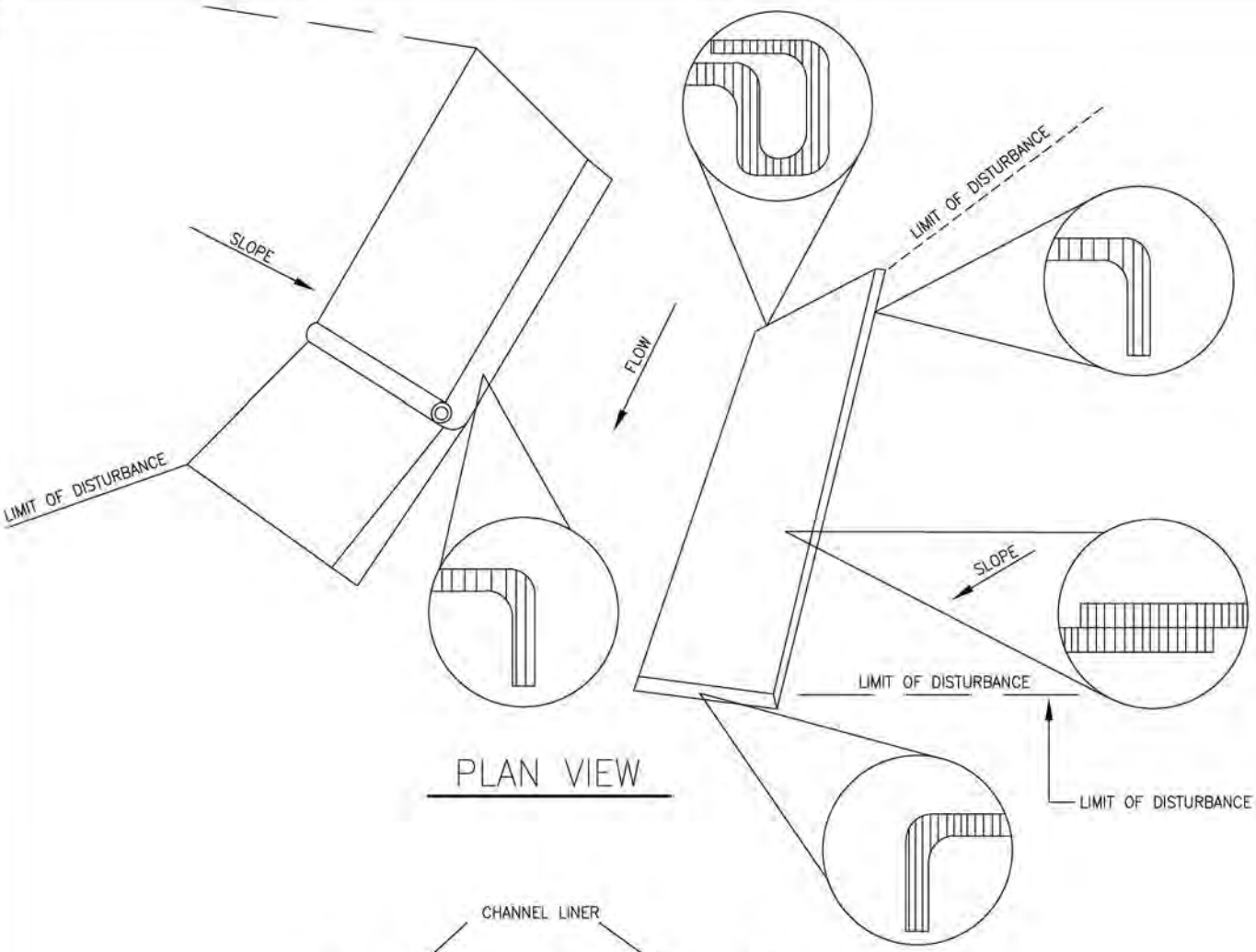


SECTION B–B

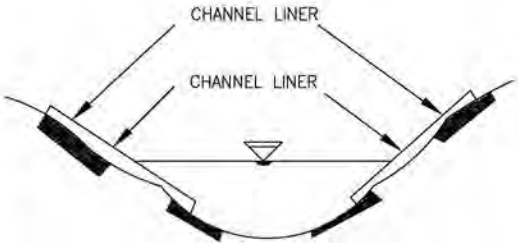
BakkenLink

TYPICAL CONSTRUCTION
RAILCAR
BRIDGE CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–17	REV A



PLAN VIEW



SECTION A–A

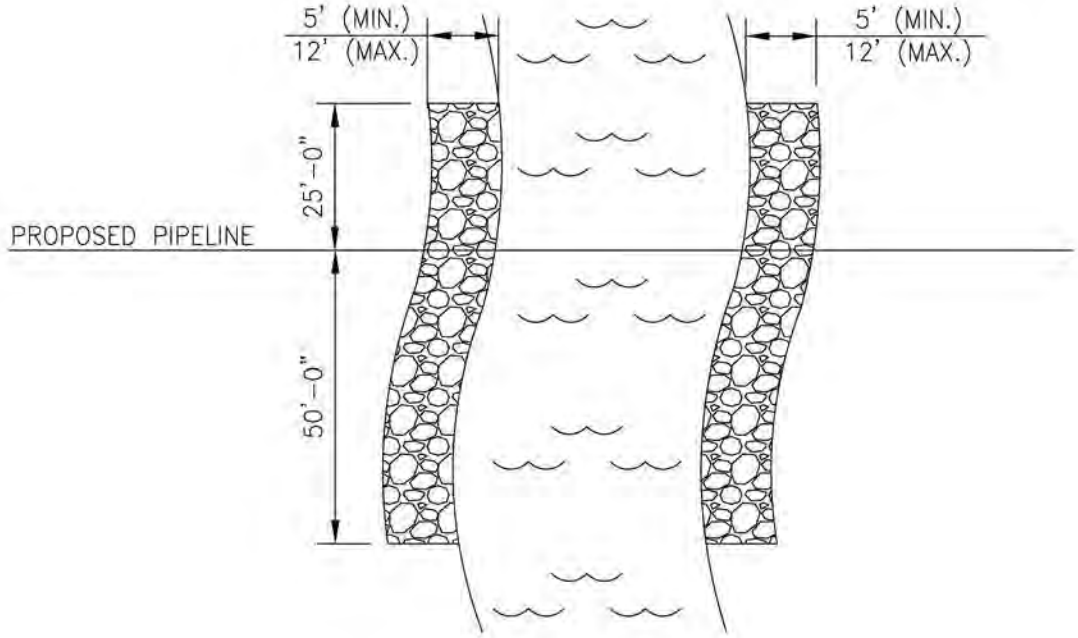
NOTES:

1. INSTALL AND ANCHOR LINERS FOLLOWING MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING CHANNEL LINER, INCLUDING THE APPLICATION OF FERTILIZER AND SEED. CHANNEL LINERS SHOULD EXTEND COMPLETELY ACROSS DISTURBED BANK AREAS TO PROTECT ERODIBLE SURFACES.
3. BEGIN AT THE END OF THE CHANNEL BY ANCHORING THE LINER IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
4. ROLL LINER IN DIRECTION OF WATER FLOW.
5. INSTALL LINERS END–OVER–END (SHINGLE STYLE) WITH OVERLAP USING A DOUBLE ROW OF STAGGERED STAPLES 4 INCHES BELOW THE FIRST ROW IN STAGGERED PATTERN.
6. IN HIGH FLOW CHANNEL APPLICATIONS A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FEET INTERVAOLS. USE A ROW OF STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
7. INSTALL CHANNEL LINER TO THE TOP OF DEFINED CHANNEL SECTION TO OR MORE ROWS OF BLANKETS MAY BE NECESSARY, THESE LINERS MUST BE OVERLAPPED 4 INCHES AND STAPLED.
8. THE CHANNEL LINER SHOULD EXTEND TO THE BASE OF THE CHANNEL AND STAPLED. FOR CHANNELS WITH VERY LITTLE OR NO FLOW, EXTEND A MINIMUM OF 1 FOOT BELOW WATER LEVEL AND STAPLE IN PLACE.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

BakkenLink

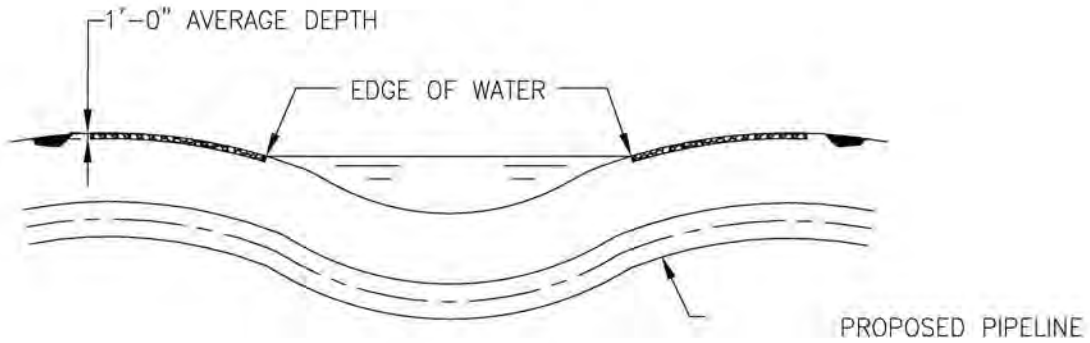
TYPICAL CONSTRUCTION
FLEXIBLE CHANNEL
LINER INSTALLATION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL–18	REV A



PLAN VIEW

N.T.S.



CROSS-SECTION

N.T.S.

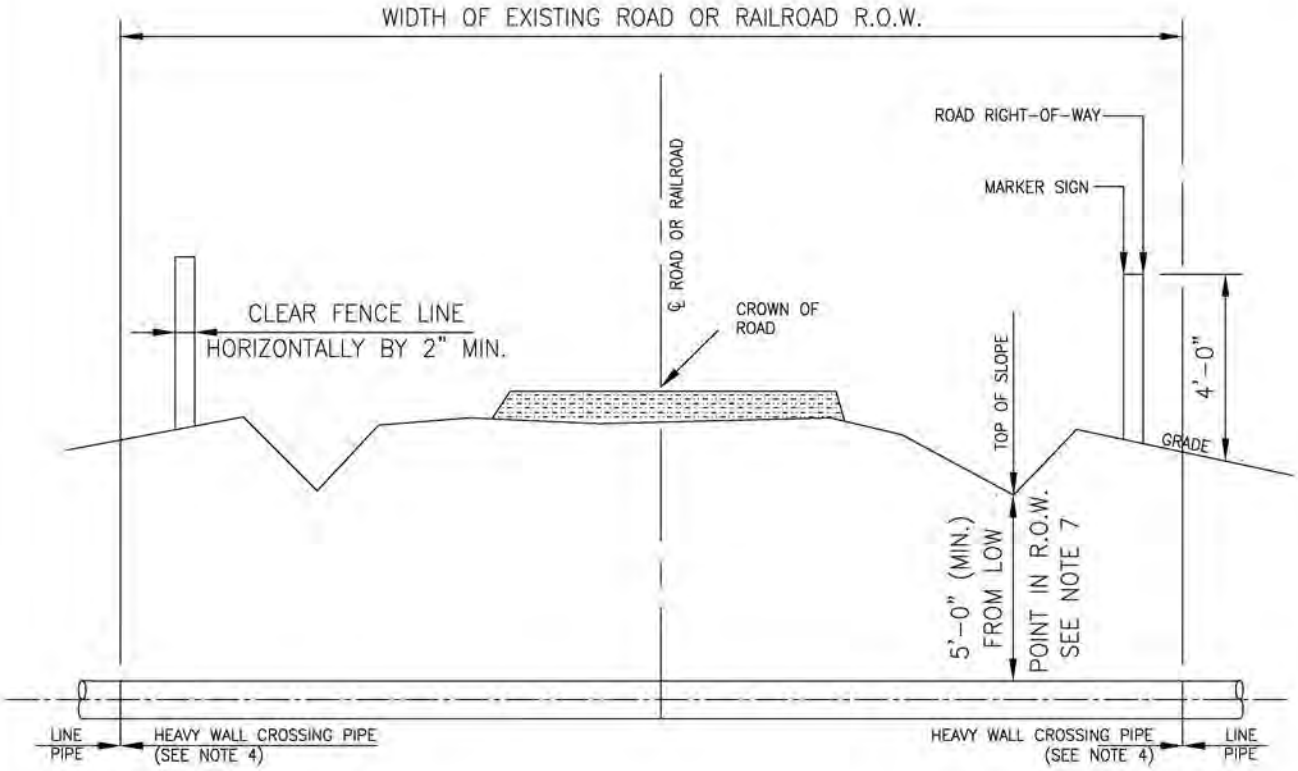
NOTES:

1. RIP-RAP IS LESS THAN 500 FEET IN LENGTH.
2. RIP-RAP WILL NOT EXCEED AN AVERAGE OF ONE (1) CUBIC YARD PER RUNNING FOOT.
3. RIP-RAP INSTALLATION SHALL BE IN COMPLIANCE WITH ALL APPLICABLE PERMITS.

BakkenLink

TYPICAL CONSTRUCTION
RIP-RAP PLACEMENT

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-19	REV A



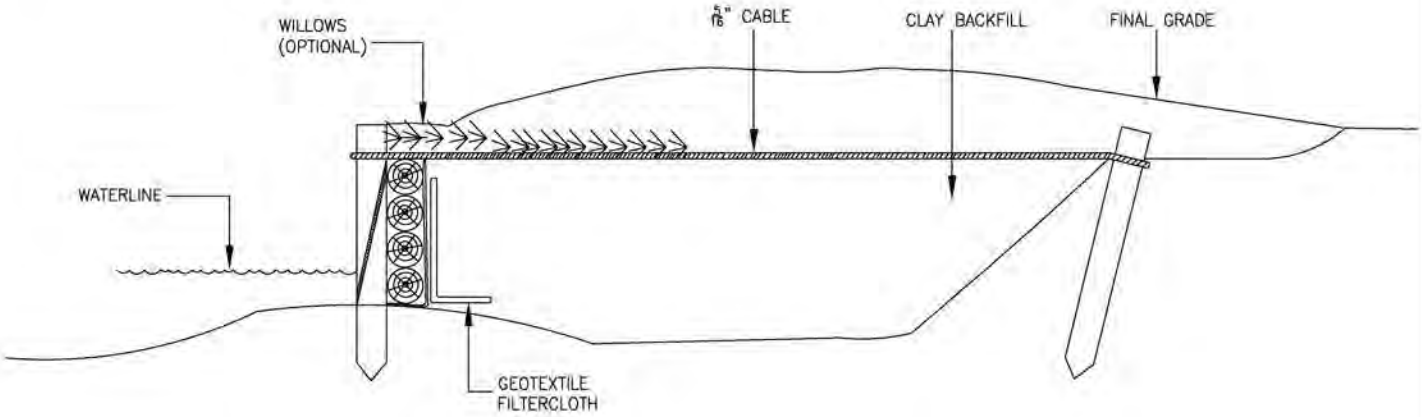
NOTES:

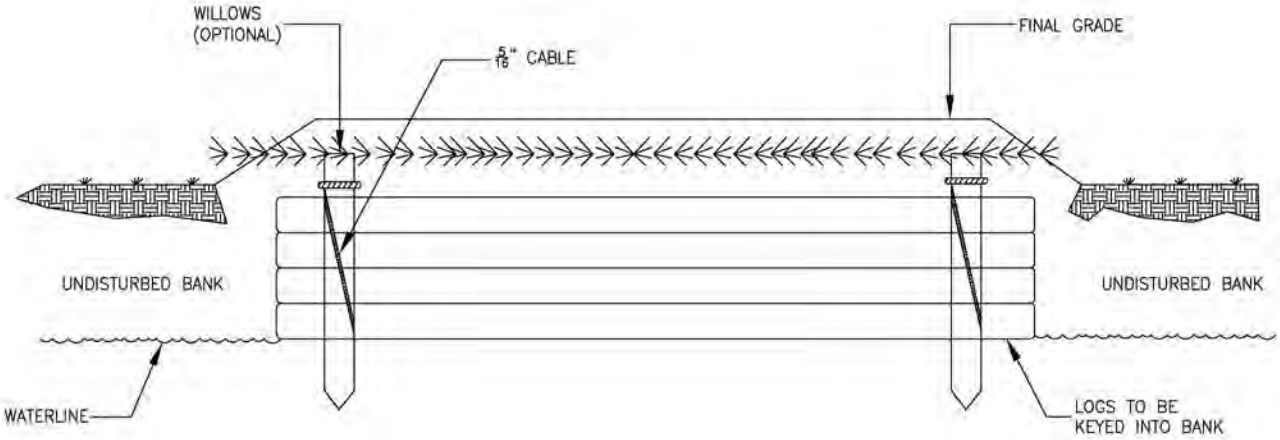
1. CROSSINGS SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. ROAD CROSSING PIPE SHALL EXTEND AT MINIMUM TO RIGHT-OF-WAY LINE UNLESS OTHERWISE SPECIFIED.
3. THE TYPE AND MINIMUM REQUIRED LENGTH OF PIPE FOR CROSSINGS OF ROADS SHALL BE AS SPECIFIED ON ALIGNMENT SHEETS.
4. PIPE FOR BORED CROSSINGS TO INCLUDE ABRASION-RESISTANT (ARB) COATING.
5. PIPELINE MARKER AND TEST STATIONS TO BE INSTALLED ON RIGHT-OF-WAY LINE NEXT TO FENCE IF POSSIBLE.
6. THE CROSSING PIPE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN ROAD RIGHT-OF-WAY.
7. MINIMUM PIPELINE COVER IN DRAINAGE DITCHES AT PUBLIC ROADS IS 60 INCHES, 36 INCHES IN CONSOLIDATED ROCK.

BakkenLink

TYPICAL CONSTRUCTION
UNCASED ROAD/RAILROAD
CROSSING BORE PROFILE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-20	REV A





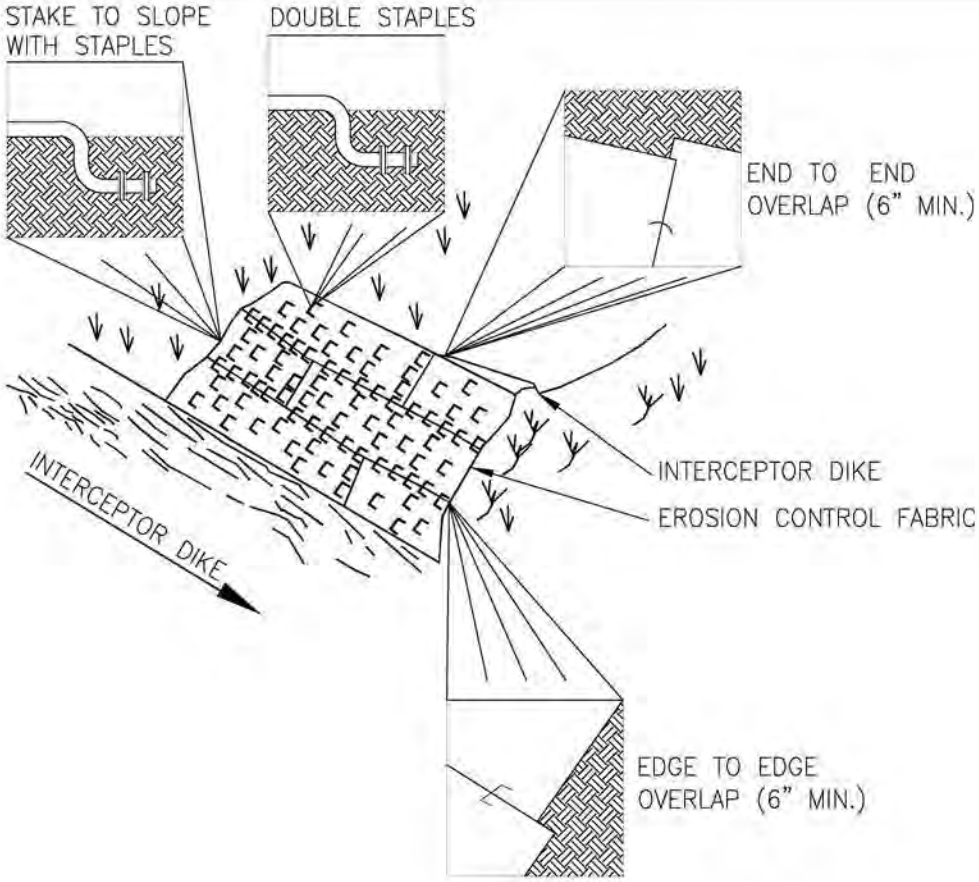
NOTES:

1. LOG WALLS TO BE CONSTRUCTED USING CONIFEROUS MATERIAL.
2. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED AS FILL MATERIAL.
3. ANCHOR PILINGS OR DEADMAN ANCHORS TO BE USED TO SECURE CABLE IN BANK.
4. NON-WOVEN FILTER CLOTH (NYLEX C34 OR EQUIVALENT) TO BE USED TO LINE LOG WALL.
5. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SITE CONDITIONS.

BakkenLink

TYPICAL CONSTRUCTION
STREAM BANK RECLAMATION
LOG WALL

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-21	REV A



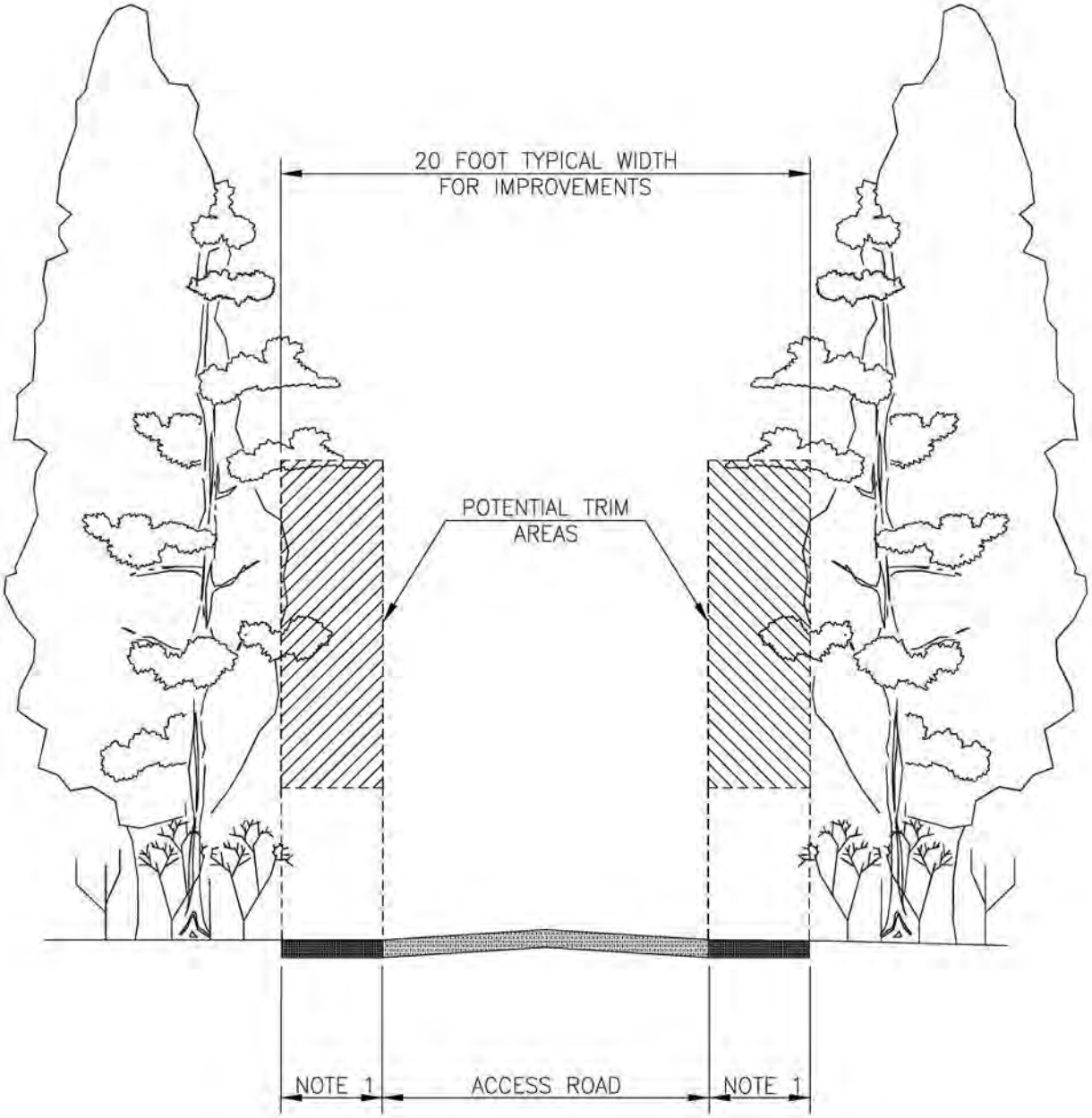
NOTES:

1. EROSION CONTROL MATTING SHALL BE PLACED ON THE BANKS OF FLOWING STREAMS WHERE VEGETATION HAS BEEN REMOVED OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. EROSION CONTROL MATTING SHALL MEET THE REQUIREMENTS SPECIFIED IN THE PLAN AND/OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
3. STAPLES SHALL BE MADE OF 11 GAUGE WIRE, U-SHAPED WITH SIX (6) INCH LEGS AND A ONE (1) INCH CROWN. STAPLES SHALL BE DRIVEN INTO THE GROUND FOR THE FULL LENGTH OF THE STAPLE LEGS.
4. MATTING SHALL BE INSTALLED ACCORDING TO MANUFACTURER SPECIFICATIONS OR AS STATED BELOW:
   - EXTEND TOP OF BLANKET THREE (2) FEET PAST THE UPPER EDGE OF THE HIGH WATER MARK. IF AN INTERCEPTOR DIKE IS PRESENT ON THE APPROACH SLOPE, BEGIN THE BLANKET ON THE UPHILL SIDE OF THE INTERCEPTOR DIKE.
   - INSTALL BLANKET(S) ACROSS THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
   - ANCHOR ("KEY") THE UPSTREAM EDGE OF THE BLANKET(S) INTO THE SLOPE USING A SIX (6) INCH DEEP TRENCH. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - ANCHOR ("KEY") THE UPPER EDGE OF THE BLANKET(S) INTO THE SLOPE USING A SIX (6) INCH DEEP TRENCH. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - TRENCH AND ROLL THE BLANKET DOWN THE HILL. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   - OVERLAP THE EDGES OF PARALLEL BLANKETS A MINIMUM OF SIX (6) INCHES. PLACE THE UPPER BLANKET OVER THE LOWER BLANKET (SHINGLE STYLE) AND STAPLE EVERY 12" ALONG THE LENGTH OF THE EDGE.
   - WHEN BLANKET ENDS ARE ADJOINED, PLACE THE UPSTREAM BLANKET OVER THE DOWNSTREAM BLANKET (SHIGLE STYLE) WITH APPROXIMATELY (6) INCH OF OVERLAP AND STAPLE THROUGH THE OVERLAPPED AREA EVERY 12".
   - STAPLE DOWN THE CENTER OF THE BLANKET(S), THREE(3) STAPLES IN EVERY SQUARE YARD.
5. IN LIVESTOCK AREAS WHERE EROSION CONTROL MATTING IS APPLIED TO THE SLOPES, FENCING WILL BE USED IF NECESSARY TO EXCLUDE LIVESTOCK, WITH PERMISSION OF THE LANDOWNER.
6. MONITOR WASHOUTS, STAPLE INTEGRITY OR MAT MOVEMENT. REPLACE OR REPAIR AS NECESSARY.

BakkenLink

TYPICAL CONSTRUCTION
MATTING OF STREAM BANKS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL-22	REV A



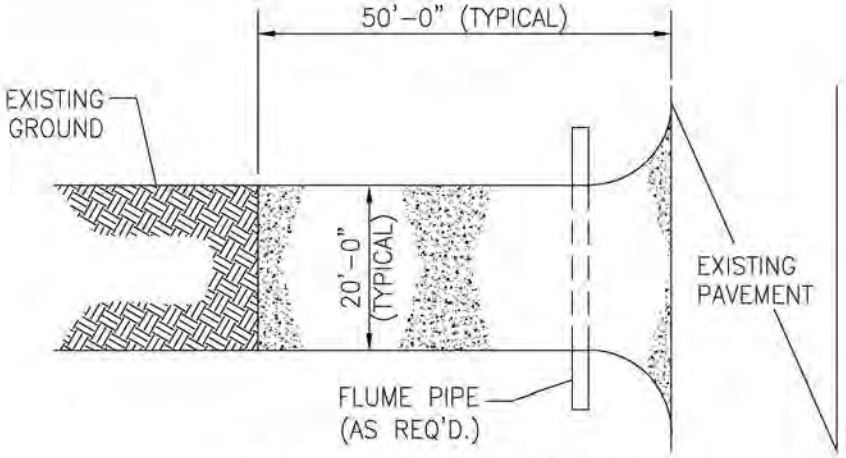
NOTE:

1. POTENTIAL WIDENING OF EXISTING ROADS WITH BASE MATERIAL (IF NEEDED).

BakkenLink

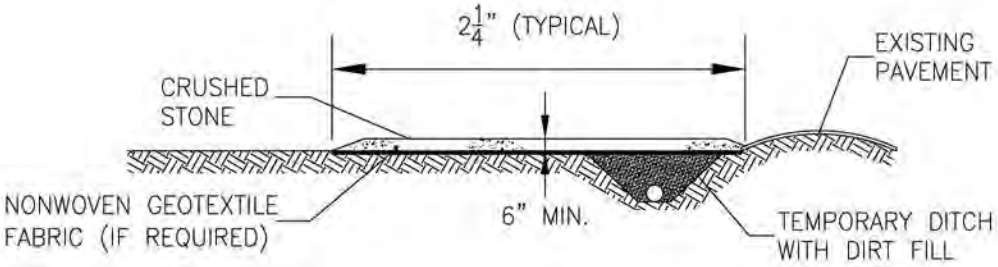
TYPICAL CONSTRUCTION
ACCESS ROAD CROSS SECTION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 23	REV A



PLAN VIEW

NOT TO SCALE



CROSS SECTION

NOT TO SCALE

CONSTRUCTION SPECIFICATIONS:

1. STONE SIZE = 4"-6" (AVG.) CRUSHED STONE.

2. ALL STONE MUST BE PLACED ON NON-WOVEN GEOTEXTILE FABRIC IF USED IN RESIDENTIAL OR ACTIVE AGRICULTURAL AREAS.

3. LENGTH: FIFTY (50) FEET TYPICAL (IF SITE CONDITIONS ALLOW).
   WIDTH: TWENTY (20) FEET TYPICAL.
   THICKNESS: SIX (6) INCHES MINIMUM.

4. ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A DRIVABLE BERM OR OTHER TEMPORARY EROSION CONTROL DEVICE CAN BE USED.

5. THE ENTRANCE SHALL BE PERIODICALLY INSPECTED AND MAINTAINED IN A CONDITION THAT MINIMIZES TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. MAINTENANCE MAY INCLUDE PERIODIC TOP DRESSING WITH AN ADDITIONAL STONE OR THE REPAIR/CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ANY SEDIMENT THAT IS SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED AS SOON AS PRACTICAL.

BakkenLink

TYPICAL CONSTRUCTION ROCK ACCESS PAD

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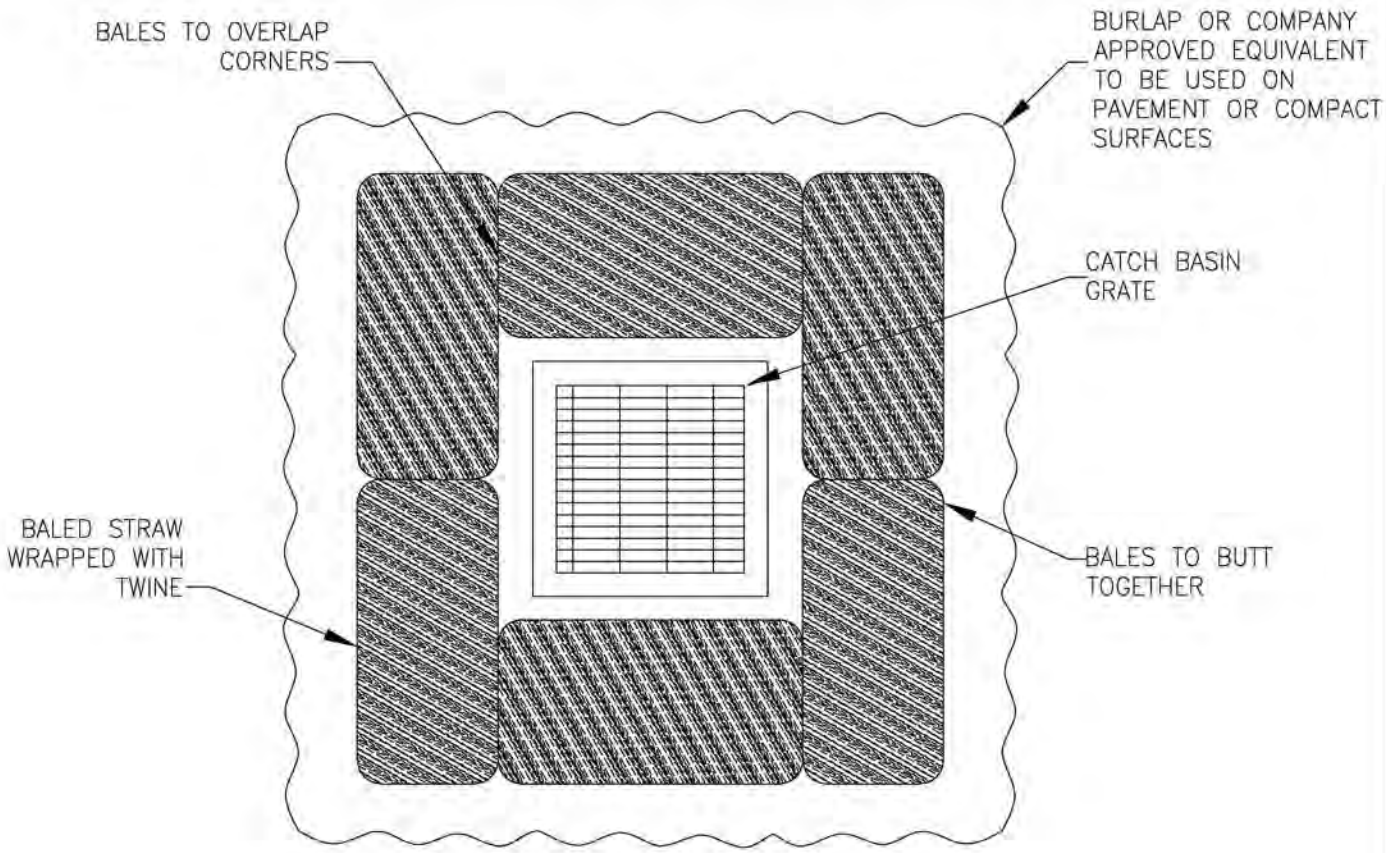
DATE:	APPRV. BY:
DWG. NO. DETAIL 24	REV A



STORM DRAIN INLET PROTECTION

NOT TO SCALE

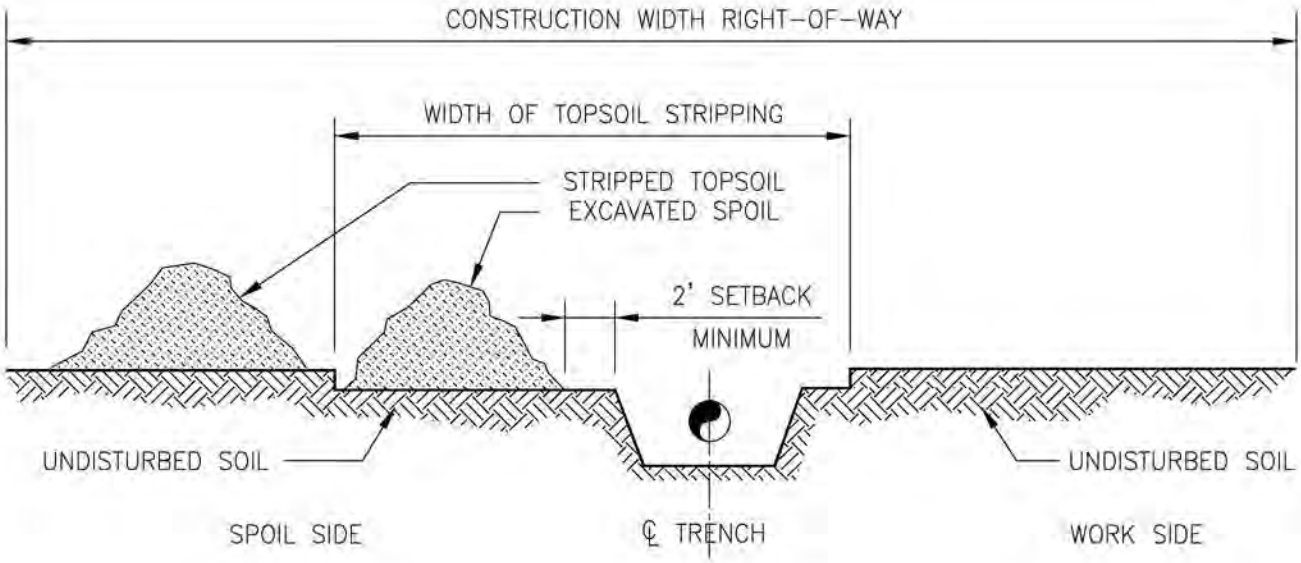
NOTES:

1. SURROUND STREET DRAINAGE STRUCTURE INLET WITH BALES PRIOR TO CONSTRUCTION AND MAINTAIN UNTIL CONSTRUCTION IS COMPLETED.
2. FOR BALES PLACED ON PAVEMENT (OR COMPACT SURFACES), PLACE BURLAP OR COMPANY APPROVED EQUIVALENT BETWEEN PAVEMENT AND BALE.
3. REMOVE ACCUMULATED SEDIMENT.

BakkenLink

TYPICAL CONSTRUCTION
STORM DRAIN INLET PROTECTION

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 25	REV A



TRENCH & SPOIL SIDE TOPSOIL STRIPPING

NOT TO SCALE

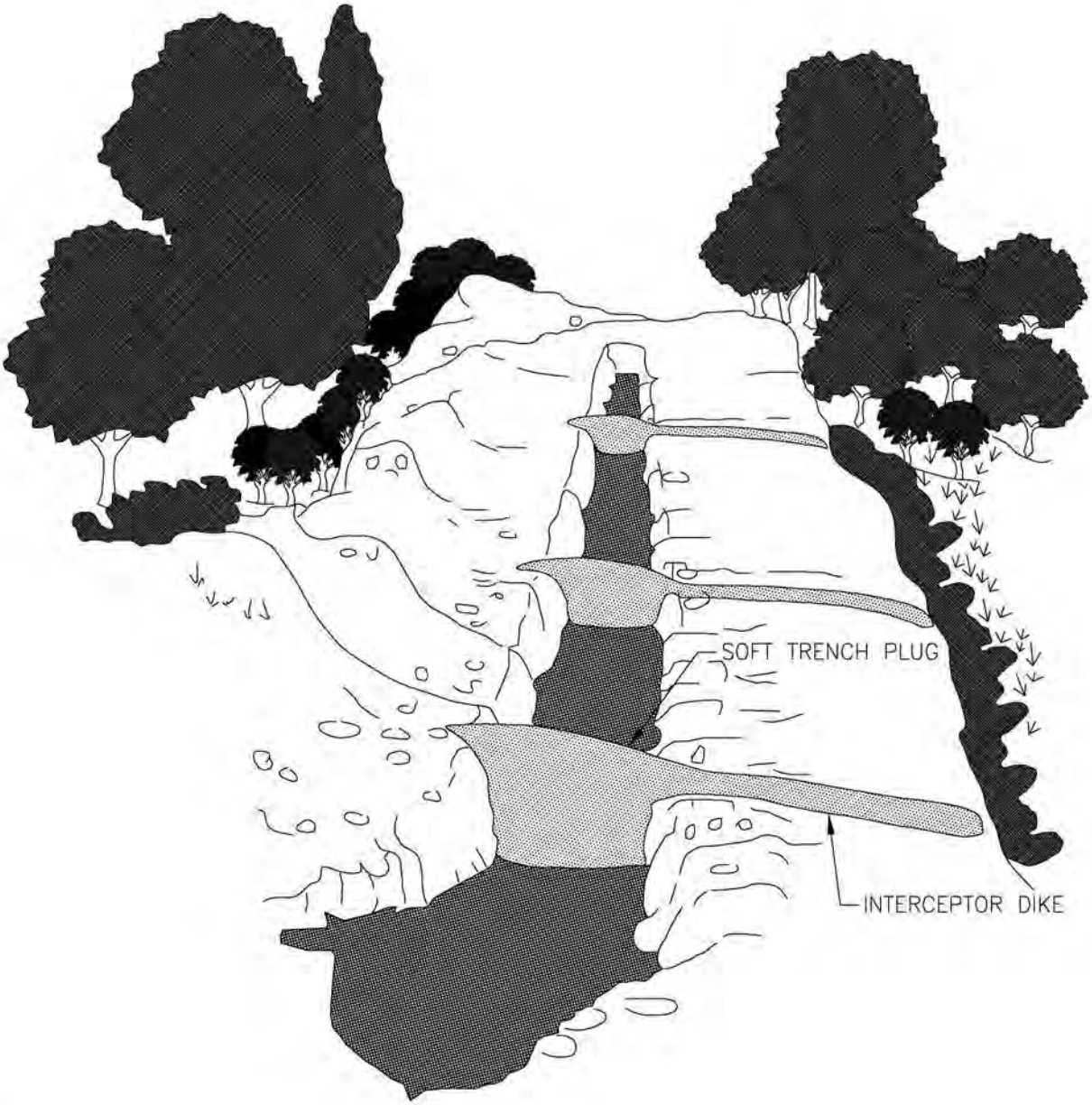
NOTES:

1. TOPSOIL MAY BE STORED IN LOCATIONS AS SHOWN ABOVE, OR AT OTHER COMPANY APPROVED LOCATIONS WITHIN THE CONSTRUCTION RIGHT-OF-WAY.
2. LEAVE GAPS IN SPOIL PILES FOR WATER RUN-OFF.

BakkenLink

TYPICAL CONSTRUCTION
TOPSOIL SEGREGATION TECHNIQUES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 26	REV A



NOTES:

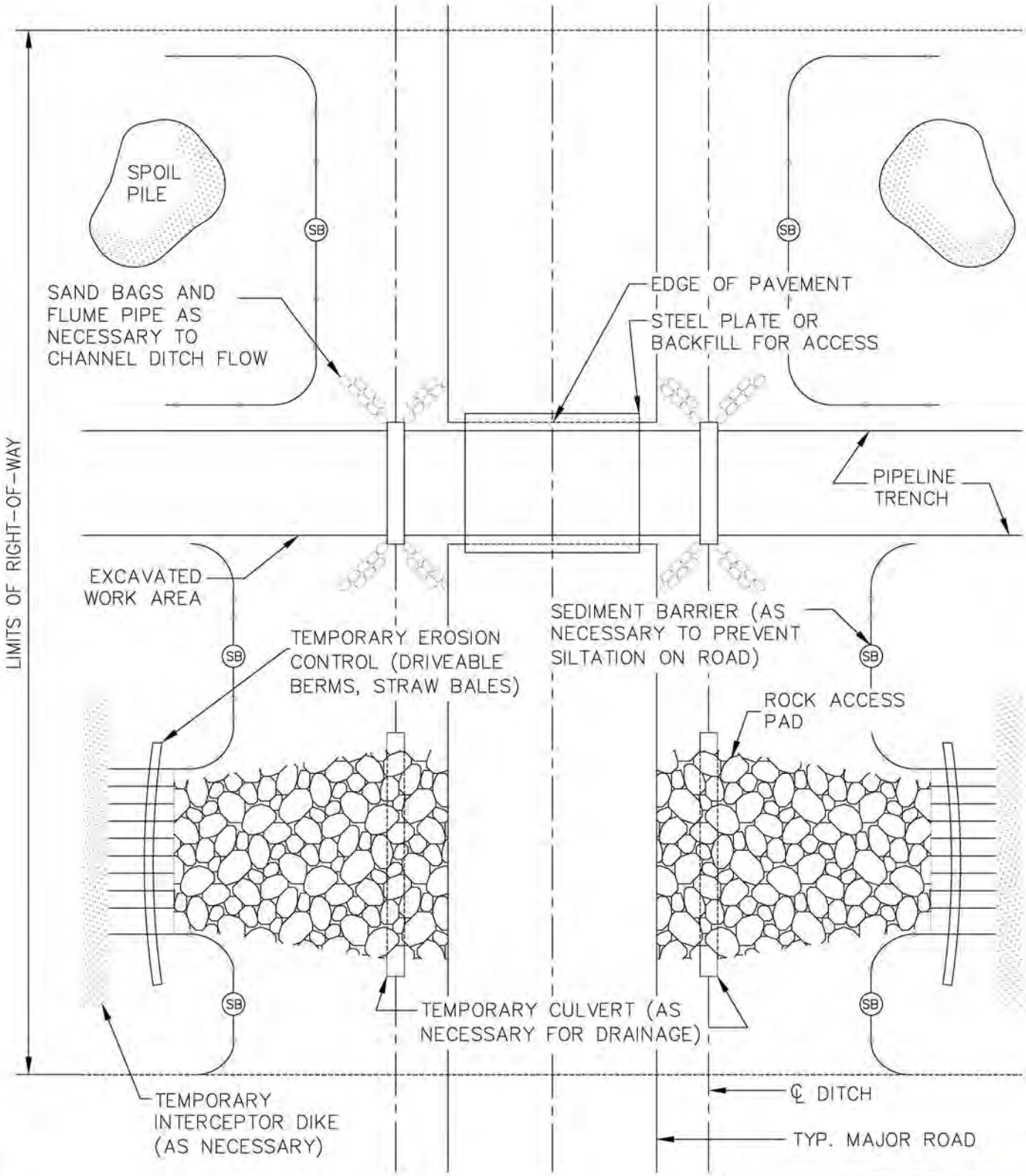
1. TEMPORARY TRENCH PLUGS MAY BE USED IN CONJUNCTION WITH INTERCEPTOR DIKES TO PREVENT WATER FROM OVERFLOWING INTO SENSITIVE RESOURCE AREAS.

2. DIVERT TRENCH OVERFLOW TO A WELL-VEGETATED OFF-RIGHT-OF-WAY LOCATION, OR INSTALL AN APPROPRIATE ENERGY DISSIPATING DEVICE.

BakkenLink

TYPICAL CONSTRUCTION
TEMPORARY TRENCH PLUGS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 27	REV A



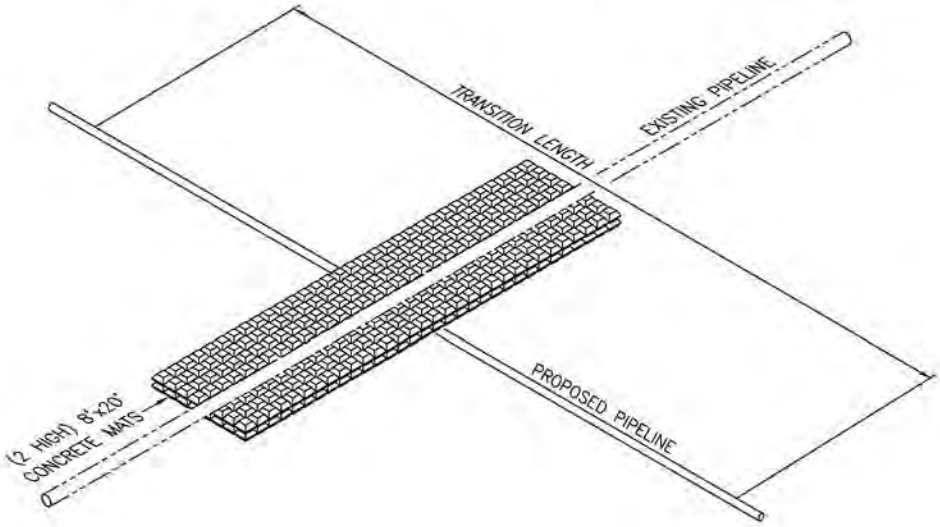
(SB) TEMPORARY SEDIMENT BARRIER OF SILT FENCE AND/OR STRAW BALES.

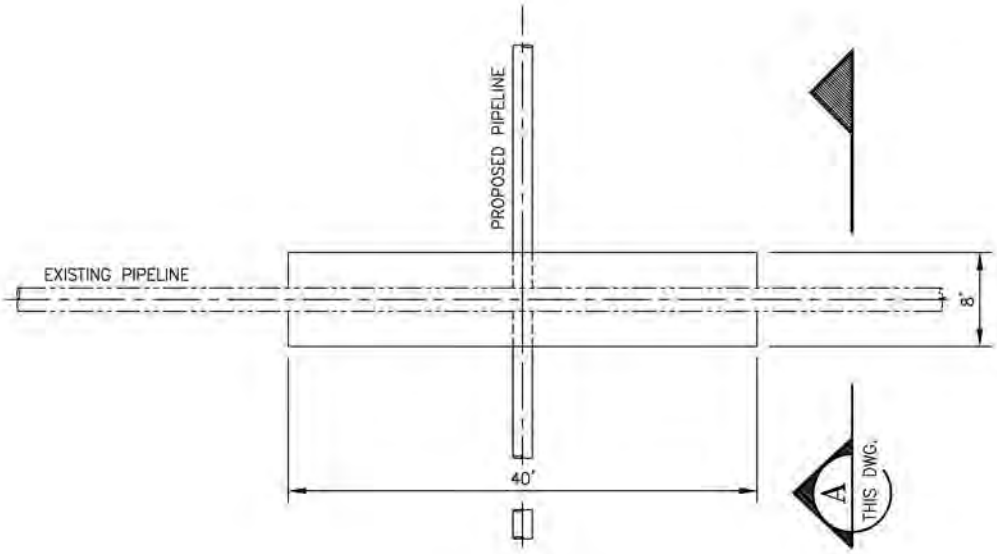
BakkenLink

TYPICAL CONSTRUCTION
PAVED ROAD CROSSING (OPEN CUT)

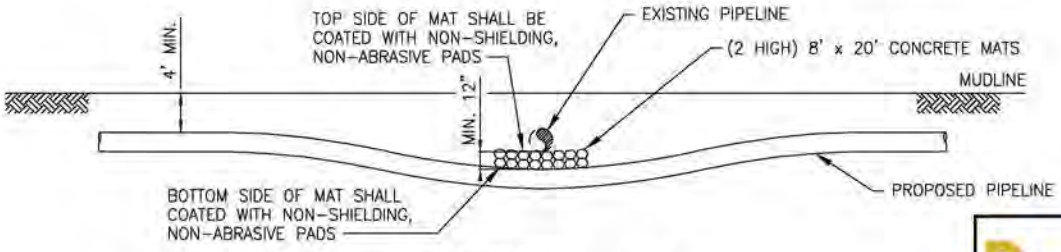
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 28	REV A

TYP. PIPELINE CROSSING UNDER EXISTING PIPELINE





PLAN



SECTION A

SCALE: N.T.S. (A THIS DWG.)

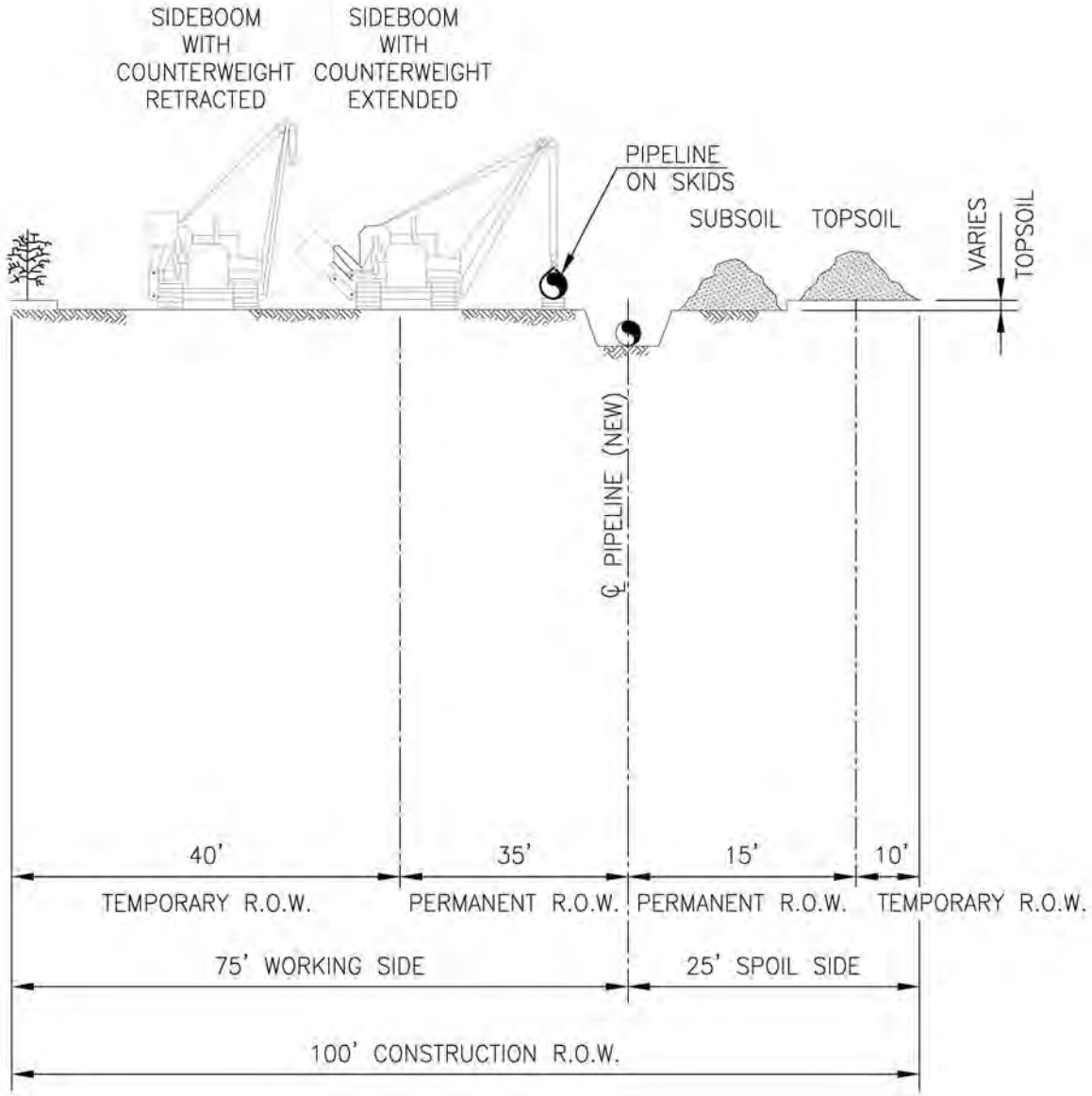
NOTES:

1. SAND/CEMENT BAGS MAY BE USED SEPARATELY OR IN COMBINATION WITH CONCRETE MATS TO ACHIEVE 18 INCH SEPARATION BETWEEN PIPELINES.
2. EDGES OF CONCRETE MATS SHALL BE BURIED BELOW MUDLINE.

BakkenLink

TYPICAL CONSTRUCTION
CROSSING UNDER EXISTING PIPELINE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 29	REV A



NOTES:

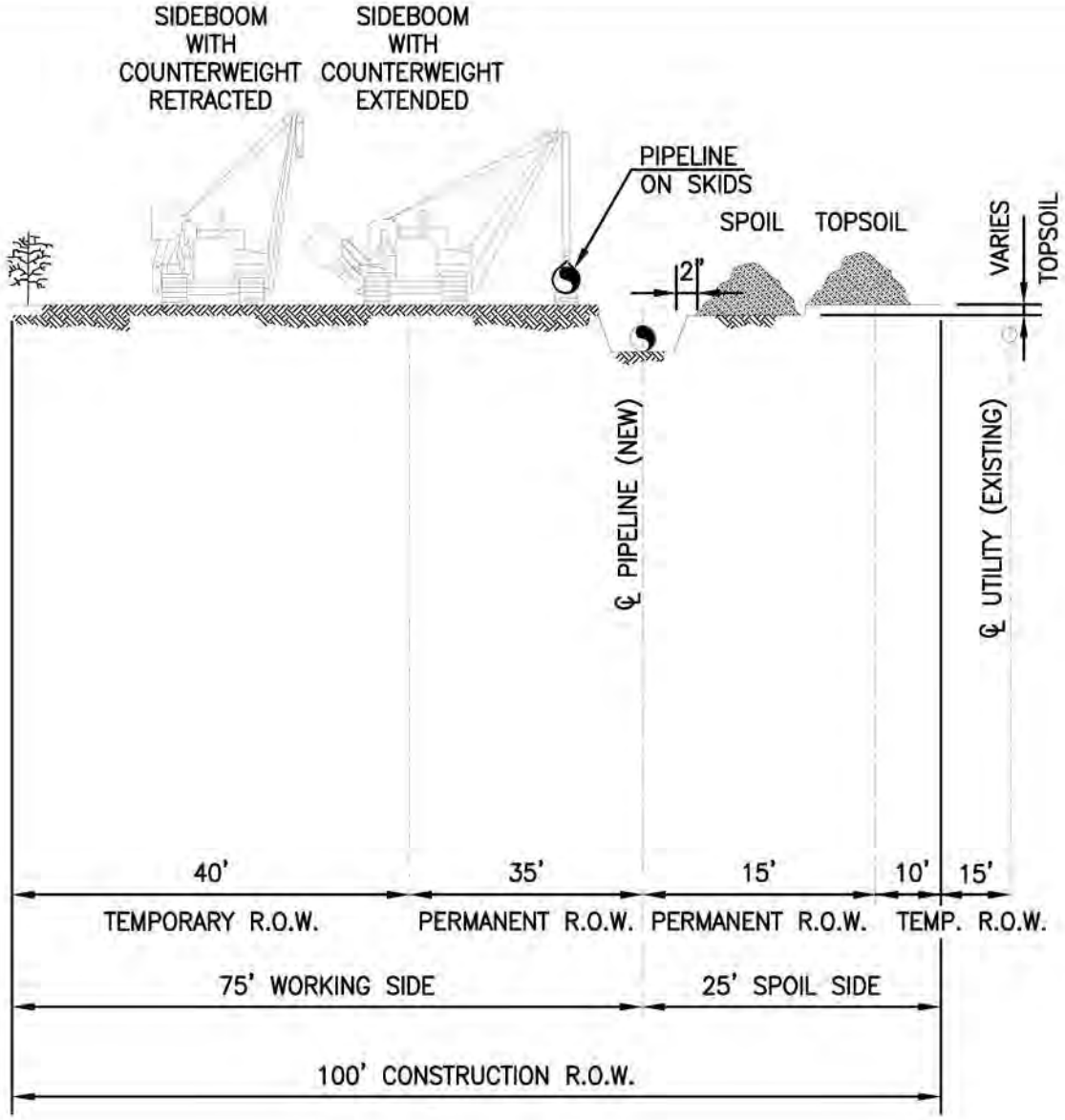
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 30	REV A



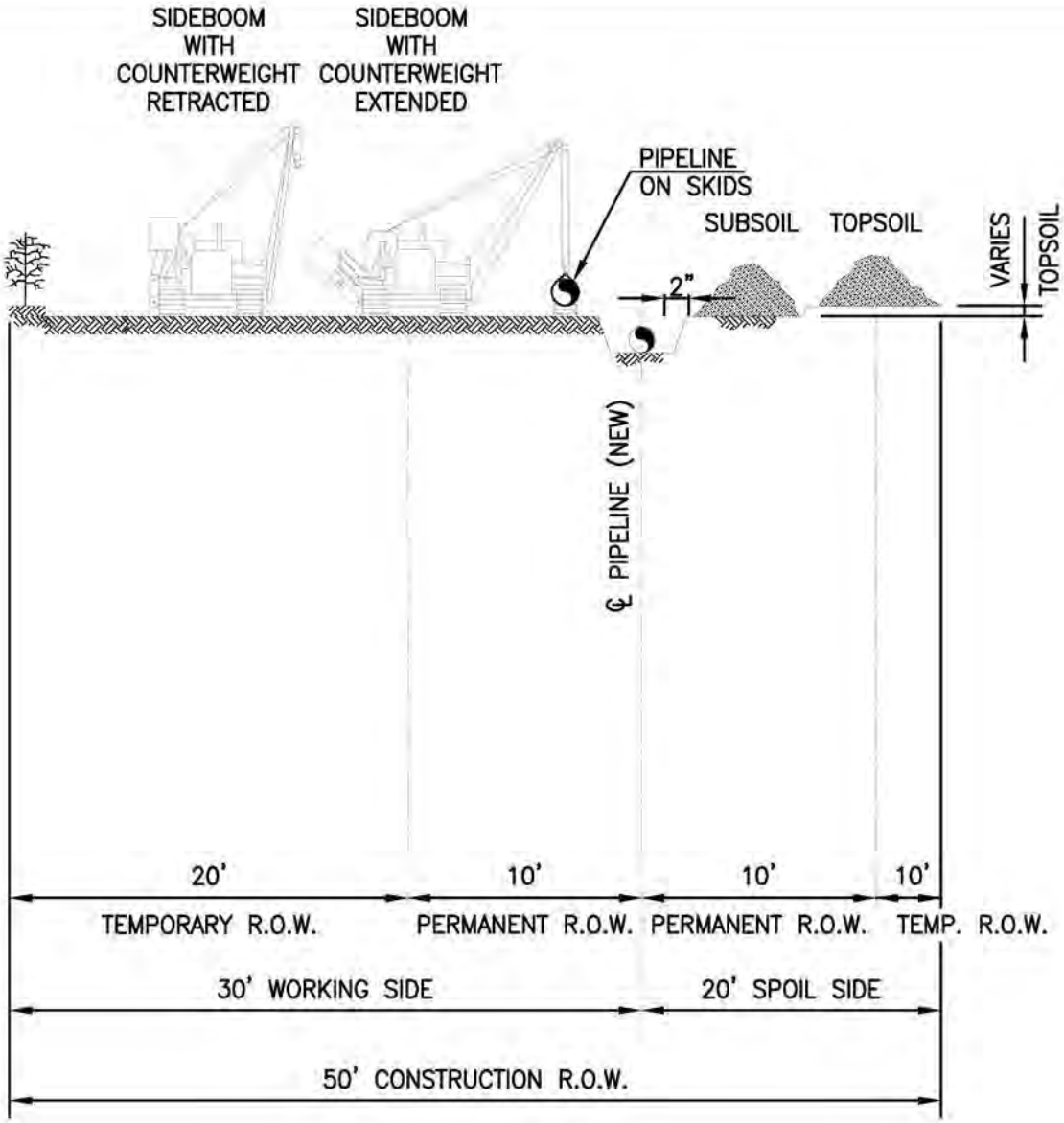
NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
PARALLEL TO EXISTING UTILITIES

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 31	REV A



NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE ENTIRE 50 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
RIGHT-OF-WAY
WITHIN FOREST SERVICE LANDS

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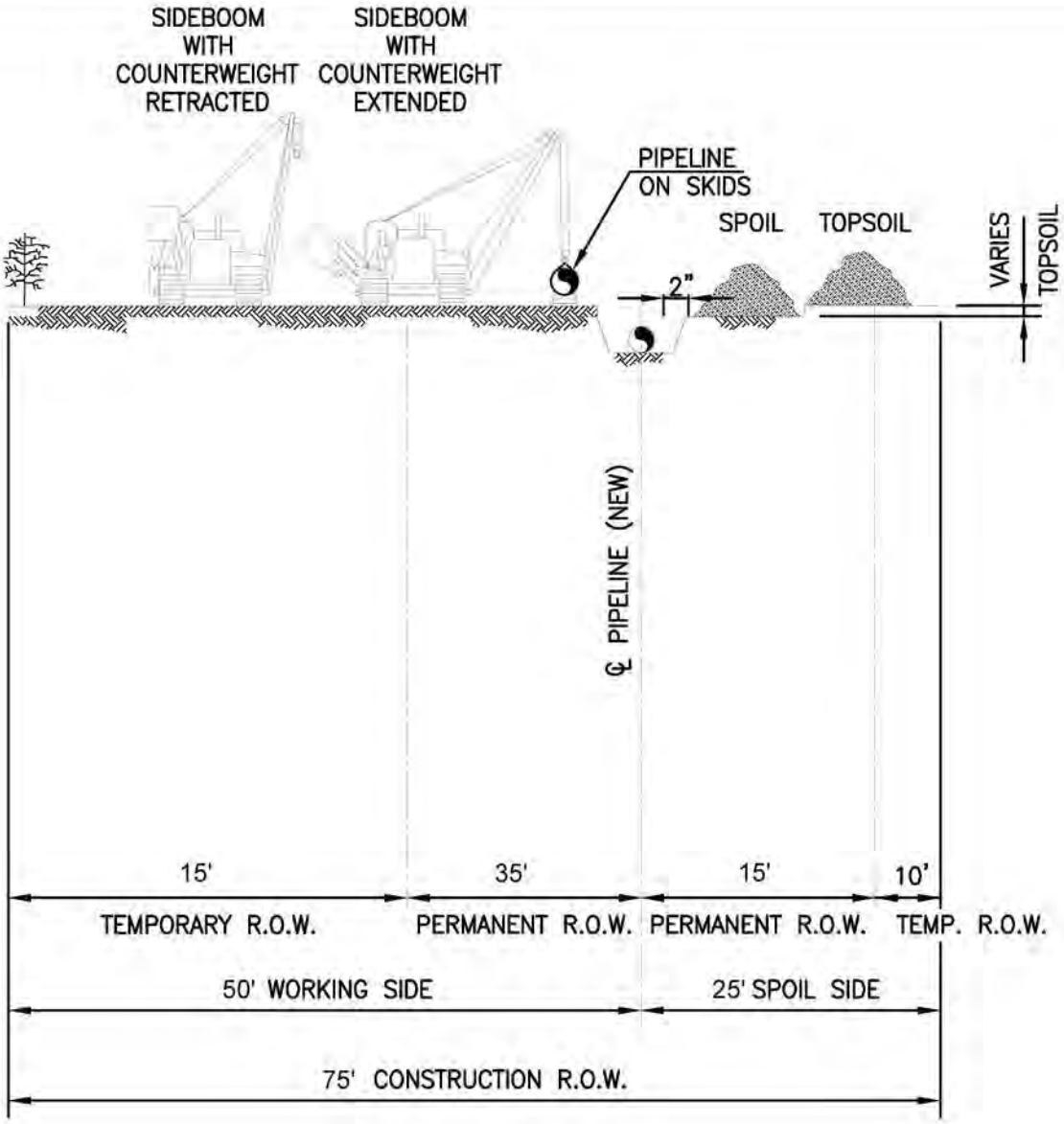
DWG. NO. DETAIL 32	REV A



NOTES:

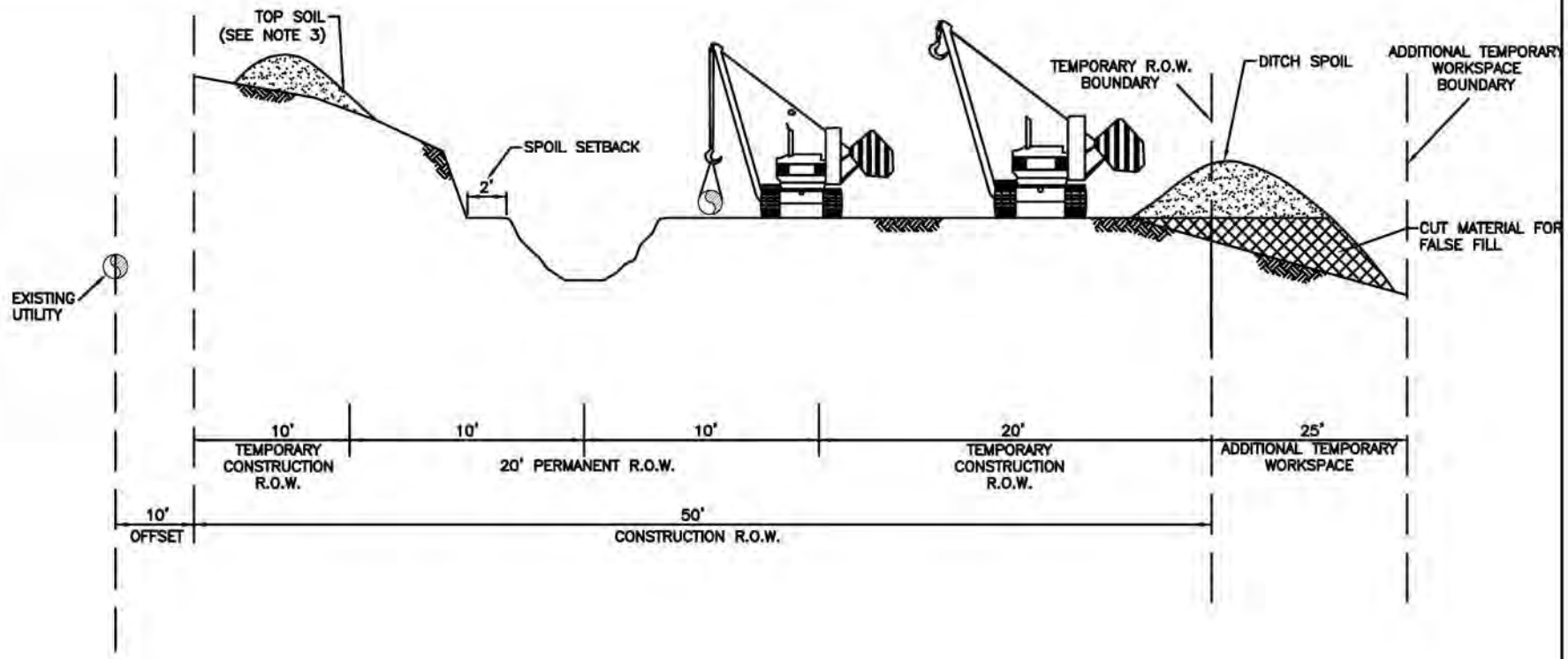
1. ALTHOUGH THE DIMENSIONS SHOWN ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS. UNLESS OTHERWISE INDICATED ON THE ALIGNMENT SHEETS, THE MAXIMUM WIDTH OF THE CONSTRUCTION RIGHT-OF-WAY SHALL BE AS SHOWN IN THE TABLE FOR THE APPROPRIATE PIPE DIAMETER.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION RIGHT-OF-WAY WITHIN WETLANDS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 33	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

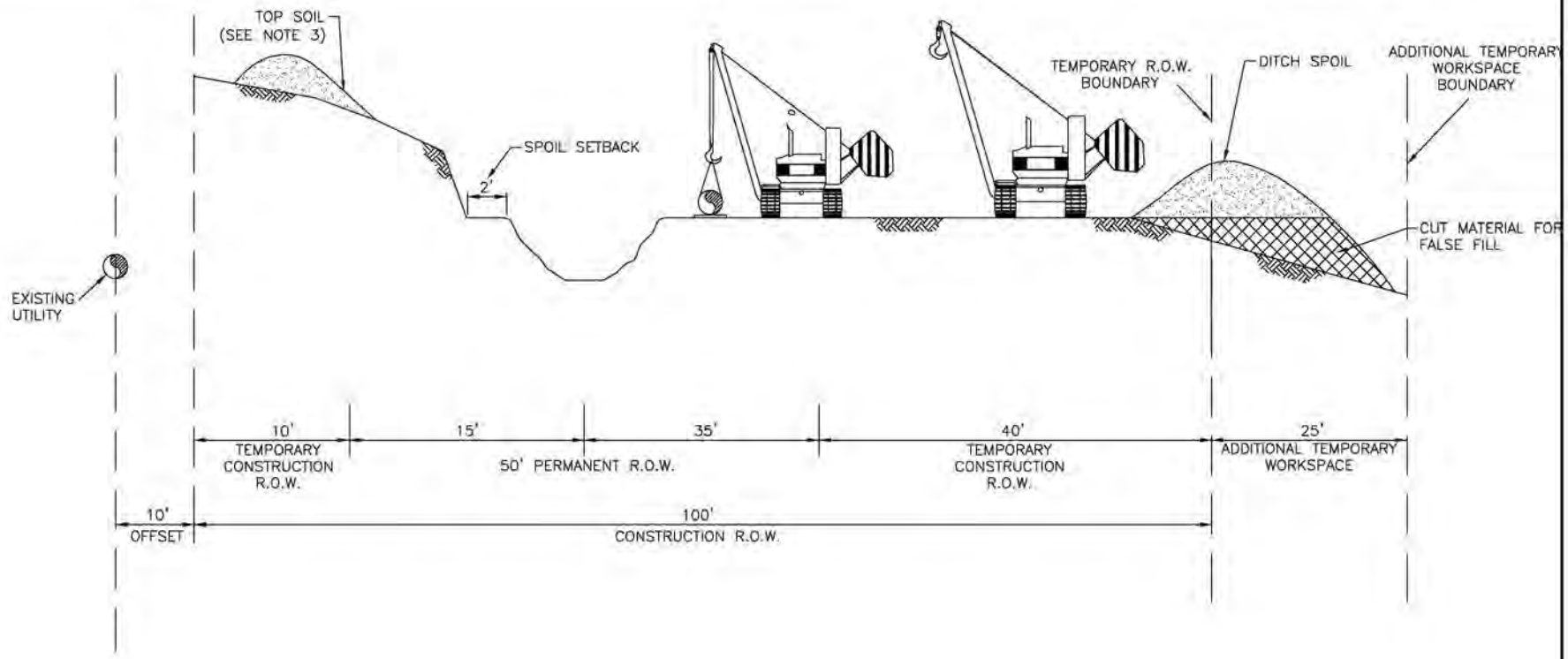
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W.(TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE
WORKSPACE WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 34	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

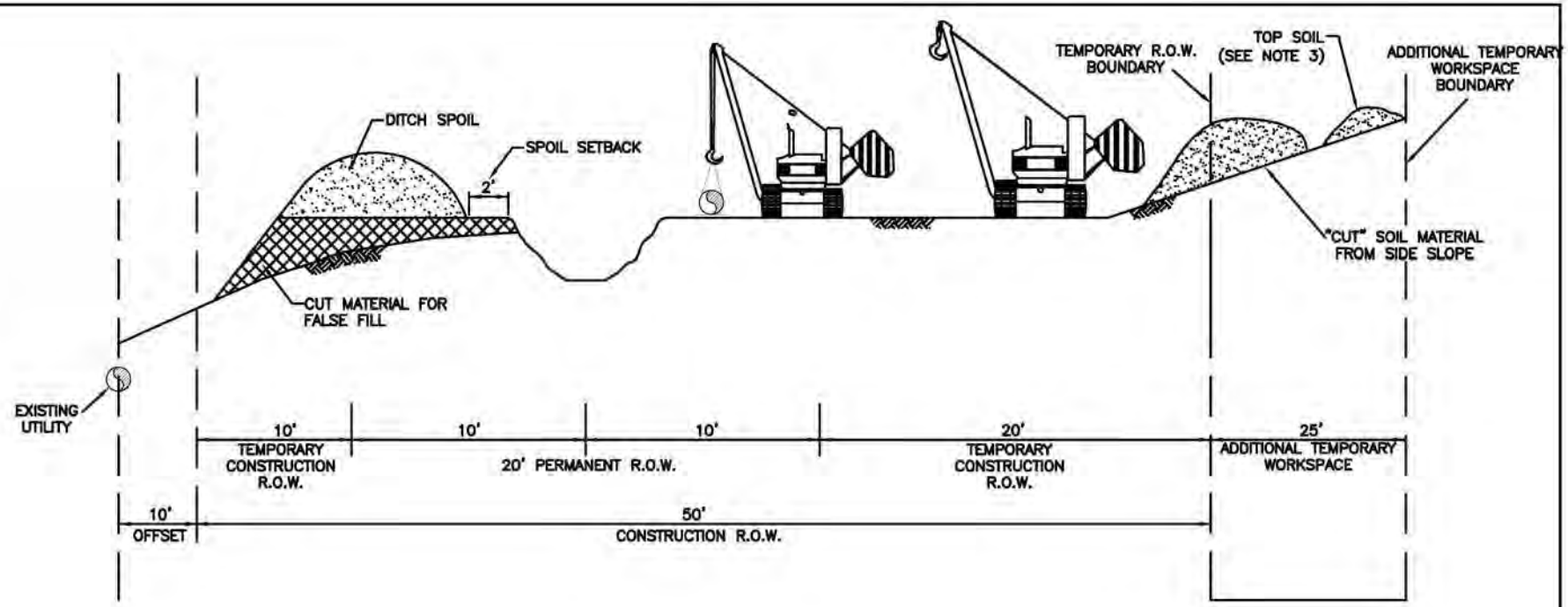
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
DOWNWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 35	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

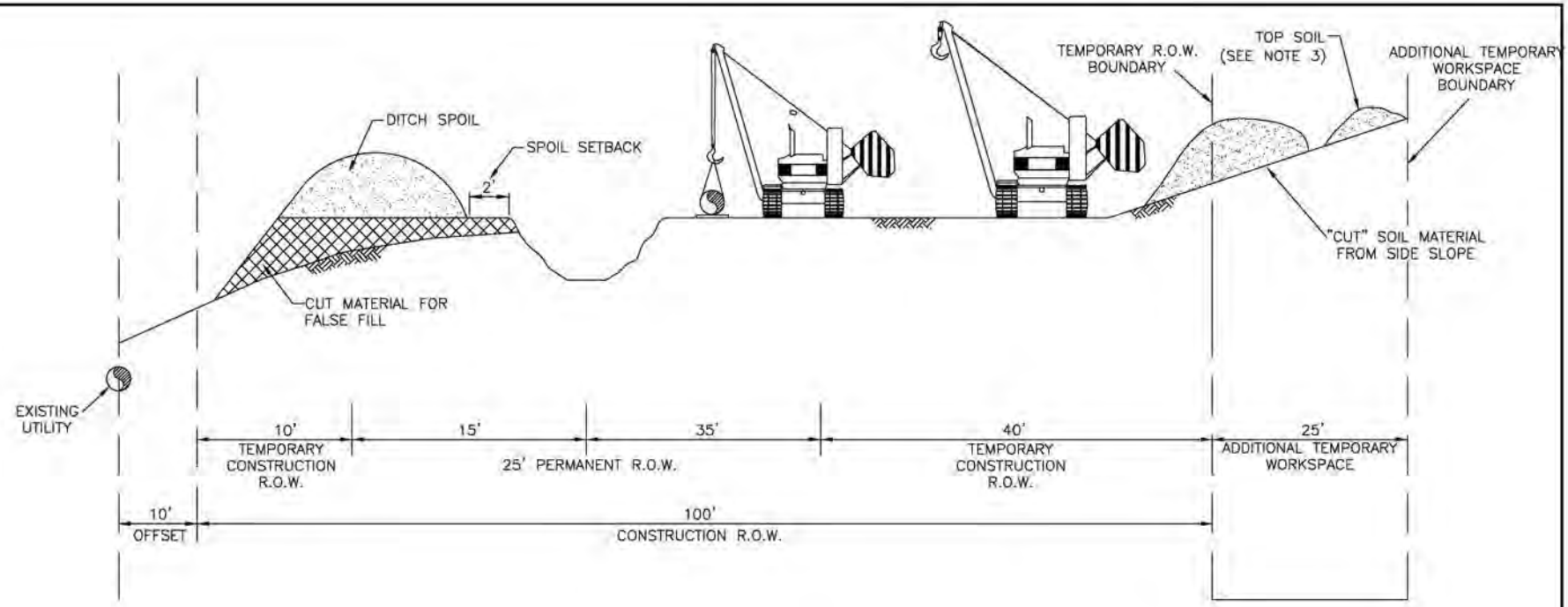
NOTES:

1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 75 FEET WIDE CONSISTING OF 20 FEET OF PERMANENT EASEMENT, 30 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOL SHALL BE STRIPPED AND SEGREGATED FROM THE ENTIRE 75 FOOT R.O.W. (TRENCH, SPOIL AND WORKING SIDES).

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE
WITHIN FOREST SERVICE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 36	REV A



PROFILE

* DIMENSIONS ARE TYPICAL, SEE ALIGNMENT SHEETS FOR ACTUAL RIGHT-OF-WAY CONFIGURATIONS AND CLEARING LIMITS.

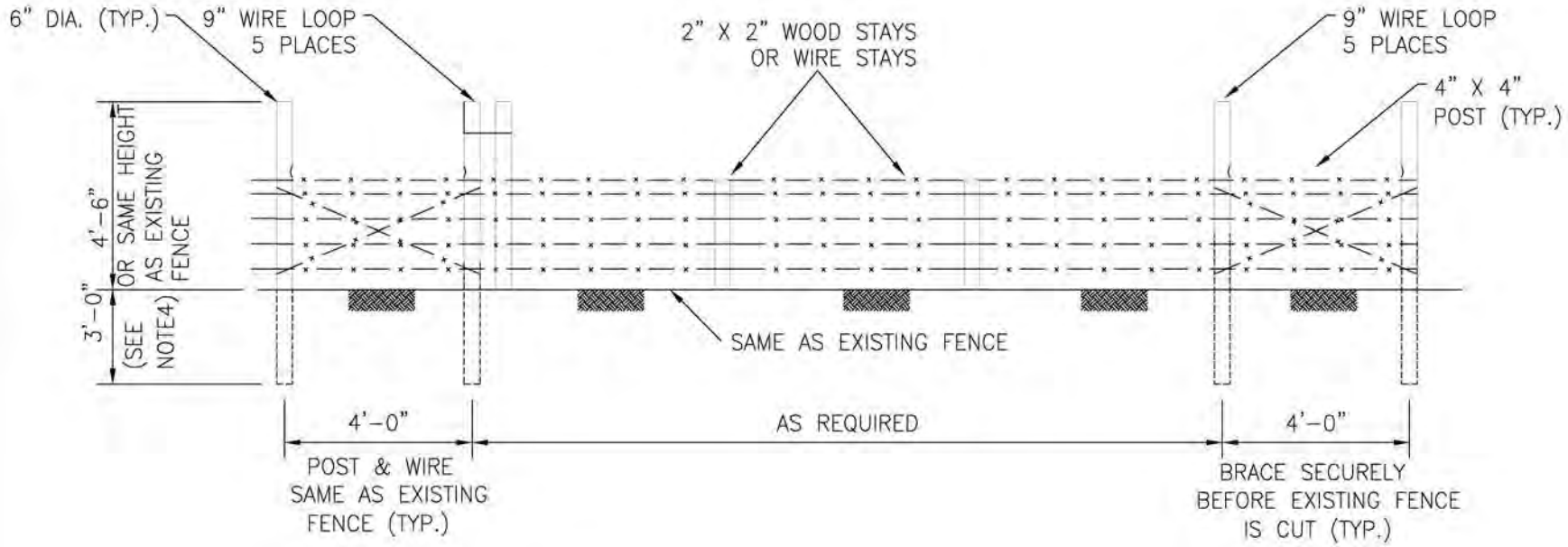
NOTES:

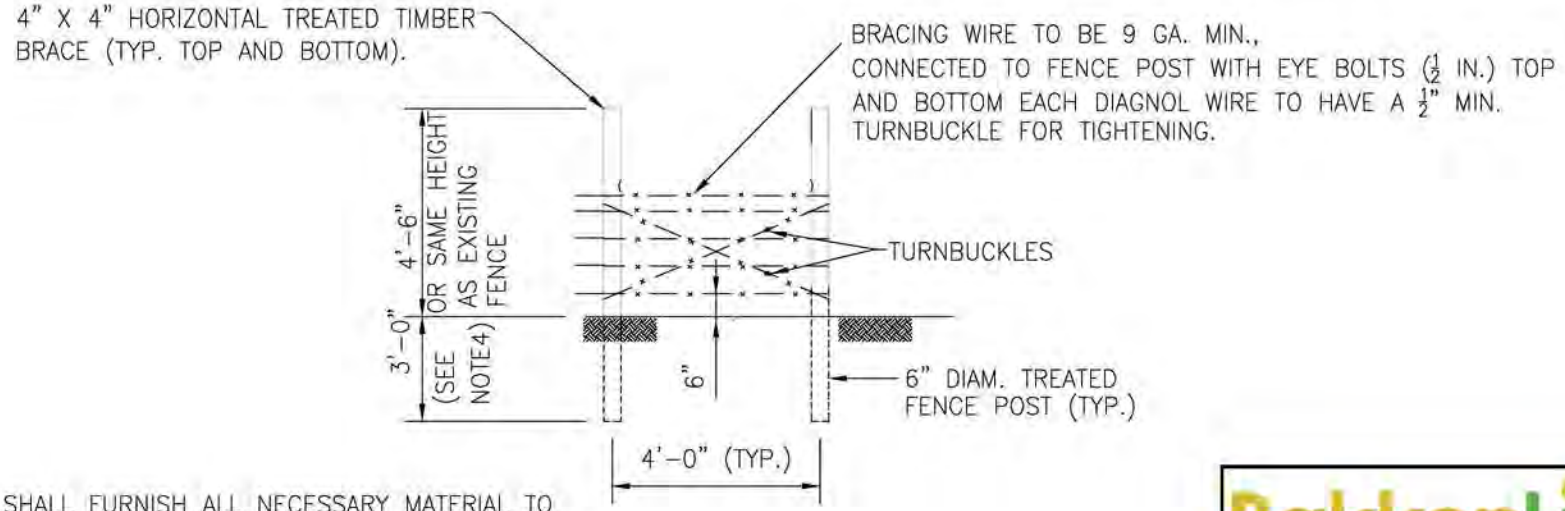
1. CONSTRUCTION RIGHT-OF-WAY WILL TYPICALLY BE 125 FEET WIDE CONSISTING OF 50 FEET OF PERMANENT EASEMENT, 50 FEET OF TEMPORARY WORKSPACE AND 25 FEET OF ADDITIONAL TEMPORARY WORKSPACE. FURTHER ADDITIONAL TEMPORARY WORKSPACE WILL BE NECESSARY AT ROAD, RAIL AND RIVER CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES, AS REQUIRED. CERTAIN SITUATIONS MAY REQUIRE A NARROWER WIDTH.
2. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CANALS OR WETLANDS.
3. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE TRENCH, AND SPOIL SIDES.

BakkenLink

TYPICAL CONSTRUCTION
UPWARD SIDE SLOPE WORKSPACE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 37	REV A





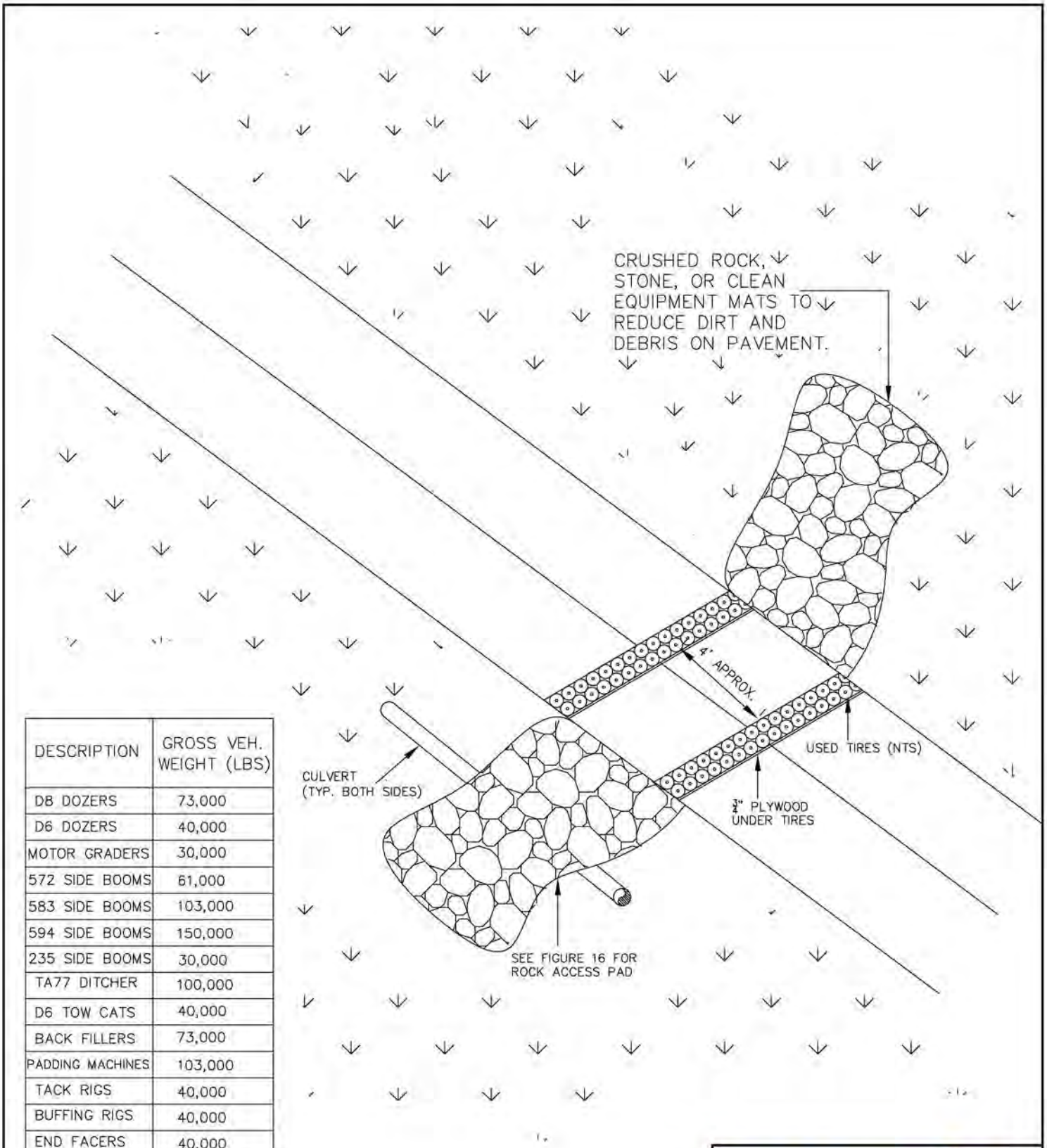
NOTES:

1. CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIAL TO CONSTRUCT FENCE GATE TO MATCH EXISTING FENCE.
2. POSTS, WIRE AND OTHER MATERIAL SHALL BE SAME AS OR EQUIVALENT MATERIAL TO MATCH EXISTING.
3. BRACE SPAN TO BE CONSTRUCTED ON EACH SIDE OF PIPELINE RIGHT-OF-WAY, PRIOR TO INITIAL DISMANTLING OF FENCE.
4. ACTUAL DEPTH REQUIRED TO BE SET BY WHAT IS REQUIRED TO ACHIEVE A STABLE SUPPORT POST.
5. OFFSET METHOD TO BE USED FOR GATE AT CUTS.

BakkenLink

TYPICAL CONSTRUCTION
FENCE WITH TEMPORARY GATE

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 38	REV A



DESCRIPTION	GROSS VEH. WEIGHT (LBS)
D8 DOZERS	73,000
D6 DOZERS	40,000
MOTOR GRADERS	30,000
572 SIDE BOOMS	61,000
583 SIDE BOOMS	103,000
594 SIDE BOOMS	150,000
235 SIDE BOOMS	30,000
TA77 DITCHER	100,000
D6 TOW CATS	40,000
BACK FILLERS	73,000
PADDING MACHINES	103,000
TACK RIGS	40,000
BUFFING RIGS	40,000
END FACERS	40,000

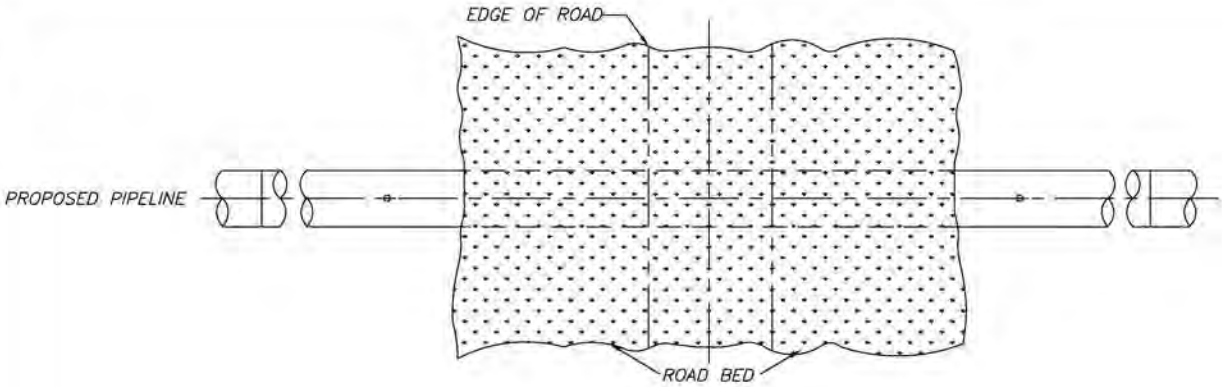
NOTES:

1. ACCESS PADS (ROCK) OR EQUIPMENT MATS MUST BE KEPT FREE OF DIRT AND DEBRIS TO KEEP ROADWAY CLEAN.
2. MATS, ROCK, PLYWOOD AND TIRES MUST BE COMPLETELY REMOVED AND SITE COMPLETELY RESTORED AFTER COMPLETION OF CONSTRUCTION ACTIVITY.
3. REMOVE TIRES AND PLYWOOD BETWEEN EQUIPMENT CROSSINGS ACROSS ROAD ONLY.

BakkenLink

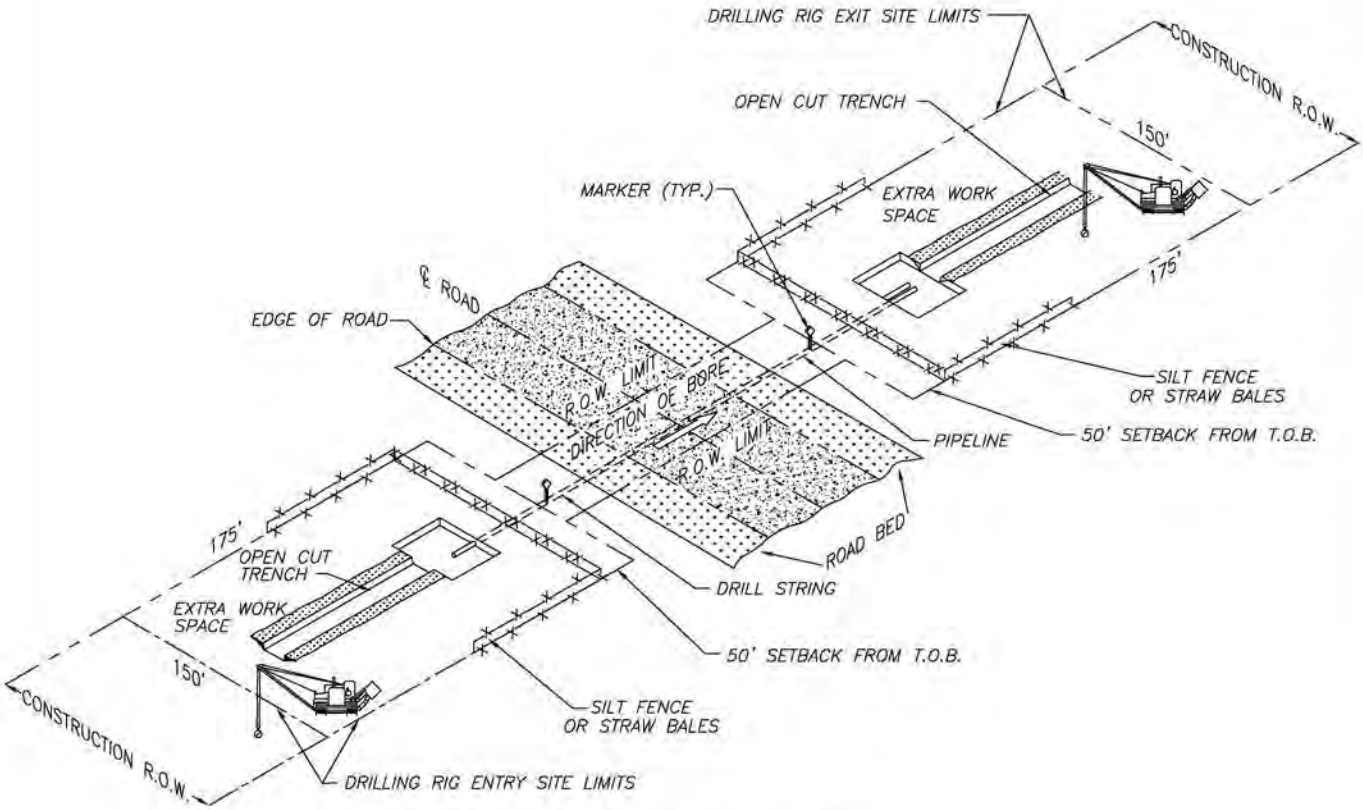
TYPICAL CONSTRUCTION TRACKED VEHICLE ROAD CROSSING TECHNIQUE AND PROCEDURE DETAILS

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 39	REV A



PLAN VIEW

NOT TO SCALE



PLAN VIEW 'A'

NOT TO SCALE

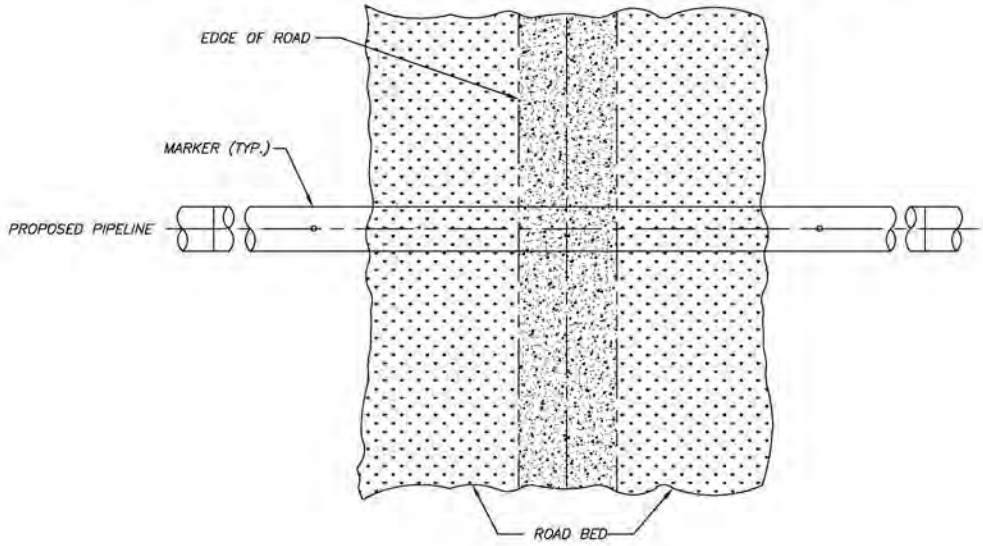
NOTES:

1. EXTRA WORK SPACE NOT LOCATED IN WETLAND WHEN POSSIBLE AND PRACTICAL.
2. RIGHT-OF-WAY LIMITS FOR WETLAND AND UPLAND ARE 100' AND 120' RESPECTIVELY.
3. WORK AREA WILL BE TEMPORARILY MATTED FOR MARSH AREAS.

BakkenLink

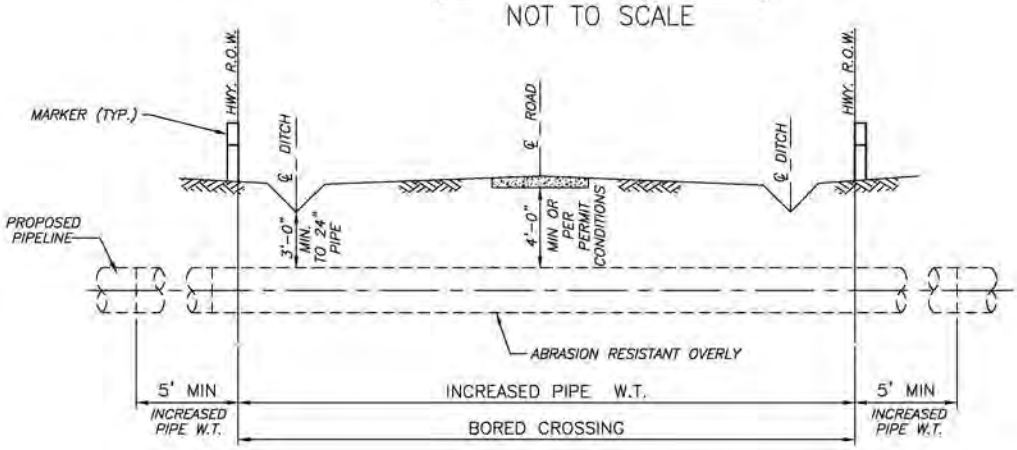
TYPICAL CONSTRUCTION
BORED ROAD CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 40-A	REV A



PLAN VIEW

NOT TO SCALE



PROFILE

NOT TO SCALE

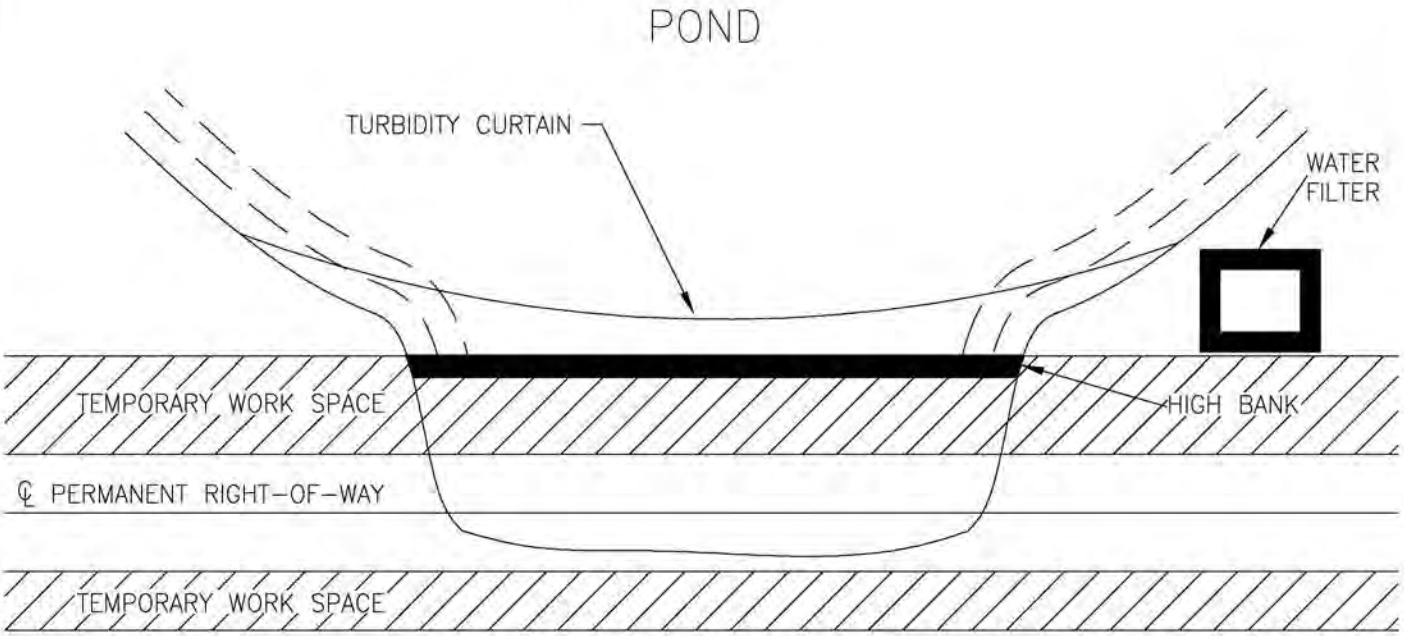
NOTES:

1. CROSSING INSTALLATION SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. BORED CROSSINGS SHALL BE ACCOMPLISHED VIA SLICK, HAMMER OR AUGER METHODS.
3. ALL CARRIER PIPE SHALL BE ERW, CARBON STEEL PIPE, EXTERNALLY COATED WITH FUSION BONDED EPOXY AND ABRASION RESISTANT OVERLAY.
4. ALL GIRTH WELDS SHALL BE INSPECTED PER API-1104 SPECIFICATIONS.
5. ALL LONGITUDINAL SEAMS SHALL BE MILL INSPECTED PER API-5L SPECIFICATIONS.
6. CARRIER PIPE DIAMETER, WALL THICKNESS, AND GRADE SHALL BE SPECIFIED ON THE ALIGNMENT SHEET DRAWINGS.
7. COMPANY SUPPLIED WARNING SIGNS SHALL BE INSTALLED.
8. USE OF BORE OR HDD CROSSING WILL BE DETERMINED UPON COMPLETION OF DETAIL SURVEY.

BakkenLink

TYPICAL CONSTRUCTION
BORED ROAD CROSSING

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 40-B	REV A



PLAN

THE INITIAL APPROACH TO ANY POND CROSSING WILL BE ATTEMPT TO OBTAIN PERMISSION FROM THE LAND OWNER AND TO HAVE THE LAND OWNER LOWER THE POND WATER TABLE TO AN ELEVATION BELOW THE CONSTRUCTION WORK SPACE SO NORMAL PIPE LAY CAN BE CONDUCTED THROUGH THE AREA. IF AN AGREEMENT CANNOT BE REACHED. THE FOLLOWING METHOD WILL BE USED:

TYPICAL POND CROSSING WILL CONSIST OF THE INSTALLATION OF AN EARTH DAM OR PORTABLE WATER DAM TO BE INSTALLED FROM HIGH BANK TO HIGH BANK. A TURBIDITY CURTAIN WILL BE USED TO PREVENT SEDIMENTATION FROM SPREADING THROUGHOUT THE POND AREA. THE WATER WITHIN THE CONSTRUCTION WORK AREA WILL BE PUMPED OVER INTO A WATER FILTER STRUCTURE AND ALLOW TO FLOW NATURALLY BACK INTO POND. THE WATER TABLE WITHIN THE WORK AREA WILL BE LOWERED TO A SAFE WORKING ELEVATION. ONCE PIPELINE INSTALLATION IS COMPLETE, ALL DAM MATERIAL WILL BE REMOVED AND POND RESTORED TO ITS PREVIOUS WATER TABLE ELEVATION AND CONDITIONS.

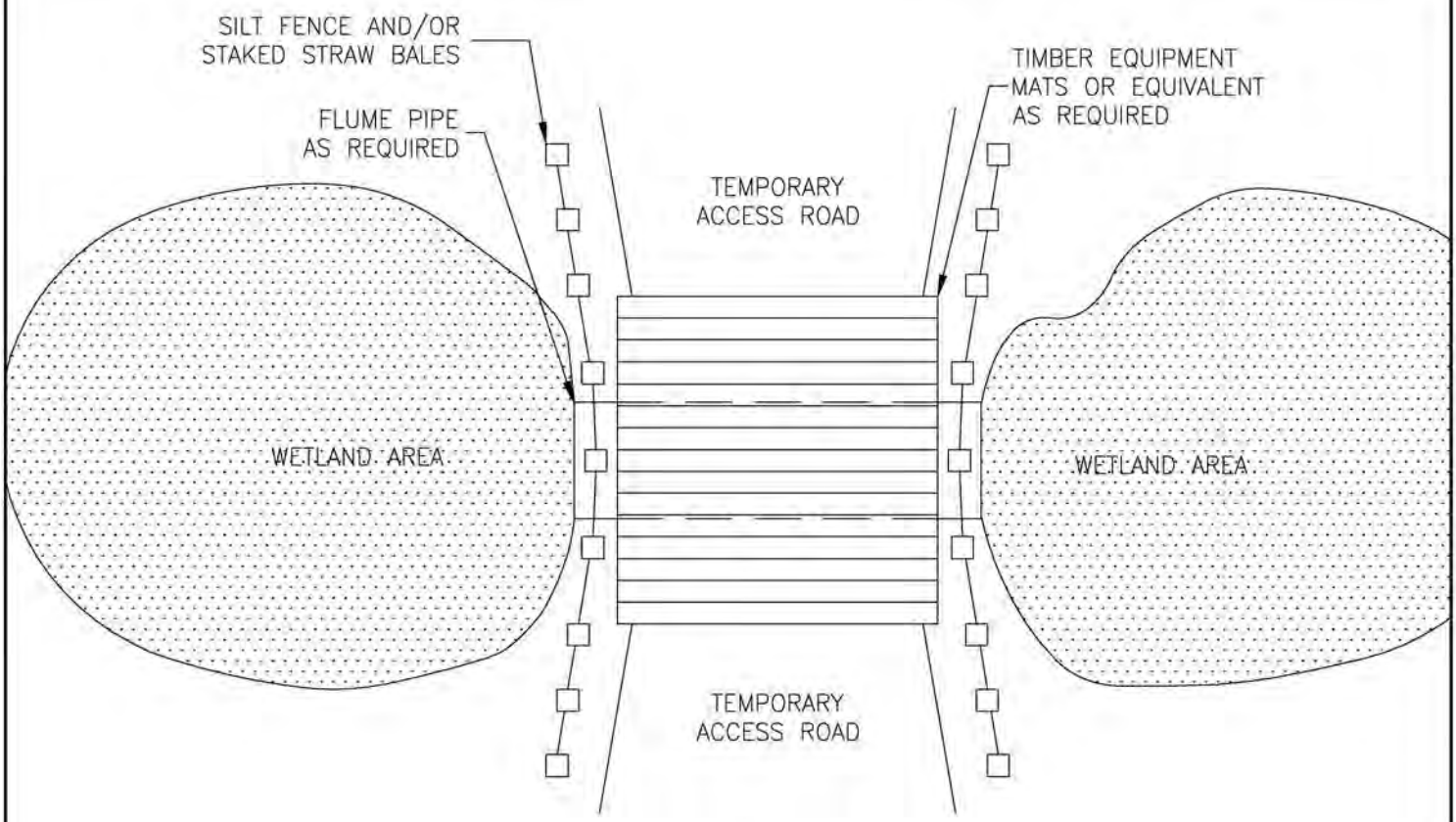
NOTES:

1. CONSTRUCT EARTH OR PORTABLE WATER DAM.
2. INSTALL TURBIDITY CURTAIN.
3. PUMP WATER OUT OF WORKSPACE INTO WATER FILTER STRUCTURE.
4. TURBIDITY CURTAIN AND WATER FILTER AREA WILL BE AGREED UPON BY LANDOWNER.

BakkenLink

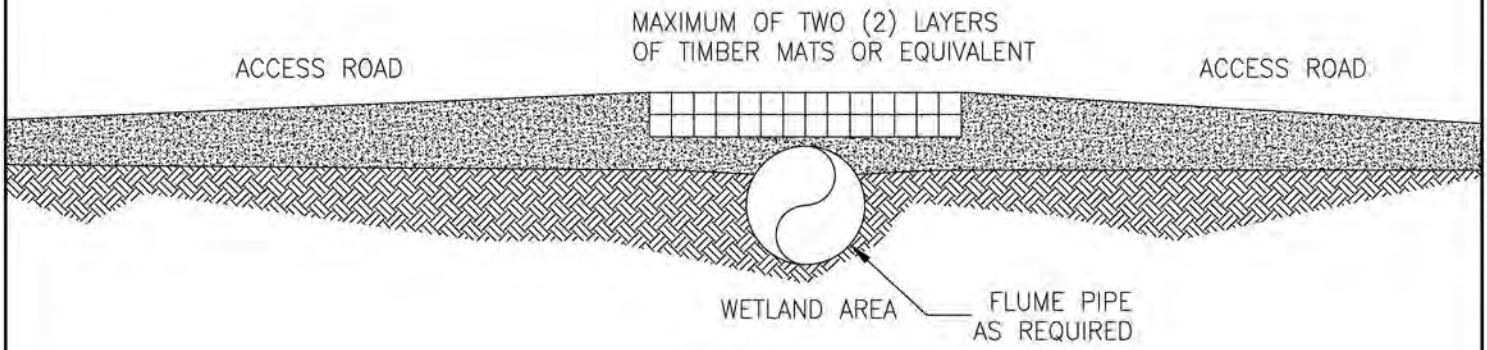
TYPICAL CONSTRUCTION FOR POND ENCROACHMENT

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 41	REV A



PLAN VIEW

NOT TO SCALE



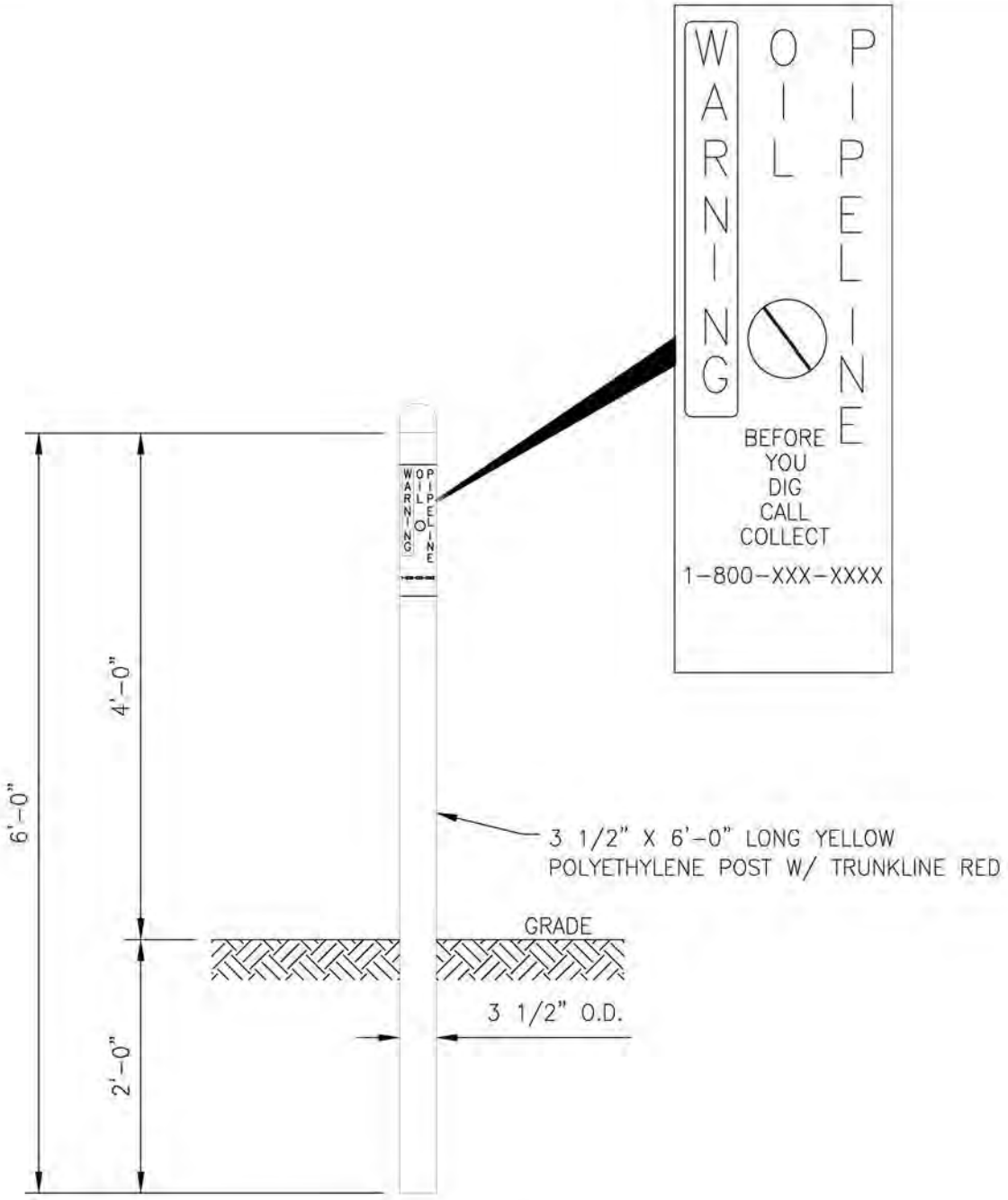
CROSS SECTION

NOT TO SCALE

BakkenLink

TYPICAL CONSTRUCTION
WETLANDS ACCESS ROAD

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 42	REV A



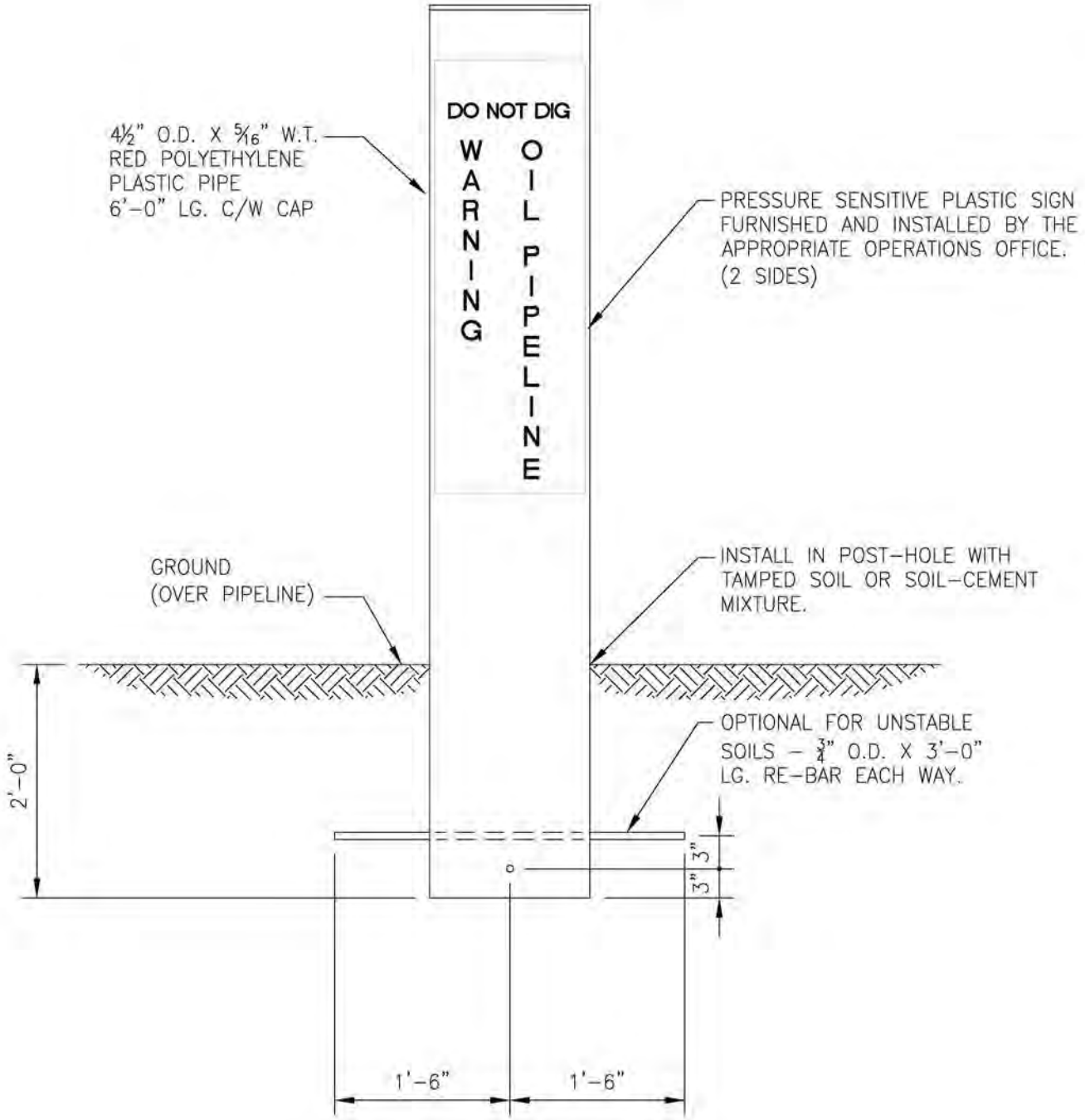
ELEVATION

PIPELINE MARKER TYPE 1

BakkenLink

TYPICAL CONSTRUCTION
PIPELINE MARKER TYPE 1

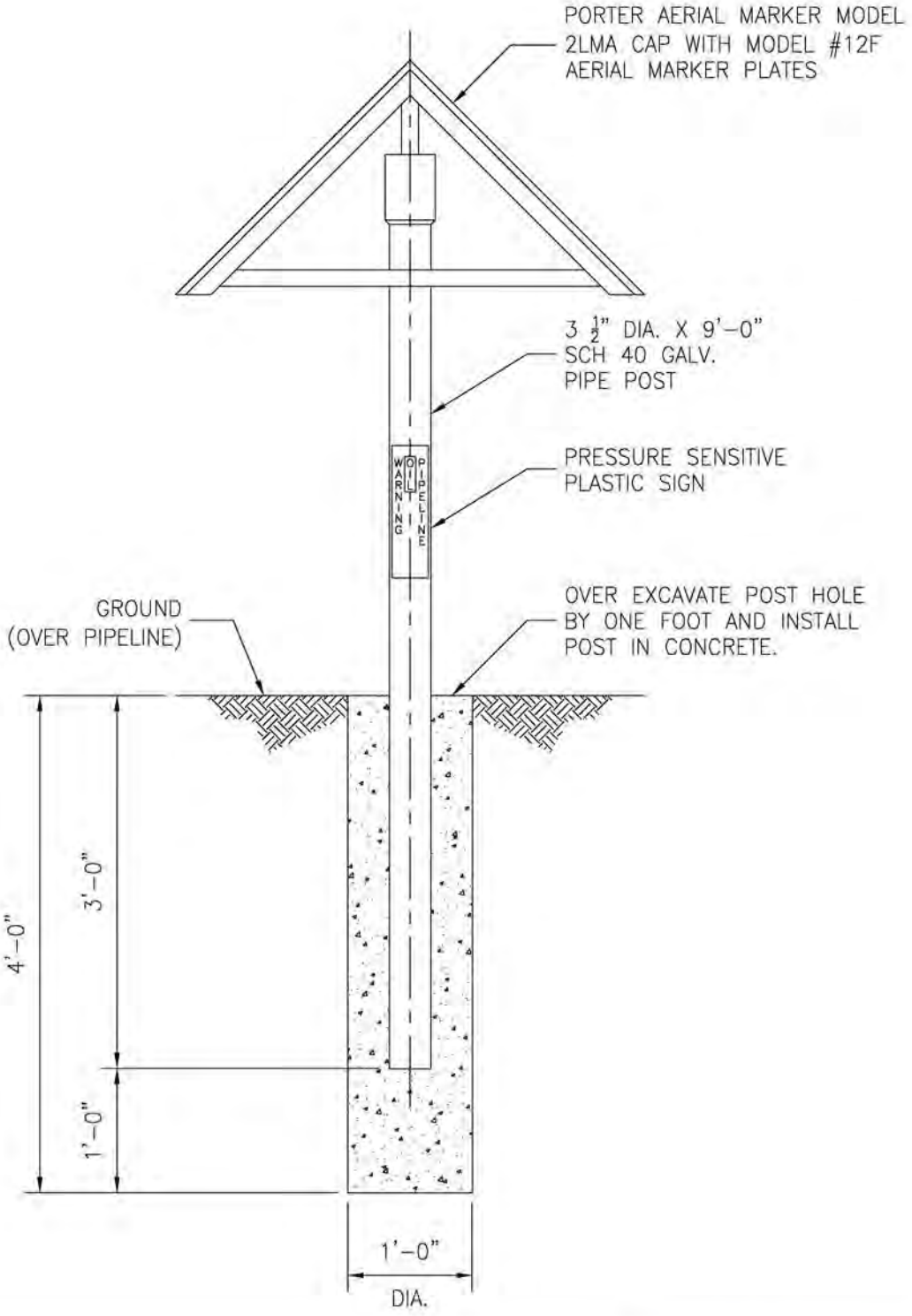
DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 43	REV A



BakkenLink

TYPICAL CONSTRUCTION
PIPELINE MARKER TYPE 2

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 44	REV A



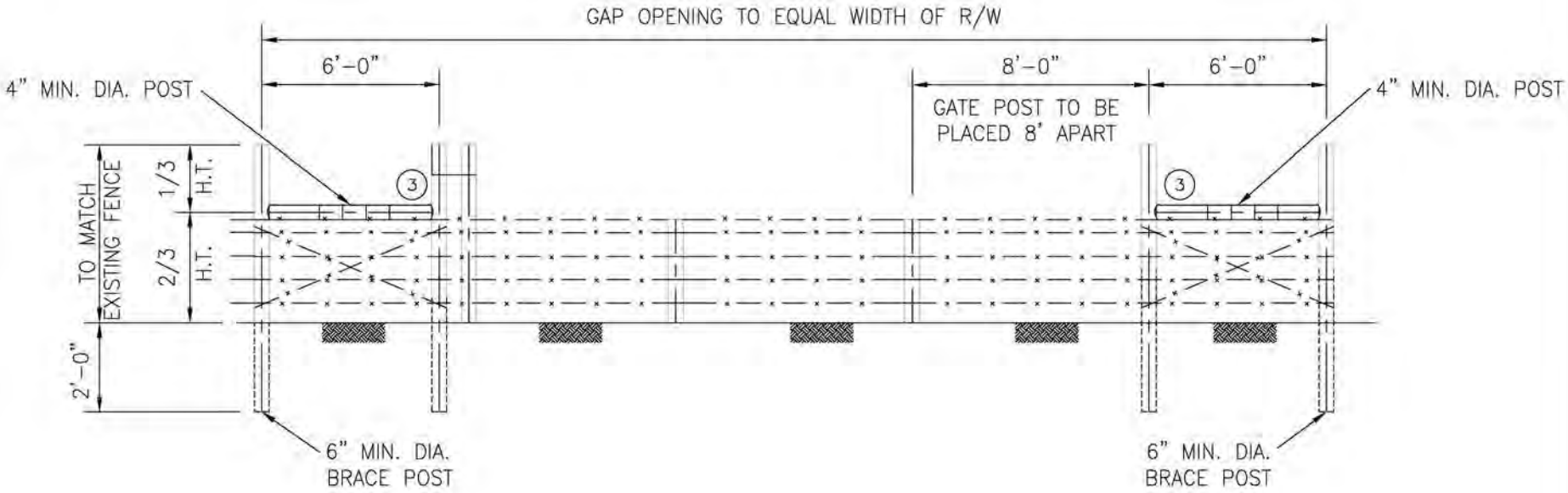
NOTES:

1. AERIAL MARKERS SHALL BE LOCATED AS DIRECTED BY INSPECTOR.

BakkenLink

TYPICAL CONSTRUCTION
PIPELINE AERIAL MARKER

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 45	REV A



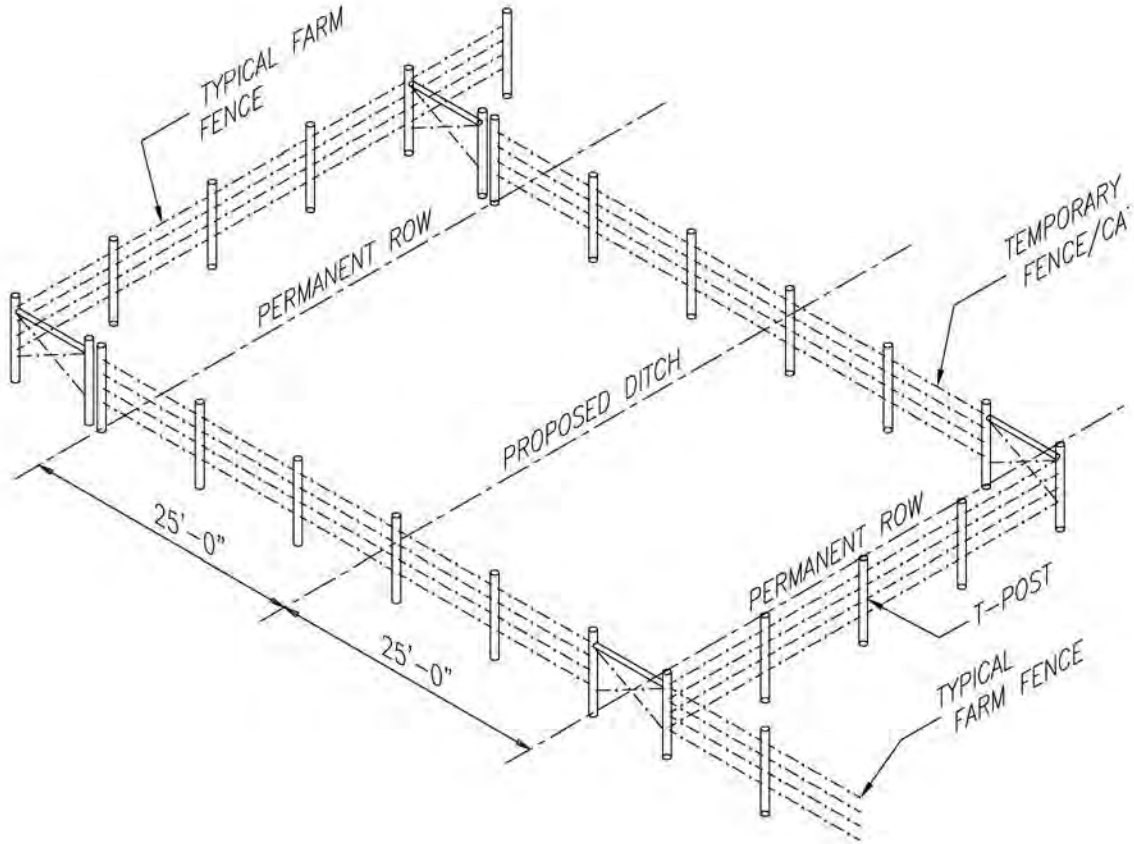
NOTES:

1. INSTALL BRACE POSTS AND SECURE FENCE BEFORE CUTTING EXISTING WIRES. REPLACEMENT FENCE TO BE EQUAL OR BETTER THAN EXISTING FENCE. ALL POST AND WIRE TO BE FURNISHED AND INSTALLED BY CONTRACTOR.
2. ALL POST TO BE ROUND WOODEN POSTS, CUT AND MANUFACTURED FROM LIVE, SOUND, AND GROWING TREES AND SHALL BE SOUTHERN YELLOW PINE, RED (NORWAY) PINE, WHITE PINE, OR JACK PINE, PRESSURE TREATED WITH PENTACHLOROPHENOL PRESERVATIVE. UNTREATED CEDAR POSTS MAY BE USED.
3. CATCH OFF OF FENCE STRETCHER TO BE PLACED THIS SIDE OF BRACE POST BEFORE CUTTING FENCE WIRE. CUT WIRE TO BE SECURED TO BRACE POST BY WRAPPING AROUND POST.

BakkenLink

TYPICAL CONSTRUCTION
FENCE BRACE POST DETAIL

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 46	REV A



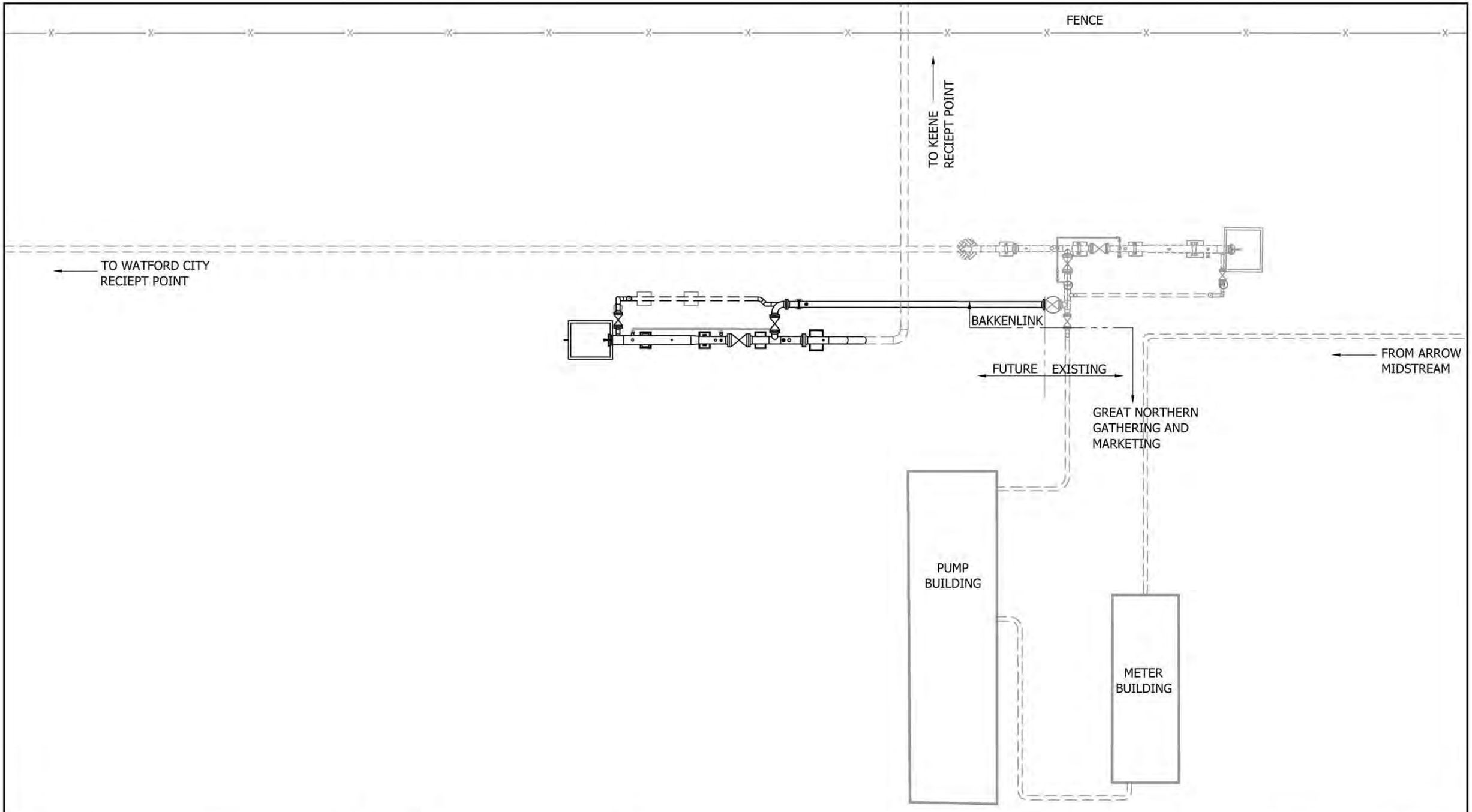
BakkenLink

TYPICAL CONSTRUCTION
TEMPORARY FENCE ALONG R.O.W.

DRAWN BY:	CHK'D. BY:
DATE:	APPRV. BY:
DWG. NO. DETAIL 47	REV A

Appendix IV

Dry Creek Terminal Connect Detail



#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

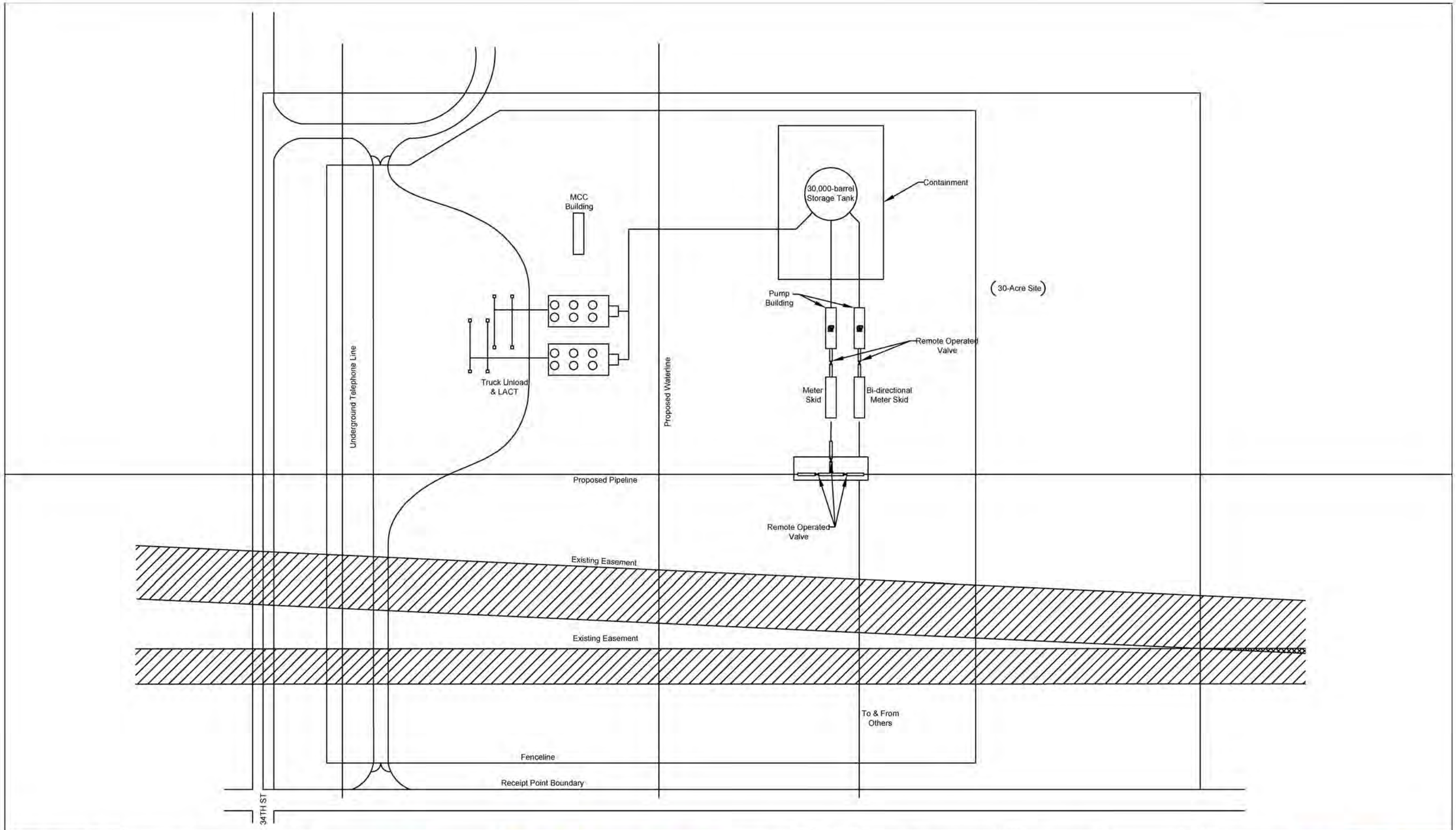
DRY CREEK INTERCONNECT SITE PLAN

BARTLETT & WEST
3456 E CENTURY AVENUE - BISMARCK ND 58503
PHONE 701.258.1110 - FAX 701.258.1111
WWW.BARTWEST.COM

DESIGNED BY: .	PROJ NO: 16853.001	DRAWING NO: .
DRAWN BY: .	CONST PROJ: SITE PLAN	
CHECKED BY: .	SCALE:	SHEET NO:
PROJECT ENGR: .	DATE: 2/7/2014	XX OF XX

Appendix V

Keene Receipt Point Connect Detail



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC
CHK'D BY:
PROJECT NO: 016853.200
DATE: 05/27/2014

Scale Ratio 1:1500
0 25' 50' 100'

Keene Receipt Point
Portion of the SE 1/4 of the SE 1/4 of S 12, T 151 N, R 96 W
McKenzie County, ND

SHEET NO. 1 of 1

BakkenLink
BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

BILL OF MATERIALS

ITEM		QTY

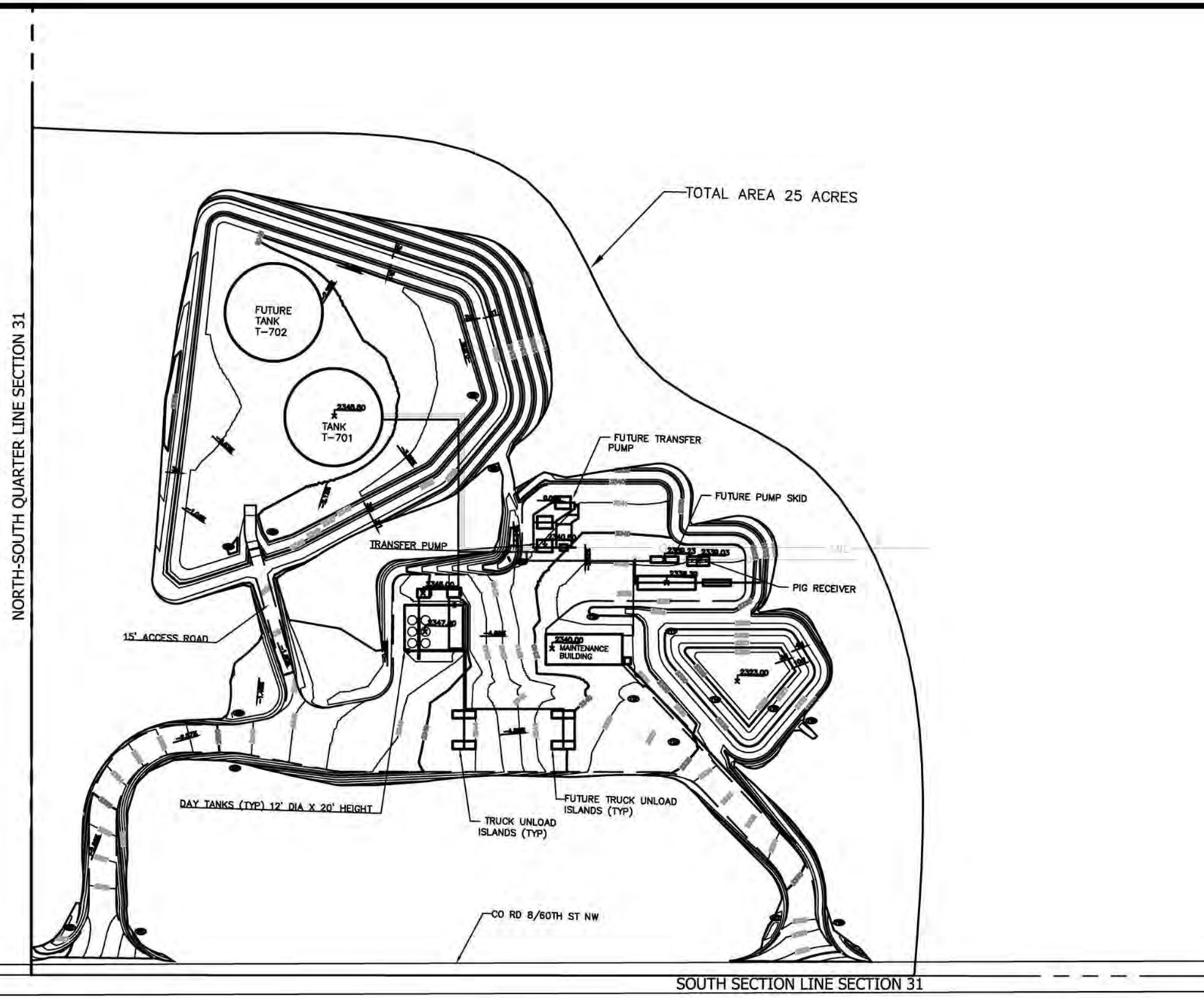
NOTES
1. THIS IS NOT A SURVEY DOCUMENT. SURVEY DATA PROVIDED BY BARTLETT & WEST, INC.

LEGEND

BARTLETT & WEST
3456 Century Ave.
Bismarck, ND 58503

Appendix VI

Beaver Lodge Connect Detail

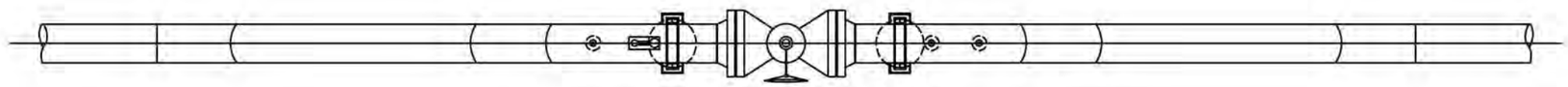


(IN FEET)
1 inch = 150 ft.

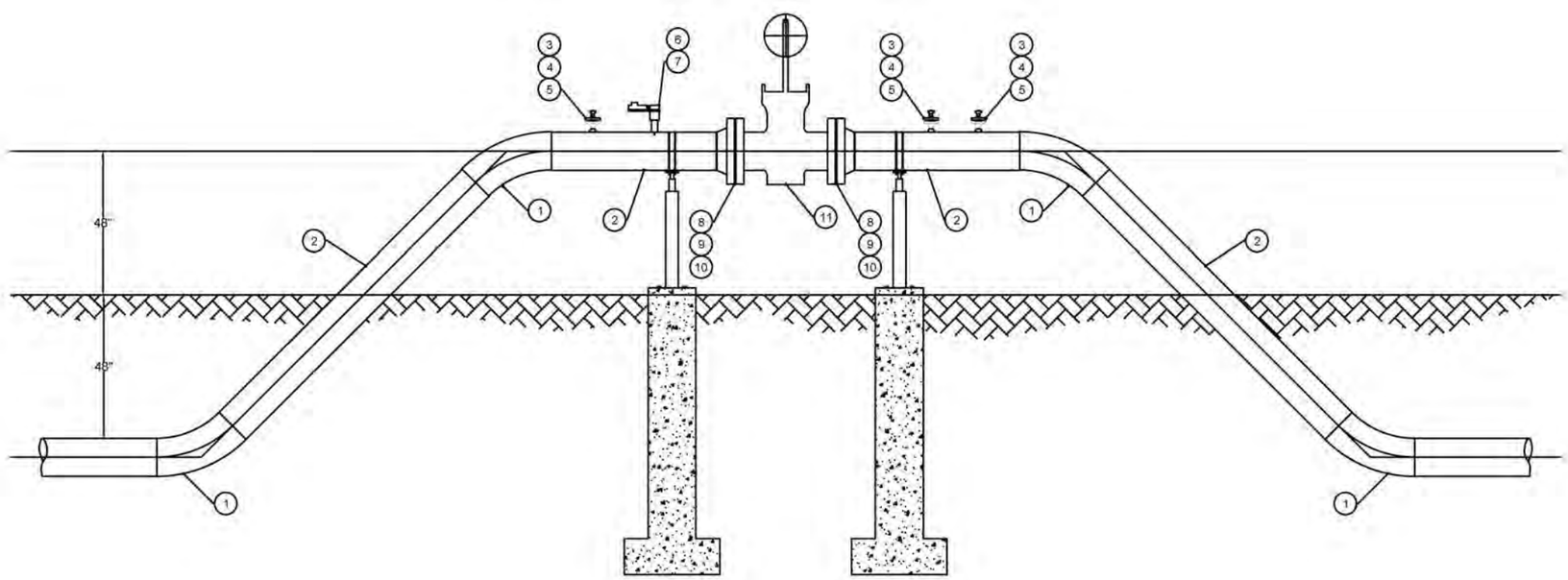
Appendix VII

Mainline Valve Typical Site

PLAN



PROFILE



REVISIONS			
NO.	DATE	BY	DESCRIPTION

DRWN. BY: DJC
CHK'D BY:
PROJECT NO: 016653.300
DATE: 00/00/0000

Scale $\frac{1}{4}$" = 1'

Typical Main Line Valve Site

SHEET NO. 1 of 1

BakkenLink

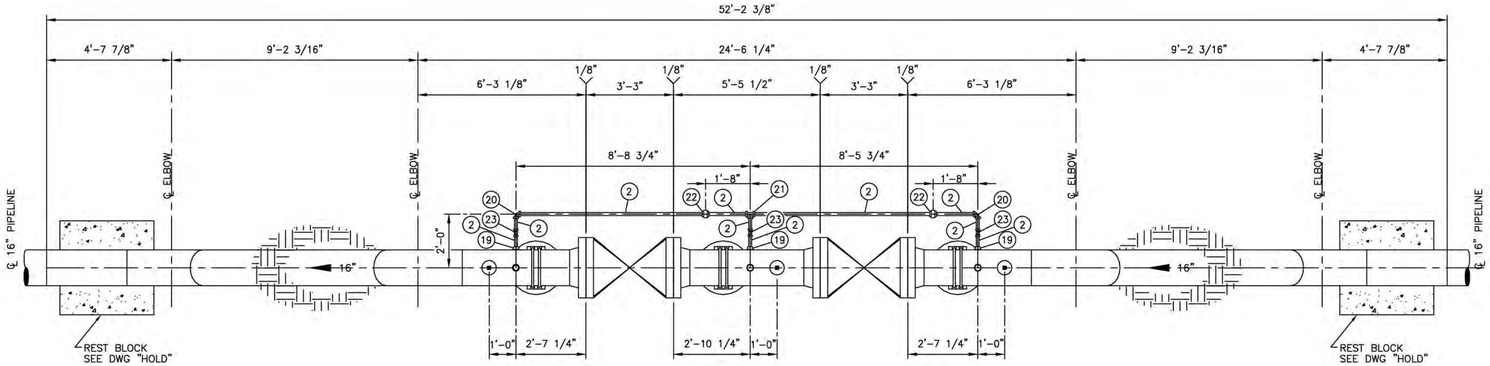
BakkenLink Pipeline, LLC
2101 46th Ave SE, Suite 2
Mandan, ND 58503

NOTES

LEGEND

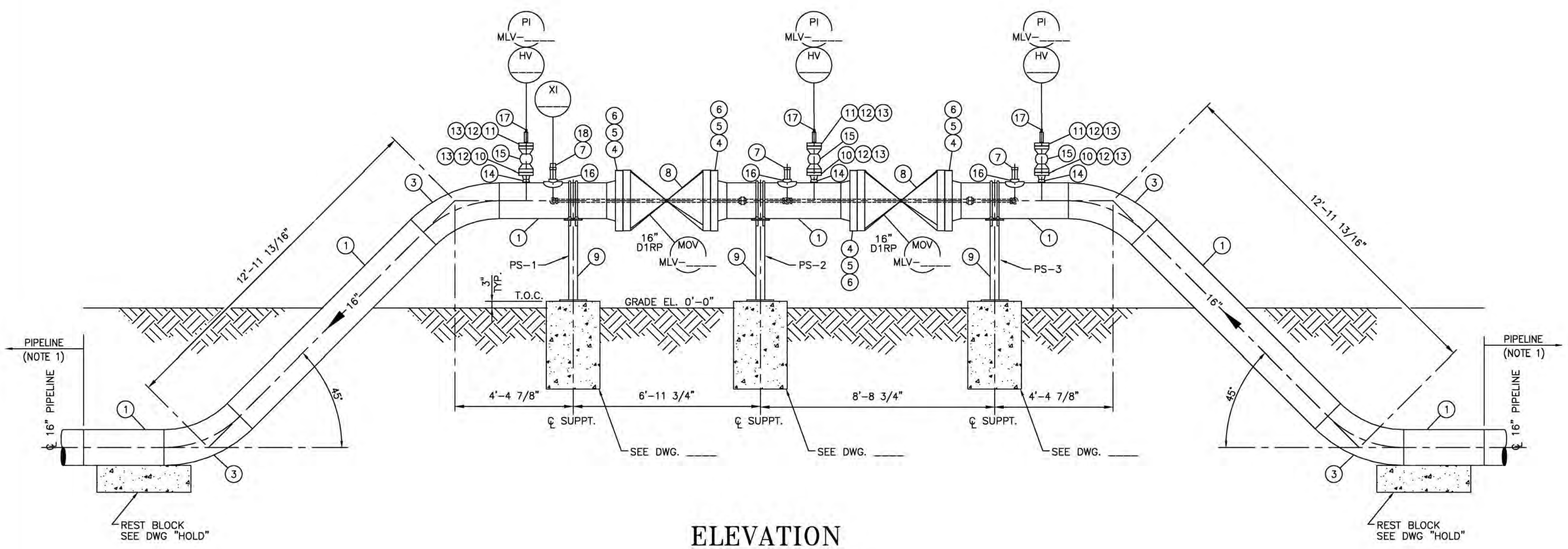
BARTLETT & WEST

3456 Century Ave.
Bismarck, ND 58503



PLAN

SCALE: 3/8" =1'-0"



ELEVATION

SCALE: 3/8" =1'-0"

BILL OF MATERIALS

ITEM	QTY	UNITS	DESCRIPTION
1	38	LF	PIPE, 16.000" O.D. X 0.500" W.T., API 5L X-60
2	20	LF	PIPE, 1.315" O.D. X 0.250" W.T., ASTM A-106
3	4	LF	ELBOW, WELD, 16.00" O.D. X 0.500" W.T., 45 DEGREE, 3R, MSS SP-75 WPHY-60
4	4	LF	FLANGE, 16", ANSI 600, RFWN, BORE TO MATCH 0.500" W.T. PIPE, MSS SP-44 F60
5	80	EA	STUD BOLT ASSEMBLY-1 1/2" DIA X A 10" LG, ASTM A-193, GR. B7 ALLOY STEEL STUD BOLT W/ 2 HEX NUTS EA.,ASTM A194, GR 2 H CARBON STEEL, FLOUROCARBON COATED (16" ANSI 600 FLANGE BOLTS - 20 BOLTS PER)
6	4	EA	GASKET, SPIRAL WOUND TEFLON-16", ANSI 600 RF, FLEXITALLIC STYLE CGI OR EQUAL, 304 SS WINDINGS WITH FLEXICARB FILLER, CS INNER & OUTER RINGS, 1/8" THICK, ASME B16.20
7	3	EA	THREAD-O-RING, 2" TDW PART 2" -0000-0001-00
8	2	EA	VALVE, EXPANDING GATE, 16" ANSI 600, RF X RF, NACE TRIM, API 6D
9	3	EA	SUPPORT, PIPE, DIMENSION D = 1218-F I/R, I-ROD W/UBOLTS, "BASE PL W/HLS, 16" PIPE, EZ-LINE.
10	3	EA	FLANGE, 2", ANSI 600, RFWN, BORE TO MATCH 0.218" W.T. PIPE, ASTM A105, ANSI B16.5
11	3	EA	FLANGE, BLIND, 2", ANSI 600, RF, ASTM A105, ANSI B16.5, CENTER DRILL AND TAP 3/4"
12	48	EA	BOLTS, STUD, 5/8" X 4 1/4"LG, ASTM A193 GRADE B7 W/2 A194 GRADE 2H HH NUTS EACH, FLUOROCARBON COATED, (FOR 2", ANSI 600, 8 PER SET)
13	6	EA	GASKET, 2", ANSI 600, RF, 1/8" THK, SPIRAL WOUND TEFLON, FLEXITALLIC, 304 STAINLESS STEEL, GRAPHITE FILLER, STYLE CGI, ASME B16.20
14	3	EA	WELDOLET, 2.375" O.D. X 0.154" W.T. BRANCH X 16.00" O.D. X 0.500" W.T. RUN, MSS SP-97
15	3	EA	VALVE, BALL, 2", ANSI 600 CLASS, RF X RF, FULL OPEN, NACE TRIM, API 6D, LEVER OPERATED
16	3	EA	SADDLE, WELD, 2.375" O.D. ON 16.00" O.D. W/ VENT HOLE, MSS SP-75 WPHY-60
17	3	EA	VALVE, GAUGE, 3/4" MNPT X (2) 1/2" FNPT, 6000 LB, 316 STAINLESS STEEL
18	1	EA	TDW PIG SIG V, ELECTRIC/INDICATOR PART NO. 04-3800-1001-51
19	3	EA	THREADOLET, 1.315" O.D. X 0.250" W.T. BRANCH X 16.00" O.D. X 0.500" W.T. RUN, MSS SP-97
20	2	EA	ELBOW, 1", 90°, THREADED, 3000LB, FS, ASME B16.11
21	1	EA	TEE, STRAIGHT, 1", THREADED, 3000LB, FS, ASME B16.11
22	2	EA	UNION, 1", THREADED, 3000LB, FS, ASME B16.11
23	3	EA	VALVE, 1", BALL, THREADED, BALL, ASME B16.34
24			

PRELIMINARY
NOT FOR CONSTRUCTION

REFERENCE DRAWINGS

BakkenLink®
BAKKENLINK PIPELINE LLC.

NO.	DATE	DESCRIPTION	DRAWN	CHK'D.	APPRV'D.
A	08/20/12	ISSUED FOR REVIEW	WRA	MRI	MRI

REVISIONS

BAKKENLINK PIPELINE
MAINLINE VALVE DOUBLE BLOCK
PLAN AND ELEVATION

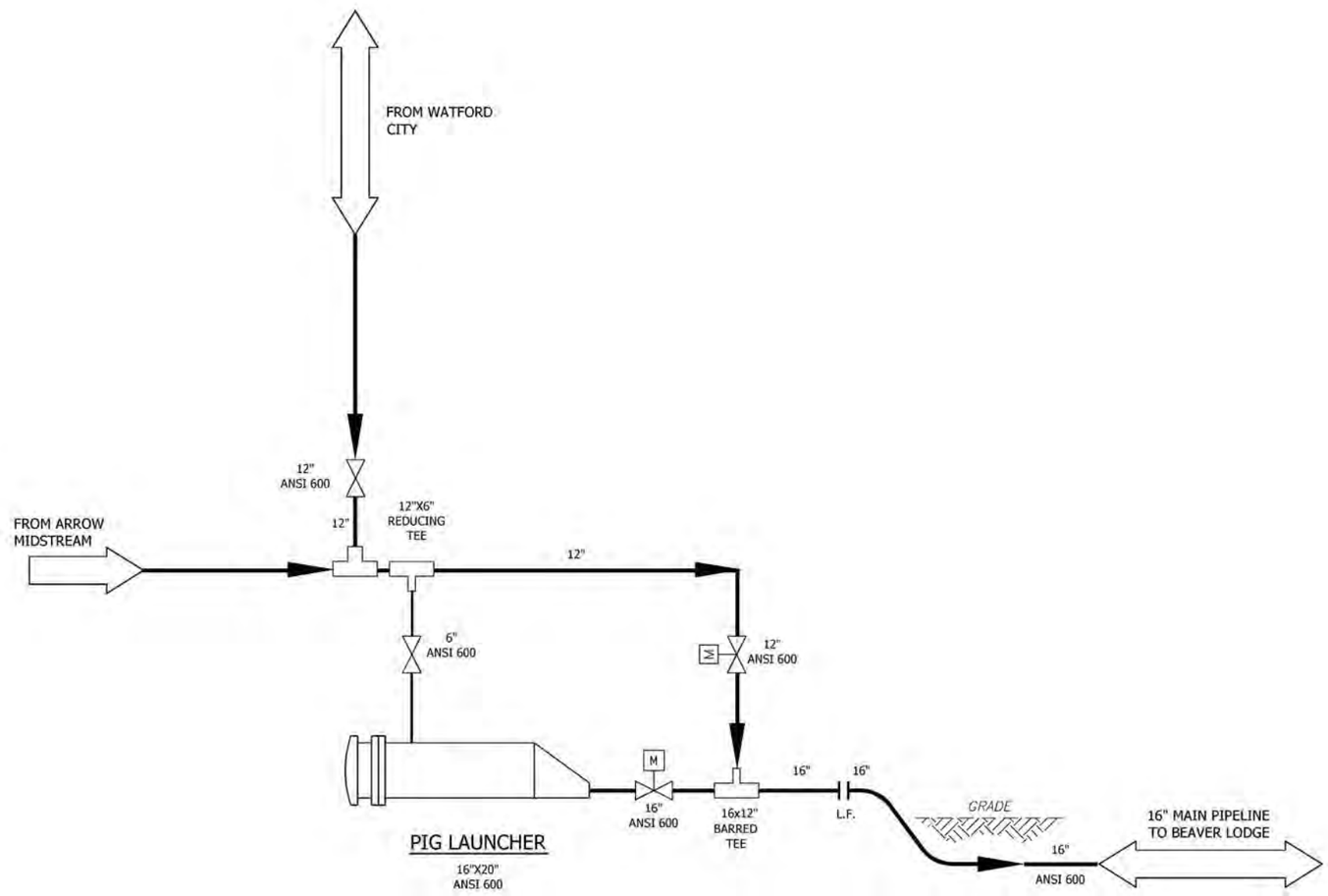
DRAWN BY:	WRA	APPROVED BY:	MRI
SCALE:		PROJ. ENGR.:	MRI
DATE:	08/15/14	PROJ. MGR.:	JD
CHECKED BY:	MRI	SHEET:	1 OF 1

DWG. NO.BL-ME-DBB REV. A

08-19-14 1:30:06 14003 03 WRA p:\bakkenlink\14003\working\mech\bl-me-dbb.dwg

Appendix VIII

Facility Typical and Preliminary Process Flow Diagram Schematics



DRY CREEK TERMINAL

PRELIMINARY
NOT FOR
CONSTRUCTION

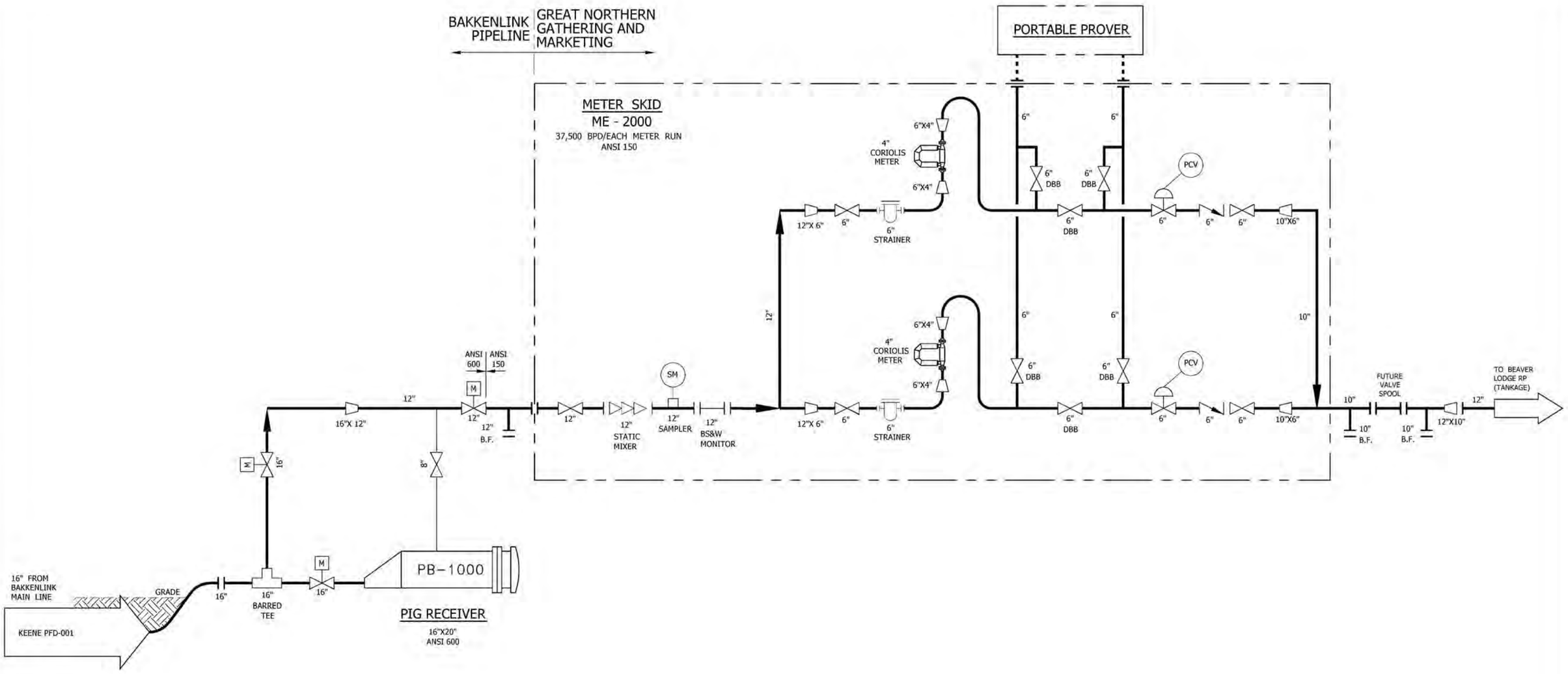
#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM DRY CREEK TERMINAL RECEIPT POINT AND INTERCONNECT

BARTLETT & WEST
3836 E CENTURY AVENUE · BISMARCK ND 58503
PHONE 701.258.1110 · FAX 701.258.1111
WWW.BARTWEST.COM

DESIGNED BY: .	PROJ NO: 16853.001	DRAWING NO: 1
DRAWN BY: .	CONST PROJ: ARROW MIDSTREAM PFD-001	
CHECKED BY: .	SCALE: AS NOTED	SHEET NO: XX OF XX
PROJECT ENGR: .	DATE: 2/7/2014	



PRELIMINARY
NOT FOR
CONSTRUCTION

#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM BEAVER LODGE RECEIPT POINT

BARTLETT & WEST
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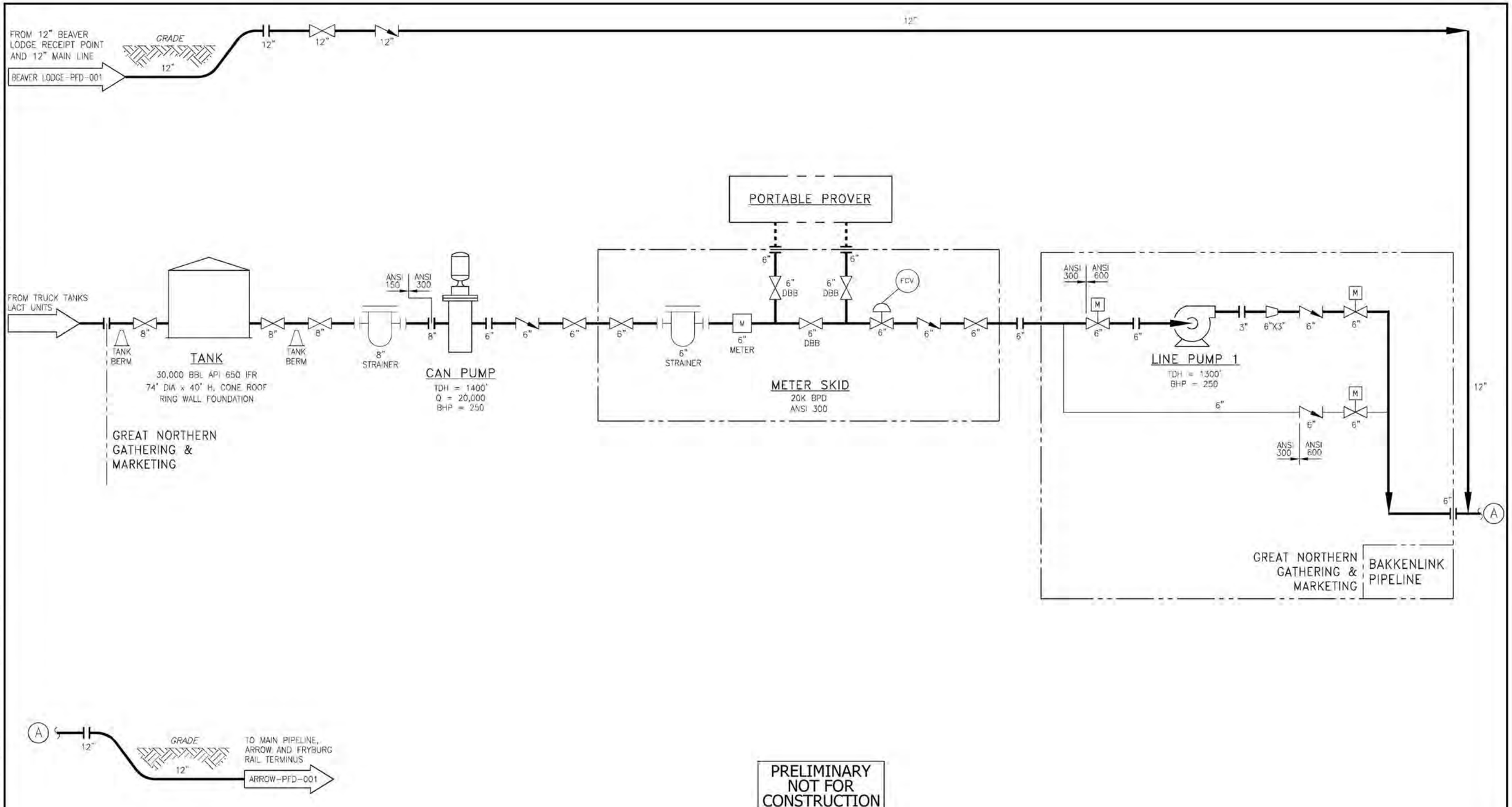
DRAWN BY: .	CONST PROJ: BEAVER LODGE-PFD-0001	
CHECKED BY: .	SCALE: AS NOTED	SHEET NO: XX OF XX
PROJECT ENGR: .	DATE: 2/7/2014	



PRELIMINARY
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CONSTRUCTION

#	DATE	REVISIONS	BY

GREAT NORTHERN GATHERING AND MARKETING

PROCESS FLOW DIAGRAM
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Appendix IX

Waterbody Crossings

Waterbody and Wetland Crossings
BakkenLink Pipeline
Dry Creek Terminal to Beaver Lodge

WATERBODY CROSSINGS									
Waterbody ID	County	Waterbody Name	Type[1]	Length[2]	Section	TWP	RNG	Crossing Method	Approx. MP
Mainline									
18150095-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	18	150	96	In survey corridor – does not cross	0.1
18150095-wb1	McKenzie	Unnamed tributary to Dry Creek	I	80	18	150	96	HDD	0.2
12150096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	30	12	150	96	Open Cut	1.2
01150096-wb1	McKenzie	Unnamed tributary to Dry Creek (stock dam)	I	210	1	150	96	HDD	2.6
01150096-wb2	McKenzie	Unnamed tributary to Dry Creek	I	120	1	150	96	Open Cut	3.0
36151096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	36	151	96	In survey corridor – does not cross	3.9
36151096-wb1	McKenzie	Unnamed tributary to Dry Creek	I	0	36	151	96	In survey corridor – does not cross	3.8
12151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	55	12	151	96	Open Cut	8.4
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	185	1	151	96	Open Cut	8.7
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	170	1	151	96	Open Cut	8.9
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	170	1	151	96	Open Cut	9.0
01151096-wb1	McKenzie	Unnamed tributary to Clear Creek	I	230	1	151	96	Open Cut	9.1
36152096-wb2	McKenzie	North Branch Clear Creek	I	20	36	152	96	Open Cut	10.4
25152096-wb1	McKenzie	Unnamed tributary to Clear Creek (stock dam)	I	175	25	152	96	HDD	11.4
13152096-wb1	McKenzie	Unnamed tributary to Sand Creek	I	35	13	152	96	Open Cut	13.4
33153095-wb1	McKenzie	Unnamed tributary to Sand Creek	I	0	33	153	95	In survey corridor – does not cross	16.0

WATERBODY CROSSINGS									
Waterbody ID	County	Waterbody Name	Type[1]	Length[2]	Section	TWP	RNG	Crossing Method	Approx. MP
Mainline									
33153095-wb3	McKenzie	Sand Creek	I	0	33	153	95	In survey corridor – does not cross	16.7
28153095-wb1	McKenzie	Sand Creek	I	114	28	153	95	HDD	16.8
09153095-wb1	McKenzie	Unnamed Tributary to Lake Sakakawea	I	10	9	153	95	HDD	20.9
	Mckenzie, Williams	Missouri River/Lake Sakakawea	P	12,100	21,27,28, 34	154	95	Trench/ Pull	23.2
09154095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	35	9	154	95	HDD	27.2
04154095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	80	4	154	95	Open Cut	28.2
21155095-wb1	Williams	Dry Fork Creek	I	30	21	155	95	Open Cut	32.1
20155095-wb2	Williams	Unnamed tributary to Dry Fork Creek	I	20	20	155	95	HDD	32.7
17155095-wb2	Williams	Unnamed tributary to Dry Fork Creek	I	172	17	155	95	HDD	33.7
17155095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	190	17	155	95	HDD	34.3
31156095-wb1	Williams	Unnamed tributary to Dry Fork Creek	I	60	31	156	95	HDD	36.8
Access Roads									
36152096-wb3	McKenzie	Unnamed tributary to North Branch Clear Creek	I	25	36	152	96	Mat	
36152096-wb4	McKenzie	North Branch Clear Creek	I	20	36	152	96	Mat	
27155095-wb1	Williams	Unnamed tributary to Alkali Creek	I	30	27	155	95	Mat	
33153095-wb2	McKenzie	Unnamed tributary to Sand Creek	I	45	33	153	95	Open Cut	16.5

[1]Where I is Intermittent and P is perennial

[2]Where Length is in feet

WETLAND CROSSINGS								
Wetland ID	County	National Wetland Inventory Classification Code	Acres	Section	TWP	RNG	Crossing Method	Approx. MP
Mainline								
25151096-w1	McKenzie	NA	0.14	25	151	96	HDD	5.4
13151096-w1	McKenzie	NA	0.19	13	151	96	Open Cut	7.4
36152096-w1	McKenzie	NA	0.10	36	152	96	In survey corridor – does not cross	10.2
12152096-w1	McKenzie	PEMA	0.16	12	152	96	Open Cut	14.1
12152096-w2	McKenzie	PEMA	1.17	12	152	96	Open Cut	14.4
01152096-w1	McKenzie	PEMAd	0.06	1	152	96	Open Cut	14.9
28153095-w1	McKenzie	PEMA	1.89	28	153	95	HDD	17.0
28153095-w1	McKenzie	PEMA	1.89	28	153	95	Open Cut	17.0
28153095-w2	McKenzie	NA	0.39	28	153	95	Open Cut	17.6
22153095-w1	McKenzie	PEMC	1.40	22	153	95	HDD	18.7
22153095-w2	McKenzie	PEMC	0.16	22	153	95	In survey corridor – does not cross	19.1
15153095-w1	McKenzie	PEMA	0.29	15	153	95	Open Cut	19.5
04153095-w1	McKenzie	PEMC	0.02	4	153	95	Open Cut	21.9
04153095-w2	McKenzie	PEMC	0.05	4	153	95	In survey corridor – does not cross	21.9
16154095-w1	Williams	PEMC	1.30	16	154	95	Open Cut	26.6
09154095-w1	Williams	PEMC	0.07	9	154	95	Open Cut	27.5
20155095-w1	Williams	NA	0.02	20	155	95	NA	33.0
17155095-w2	Williams	NA	0.27	17	155	95	HDD	33.7
17155095-w1	Williams	NA	0.52	17	155	95	HDD	34.3
Beaver Lodge Receipt Point								
31156095-w1	Williams	NA	0.06	31	156	95	In survey corridor – does not cross	

Appendix X

Lake Sakakawea Crossing

A) Addendum
B) Lake Sakakawea Crossing - Report, Methodology, Maps, Soil Report, CWC Protection, Equipment Lowering (Sections A-F)
C) Lake Sakakawea Crossing – HDD Crossing Report
D) Lake Sakakawea Crossing – BakkenLink USACE Shallow Bore Hole Location
E) Lake Sakakawea Crossing – Work Plan
F) Lake Sakakawea Crossing – Design Basis

BakkenLink

Addendum to Lake Sakakawea Crossing Reports:

"Lake Sakakawea Pipeline Crossing Report – BakkenLink Pipeline Project Western North Dakota" Revision 2 – November 14, 2011

"Lake Sakakawea Pipeline Crossing Report - Construction Methodology Evaluation Horizontal Directional Drilling" – March 1, 2012

Summary of Addendum:

The United States Bureau of Land Management (BLM) prepared an Environmental Assessment (EA) that analyzed the environmental effects of the BakkenLink Pipeline. Phase I of the BakkenLink pipeline project (from the Johnson's Corner area to the Fryburg Rail Terminal exclusive of the Lake Sakakawea crossing) was issued a Finding of No Significant Impact (FONSI) by the BLM on October 22, 2012. A crossing of Lake Sakakawea was not included as part of the FONSI. BakkenLink now wishes to pursue approval of that portion of the Project.

The crossing of Lake Sakakawea is an integral part of the Project as it will provide Bakken oil producers in portions of McKenzie and Williams Counties, North Dakota, with pipeline access to additional export options both north and south of the lake. The pipeline will reduce the amount of crude being transported by trucks on both sides of the lake. As detailed in the Lake Sakakawea Crossing Report dated November 14, 2011, and submitted with the Environmental Assessment's Plan of Development, BakkenLink is proposing to cross the Lake employing a conventional pipe pull method.

BakkenLink has sought consultation with the relevant federal agencies over the past years to collaborate on the preferred crossing location and methodology of Lake Sakakawea.

As part of the NEPA process during agency consultation, BakkenLink was requested to provide a detailed feasibility report of the Horizontal Directional Drill (HDD) method of crossing Lake Sakakawea, supported by empirical geotechnical data. Subsequent to this request, BakkenLink engaged Braun Intertec Corporation (Braun) to conduct a geotechnical evaluation consisting of nine (9) bore hole locations with depths up to 300 feet. The cores were strategically located to investigate the subsurface conditions of Lake Sakakawea and provide sufficient data to evaluate the feasibility of the HDD installation. BakkenLink also contracted Laney Directional Drilling (Laney) to analyze the geotechnical data and professionally evaluate the feasibility of an HDD crossing of Lake Sakakawea. Laney has 24 years of experience and has successfully constructed HDD installation of steel pipelines with diameters from 4 to 54 –inches, and lengths ranging from 300 to 11,000 feet. Laney is considered experts in the field of HDD concept, engineering, design and installation.

The Lake Sakakawea HDD Feasibility Report (Report) produced by Laney describes the findings from the geotechnical acquisition program conducted in the Fall of 2012 and its relevance to the feasibility of crossing Lake Sakakawea utilizing the HDD method. The Report analyses the expected crossing using the geotechnical report and more specifically the detailed laboratory evaluations of the nine (9) cores acquired by the geotechnical engineer Braun. The Report reviews various HDD installation options and in all cases finds that a HDD crossing solution is not technically feasible. The factors negatively impacting feasibility include subsurface conditions that do not support a drilling operation combined with the challenges associated with the length of the crossing. Additionally, the terrain on either side of the proposed HDD location prevents fabrication of a single pipe string for pulling through the completed HDD hole. Laney concludes that there is less than a 10% chance of a successful HDD installation across Lake Sakakawea. Laney follows this assessment with a recommendation for BakkenLink to develop an alternative crossing construction methodology.

Based on the determination and findings of the Laney Report, BakkenLink proposes the more conventional and proven pipe pull method that was previously detailed in the Lake Sakakawea Crossing Report dated November 14, 2011 submission. The pipe pull method is the most reasonable method of crossing the Lake with implementable mitigation measures to address regulatory agencies' concerns. BakkenLink would like to consult with the agencies to determine the recommended mitigation measures that will be developed, engineered, and employed during the installation of the pipeline using the pipe pull method.

As part of the project development and progression of the engineering design, The "Lake Sakakawea Pipeline Crossing Proposed Work Plan" – October 6,2015 and the "Design Basis Memorandum – Lake Sakakawea Crossing Pipeline Segment" - September 30, 2015 have been developed to provide additional detail to the engineering design parameters and the proposed installation plan. Both the Design Basis Memorandum and the Work Plan builds on the information in the previously developed reports and supercedes the previously submitted plans. Additional evaluation on the Concrete Weight Coating system has been performed and is represented in Append C to the Design Basis Memorandum.

The scope of the project for which the Supplemental Environmental Assessment is being performed has been revised as follows:

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline (Project) consisting of approximately 37 miles of 16-inch steel crude oil pipeline extending from the Beaver Lodge receipt point in Williams County, North Dakota to the Dry Creek Terminal in McKenzie County, North Dakota. The interconnect to the Dry Creek Terminal will establish a connection with the existing BakkenLink Pipeline that is transporting crude oil to a rail facility operated by Great Northern Midstream LLC at Fryburg, North Dakota. BakkenLink is developing and intends to construct, own, and operate the Project.

The Project will address anticipated regional pipeline and outlet constraints due to increased development of the Bakken formation. With outlets via the Fryburg Rail Facility and Beaver Lodge, BakkenLink will immediately reduce crude oil truck hauling distances. Over the longer term, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The proposed project is designed to initially carry up to 100,000 barrels per day (BPD) and would transport crude oil from three proposed receipt points, including one existing and two new proposed crude oil truck receipt locations and pipeline gathering receipt stations.

The Project will consist of the following assets:

- Approximately 37 miles of bi-directional 16-inch steel pipeline that would transport crude oil between Beaver Lodge Receipt Point on the north end of the system and the Dry Creek Terminal on the south end.
- There are three receipt points associated with the Project:
    - Beaver Lodge Receipt Point, Williams County (Proposed)
    - Keene Receipt Point, McKenzie County (Proposed)
    - Dry Creek Terminal, McKenzie County (Existing)

Project Schedule

The commencement of construction activities is dependent upon permitting, ROW acquisition, and other development activities. The anticipated in-service date for the Lake Sakakawea portion of the Project is Q3/Q4 2016. The anticipated in-service date for the Dry Creek Terminal to Beaver Lodge portion of the Project is Q3/Q4 2016. BakkenLink proposes to develop the Project on the following schedule:

Project Milestone (timing subject to permit approvals)	Completion Date
Engineering and Design (Lake Sakakawea)	November 2011
Construction Complete Phase 1 (Fryburg to Dry Creek Terminal)	August 2013
Commissioning Phase 1 (Fryburg to Dry Creek Terminal)	September 2013
In-Service Phase 1 (Fryburg to Dry Creek Terminal)	September 2013
Engineering and Design Phase 2 (Dry Creek Terminal to Beaver Lodge)	Q4 2015
Construction/Environmental Permitting Phase 2 (Dry Creek Terminal to Beaver Lodge)	Q4 2015
ROW Land Acquisition Phase 2 (Dry Creek Terminal to Beaver Lodge)	Q3 2015
Start Construction (Lake Sakakawea)	Once Permits received (pending timing stipulations)
Construction Complete (Lake Sakakawea)	Q4 2016
Start Construction Phase 2 (Dry Creek Terminal to Beaver Lodge)	Once Permits received (pending timing stipulations)
Construction Complete Phase 2 (Dry Creek Terminal to Beaver Lodge)	Q3 2016
Commissioning Phase 2 (Dry Creek Terminal to Beaver Lodge)	Q3/Q4 2016
In-Service Phase 2	Q3/Q4 2016

The findings of the subject reports issued relative to the Lake Sakakawea Crossing are still relevant for the revised scope as described above.

Additionally, many agency consultations have occurred since the previously documented meetings in the "Lake Sakakawea Pipeline Crossing Report – BakkenLink Pipeline Project Western North Dakota" Revision 2 – November 14, 2011.

- March , 2013 – USACE Riverdale interagency meeting – Meeting held in the USACE office in Riverdale; Agencies represented: USFWS, USACE, BLM, North Dakota Department of Health, and North Dakota Game and Fish
    - Presentation of the geotechnical evaluation of the soil borings taken across Lake Sakakawea and the Horizontal Directional Drilling evaluation.
    - The Geotechnical evaluation of the subsurface conditions along the proposed route across the Lake does not support a successful HDD across the Lake Sakakawea.

- November 2013 – USACE-Omaha interagency meeting – Meeting held in the USACE office in Omaha:
    - Follow up with USACE Engineering division with findings of Geotechnical evaluation discussed in March 22nd interagency meeting and the resulting HDD Feasibility report.
    - Findings were discussed with USACE Subject Matter Experts.
    - USACE included as consulting agency for Supplemental Environmental Assessment for Phase 2 of the Project.

- January 2014 – USACE-Bismarck interagency meeting – Meeting held in the USACE office in Bismarck
    - Discussed Supplemental Environmental Assessment status of Phase 2 of the Project with USFWS, USACE, and BLM
- May 2014 - USACE letter concurring that an HDD was not a feasible option to cross Lake Sakakawea.
- July 2014 - Meeting in Riverdale with BLM, Corps, and BakkenLink.
- July 2014 - EC 1165-2-216 is issued
- August 2014 - Communication between BakkenLink and Corps related to new EC. USACE directs BLM to have BakkenLink submit application for Section 408 review.
- October 2014 - BakkenLinkpl Section 408 application sent to USACE
- October 31, 2014 - The USACE, USFS, and USFWS are provided a copy of the BLMview.r
- December 5, 2014 - The USACE provides 161 comments on the PDEA to BLM
- January 9, 2015 - BLM provides responses to USACE PDEA comments
- March 2015 - BakkenLink submits application for Section 404 Authorization to USACE
- May 4, 2015 - Meeting in Omaha to discuss information needs for Section 408 review
- June 9, 2015 - USACE Regulatory staff issues 30-day Public Notice on the Project
- June 26, 2015 - 401 Water Quality Certification received from ND Dept of Health
- June 26, 2015 - Funds for Section 408 review identified
- July 14, 2015 – USACE Regulatory staff forwards on comment letters
- August 2015 – Meeting with USACE Omaha and Riverdale Offices
- September 2015 - Meeting with USACE Omaha and Riverdale to review USACE comments to the EA documents.

List of Significant Work Plan Changes

03/18/2015 to 10/06/2015

The following list defines High-Level changes that have been inserted into the Lake Sakakawea Work Plan

1. Section 1 – Project Overview

1.1. No significant changes required to align with project design.

2. Section 2 – Construction Overview

2.1. Added details for avoidance of impact to North Shore cultural resources buffer boundary.

2.2. Added details of shoreline crossing trench excavation, using backhoe or crane on flexifloats to supplement onshore excavator trenching operation.

2.3. Clarified details that pipeline lowering within Lake Sakakawea will be accomplished:

2.3.1. With either new-build lowering sled (LS) or modification to existing equipment;

2.3.2. With turbidity-reduction mat details of which are further clarified in Section 7.4.

2.4. Described ancillary equipment to be placed on the Surface Support Vessel (SSV).

2.5. Added details to address turbidity mitigation during lowering operations.

2.6. Added details to resolve questions regarding application of corrosion protection coating (FBE) and pipeline protection coating (CWC) onto the 16" pipeline to be installed within Lake Sakakawea. Results of engineering analyses resolving the acceptability of the proposed design protecting the pipeline are included in the Design Basis Memorandum.

2.7. Added details to resolve questions regarding pipeline protection from wave action and ice effects at shoreline crossings with details provided on drawings contained in Section 8.

2.8. Added Tables – Lake Sakakawea Crossing Impact to USACE Lands (results in Table 1, bases of calculations in Table 2).

2.9. Added details for placement of the shoreline crossing pipeline protection system, including:

2.9.1. Added details for backfill of shoreline crossing trenches.

2.9.2. Added details for placement of riprap or cable-tied concrete mats.

2.10. Added details for north shore restoration provided in drawings contained in Section 8.

3. Section 3 – Construction Schedule

3.1. Update completion dates to align with current status.

4. Section 4 – Schedule restrictions for this area

4.1. Update completion dates to align with current status.

5. Section 5 – Construction Plan Sequence

5.1. Section 5.1.1 – Added details regarding identification of existing foreign pipelines/utilities at the Work sites.

5.2. Section 5.1.3 – Added task for safety and environmental orientation of all construction crews prior to commencement of Work.

5.3. Section 5.1.4 – Restated BakkenLink intention to inspect all vessels for weeds and aquatic nuisance species (ANS) prior to launching into Lake Sakakawea.

5.4. Section 5.1.5 – Restated BakkenLink intention that Contractor crews will participate in Job Safety Analysis (JSA) meetings prior to commencement of any new task described within this section

5.5. Section 5.1.7 and 5.1.8 – Added details for pipe stringing equipment set-up on North Shore.

5.6. Section 5.2.1 through 5.2.3 – Clarified repetition of North shore tasks for site set-up on the south shore.

5.7. Section 5.3 – Clarified methodology and descriptions to define excavation of the shoreline crossing trenches between elevation 1860 feet NAVD and 1820 feet NAVD where the pipeline will be protected with the previously described pipeline protection system.

5.8. Section 5.5 – Added new section with details for conducting pre-installation survey of the Lake Bed. Note that this will be the first of four route surveys.

5.9. Section 5.6 – Clarified details of installing pipeline pulling cable.

5.10. Section 5.7 – Clarified details of the pipe pull operation.

5.11. Section 5.8 – Added new section to resolve questions regarding tie-in of the Lake Crossing section of the system with adjacent onshore sections.

5.12. Section 5.9 – Added details to resolve questions regarding running gauging plate through the Lake Crossing section of the system.

5.13. Section 5.10 – Added details to clarify methodology for conducting As-Installed survey of the pipeline. This is the second of four surveys of the route.

5.14. Section 5.11 – Added details to clarify methodology during operations with the lowering sled, including use of the sled to tie the Lake lowering task into the trench excavated for the shoreline crossing pipeline protection trenches.

5.15. Section 5.12 – Added details to clarify methodology for conducting As-lowered survey of the pipeline. This is the third of four surveys of the route.

5.16. Section 5.13 – Added details to clarify supplemental lowering methods. Also see photo in Figure 33.

5.17. Section 5.14 - Added details to clarify methodology for conducting As-Built survey of the pipeline. This is the third of four surveys of the route.

5.18. Section 5.15 – Added statement to clarify results of the As-Built survey will be used during consultation with USACE and other agencies. .

5.19. Section 5.16 – Added details to shore crossing restoration and confirmed shoreline crossing pipeline protection system will be tied-in with onshore restoration. .

5.20. Section 5.17 – Added details to resolve discussion regarding maximum operating pressure vs. hydrostatic test pressure – the system will by hydrostatically pressure tested to 1.25 maximum operating pressure (MOP) in accordance with 49 CFR, Part 195.

6. Section 6 – Quality Assurance / Quality Control

6.1. Added details to clarify the QA/QC processes to be followed during construction.

7. Section 7 – Construction Plan Sequence

7.1. Section 7.1 – Overview Map

7.1.1. Figure 4 – provided updated overview map of BakkenLink North Pipeline Project system.

7.2. Section 7.2 – Work Flow Chart

7.2.1. Figure 5 – Inserted new chart to resolve questions regarding construction sequence decision matrix. .

7.3. Section 7.3 – Workspace Details and Impacts to USACE Lands

7.3.1. Figures 6 through 8 – Provided updated work space drawings, which provide locations of points referenced in Table 1 and Table 2. .

7.4. Section 7.4 – Lowering System

7.4.1. Figures 11 and 11 – Inserted new sketches to clarify intentions of the lowering sled turbidity mat. .

7.4.2. Figure 13 – Inserted new photo of existing pipeline lowering device.

7.5. Section 7.5 – Lake Crossing Sequence Sketches

7.5.1. Figures 14 through 19 – Inserted new sketches to provided further clarity to Section 5 – Construction Plan Sequence.

7.6. Section 7.6 – Typical Pipeline Construction Photographs

7.6.1. Figures 26 through 29 – Inserted new photos to clarify understanding of marine-based pipeline pulls.

7.6.2. Figure 30 – Inserted new photo of corrosion coating (FBE) and pipeline protection (CWC) on typical joint of pipe.

7.6.3. Figure 32 – Inserted new photo of rock grapple bucket.

7.6.4. Figure 33 – Inserted new photo of diver hand jet.

7.6.5. Figure 34 – Inserted new sketch of typical construction exclusion fencing to clarify BakkenLink intention for delineating north shore cultural resource buffer zone.

7.7. Section 7.7 – North Shore Archaeological Monitoring Location Map

7.7.1. No change.

7.8. Section 7.8 – Pipe Pull Method Historical Projects List

7.8.1. No change.

8. Section 8 – Preliminary Drawings

8.1. Drawing BL-BLN-CV-001 – Rev D – North Shore Grading – New drawing to provide details of north shore restoration plan.

8.2. Drawing BL-BLN-CV-002 – Rev C – Profile Sheet, Section A-A – New drawing to provide details of north shore restoration plan.

8.3. Drawing BL-BLN-CV-003 – Rev A – Pipe Protection Details – New drawing to provide details of the pipeline protection system. This drawing provides details that supersede those provided in the previous (03/15/2015) iteration of the work plan.

8.4. Drawing BL-BLN-ME-001 – Rev 0 - BakkenLink North Pipeline, Mainline Valve #1, Plan & Elevation – provides revisions to the previously-submitted MLV drawing.

8.5. Drawing BL-BLN-ME-002 – Rev 0 - BakkenLink North Pipeline, Mainline Valve #2, Plan & Elevation - provides revisions to the previously-submitted MLV drawing.

LAKE SAKAKAWEA PIPELINE CROSSING REPORT

BakkenLink Pipeline Project
Western North Dakota

BakkenLink Pipeline, LLC

REGISTERED PROFESSIONAL ENGINEER
MICHAEL R. ISTRE
PE-6807
DATE 11/15/11
NORTH DAKOTA

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1. Project Description

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline (Project) to provide much-needed capacity to transport the increasing supplies of crude oil produced from the Bakken oil play. The pipeline will consist of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from Beaver Lodge, North Dakota to a proposed crude oil rail loading facility located near Fryburg, North Dakota (Rail Facility). Additional initial outlets being considered include third party interconnects in the Beaver Lodge/Ramburg area south of Tioga, North Dakota

The Project will address anticipated regional pipeline and outlet constraints due to increased development of the Bakken formation. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will immediately reduce crude oil truck hauling distances. Over the longer term, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

The crossing of Lake Sakakawea is an integral part of the Project as it will provide Bakken oil producers in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, with pipeline access to additional export options both north and south of the lake. It will reduce the amount of crude being transported by trucks on both sides of the lake.

Several meetings have been held with the relevant federal agencies over the past eleven months to collaborate on the preferred crossing location.

This report describes selection of the selected crossing location, the studies performed to date at the site, and the evaluation of various construction methodologies. Also the report includes case study discussion and relevant marine experience of the engineering and construction contractor.

2. Description of Proposed Project

The proposed Project is a crude oil pipeline system consisting of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from multiple receipt points in Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota, to an interconnect with a new Rail Facility at Fryburg, North Dakota. The trunkline will have bi-directional capability, and will be able to transport crude oil to/from the Rail Facility and Beaver Lodge. BakkenLink is developing and intends to construct, own and operate the pipeline. Another entity is developing the Rail Facility.

The proposed Project will provide much-needed pipeline capacity to transport the increasing supplies of crude oil produced in portions of Billings, Dunn, McKenzie, Stark and Williams Counties, North Dakota. The system will only accept for transport light sweet crude, typical of production from Bakken formation in North Dakota.

The Project will be designed, constructed, and operated in compliance with applicable portions of the United States Department of Transportation (USDOT) regulations as set forth in 49 CFR Code of Federal Regulations (CFR) Part 195, Transportation of Hazardous Liquids by Pipeline. These regulations encompass general requirements, accident reporting and safety related condition reporting, design requirements, construction, pressure testing, operation and maintenance, qualification of pipeline personnel, and corrosion control. Relevant industry standards are incorporated into these regulations by

reference, including those of the American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), and the American Standard for Testing and Materials (ASTM) and others.

The proposed trunkline is designed to initially carry up to 65,000 barrels per day (BPD) and will have expansion capabilities.

The Project will consist of the following assets:

- Approximately 122 miles of 12-inch steel trunkline for the transportation of crude oil originating from, initially, up to six proposed receipt points including existing and proposed crude oil truck receipt locations and pipeline gathering receipt stations. This trunkline will be bi-directional and will transport crude oil to/from the Rail Facility and Beaver Lodge.
- Approximately 18 miles of 8-inch steel lateral from the Dunn Receipt Point, which will deliver into the trunk line approximately 30 miles north of Belfield.
- Approximately 4 miles of 8-inch steel lateral from the Belfield Receipt Point, which will deliver into the trunk line just north of Belfield.
- Initially, six receipt points will be constructed for input of product. The receipt points will be located at:
    - Beaver Lodge Receipt Point, Williams County
    - Keene Receipt Point, McKenzie County
    - Arrow Midstream Receipt Point, McKenzie County
    - Watford City Receipt Point, McKenzie County
    - Dunn Receipt Point, Dunn County
    - Belfield Receipt Point, Stark County

The Project will be located in the following North Dakota counties: Billings, Dunn, McKenzie, Stark and Williams. Maps depicting the Project location are provided in Appendix 9.2.

BakkenLink anticipates receiving necessary pre-construction permits and approvals, acquiring the necessary right-of-way (ROW), and finalizing other agreements no later than April 2012. The commencement of construction activities is dependent upon permitting, ROW acquisition, and other development activities. The anticipated in-service date for the Arrow to Belfield portion of the Project is September 2012. The anticipated in-service date for the Beaver Lodge to Arrow portion of the Project is December 2012. BakkenLink proposes to develop the Project on the following schedule:

Project Milestone	Completion Date
Certificate of Corridor Compatibility and Route Permit	November 2011
Engineering and Design	November 2011
Construction/Environmental Permitting	March 2012
ROW Land Acquisition	April 2012
Start Construction	April 2012
Construction Complete (Arrow to Belfield)	September 2012
Commissioning (Arrow to Belfield)	September-October 2012
In Service (Arrow to Belfield)	October 2012
Construction Complete (Beaver Lodge to Belfield)	November 2012
Commissioning (Beaver Lodge to Arrow)	November-December 2012
In Service (Beaver Lodge to Arrow)	December 2012

In the future, additional receipt points may be developed, as well as outlet connections with third party pipelines, including potentially the Enbridge North Dakota pipeline system, the Tesoro High Plains Pipeline system, the Bridger Pipeline system, and if approved and it moves to construction, the Keystone XL Pipeline system. An extension of the Project to an interconnect with TransCanada's Marketlink and Keystone XL Pipeline system projects is currently being assessed by BakkenLink.

3. Need for Facility

The Project will address anticipated regional pipeline and outlet constraints as development of the Bakken formation continues. With the initial outlets via the Rail Facility and Beaver Lodge, BakkenLink will provide a number of producers in western North Dakota with a much needed alternative means of transporting their crude oil. Additionally, the strategic position of the Project will encourage the development of pipeline gathering laterals and receipt points and outlet connections with third party pipelines.

Over the last five years, development of the middle Bakken and upper Three Forks formations has steadily increased in North Dakota. Technological advancements in horizontal drilling and fracture stimulation have made recovering the oil in these formations economically feasible. Favorable oil prices have further accelerated this development.

An initial study by the United States Geological Survey (USGS) released in 2008 claimed stated that the middle Bakken had 4 billion barrels of recoverable oil in the Williston Basin. The latest official estimate from the North Dakota Industrial Commission (NDIC) is that up to 11 billion barrels may be recoverable from the middle Bakken and upper Three Forks formation in North Dakota. Continental Resources, Inc., a leading Bakken producer, has indicated that at current economics and with current technology the Bakken and Three Forks has 24 billion barrels of recoverable oil. As technological advances continue, even these higher estimates may be exceeded.

Production is forecasted to grow in North Dakota from a record 444,000 BPD in August 2011 to up to and in excess of 1,000,000 BPD over the next five years. During August 2011, there were approximately 192 rigs drilling for oil in North Dakota. According to the NDIC, over 95% of drilling is targeting the middle Bakken and upper Three Forks formations. It is expected that the rig count could rise above 200 rigs during 2012.

This Project will provide an environmentally sensitive method of transporting crude oil from the heart of the Bakken play, greatly benefiting producers, landowners, citizens in the State of North Dakota, local municipalities, and mineral interest owners.

4. Lake Crossing Information

4.1. Routing Selection Process

BakkenLink evaluated several options for the proposed Project route. Each option was considered with respect to regional access to markets, economics, engineering design, construction feasibility, and environmental impacts. Efforts were coordinated with the regional US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), and US Fish & Wildlife Service (USFWS) offices. The location of the proposed route was selected to have minimal effects on resources and residents while maintaining a strong positive impact for the region.

The route design for the Project will provide multiple origination points (Receipt Points) in the most prolific

and active parts of the middle Bakken and upper Three Forks development in addition to opening up new areas that are not currently accessible to pipeline service, especially between Johnson's Corner and Watford City and between Watford City and Belfield. The planned 12-inch trunkline allows for economic expansion opportunities that are supported by the proprietary catchment study, including the original oil in place estimates.

Key routing considerations included:

- Location and number of receipt points in relation to existing and proposed oil field production facilities;
- The crossing of the Missouri River at Lake Sakakawea;
- The pipeline route across the Little Missouri National Grasslands (LMNG).

The Lake Sakakawea crossing is a key logistical consideration. Several crossing locations were evaluated during preliminary design and planning of the Project. The proposed route is a crossing north of Keene, ND. Another location given consideration, east of Williston, was approximately 10 miles west of the proposed location and provided a more favorable approach to the lake shoreline. The total crossing length would have been reduced by nearly 4,000 feet compared to the proposed route; making the use of HDD technology more feasible. Two other crossing locations were evaluated – at the Four Bears Bridge near New Town and another route near Williston. BakkenLink presented the different crossing location options for discussion at meetings with federal agencies on October 5, and December 9, 2010, and on February 8, 2011. In these meetings, the USACE identified the current crossing location as their preferred route due to the presence of existing pipelines at that location. Other entities in the region reportedly have also been exploring the same river crossing location and certain advantages exist for locating their pipeline adjacent to this route.

As a result of the aforementioned meetings, all other crossing locations were abandoned in favor of the proposed route north of Keene. A summary of the meeting minutes concerning lake crossing locations and methods is below in Section 4.3. Further information and meeting minutes can be provided upon request.

4.2. Pipelines and Facilities in the Vicinity

In the evaluation of the Lake Sakakawea approach, the following pipelines have been identified in the vicinity of the proposed BakkenLink Pipeline crossing:

Pipeline Owner	Outer Diameter of Pipe	Number of Pipelines	Construction Method	Product
Amerada Hess	8"	3	Open cut – 1950s	Gas
Amerada Hess	16"	1	Open cut – 1950s	Gas
Dakota Gassification Company		1	Open cut	Carbon Dioxide

During interagency discussions, the USACE noted that Amerada Hess has three 8" and one 16" lines across the Lake that that were installed in the 1950's. These pipelines predate the lake and were installed utilizing open cut trenching methods. The Dakota Gassification Company (DGC) pipeline, also installed using open cut techniques, was constructed when the lake water level was only 10 feet in the center of the Missouri River Thalweg (old river channel). The alignment of the proposed pipeline is approximately 200 feet away from the existing DGC pipeline.

4.3. Summary of Agency Meetings for Lake Crossing Site

- October 5, 2010 -- USACE/USFWS – Meeting held in USACE office in Riverdale
    - Notified by USACE-Riverdale that water depth at time of construction would be +/- 48 ft. Advised the agencies the water depth increase would change the recommended construction methodology.

- December 9, 2010 – USACE-Bismarck interagency meeting – Meeting held in USACE office in Bismarck
    - Presentation of crossing methodology at the proposed location. Assumed maximum water depth was +/- 20 ft. Proposed methodology was pre-trenching using backhoe/excavator on a floating platform. Jetting was discussed and expressed as not feasible due to limited water depth and desire to minimize turbidity.
    - USACE advised that Enbridge indicated findings that an HDD would be possible at a depth of 300 feet below surface due to pressure and soil conditions. BakkenLink related that HDD crossing of the lake would require a world record 14,000 LF drill using a "hand-shake" method, where the drill begins on both banks and meets in the middle. The USACE asked if another location would be more favorable and received the response that no locations within a reasonable distance would reduce the HDD length and risk. The proposed location was recommended because the existing corridor at this location would be favorable for the alternative trenching-based installation method.
    - Bucket dredging and jetting techniques were discussed but not ideal because of turbidity issues

- February 8, 2011 -- USACE-Bismarck, United States Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), US Forest Service (USFS) – Meeting held in USFWS office in Watford City
    - Discussed Lake Sakakawea pipeline crossing in general terms. Alternative crossing locations were discussed. USFS preference was western alternative to move the route off of Forest Service lands. After BakkenLink confirmed that other locations would not produce more favorable HDD conditions, USACE's preference was the current proposed location. USACE maintained its preference of an HDD crossing but was open to discussing alternative methods.
    - Construction methodology options were discussed including discussion of the favorability of the proposed location due to knowledge of the existing soil conditions in the corridor.

- September 20, 2011 -- North Dakota Department of Health Water Quality Division – Teleconference
    - Presentation of Push/Pull Crossing method of Lake. Discussions of turbidity control during construction operations. ND Dept. of Health communicated comfort level with proposed construction method and turbidity control relative to resuspension of soils and elutriate testing

4.4. Schedule Restrictions for this Area

As part of the project development the regulatory agencies have been consulted regarding temporal construction restrictions around Lake Sakakawea. The species of concern in and around the lake are Pallid Sturgeon and shoreline birds nesting along the banks of the lake. The USACE advised that the Pallid Sturgeon spawning period ended around June 15. Additionally, the shoreline avian species of concern nesting period ends around July 15. BakkenLink was advised to add a one month temporal buffer to address any concerns related to nesting and spawning activities. Therefore, the commencement of any construction activities around Lake Sakakawea was discouraged prior to August 15.

4.5. Description of Selected Crossing

The crossing location preferred by the USACE (see map, Appendix 9.2) is approximately 12,100 linear feet from shore to shore. At the time of the hydrographic survey, the maximum water depth was approximately 50 feet and the bottom substrate is characterized by one to two foot layer of fine silt and mud. The relic Thalweg of the Missouri River can be seen in the hydrographic survey data

A key aspect in the design of a pipeline is a thorough review of the protection of the asset with reference to operating conditions, potential third party interactions, and other circumstances or events that might impact the safety and operating ability of the pipeline. Each marine pipeline project is unique and requires specific design and construction efforts to ensure that the pipeline is installed and operated in a safe manner based on the location and marine traffic plying the waters in the immediate vicinity. For the Lake Sakakawea crossing, an assessment of the marine traffic determined that the weight of mooring systems is less than 40 pounds and will not damage or impact a bare, uncoated steel pipeline. Appendix 9.4 expands on this premise and refers to the results of a previous field test for a project crossing an active seaway. For the test, large anchors were deliberately dropped on a series of pipe joints (40 feet sections) ranging from bare pipe to pipe with 3 or more inches of concrete weight coating.

The conclusion that was reached after review of these test results was that the crossing pipeline was safe from damage in its original bare pipe state however, as additional protection, it was decided to increase the steel wall thickness by 20% and to apply a 2 to 3 inch concrete weight coating outer sheath for pipeline stabilization purposes as well as for additional protection. Burial of the pipeline will further serve the purposes of added protection and stabilization. The proposed burial depth is 3 feet to the top of the pipe for the lake crossing, as required by 49 CFR Part 195 regulations.

Based on these conditions, PCS is satisfied that with the pipeline, as designed and lowered with the top of pipe below the natural lake bed, will be adequately protected and safe for operation.

4.6. Studies

4.6.1. Hydrographic Surveys

The hydrographic and geophysical survey was performed by Chris Ransome and Associates (CRA) during the period May 18 to June 8, 2011. Prior to the mobilization of the CRA survey crew, the onshore survey team established the crossing centerline alignment on both sides of the lake and installed bench marks to ensure compatibility between the onshore and marine surveys (see figures on following pages).

The purpose of the high-resolution survey was to:

- Acquire bathymetric data
- Identify and map lake bed hazards to construction and debris
- Identify and locate adjacent existing foreign pipelines and identify and map possible environmental and cultural resources within the proposed pipeline corridor.

The survey scope of work included bathymetric, side scan sonar, shallow penetration sub-bottom profiler and magnetometer survey lines run along 50 foot spaced lines parallel to and along the proposed pipeline route and extending 250 feet to each side giving a total corridor width of 500 feet. Tie-lines surveyed perpendicular to the pipeline were run in both directions every 500 feet. Supplemental survey lines were also run in areas of special interest or geological complexity.

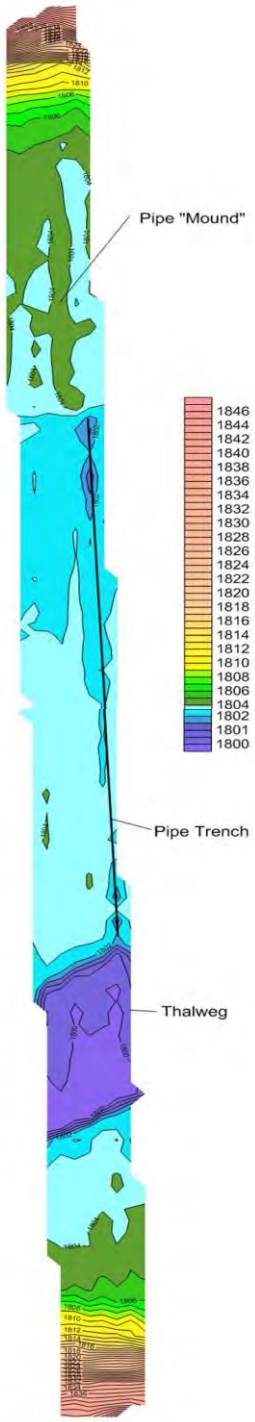
The results of the magnetometer and side-scan surveys did not reveal any significant objects on the lake bottom that could be a hazard to the construction of the proposed pipeline (see crossing bottom contours). The spoil side cast during the trenching of the adjacent Dakota Gasification (DGC) pipeline (when the depth of the lake was less than 20 feet) is evident on the northern side of the crossing but has naturally returned to the trench on the southern side of the lake. There is a 1 to 2 feet thick layer of fine silt and mud over most of the crossing deepening to over 2 feet in the Thalweg. The longitudinal profiles indicated that the original ground level is below this thin layer and contains a stiffer and more consolidated material than the first layer.

Bottom Contours

The lake bottom contours, based on the high frequency data, and produced in the program "Surfer", are shown in diagrammatic form in the graphic to the right. Overall, after the initial slopes from the current shoreline (elev. 1853.8 feet), the majority of the lake is extremely flat with elevations of between 1802 and 1804 feet. A slight change of slope appears about 500 feet from the northern shoreline, but the most prominent topographic feature is the Missouri River Thalweg, denoting the original river route prior to the flooding and creation of the lake. In the work area, the Thalweg runs in a southwest to northeast direction with respect to the shorelines, with bank elevations of 1803 feet and a bottom elevation approximately 3 feet deeper to 1800 feet. It is centered approximately 3300 feet from the southern shoreline.

Other features to note include the trench from the existing DGC pipeline on the east side of the proposed corridor, and, in some areas, the small mound which runs parallel to the pipeline trench and which has been interpreted as the material excavated from the lake bottom during past trenching. In each case where these features could be identified on the cross-lines, a central coordinate was picked to be plotted on the final plan view drawing as further evidence of the location of the existing pipeline. In addition, these cross-lines over the existing pipe show the depth of the trench, and, in many sections, the amount of infilling material now over the pipe (typically about 1.5 feet of very soft unconsolidated sediment).

Finally, when the images from the depth sounder records were imported into the CAD drawings, the reflectors beneath the lake bed revealed by the lower operational frequency were examined and compared with the same results from the sub-bottom profiler.

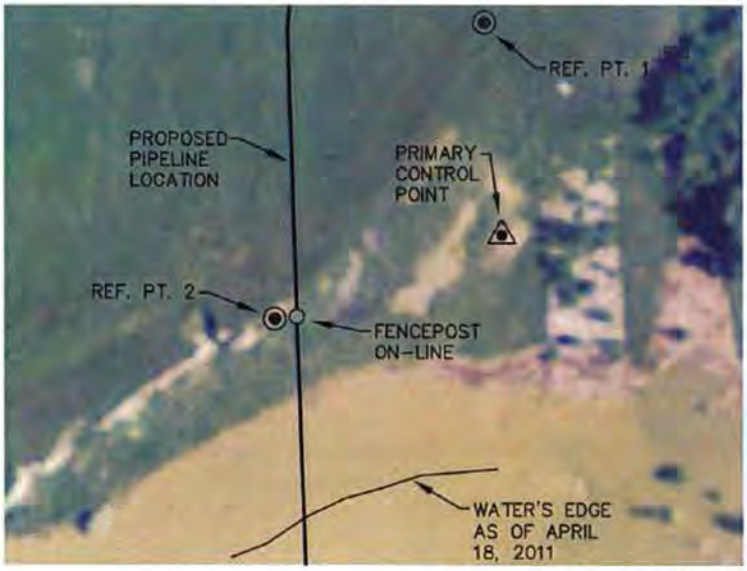


Bottom Contours

SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (NORTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



PRIMARY CONTROL POINT
N 429,077.92
E 1,384,273.98
EL 1860.34

REF. POINT 1
N 429,214.90
E 1,384,262.83
EL 1876.27

REF. POINT 2
N 429,024.26
E 1,384,127.15
EL 1875.25

FENCEPOST ON-LINE
N 429,025.62
E 1,384,141.43

GRAPHIC SCALE

100 0 50 100

(IN FEET)
1 inch = 100 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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This report was prepared by or under the direction of Bruce P. Zelmer, a Licensed Land Surveyor in and for the State of North Dakota.

Bruce P. Zelmer 5-6-11
Bruce P. Zelmer L.S. #3756 Date

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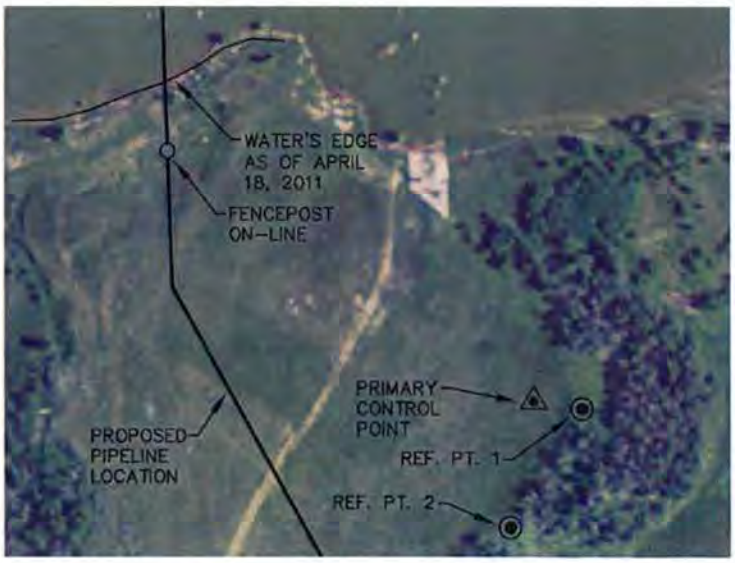
NORTH DAKOTA

SURVEY MARKER FOR BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING (SOUTH SIDE)

SITE PHOTO

VICINITY MAP
NO SCALE



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E 1,385,073.78
EL 1858.26

REF. POINT 1
N 416,221.40
E 1,385,137.50
EL 1858.03

REF. POINT 2
N 416,066.04
E 1,385,043.35
EL 1862.62

FENCEPOST ON-LINE
N 416,558.72
E 1,384,594.75

GRAPHIC SCALE

200 0 100 200

(IN FEET)
1 inch = 200 ft.

COORDINATE DATUM

The horizontal coordinates shown hereon are based on the North Dakota State Plane Coordinate System, North Zone (NAD83). The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88) using Geoid 09.

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Bruce P. Zelmer, L.S. #3756 Date

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4.6.2. Soil Investigation

Soil boring sites and spacing were determined in consultation with North Dakota Department of Health (NDDH). Six bores locations were chosen and were evenly spaced across the crossing location. Standard penetration test borings were performed from July 25 - 27, 2011, with a trailer mounted core and auger drill equipped with 3 1/4-inch, inside diameter hollow-stem auger to a depth of 10-feet below the lake bottom. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." The boreholes were advanced with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 2 feet below the tip of the hollow-stem auger. The blows for the middle foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 foot vertical intervals down to the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment was encountered in four of the six borings and appeared to consist of 1-foot of sediment classified as fat clay; however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the deposited sediment layer, alluvial soils were encountered having textures matching that of lean clay, silty sand, and poorly graded sand with silt and gravel. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency, and the granular portions were very loose to medium dense soils. The soils below the lake sediment were determined to adequately support the lowered pipeline or any supporting structure.

Additional information regarding the soils investigation and boring logs can be found in Appendix 9.3.

4.6.3. Water Quality Standards

The North Dakota Department of Health is a cooperating agency with the USACE to certify federal licenses and permits in accordance with Section 401 of the Federal Clean Water Act. Specifically, the NDDH will make a determination if the proposed construction will violate applicable standards of water quality (Standards of Quality for Waters of the State - North Dakota Administrative Code Section 33-16-02.1). The certification, if issued, will express the NDDH's opinion that the project will not result in a violation of applicable water quality standards. Although water quality certification is a prerequisite for issuance of a USACE permit, certification alone does not guarantee a permit will be issued for the project.

Consultation with the NDDH and USACE directed BakkenLink to perform analytical testing of lake sediments for certain parameters in order to characterize the chemistry of the soil relative to maintaining water quality during construction activities. Sediments normally contain constituents that exist in various chemical forms and in various concentrations in several locations within the sediment. These include: Nitrogen, Phosphorous, and metals.

Composite samples of sediment were obtained at the locations and as described in Section 4.6.2 above. Samples were composites of sediments obtained during the soil testing. Samples were obtained at two depth ranges: 0-4' and 6-10'. These depth ranges were selected to represent typical pipeline installation depths.

An elutriate test may be used to predict the effect on water quality due to release of contaminants from the sediment to the water column. The results of the analysis are reported as 4:1 elutriate results (table below) for sediment from the proposed crossing, and the values are reported as comparisons against the North Dakota surface water quality criteria. Presumably, the intent is to show a "worst case" water quality if sediment is suspended in/near the trench.

Constituent	ND Surface Water Quality Standards Acute/Chronic	Sample 4, Boring 1, 0-4'	Sample 4, Boring 2, 0-4'	Sample 4, Boring 3, 0-4'	Sample 4, Boring 4, 0-4'	Sample 4, Boring 5, 0-4'	Sample 4, Boring 6, 0-4'	Sample 7, Boring B-1, 6-10'	Sample 7, Boring 2, 6-10'	Sample 7, Boring 3, 6-10'	Sample 7, Boring 4, 6-10'	Sample 7, Boring 5, 6-10'	Sample 7, Boring 6, 6-10'
	All Measurement in mg/L (ppm)												
Organic Nitrogen		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5.19	< 5	6.02
Ammonia-Nitrogen as N		2.93	6.01	4.23	4.43	1.82	3.25	5.87	0.21	0.42	0.41	0.99	0.28
Phosphorus as P - Total	0.02	0.12	0.11	0.51	0.57	< 0.1	< 0.13	< 0.78	< 0.1	< 0.34	1.13	< 0.52	1.37
Total Kjeldahl Nitrogen		< 5	< 7.1	< 5	< 6.9	< 5	< 5	8.1	< 5	< 5	5.6	< 5	6.3
Mercury - Total	0.0017/0.00012	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	< 0.0002	0.0006
Chromium - Total	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.11	0.07	0.25
Copper - Total	0.014/0.093	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.16	0.07	0.37
Nickel - Total	0.47/0.052	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.09	0.04	0.22
Zinc - Total	0.12/0.12	0.06	0.11	0.16	0.12	0.05	0.11	0.12	< 0.05	< 0.12	0.45	0.21	0.92
Arsenic - Total	0.34/0.15	0.003	0.002	0.004	0.0137	0.0032	0.0029	0.0068	< 0.002	< 0.0151	0.0458	0.0239	0.1058
Cadmium - Total	0.0021/.00027	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.00132	< 0.001	< 0.001	< 0.001	0.00166	0.00115	0.0054
Lead - Total	0.082/0.0032	< 0.002	< 0.002	0.0049	0.0237	0.0026	0.0031	0.0088	< 0.002	< 0.0238	0.0712	0.043	0.1862
Selenium - Total	0.020/0.0005	< 0.002	< 0.002	< 0.002	0.0029	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.0042	0.0027	0.0093

Results are reported in volume(s) of mg/L or parts per million (ppm). Generally, the results show that the parameters meet or exceed Water Quality Standards except for three samples:

- Sample 7, Boring-4
- Sample 7, Boring-5; and
- Sample 7, Boring-6

These three samples indicate levels of zinc that exceed the Water Quality Standards. In addition, cadmium and lead in Sample 7, Boring-6 also exceeds Water Quality Standards. Zinc as reported in Sample 4, Boring-3 is within statistical error analysis when considering levels of ppm.

The proposed pipeline will be installed with approximately three feet of cover to the top of the pipe (four feet total depth) with approaches near the shorelines installed at deeper depths. These results indicate that constituents within the sediments across the majority of the crossing – at the installation depth – meet or exceed the Water Quality Standards.
Results should also be evaluated in light of the volume and rate of the intended discharge, the type of discharge, the hydrodynamic regime at the site, and other information relevant to the impact on water quality. The mixing zone should also be considered when evaluating water column effects. In addition, the reporting levels are based on tenths (or hundreds) of ppm. Other considerations include:

- The criteria for several metals are hardness related. The ND Water Quality Standards are based on an assumed hardness of 100 mg/L. To derive a hardness adjusted value, it would be necessary to get a value for lake hardness. A higher lake hardness would result in higher criteria standards for these metals.
- The criterion for most metals is based on dissolved metals. The data here is reported as total metals.
- Nutrients (phosphorus and nitrogen) are not toxicity concerns. The values listed are related to possible eutrophication increase from liberation of nutrients. This increase would be temporary, and of little immediate consequence if it occurs outside the growing season.
- The phosphorus is reported as total phosphorus. The listed criterion is a guidance value for lake management based on phosphate phosphorus. The criterion is not toxicity based, but based on eutrophication. Free phosphate phosphorus is only a small portion of the total phosphorus in the system. There is no total phosphorus criterion.
- The Water Quality Standards present an eutrophication guidance value for NO3-N of 0.25 mg/L, but the data were reported for three types of nitrogen: organic, Kjeldahl, and ammonia nitrogen,

but not for nitrate N. Each stream or lake has unique characteristics which determine the concentration of this constituent that will cause excessive plant growth.

- The disturbance from trenching would be on a relatively short term basis, and therefore the higher (acute) value is a better indicator of potential toxicity than the lower (chronic) value.
- The nature of the trenching disturbance will generate fairly localized suspension of sediments, silting and turbidity. However, these also can be controlled.

In summary, the contamination investigation provides evidence that metals should not be an issue for this site. However, turbidity and silting might be a larger concern, in terms of narrative water quality.

5. Construction Methodology Evaluation

5.1. General

Discussed below are several possible crossing options evaluated during the project development of the proposed 12" OD crude line across Lake Sakakawea in North Dakota. The options considered include:

- Horizontal Directional Drill (HDD) across the entire lake crossing from a single onshore location
- HDD from both sides of the crossing to a midpoint in the crossing and then an intermediate tie-in operation.
- HDD from the center of the crossing to each onshore location and then an intermediate tie-in operation.
- Trench and conventional lay of the entire pipeline from a marine barge accompanied by separate shore crossing operations at each end.
- Trench and perform a push-pull operation with a buoyant pipeline constructed on an offshore barge positioned midstream and then push-pull the line toward each shore line in sequence. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the intermediate tie-in operation from the vessel.
- Trench and perform a push-pull operation with the pipeline made up along one shoreline and then push-pull the line across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.
- Trench and perform a push-pull operation with the pipeline made up in sections within a pre-constructed onshore trench and then pulled across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.

5.2. Horizontal Direction Drill (HDD)

Because of the length of the crossing of 2.3 miles, a single HDD operation across the entire lake crossing is not feasible for the pipeline diameter required for this Project. Although such a lengthy HDD operation could be technically feasible, there are many risks involved, which no construction contractor consulted would consider undertaking. The risks include loss of pipe due to sticking, buckling of the pipe during the push operation, large surface units and space requirements for the operation, etc. In addition, the success of an HDD depends on the soil characteristics. In this area, the undisclosed soil investigations anecdotally indicated the plausibility of such an HDD; however, the exact conditions will require further investigation to confirm this method.

A more feasible and less risk adverse approach using HDD technology was discussed using two drills instead of the single drill.

The first dual HDD option was to drill from both the north and south banks and join the pipeline in the middle of the lake. The length for each drill would be approximately 6000 feet leaving a 650 feet length of pipe for each section (a total of 1300 feet length) in the middle of the lake to make the connection. This section would then to be lowered and protected. This option requires extensive dredging activities to dig the two exit holes and pipeline break-over areas. The amount of bottom disturbance was considered unacceptable plus the risk of a failed drill in these soils was a serious concern and one without a valid contingency plan or remedial action.

The second dual HDD option consists of drilling from the center of the lake but was not feasible due to the excessive water depth. Additionally, HDD's originating from a marine location would require extensive specialized marine equipment that is limited to a 20 to 30 feet water depth. The proposed crossing has a mid-stream water depth of 50 feet rendering this option invalid.

5.3. Conventional Pipe Lay

A conventional pipe lay operation into a pre-trenched ditch across the waterway was evaluated as an alternative option. The concrete weighted pipeline would be laid across the waterway by constantly changing the position of the lay barge in a similar manner to a conventional offshore pipelay operation. A separate shore approach method involving trenching would be developed at each shoreline. Due to the nature of the bottom topography, some type of jetting or trenching operation along with a pull operation would be required in the near shore marine and terrestrial land areas.

Due to the isolated nature of the lake and the difficulties in mobilizing large, specialized equipment to the area, a small scale pipe lay inland barge system would be mobilized in sections and rigged on site. The barge would consist of a deck length having at least one or two pipe-welding stations, a nondestructive testing station to evaluate welds and a coating station to apply the protective corrosion coating to the welded pipe joints. The individual barge sections would be attached bow to stern and would require a crane and several positioning winches for anchoring operations. With the use of spuds not feasible due to the water depths, an option to conventional anchoring could be the installation of mooring piles at strategic locations along the pipeline route to moor the barge and to progress the barge across the lake as it installs the pipeline.

The lack of local marine equipment and the cost to mobilize, fabricate, and rig-up an extensive marine pipe lay spread, in addition to the mobilization of support vessels and other marine equipment, makes the conventional pipe lay option impractical, inefficient and unworkable.

5.4. Push-Pull Method – Preferred Method

The push-pull method of installation is a highly proven and successful technique used for installing pipelines in water depth ranges similar to that of the lake. Lake Sakakawea is an inland lake with a crossing distance (2.3 miles) that would be suitable for this operation. This technique requires that the concrete coated pipe be welded into one or more strings either on land, along the shore, or off a permanently positioned marine barge on the lake and have temporary buoyancy flotation collars keep the pipe afloat. The floating pipe strings are maneuvered by pushing or pulling operations until in the desired position. Once in position, the floatation collars are sequentially removed and the pipe settles onto the lake bottom.

In order to lower and bury the pipeline beyond the reach of the land-based excavators, a pair of mud/slurry submersible pumps (Toyo brand or equivalent) fitted to a purpose-built lowering sled will be

used. The burial sled will extract soil from beneath the installed pipeline and discharge the resulting slurry into the pipeline ditch astern of the sled. The exact design of the burial sled will be specific for this Project; however, the concept of the dual slurry pumps has been utilized before by several construction groups for pipeline lowering in difficult and environmentally sensitive locations. The ability to trail a turbidity mat over the discharge diffuser is designed to direct the slurry back into the trench to reduce lateral dispersion, provide positive backfill over the lowered pipeline, and reduce the water column turbidity. Further detail about this proposed construction methodology can be found in Appendix 9.1.

The burial operation will be performed immediately after the installed pipeline is flooded and after the installed pipeline elevation is surveyed. The Project Team will deploy turbidity monitoring instrumentation at agreed locations with STOP authority in case of the construction activity exceeding a turbidity level above that observed prior to work commencement (the control measurement). The depth of cover achieved over the pipeline with the lowering sled will be verified real time with divers positioned aft of the jet sled. If the adequate coverage is not being achieved, the lowering sled can be slowed until the pipe is buried to a sufficient depth. The pump employed on the lowering sled is well suited for the classification of substrate on the lake floor.

Although the purpose-built lowering sled will be specific to this project, the USACE Waterways Experiment Stations (WES), as part of their Dredging Research Program (DRP), has tested similar hydraulic excavators. Among the competing vendors, the results found that a Toyo brand slurry pump had the overall best performance. See Appendix 9.3 for full report. In practice, the pumps have been proven effective in multiple projects world-wide where pipeline lowering was required in confined or sensitive areas. One such project involved successfully lowering 7,000 linear feet of 36-inch live gas pipelines in the shallow waters of the Gulf of Mexico. Additional details concerning this burial technique and the engineering firm's experience with this equipment see Appendix 9.5.

6. Code Compliance

The pipeline and pipeline system will be designed in accordance with the Code of Federal Regulations Title 49, Part 195, "Transportation of Hazardous Liquids by Pipeline" (latest edition). Provided all minimum federal safety standards have been met, ASME B31.4-2009 "Pipeline Transportation of Hydrocarbons and Other Liquids" will be used to supplement the requirements of 49 CFR, Part 195. For issues where both of the above publications are silent or additional guidance is required, codes and/or recommended practices from the following organizations are incorporated into the design as applicable (latest edition unless otherwise noted):

Code	Title
ASME B31.8	American Society of Mechanical Engineers: Gas Transmission and Distribution Piping Systems
API Spec. 5L	American Petroleum Institute: Specification for Line Pipe
API RP 1102	American Petroleum Institute: Steel Pipelines Crossing Railroads and Highways
API Std. 1104	American Petroleum Institute: Welding of Pipelines and Related Facilities
API Std. 1130	American Petroleum Institute: Computational Pipeline Modeling for Liquid Pipelines
API RP 5LW	American Petroleum Institute: Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels
NACE SP0169	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NACE SP0177	National Association of Corrosion Engineers: Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
NACE MR0175 /ISO 15156	National Association of Corrosion Engineers: Control of External Corrosion on Underground or Submerged Metallic Piping Systems
ISO 15589-1	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 1: On-land Pipelines
ISO 15589-2	Petroleum and natural gas industries – Cathodic protection of pipeline transportation systems – Part 2: Offshore Pipelines
API Spec. 6D	American Petroleum Institute: Specification for Pipeline Valves (Gate, Plug, Ball and Check Valves)
ASME B16.5	American Society of Mechanical Engineers: Pipe Flanges and Flanged Fittings
ASME B16.9	American Society of Mechanical Engineers: Factory-Made Wrought Steel Butt Welding Fittings
MSS-SP-44	Manufacturers Standardization Society: Steel Pipe Line Flanges
MSS-SP-75	Manufacturers Standardization Society: Specification for High Test Wrought Butt Welding Fittings
MSS-SP-97	Manufacturers Standardization Society: Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Butt Welding Ends
ASME Section IX	American Society of Mechanical Engineers: Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications

Consultation was sought with PHMSA Central Region regarding the Lake Sakakawea crossing. PHMSA indicated that pipe would need to be lowered to provide the necessary protection of the pipeline. If statutory burial depth could not be achieved, mechanical protection would need to be provided that would provide equivalent protection.

Mainline Valve Assemblies

The mainline valve sites will provide means for isolation of segments of the pipeline and limits release of the product in the unlikely event of a pipeline leak. The valves shall be installed in a location, accessible to authorized employees and protected from damage or tampering **[49 CFR, 195.258(a)].**

All valves will be of a class pressure-temperature rating for the specified design pressure in Section 2.3.1 and meeting the requirements of 49 CFR, Part 195.104. The valves shall meet the requirements and stamped API 6D as well as the following minimum design requirements:

- Compatible with the pipe or fittings to which the valve is attached
- Compatible with the liquid the pipeline may carry
- Both hydrostatically shell and seat tested without leakage per Section 10 of API 6D
- Equipped with a means for clearly indicating open or closed
- Marked on the body or nameplate with the following:
- Manufacturer's name or trademark
- Class designation or maximum working pressure
- Body material
- Nominal size **[49 CFR, 195.116]**

Each mainline valve installation, extending 5 pipe diameters beyond the last fitting, will have 0.60 design factor. Mainline valve sites will be in accordance with the requirements of **49 CFR, Part 195.260**:

- On the suction and discharge of a pump station to permit isolation of the pump station equipment
- On each line entering or leaving a breakout storage tank area that permits isolation of the tank area from other facilities
- Along the mainline at locations that minimize damage or pollution from accidental discharge as appropriate for the terrain in open country or for populated areas
- On each lateral takeoff from a trunk line that permits shutting off the lateral without interrupting the flow in the trunk line
- On each side of a water crossing that is more than 100 feet wide from high-water mark to high-water mark
- On each side of a reservoir holding water for human consumption

Mainline valve sites shall be designed to provide adequate access and work space for operation personnel, vehicles and equipment. Roadways shall be graveled and raised to permit drainage. Sub-surface drainage structures other than culverts under roadways are not anticipated. The area within 1-foot outside a station fence shall be covered with 4-inch of crushed stone, over a geotextile fabric, for weed control. The fencing shall be 6-foot high chain link, topped with three strands of barbed wire. The main entrance gate shall be a double swing gate 12-ft wide. Steel guard posts will be installed as appropriate at each mainline valve to protect the installed facility.

7. Spill Mitigation

BakkenLink has prepared a Spill Prevention, Containment, and Countermeasures (SPCC) Plan to be implemented during construction of the BakkenLink Pipeline Project (Project) in accordance with Section IV.A of the Federal Energy Regulatory Commission Wetland and Waterbody Construction and Mitigation Procedures, January 17, 2003 version. The SPCC Plan describes specific preventive measures to be followed to reduce the likelihood of the accidental release of a hazardous or regulated liquid during construction activities and sets forth procedures and response actions in the event of an actual release.

The goal of the SPCC Plan is to minimize the potential for a spill of these materials, to contain any spillage to the smallest area possible, and to protect areas that are considered environmentally sensitive (e.g. streams, groundwater wells, wetlands, etc.). The policies are outlined in a general way below:

- Preventive measures will be in place that restrict the location of fuel storage, refueling activities, and construction equipment maintenance along the construction right-of-way, staging area and work yards.
- Release of any petroleum product or hazardous liquids in vulnerable aquifer areas will be mitigated by immediate actions dictated in the SPCC. These areas will be treated with the highest levels of sensitivity.
- The response action priorities upon discovery of a spill are to protect the safety of personnel and the public, minimize environmental impacts, and control costs associated with cleanup and restoration.
- BakkenLink will provide spill prevention, response training and safety training to its personnel and contractors. The training program will be designed to improve awareness of safety requirements, pollution control laws, proper operation and maintenance of equipment, and implementation of spill response actions.
- BakkenLink will approve of a Contractor appointed Field Coordinator who will be responsible for reporting spills, coordinating Contractor personnel for spill cleanup, completing subsequent site investigations, and preparing incident reports.
- BakkenLink will prepare Spill Report Forms and notify state and federal agencies as required in the event of a release.
- Further details are to be found in the SPCC.

In addition to the SPCC, BakkenLink will be joining the Sakakawea Area Spill Response team. Six companies with oil interests in the area of Lake Sakakawea are forming a joint company (Sakakawea Area Spill Response, LLC) whose primary purpose is spill response for the area. The joint effort will share the equipment and training costs to handle small-to-medium oil spills, with an initial $300,000 going toward three vessels, two oil skimmers and a boom. This effort is in response to saltwater and oil spills occurring in the spring of 2011, many having been caused by the historic flooding in the area. At least sixteen other companies have shown interest in joining the group effort. BakkenLink intends to pursue agreements to join this response effort.

8. Qualifications of Engineering Firm for the Work

Project Consulting Services, Inc. (PCS) is a company specializing in the design, engineering, and construction management of onshore and offshore pipelines, platforms, and subsea facilities. Since PCS began operations in 1992, it has successfully completed over 2000 projects. Corporate headquarters are located in Metairie, Louisiana, with regional offices in Houston, Texas; Atlanta, Georgia; and Birmingham, Alabama. Internationally, with foreign project offices, PCS has provided services to clients for projects in South America, Russia, Southeast Asia, Canada, Mexico, and West Africa. The company's knowledge of pipeline operations is exceptional, with engineers who have participated in and played a key role in many industry firsts. In addition to its qualifications in the onshore pipeline industry, PCS' personnel have extensive experience in other marine construction projects such as the conceptual and engineering development of Deep Water Ports (DWP) plus offshore platform installation, modification, and salvage. Project responsibilities have included feasibility studies, cost analysis and scheduling, design, permitting, project management for installation of onshore and offshore pipeline project.

Some pipeline projects, having pertinent similarities to the lake crossing, with which PCS has been involved include:

- Denbury Green Pipeline: Galveston Bay Crossing – 320 miles of 24-inch CO_2 pipeline with a shallow water crossing at Galveston Bay, TX
- Creole Trail Pipeline: a 42" natural gas pipeline from Creole Trail LNG Facility, through low lands and shallow water to a transmission system near Carlyss, LA
- Louisiana Offshore Oil Port – Gulf of Mexico deepwater oil port Phase 2 expansion project;
- Main Pass Energy Hub – Gulf of Mexico LNG Terminal (Proposed)
- Northeast Gateway – Boston Harbor DWP
- Broadwater and Islander East proposed installations in Long Island Sound
- Gulfstream Natural Gas System – 744-mile natural gas system, over 430 miles of which are 36-inch-diameter marine pipeline within the coastal areas of Alabama to Tampa, Florida
- Gathering and flowline systems for major producers in and around Mobile Bay, Alabama, to transport natural gas, some of it with corrosive and dangerous properties, to onshore processing facilities

Further information about PCS' experience with this crossing technique is included in Appendix 9.5.

9. Appendix

9.1. Detail Lake Crossing Methodology Document
9.2. Maps
9.3. Soil Boring Report and Logs
9.4. Memo on Concrete Weight Coating of Marine Pipeline Protection
9.5. Memo on Lake Crossing Lowering Equipment, Experience and Planning

LAKE SAKAKAWEA PIPELINE CROSSING REPORT

Appendix 9.1

Detail Lake Crossing Methodology Document

REGISTERED PROFESSIONAL ENGINEER
MICHAEL R. ISTRE
PE-6807
DATE 11/7/11
NORTH DAKOTA

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Executive Summary

This Proposed Construction Methodology describes the planned work program and sequence of events to install, lower and pre-commission a 12-inch diameter pipeline crossing of Lake Sakakawea as part of the Bakkenlink Pipeline Project.

The planned pipeline installation is based on a conventional pull with strings of pipe welded together in sections on the north shore and then joined into a 13,000 feet (approximate) single pipeline as the pipeline is pulled toward the south shore by a linear winch located on the south shore.

The lowering and protection of the pipeline at the North and South shorelines will be achieved by excavating a trench using long-reach excavators on both banks. The excavators will commence at the shore line and construct a berm adjacent to the pipeline centerline from trench materials and use the berm to walk the excavator out from the shore as determined by site conditions and water depths. After the pipeline is installed, the excavators will reverse the process and transfer the berm material back into the trench and over the pipeline.

Lowering the pipeline beyond the reach of the land-based excavators will be achieved using a pair of Toyo submersible pumps fitted to a purpose-built lowering sled that will extract soil from beneath the installed pipeline and discharge the resulting slurry into the pipeline ditch astern of the sled. The design of the lowering sled will be specific for this project however the concept of the dual Toyo pumps and has been utilized before by several construction groups for pipeline lowering in difficult and environmental sensitive locations. The ability to trail a turbidity mat over the discharge and diffuser is designed to direct the slurry back into the trench to reduce lateral dispersion and provide positive backfill over the lowered pipeline while reducing water column turbidity.

The support equipment for the lowering operation will include a Flexifloat catamaran that will house the power generator for the Toyo pumps. An initial conceptual set of drawings of the lowering system is included in this document and will be supplemented by actual design drawings as the program is developed to fabrication. The operation will include a team, divers vessels, diving equipment, marine and land surveys and instrumentation, an onshore crane, the linear winch and crew, a hold back winch and crew.

The dive team will operate and monitor the lowering operation including pipeline lowering depths and discharge. Both the Flexifloat and the lowering sled will be pulled across the lake by the winch previously used for the pipeline pull. The pull cable will incorporate floatation and will connect to both the water surface pontoon and the sled.

The lowering operation will be performed immediately after the installed pipeline is flooded and after the installed pipeline elevation is surveyed. The Project Team will deploy turbidity monitoring instrumentation at agreed locations with STOP authority in case of the construction activity exceeding an agreed turbidity level above that observed prior to work commencement (the background measurement). Additional lowering passes will be performed until the pipeline reaches the designed depth.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Protection of the pipeline will be achieved based on a fitness for use criteria. A concrete weight coating system will be utilized to protect the pipeline from dropped objects, e.g. anchors, from the expected maximum size marine traffic. The details of the concrete weight coating system are under design.

Construction Plan Summary

1) Shallow Geotechnical Acquisition Study - Completed
2) Detailed pipeline route Hazard Survey - Completed
3) Mobilization and installation of the Pipe Stringing Station at the North Shore
4) Mobilization and installation of the Pipe Pull Station at the South Shore
5) Excavate beach crossings
6) Weld pipe strings on the North Shore
7) Install the pull cable from South Shore to the North Shore
8) Pipe pull operation
9) Flood pipeline section
10) As-Installed Survey
11) Pipeline Lowering
12) As-Lowered Survey
13) Supplemental Pipeline Lowering (Diver Air Lift)
14) As-Built Survey
15) Placement of supplemental protection (as required)
16) Shore Crossing Reinstatement
17) Hydrostatically test the Crossing Section
18) Prepare for tie-in and weld-on valves.

Construction Plan Details

1.0 Shallow Geotechnical Acquisition Study – Completed

2.0 Detailed pipeline route Hazard and Route Selection Survey - Completed

3.0 Mobilization and installation of the Pipe Stringing Station at the North Shore

3.1 Mobilize equipment, plant, materials and personnel to the North Shore work location

3.2 Conduct Job Safety Analysis (JSA) pre-job meeting

3.3 Perform sufficient earth works and placement of work station footings to allow a safe operation to be performed

3.4 Arrange timbers to create a suitable pipe stringing yard for approximately ten (10) strings of pipe each approximately 1300 feet (32 or 33 double random joints/string) adjacent to the pipeline centerline

3.5 Establish a primary welding station on the centerline approximately 200 feet from the lake shoreline

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Lake Sakakawea Crossing

Proposed Construction Methodology

4.0 Mobilization and installation of the Pipe Pull Station at the South Shore

4.1 Mobilize equipment, plant, materials and personnel to the South Shore work location

4.2 Conduct Job Safety Analysis (JSA) pre-job meeting

4.3 Construct a suitable land access and level pull site for the placement of the linear line pulling winch (LLPW), wire take-up spools and the Dead Man Anchor (DMA) and hold-back rigging

4.4 Receive and place the LLPW

4.5 Excavate and install the DMA and rigging

4.6 Test pull against the DMA for safety check

5.0 Excavate Beach Crossing (North and South Shorelines)

5.1 After the pulling and welding sites are completed, transfer the excavator and dozer to the respective shore crossing sites

5.2 Excavate a trench from the work sites to the shore line

5.3 Excavate a trench through the shore line and construct a berm wall adjacent to the centerline using the excavated material from the trench and additional material from other locations

5.4 Extend the berm to approximately 100 feet from the shore line

6.0 Welding the pipe strings on the North Shore

6.1 Conduct Job Safety Analysis (JSA) pre-job meeting

6.2 Receive and place the 325 double random joints along the 10 predetermined stringing lines

6.3 Weld and complete NDE of all string sections

6.4 Apply Fusion Bonded Epoxy (FBE) coating to the completed field joints

6.5 Weld a prefabricated pull-head to the first joint

7.0 Installing the pull cable from North Shore to the South Shore

7.1 Conduct Job Safety Analysis (JSA) pre-job meeting

7.2 While the pipe strings are being welded and prepared, float a suitably sized polypropylene rope from the North to the South side of the lake using divers and other marine personnel and equipment

7.3 Attach the polypropylene rope to the wire rope on the South side pulling station and initiate pulling the wire cable to the North Shore (pipe stringing location) using dozers and excavators

7.4 Add floatation to the wire rope to assist progress and reduce pull forces. Meanwhile, divers to ensure that the wire rope alignment is installed under survey control

7.5 Receive the wire cable at the pulling station and attach the wire cable to the pulling head on the leading end of the first pipe string (String #1).

8.0 Pipe pull operation

8.1 Conduct Job Safety Analysis (JSA) pre-job meeting

8.2 Ensure communications between the North and South Shores, the Spotter/Security vessel and the Diving Inspection boat is established and that a redundant system is tested in the event of primary system failure

8.3 The Spotter/Security vessel crew will install markers or buoys during the pull operation to identify a safe boating corridor to cross the pipeline pulling operation. The vessel will provide at-site directions to boaters to ensure the safety of the boating community and will have STOP authority (the pull operation) should a boat inadvertently enter an area that is considered hazardous.

8.4 Attach a hold-back cable to String #1 to ensure that the string does not advance forward in an uncontrolled manner.

8.5 Gradually increase the pull wire tension using the LLPW

8.6 Monitor the movement of the pipe string and maintain detailed open communications with all parties and work sites.

8.7 Pull pipe string until the end of String #1 is at the Line-Up Station.

8.8 Secure the pipe string and slowly lower tension on the LLPW

8.9 Roll String #2 over onto the firing line alignment and line-up with the tail end of String #1

8.10 Complete weld, complete NDE, Inspect and accept NDE

8.11 FBE the complete field joint to provide a continuous protective coating from Sting #1 to String #2

8.12 Jeep the field joint to inspect for holidays in the coating. Repair as necessary.

8.13 When complete and all parties are ready, take up tension on the wire rope again and pull the pipeline until the tail end of String #2 is at the Line-Up Station

8.14 Align String #3 and repeat process of adding strings and pulling

8.15 Between pulls, divers to confirm that the pull head is not digging into the bottom of the trench

8.16 Continue adding strings and pulling until the pull head surfaces at the South shore.

8.17 With assistance from the bull dozer, continue the additional and last pull until the initiation head reaches the target location

9.0 Flood Pipeline Section

9.1 The Pre-Commissioning crew will control flood the lake crossing pipeline section by running a pig train that will include a gauging plate to confirm the pipeline was not damaged during the pull operation.

9.2 The gauging plate will be inspected and accepted by the Chief Inspector

10.0 As-Installed Survey

10.1 Divers will swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

10.2 Divers will also note the amount of cover (if any) at each survey location

10.3 The Project Engineer will review the results and determine if and where additional lowering is required. The lowering solution will then be initiated based on the results of the diver survey of the flooded pipeline.

11.0 Pipeline Lowering

11.1 Conduct Job Safety Analysis (JSA) pre-job meeting

11.2 Divers will assist the placement (by crane) of the lowering sled (LS) over the installed pipeline on the North side of the lake.

11.3 Divers will partially flood the LS pontoons to stabilize the unit on the bottom.

11.4 Divers will rig-up the Flexifloat Catamaran (FC) and connect the FC to the LS.

11.5 Divers and other marine personnel and equipment will float the polypropylene rope from the North to the South side of the lake

11.6 The polypropylene rope will be attached to the wire rope on the South side pulling station and pulling of the wire cable initiated toward the North Shore using bull dozer and excavators

11.7 Floatation will be added to the wire rope to assist progress and reduce pull forces. Meanwhile, divers will ensure that the wire rope alignment is installed under survey control

11.8 The wire cable will be received at the North Shore and the attached to the yolk connecting both the LS and FC.

11.9 Tension on the pull wire will be increased and the divers will check the LS on bottom alignment and readiness to commence lowering.

11.10 The Toyo pumps will be started and slowly ramped up.

11.11 When the pumps have been operating for several minutes, the pump will be shut down and divers will check the results

11.12 Pulling the LS/FC across the lake will commence with diver checks at regular intervals to confirm trenching success and correct rate of progress

11.13 The rate of progress will be determined by the soil extraction progress and the ability of the pipeline to remain lowered astern of the LS.

11.14 Two Passes of the LS are expected to achieve the design depth.

12.0 As-Lowered Survey

12.1 After recovery of the lowering equipment, divers will again swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

12.2 Divers will also note the amount of cover (if any) at each survey location

12.3 The Project Engineer will review the results and determine if and where additional lowering is required.

13.0 Supplemental Pipeline Lowering (Diver air-lift)

13.1 As instructed by the Project Engineer, the Dive crew will mobilize to noted locations and perform pipeline lowering operations

13.2 The divers will deploy the hand-held airlift equipment for short sections requiring lowering

13.3 The divers will redeploy the pipeline lowering equipment if the air-lift equipment is considered impractical

13.4 As each identified section is lowered, the divers will resurvey the elevations and advise the Project Engineer of the results

14.0 As-Built Survey

14.1 After the supplemental lowering operation, the divers will again swim the line and perform elevation checks comparing the top of pipe (TOP) to the adjacent natural lake bed.

14.2 Divers will also note the amount of cover (if any) at each survey location

14.3 The Project Engineer will review the results and determine if and where additional lowering is required.

15.0 Placement of Supplemental Protection (as required)

15.1 Based on the length of any section of pipeline that cannot be lowered to the required depth, the Project Engineer will determine the method and material that will be used as supplementary protection.

15.2 Flexible concrete mats will be the preferred protection material and these can be placed at selected locations as determined by protection requirements in areas where there is an increased level of marine traffic.

16.0 Shore Crossing Reinstatement

16.1 Land Surveyors will complete a longitudinal profile of the pipeline from the offshore limit of excavated trench to the work station +/- 200 inshore from the lake shore and confirm depth below natural ground/bed levels

16.2 After the pipeline is flooded, and during remedial lowering and back-filling operations (as needed), initiate back-filling of the shore crossing trenches at both shore lines

16.3 The excavators will transfer the berm material back to the pipeline trench and on top of the pipeline working from offshore to onshore

16.4 Continue the backfilling up to the work stations on both sides and restore the pipeline corridor

17.0 Hydrostatically Test the Crossing Section

17.1 After the as built survey is completed, Contractor will pressure the crossing section and perform an 8 hour hydrostatic test at 1.25 MAOP. This will be the official DOT hydrostatic test for the lake crossing section.

18.0 Prepare for tie-in and weld-on valves

18.1 Demobilize all equipment, materials and plant

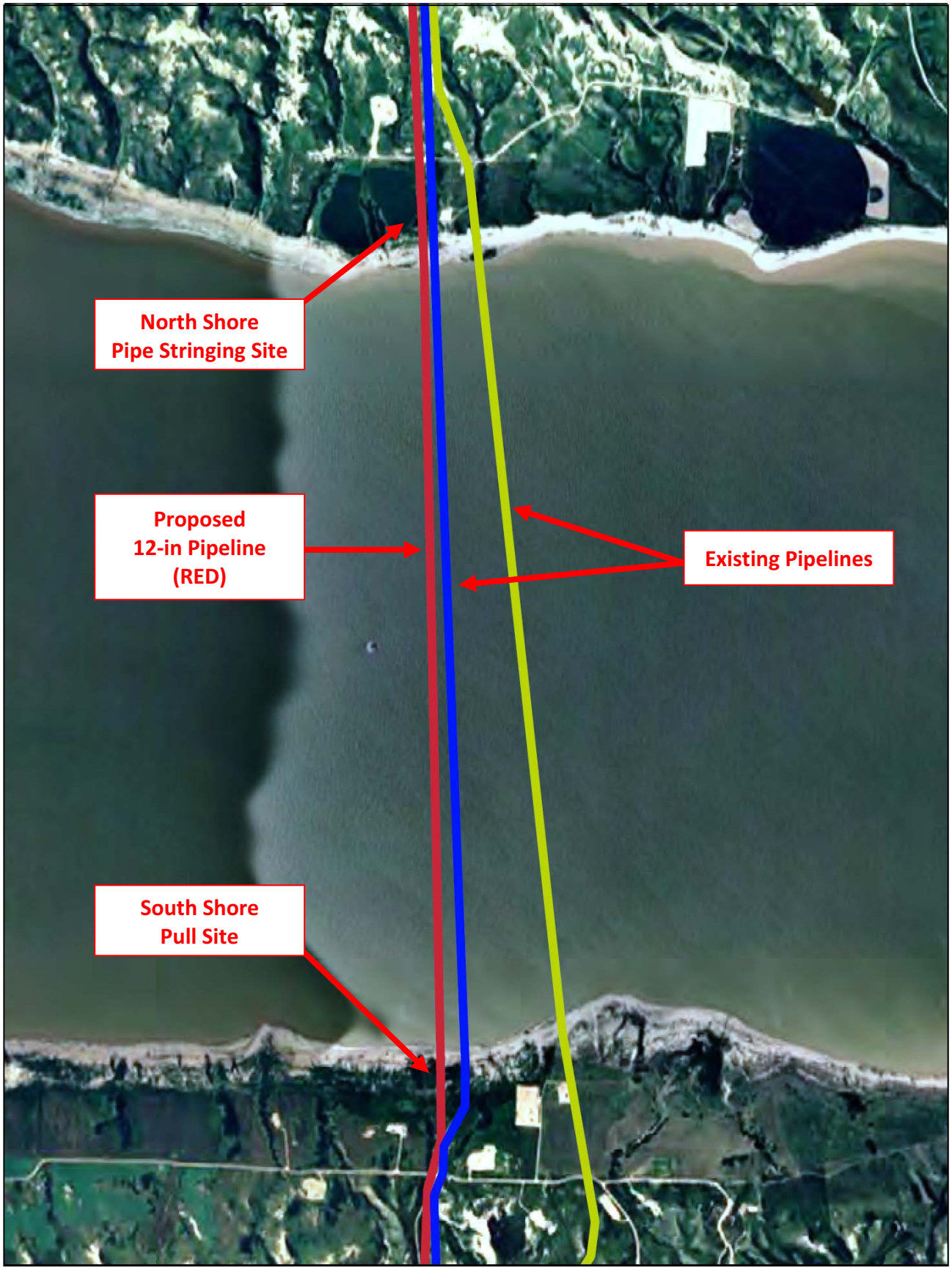
18.2 Clean up work sites

18.3 Weld a temporary security cap on the ends of the pipeline section

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Establishment of a typical main alignment pull site prior to fabricating the pipe strings. A similar site will be constructed on the north side of the lake.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Track rollers will be installed to support the pipe string on the main pull alignment as it is pulled toward the south shore.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

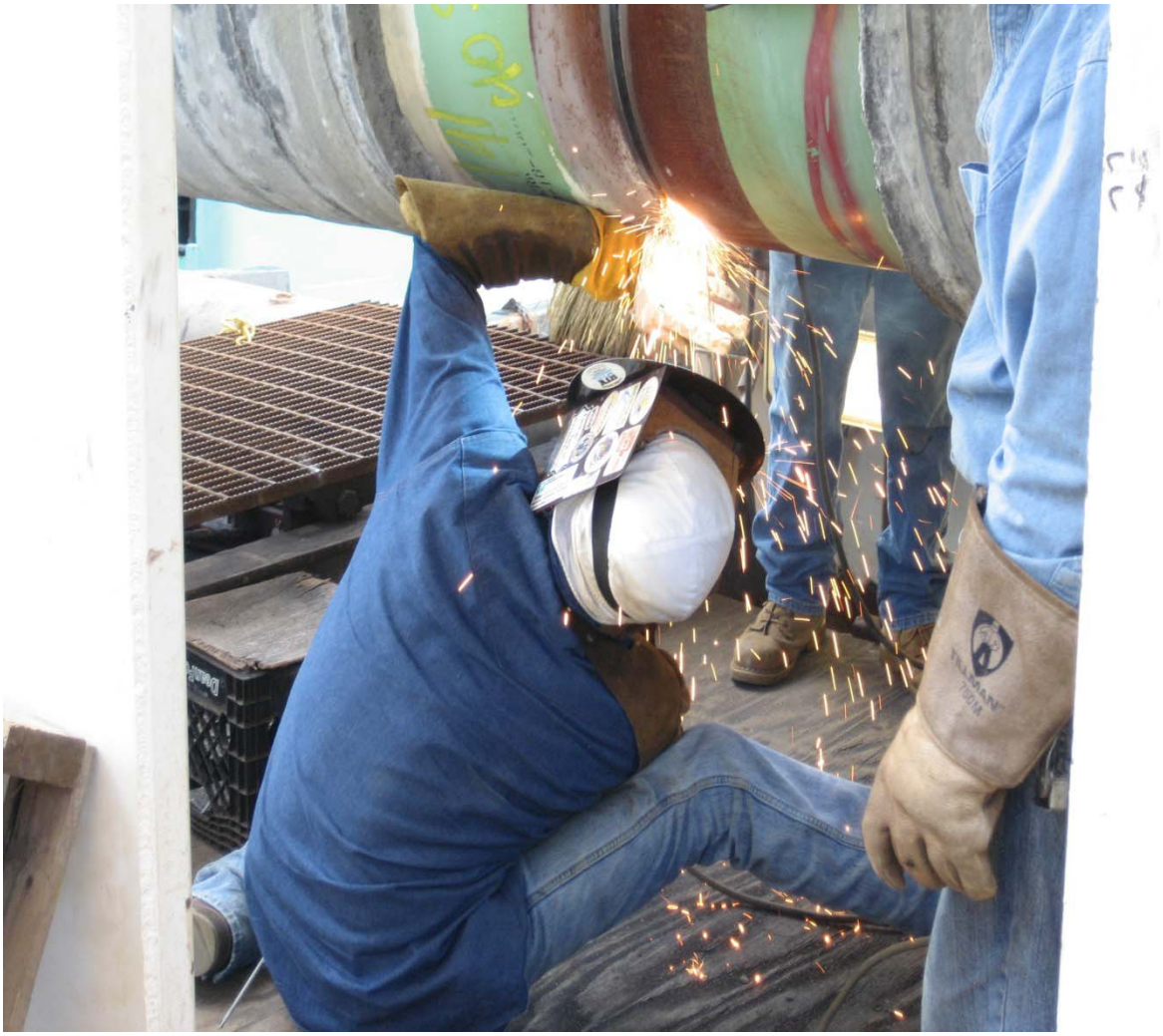
Proposed Construction Methodology

A pipe offloading operation. After offloading, the double random joints of pipe will be placed in rows for stringing.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



Typical pipe welding operation

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Typical pipe string fabrication area offset from the main pull alignment

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

A linear line pulling winch similar to the unit that will be installed on the south shore to pull the pipe across the lake

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology

Typical pipe pull across a body of water. However for the crossing of Lake Sakakawea, the pipe will be pulled used a Controlled Bottom Pull method that will have the pipe on or near to the lake bed.

10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

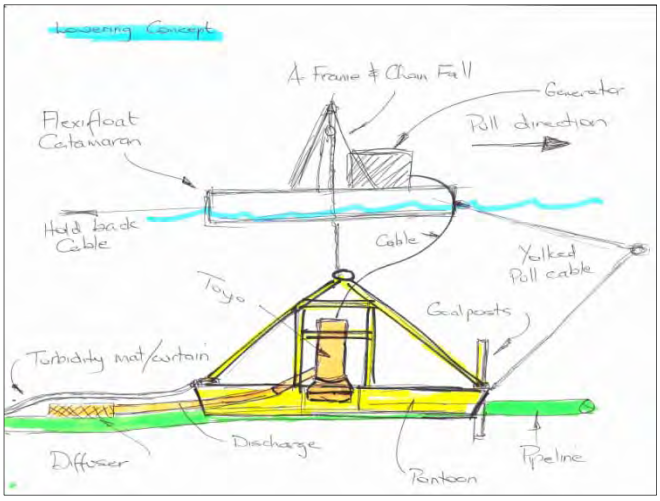
Proposed Construction Methodology

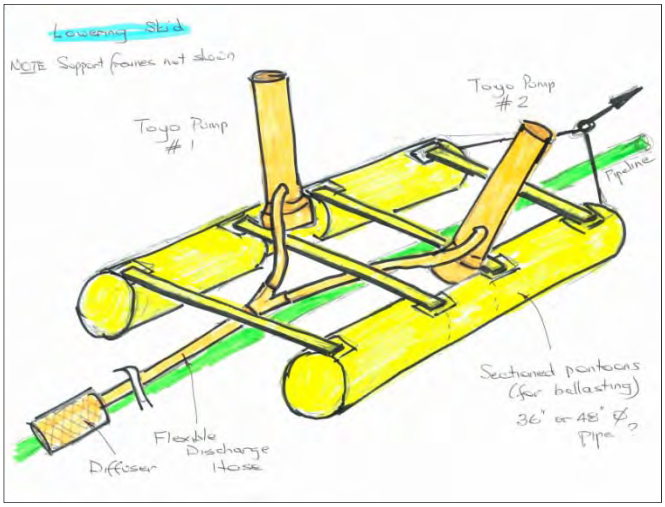
Typical shallow water survey launch that can be utilized during pull and lowering work phases to monitor progress and conformity

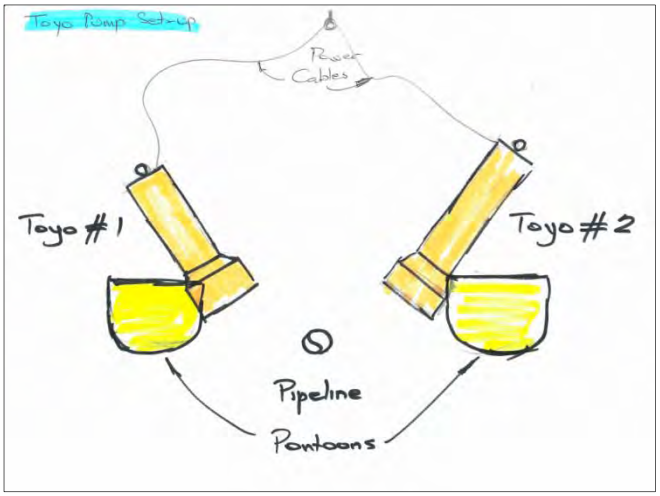
10045-BakkenLink Pipeline Project

Lake Sakakawea Crossing

Proposed Construction Methodology



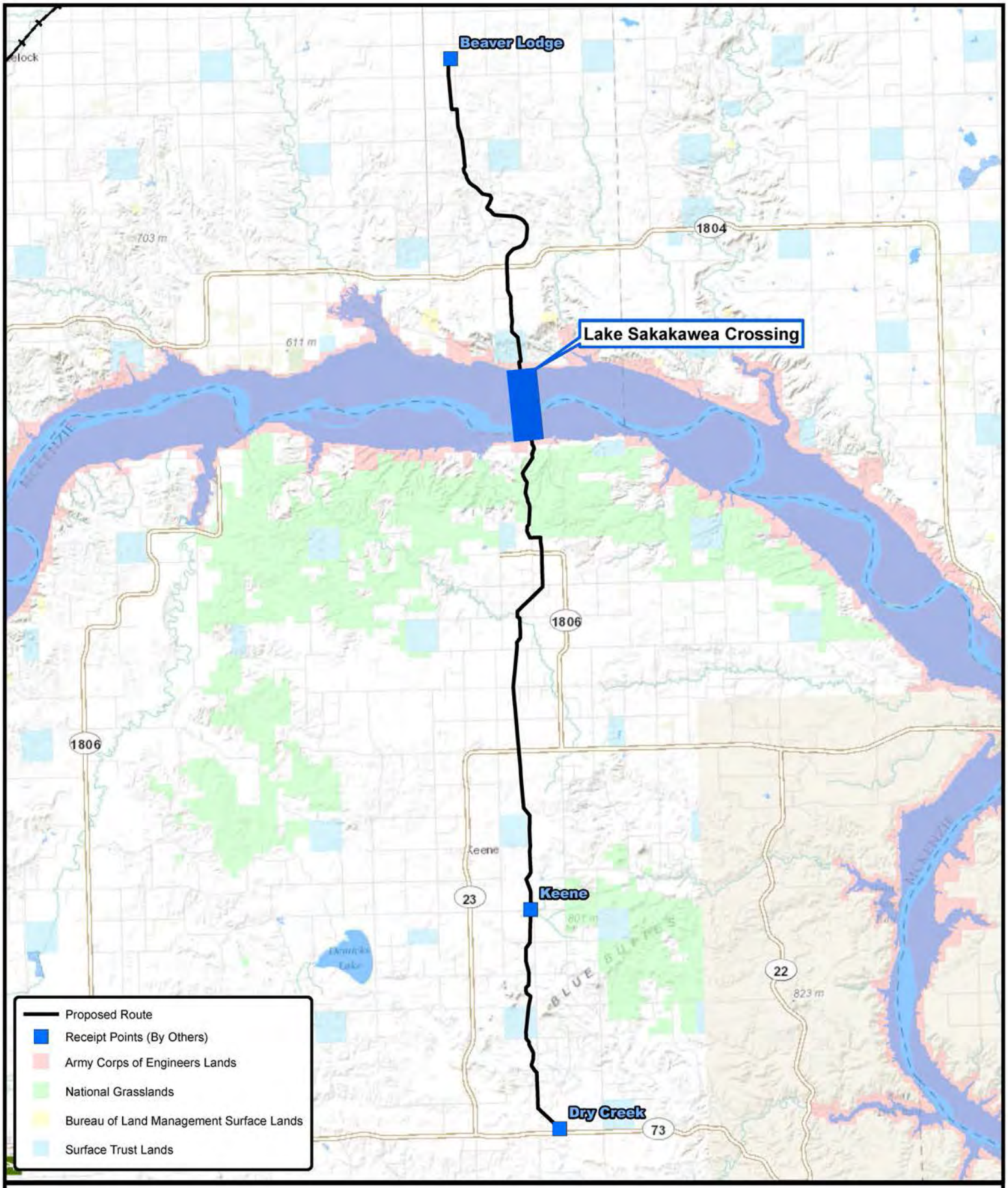




The above three conceptual sketches identify the lowering methodology that will be employed for the lake crossing

Appendix 9.2

Maps



NORTH

0 6,000 12,000 24,000

Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
PHASE II

BakkenLink

BARTLETT & WEST

Route is not final and is subject to change.

NORTH

0 600 1,200 2,400

Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA CROSSING
SHORE TO SHORE CROSSING LENGTH 11,750'

BakkenLink

BARTLETT & WEST

NORTH

0 100 200 400

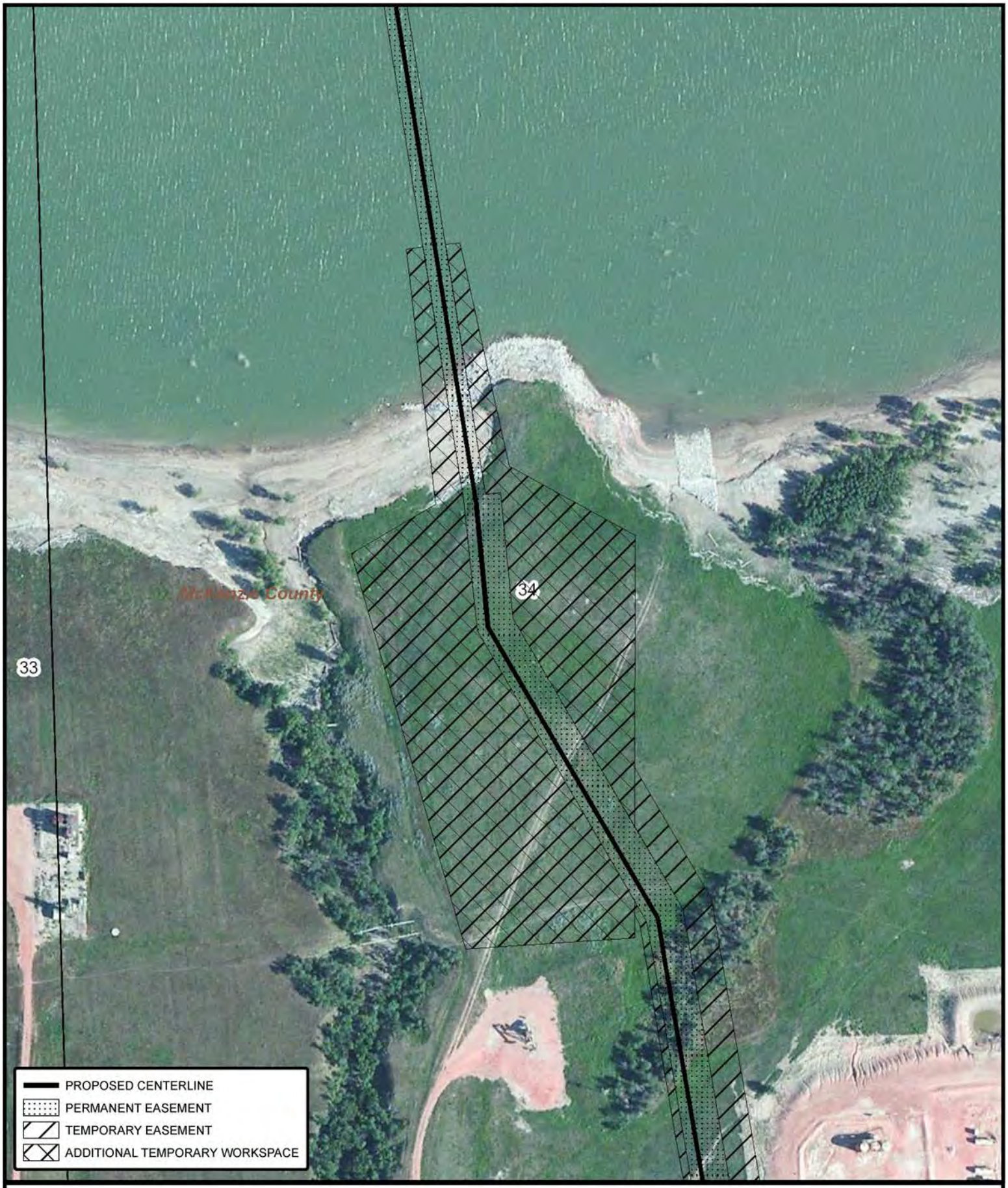
Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA
NORTH SHORE CROSSING

BakkenLink

BARTLETT & WEST



NORTH

0 50 100 200

Feet

UTM 13N FT

BAKKENLINK PIPELINE PROJECT
LAKE SAKAKAWEA
SOUTH SHORE CROSSING

BakkenLink

BARTLETT & WEST

Appendix 9.3

Soil Boring Report and Logs

A Subsurface Evaluation Report for

Bakkenlink Pipeline
Across Lake Sakakawea
South of Tioga, North Dakota

Professional Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

STEVEN P. NAGLE
REGISTERED
10-5-11
PROFESSIONAL
PE 3894
ENGINEER
NORTH DAKOTA

Steven P. Nagle, PE
Principal Engineer
Registration Number 3894

FA-11-01275
October 5, 2011
Braun Intertec Corporation

BRAUN
INTERTEC

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October 5, 2011 Project FA-11-01275

Mr. Jame Todd
Bartlett &West
3456 30th Avenue NE
Bismarck, ND 58503-0737

Dear Mr. Todd:

Re: Subsurface Evaluation for Bakkenlink Pipeline Crossing Lake Sakakawea, South of Tioga, North Dakota

We have completed the report of the Subsurface Evaluation authorized by you in accordance with the Master Service Agreement between Bartlett & West and Braun Intertec. The purpose of this evaluation was to provide lake-bottom soil data to aid in design of the pipeline which crosses Lake Sakakawea south of Tioga, North Dakota.

Summary of Results

A total of six (6) standard penetration test borings were performed in locations across the proposed alignment. The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment were encountered in three of the six borings and appeared to consist of 1 foot of "soil" that would classify as fat clay, however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the sediment, alluvial soils consisting of lean clay, silty sand, and poorly graded sand with silt and gravel was encountered. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency and the granular soils had a very loose to medium dense, relatively density.

Summary of Recommendations

The borings indicate that 0 to 1 foot of lake sediment has collected across the lake profile. It does not seem practical to "sink" a weighted pipeline into the sediment. We have provided information to assist in designing a support system, however, the soils below the lake sediment would adequately support the lowered pipeline or any supporting structure.

General

Please refer to the attached report for a more detailed summary of our analyses and recommendations. If we can provide additional assistance, or observation and testing services during construction, please call Steve Nagle at 701.238.3425.

Sincerely,

BRAUN INTERTEC CORPORATION

Debashis Sikdar, PE, PhD
Project Engineer

Steven P. Nagle, PE
Principal Engineer/Vice President

Attachment: Geotechnical Evaluation Report

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- Descriptive Terminology
- Logs of Borings (ST-01 to ST-06)
- Summary of Laboratory Test Data

A. Introduction

A.1. Project

Bartlett & West is assisting their client in the design of the Bakkenlink pipeline Lake Sakakawea crossing. To assist in the design, Braun Intertec is performing a subsurface evaluation to determine the type of material in the lake bottom which will support the pipeline.

A.2. Purpose of This Evaluation

The purpose of this geotechnical evaluation is to provide soils data for preparing plans and specifications for the pipeline crossing.

A.3. Scope

The proposed scope has been requested by Mr. Jame Todd of Bartlett & West during several email messages. The final scope of work for this project included the following tasks:

- conducting six (6) penetration test borings approximately 10 feet below the lake bottom,
- collecting samples for ellutriate testing from each boring (ellutriate testing performed by others),
- performing strength testing (unconfined compression tests) at midcore depth in each boring,
- performing grain size distributions if sands are encountered,
- performing electrical resistivity testing in three of the borings,
- classifying the samples and preparing boring logs,
- providing a bearing capacity at the surface and midpoint of the boring,
- submitting a geotechnical evaluation report containing logs of the borings, analyses of the field laboratory tests, and recommendations.

A.4. Documents Provided

We were provided a profile of the proposed pipeline, and the GPS coordinates of the six borings.

B. Results

B.1. Logs

Log of Boring sheets indicating the depths and identifications of the various soil strata, penetration resistances, water level and laboratory test results are included in the Appendix. The strata changes were inferred from the changes in the penetration test samples and auger cuttings. It should be noted that the depths shown as changes between the strata are only approximate. The changes are likely transitions and the depths of the changes vary between the borings.

Geologic origins presented for each stratum on the Log of Boring sheets are based on the soil types, blows per foot, and available common knowledge of the depositional history of the site. Because of the complex glacial and post-glacial depositional environments, geologic origins are frequently difficult to ascertain. A detailed investigation of the geologic history of the site was not performed.

B.2. Site Conditions

The project is located approximately 200 feet west of where the existing Dakota Gasification Company's CO_2 pipeline crosses Lake Sakakawea. The pipeline crosses the lake in a relatively wide location.

B.3. Soils

A total of six (6) penetration test borings were performed across the lake, just east of the existing pipeline. The general soil profile consists of lake sediment overlying both cohesive and granular soil. The individual strata are described in more detail in the following sections**.**

B.3.a. Lake Sediment. Borings ST-2, ST-3 and ST-6 encountered 1 foot of lake sediment. The lake sediment classified as fat clay based on the results of the Atterberg limits. However, the moisture contents of the sediment were significantly higher than the Liquid Limit of the soil. Therefore the sediment was acting more like a liquid then a soil.

B.3.b. Alluvium. Underlying the lake sediment, the borings encountered both cohesive and granular alluvium. This alluvium is the native soil that existed at this location prior to the lake being filled. The cohesive alluvium consisted of fat clay, and lean clay with varying amounts of sand. The cohesive soil had a very soft to medium consistency.

The granular alluvium consisted of silty sand, and poorly graded sand with silt and gravel. The penetration resistance in the granular alluvium indicateed the relative density of the granular alluvium was very loose to medium dense.

B.4. Laboratory Test Results

The result of the laboratory tests performed on the different soil samples are presented on the respective boring logs. Also, a summary of all the test results are presented in the Table "Summary of Laboratory Test Data" in the Appendix of this report.

B.4.a. Moisture Content Tests

Moisture content (MC) tests (per ASTM D2216) were conducted on selected samples to aid in our classifications and estimations of the soils' engineering properties. The moisture contents of the soils tested in the sediment soils ranged from 104 to 105% and for alluvial soils ranged from 25 to 46 percent. All the soils are submerged with approximately 50 feet of standing water. All these moisture contents are saturated moisture contents of soil samples.

The results of the moisture content tests are listed in the "MC" column of the Log of Boring Sheets attached in the Appendix.

B.4.b. Unit Weight Tests

The unit weight tests were conducted on selected samples to aid in developing engineering parameters related to settlement calculations. The tests indicated the sediment soils had uniform wet density (WD) of 90 pounds per cubic foot (pcf). The wet densities of alluvial soils varied from 107 to 123 pcf. The results of the density tests are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.4.c. Atterberg Limits Tests

The Atterberg limits tests (per ASTM D4318) were conducted on selected samples for classification, evaluation of the soils' plasticity, and estimation of engineering parameters related to consolidation to aid in settlement calculations. The tests indicated the selected

sediment sample had liquid limit (LL) of 76 percent, plastic limit (PL) of 16 percent, and plasticity index (PI) of 60 percent, indicating the soils are classified as fat clays (CH). The tests on the alluvium soil samples indicated they had liquid limits (LL) of 34 to 50 percent, plastic limits (PL) of 19 percent, and plasticity indices (PI) of 15 to 31 percent, indicating the soils are classified as lean clays (CL) and fat clays (CH). The results of the Atterberg Limits test are listed in the "Tests or Notes" column on the attached Log of Boring sheets.

B.4.d. Percent Passing the #200 Sieve Tests

Percent passing the #200 sieve analyses tests (P200) (per ASTM D1140) were performed to estimate the engineering properties of the granular material. The results of the P200 tests indicated the soils encountered had P200's ranging from 8 to 70 percent, indicating the soils are classified as poorly graded sand with silt and sandy lean clay.

B.4.e. Electrical Resistivity Testing

Electrical resistivity testing was conducted in the three selected alluvial soil samples. The electrical resistivity test results were generally in the range of 580 to 1900 Ohm-cm.

C. Analyses and Recommendations

C.1. Project Background

We understand the Bakkenlink pipeline will either be placed in the bottom of the lake through a direct cut or it will be sunk into place. Based on previous experience with pipelines crossing the lake, we assume the minimum cover depth goal is 5 feet. If sinking is feasible it will involve placing a concrete encased pipeline. At this time it does not appear that simply weighting the pipe will cause it to settle a minimum of 5 feet because we found 1 to 2 feet of sediment in three of the six borings. The direct cut method will likely require either a hydraulic jet or a dragline to create a trench for the pipeline.

If our understanding of the proposed project is not correct, or if the proposed grades differ significantly from the above grades, we should be informed. Additional analyses and revised recommendations may be necessary.

C.2. Sediment Parameters

As indicated, the sediment has moisture contents over the liquid limit of the soil and will act more like a liquid then a soil. In order to determine the weight needed in the pipeline to sink into the sediment, an estimate of the sediment unit weight is needed. The following table contains the information collected within the sediment in the various borings.

Table No. 1. Parameter of Lake Sediment.

Boring	Thickness (feet)	Moisture Content %	Wet * Density (pcf)**
ST-1	NA	-	-
ST-2	1	105	90
ST-3	1	105	90
ST-4	NA	-	-
ST-5	NA	-	-
ST-6	1	105	90

Note: * Wet Weight equals the total weight of the soil. To determine the effective weight, subtract the weight of water (62.4 pcf).
** pcf = Pounds Per Cubic Foot.

Because of the very soft and fluid nature of the sediment, we have no way to test the soil strength, however, there is likely some type of soil strength that has developed in the sediment. The strength of the sediment may be estimated as cohesion that has developed from the preconsolidation of the sediment.

On page 7.1-141 of the Department of Navy Design Manual 7.2, there is a relation to calculate the cohesion of a soil based on the preconsolidation of the soil (weight of material above the soil). The relation is: Cohesion = (Unit Weight of soil – Weight of Water) * Depth into the sediment *(0.11+0.0037 * Plastic Index of the Soil)

For this project, the PI of the sediment should be assumed to be at 60. This relationship shows that the strength of the sediment will increase with depth. The increase in the soil strength should be linear.

C.3. Bearing Capacity

As requested, we collected undisturbed samples from near the midpoint of the borings. We had planned to perform an unconfined compression test on the samples, however the samples were soft and became disturbed during the extraction process.

As an alternative, we recommend that the cohesion of the soil can be estimated by taking the blow count time 125 pounds per square foot. The ultimate bearing capacity of the soil can be roughly estimated by multipling the cohesion of a soil by 9. The net allowable bearing capacity of the alluvium soil at five feet depth below the existing lake bed for a spread footing foundation is estimated up to nine hundred (900) psf. This value includes a safety factor of at least 3.0 with regard to bearing capacity failure.

Although these soils have strength, their moisture content will cause these soils to deform and settle. Design of the pipeline will need to be designed to resist the movement of the soil.

C.3. Soil Corrosivity

The results of our electrical resistivity testing indicate that the soils are severely corrosive to steel structures. We recommend that corrosion protection be provided for below-grade ductile iron pipe.

Per current engineering practice, the corrosivity of concrete is evaluated based on the sulphate or chloride concentration tests of the on site soils. These tests were beyond the scope of work for the current project. However, based on our experience with the project site, we anticipate the soils on this site provide a mild to moderate degree of exposure to sulfate attack. Per the ACI requirements we recommend the cementitious material consist of *either* ASTM C 150 Type II cement (designed for moderate sulfate resistance) *or* a combination of any type of ASTM C 150 cement with sufficient quantities of fly ash and/or slag to produce an expansion not exceeding 0.05% at six months or 0.10% at one year when the combination is tested according to ASTM C 1012, “Standard Test Method for Length Change of Hydraulic-

Cement Mortars Exposed to a Sulfate Solution.” We also recommend that all below-grade and below-water concrete be designed with a water-cement ratio of 0.50 or less, and with a minimum 28-day compressive strength of 4000 psi.

D. Procedures

D.1. Drilling and Sampling

We performed the standard penetration test borings from July 25 to 27, 20011, with a trailer-mounted core and auger drill equipped with 3 1/4-inch, inside diameter hollow-stem auger to the bottom of the boring. Sampling for the borings was conducted in general accordance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils." We advanced the boreholes with the hollow-stem auger to the desired test depths. A 140-pound hammer falling 30 inches was then used to drive the standard 2-inch split-barrel sampler a total penetration of 2 feet below the tip of the hollow-stem auger. The blows for the middle foot of penetration were recorded and are an index of soil strength characteristics. Samples were taken at 2 foot vertical intervals for the termination depths of the borings. A representative portion of each sample was then sealed in a glass jar.

D.2. Soil Classifications

A geologist visually and manually classified soils encountered in the test borings in the field in accordance with ASTM D 2488, "Description and Identification of Soils (Visual-Manual Procedures)." A summary of the ASTM classification system is included in the Appendix. All samples were then returned to our laboratory for review of the field classifications by a geotechnical engineer. Representative samples will remain in our office for a period of 60 days to be available for your examination.

E. General

E.1. Basis of Recommendations

The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the attached boring logs. Often, variations occur between these borings, the nature and extent of which do not become evident until additional exploration or construction is conducted. A reevaluation of the recommendations of this report should be made after performing on-site observations during construction to note the characteristics of any variations. The variations may result in additional foundation costs, and it is suggested that a contingency be provided for this purpose.

It is recommended that a qualified firm be retained to perform the observation and testing program for the site preparation phase of this project. This will allow correlation of the soil conditions encountered during construction to the soil borings.

E.2. Soil Evaluation Basis

This report was prepared based on the requested scope of services. It is recommended that a qualified firm be retained to review the geotechnical aspects of any projects and specifications developed based on this report. This review should determine whether any designs have affected the validity of the recommendations, and whether our recommendations have been correctly interpreted and implemented in the design and specifications.

E.3. Use of Report

This report is for the exclusive use of Bartlett & West and their client to use to design the proposed structures and prepare construction documents. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report. The data, analyses and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us.

E.4. Level of Care

Services performed by Braun Intertec Corporation personnel for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

Appendix

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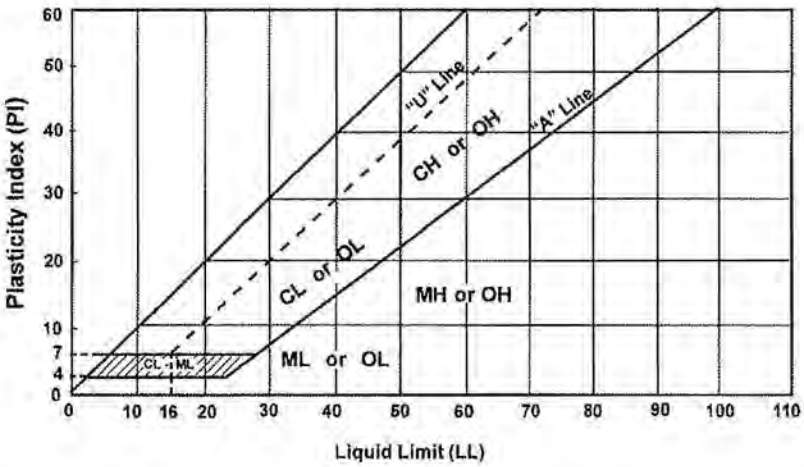
Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60}/D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

BRAUN INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-01**

LOCATION: 48 08' 56.538" N 102 53' 38.717" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/25/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1810.0	0.0	CL	SANDY LEAN CLAY, dark brown, wet, very soft. (Alluvium)	WH		27	123	P200=69.8%
1808.0	2.0	CH	FAT CLAY, dark brown and dark gray, wet, very soft. (Alluvium)	2		41	112	
				2		51	107	LL=50, PL=19, PI=31
1803.0	7.0	CL	LEAN CLAY with SAND, brown, wet, medium. (Alluvium)			46		
				6		45	110	
1800.0	10.0		Wood encountered at a depth of 9 feet.					
			END OF BORING.					
			Water depth 42 feet.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

BRAUN INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-02**

LOCATION: 48 08' 45.218" N 102 53' 37.628" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/25/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1806.0	0.0							
1805.0	1.0	CH	FAT CLAY, dark brown, wet, very soft. (Sediment)	WH		104	90	Sediment
		CL	LEAN CLAY, bown, wet, soft to rather soft. (Alluvium)	4		39	114	
1801.0	5.0					38		Electrical Resistivity =1800 ohm-cm
		SM	SILTY SAND, olive, waterbearing, medium dense to loose. (Alluvium)	14		34		P200=19.1%
				7		25		
1796.0	10.0							

END OF BORING.

Water depth 46 feet.

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BRAUN INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-03**

LOCATION: 48 08' 15.141" N 102 53' 34.395" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/26/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1803.0	0.0							
1802.0	1.0	CH	FAT CLAY, olive, wet, very soft. (Sediment)	WH		105	90	
		SM	SILTY SAND, brown, waterbearing, very loose to medium dense to dense. (Alluvium)	2		31		
			Encountered wood and organics at 3 feet.					
						35		
				11		29		P200=13.8
				29				
1793.0	10.0							
			END OF BORING.					
			Water depth 49 feet.					

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BRAUN INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-04**

LOCATION: 48 07' 16.571" N 102 53' 28.653" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/26/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1804.0	0.0	CL	LEAN CLAY, brown, wet, rather soft to soft. (Alluvium)	4		36	114	
1801.0	3.0			2		37	115	LL=34, PL=19, PI=15
		SM	SILTY SAND, dark brown, waterbearing, loose. (Alluvium)			34		Electrical Resistivity = 580 ohm-cm
				6		27		P200=46.1%
				9		29		
1794.0	10.0							
			END OF BORING.					
			Water depth 48 feet.					

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BRAUN INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-05**

LOCATION: 48 07' 11.247" N 102 53' 28.391" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/27/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1808.0	0.0	CL	SANDY LEAN CLAY, olive, wet, very soft to rather soft. (Alluvium)	1		30	120	
				WH		38	114	
						40		
				2		42		P200=83.6%
				5		38		P200=84.4%
1798.0	10.0							
			END OF BORING.					
			Water depth of 44 feet.					

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BRAUN™ INTERTEC

LOG OF BORING -

Braun Project FA-11-01275
Geotechnical Evaluation
Bakkenlink Pipeline Crossing
Lake Sakakawea
Tioga, North Dakota

BORING: **ST-06**

LOCATION: 48 07' 50.495" N 102 53' 31.978" W

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Safety Hammer | DATE: **7/27/11** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	WD pcf	Tests or Notes
1804.0	0.0							
1803.0	1.0	CH	FAT CLAY, dark brown, wet, very soft. (Sediment)	2		105	90	LL=76, PL=16, PI=60
1800.5	3.5	CL	LEAN CLAY, dark gray, wet, soft to rather soft. (Alluvium)	6		30	120	
		SP	POORLY GRADED SAND with SILT and GRAVEL, fine to medium grained, brown, waterbearing, loose. (Alluvium)			40		Electrical Resistivity = 1900 ohm-cm
				4		27		LL=NP
				11		25		Gravel=34.8%, P200=8.19%
1794.0	10.0							
			END OF BORING.					
			Water 48 feet deep.					

LOG OF BORING N:\GINT\PROJECTS\FARGO\2011\01275.GPJ BRAUN_V8_CURRENT.GDT 8/12/11 15:07

SUMMARY OF LABORATORY TEST DATA

Project No.: FA-11-01275		Bakkenlink Pipeline Crossing Lake Sakakawea Tioga, North Dakota

Boring No.	Sample Type	Depth	Moisture Content	Moisture Density	Atterberg Limits + MC	P200	Electrical Resistivity (Ohm-cm)	Remarks
ST-01	Composite	0' - 2'	27	123		69.8%		
ST-01	Composite	2' - 4'	41	112				
ST-01	Composite	4' - 6'	51	107	LL=50, PL=19, PI=31			
ST-01	Composite	6' - 8'	46					
ST-01	Composite	8' - 10'	45	110				
ST-02	Composite	0' - 2'	104	90				
ST-02	Composite	2' - 4'	39	114				
ST-02	Composite	4' - 6'	38				1800	
ST-02	Composite	6' - 8'	34			19.1%		
ST-02	Composite	8' - 10'	25					
ST-03	Composite	0' - 2'	105	90				
ST-03	Composite	2' - 4'	31					
ST-03	Composite	4' - 6'	35					
ST-03	Composite	6' - 8'	29			13.8%		
ST-03	Composite	8' - 10'						
ST-04	Composite	0' - 2'	36	114				
ST-04	Composite	2' - 4'	37	115	LL=34, PL=19, PI=15			
ST-04	Composite	4' - 6'	34				580	
ST-04	Composite	6' - 8'	27			46.1%		
ST-04	Composite	8' - 10'	29					
ST-05	Composite	0' - 2'	30	120				
ST-05	Composite	2' - 4'	38	114				
ST-05	Composite	4' - 6'	40					
ST-05	Composite	6' - 8'	42			83.6%		
ST-05	Composite	8' - 10'	38			84.4%		
ST-06	Composite	0' - 2'	105	90	LL=76, PL=16, PI=60			
ST-06	Composite	2' - 4'	30	120				
ST-06	Composite	4' - 6'	40				1900	
ST-06	Composite	6' - 8'	27		LL= NP			
ST-06	Composite	8' - 10'	25			8.19%		Gravel= 34.8%

Appendix 9.4

Memo on Concrete Weight Coating of Maine Pipeline Protection

Project Memorandum

PCS Project No.	**10045**
Project	**Bakkenlink Pipeline Project**
Aspect	**Lake Sakakawea Crossing**
To	**Jarrett Davis**
From	**Terry Oram**
Subject	**Pipeline Protection**

PCS has extensive experience in developing solutions for the protection of installed marine pipelines. Each project is unique and requires specific design and construction efforts to ensure that the pipeline is installed and operated in a safe manner based on the location and marine traffic plying the waters in the immediate vicinity. For projects in areas of higher than normal marine traffic, the safety of the pipeline under study will be reviewed and evaluated by subject matter experts (SME) in the field of marine engineering and more particularly, the study of anchors and anchor impacts, These studies are intended to develop criteria for pipe wall thicknesses, concrete weight coating density and thickness, depth of pipeline lowering, backfill requirements and in the extreme cases, engineered back-fill or other mechanical protection.

One such study involved the physical evaluation of a range (in weight/size) of anchors being dropped onto a pipeline with varied protective covering to confirm that the planned pipeline was adequately designed and the lowering and protective cover provided 100% protection. In this case a 24-inch pipeline (0.576-inch wall, X-60 with 3.35 inches of 190 pcf concrete weight coat (CWC)) was positioned on land and subjected to 2.5, 4, 7, 9, and 12.5 ton anchors being dropped on the pipeline from a crane. It was found that the concrete coated pipe was able to withstand a direct hit from up to a 4 ton anchor without any permanent dent or deformation of the steel pipe. In all test cases, including the dropping of the anchors directly on the bare girth weld, the pressurized pipe did not fail and in the case of the 2.5 ton (5000 pound) anchor, the CWC was only slightly damaged.

Our understanding of the marine traffic plying Lake Sakakawea in the area of the proposed pipeline crossing is that the boat sizes are generally less than 30 feet LOA including salmon fishing using downrigger equipment. It is assumed that with the presence of multiple existing pipelines crossing in the immediate vicinity of the proposed pipeline route and the direction from the USACE for our pipeline to be routed in this same general area as the existing pipelines, that no dredging or capital works will be performed in this area by the USACE. This being the case, protection of the pipeline will be developed for inadvertent or deliberate anchor drops from 30 feet LOA boats and impacts from downrigger equipment.

The attached *Anchor Selection and Specifications Guide* from Fortress Marine Anchors identifies that 30 feet LOA boat would not use any type of anchor weighing more than 30 pounds confirming a boaters rule of thumb of I pound per I foot of length. The downrigger system uses a 10-20 pound weight to keep the gear at a preferred depth in the water column. If the weight is lowered to the bottom during trawling, it would not damage the lowered pipeline.

Based on these conditions, PCS is satisfied that with the pipeline as designed, as concrete weight coated and lowered with the top of pipe below the natural lake bed, will be adequately protected and safe for operation.

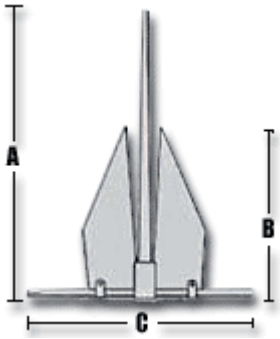
Fortress Marine Anchors
1386 West McNab Road
Fort Lauderdale, Florida, USA 33309

Anchor Selection & Specifications Guide

Boat size recommendations are for boats of average windage and proportions in 30 knots of wind, average bottom conditions, and moderate protection from open seas. Remember that the loads in 42 knots of wind are twice as much as in 30 knots.

Use three-strand nylon rope, 6-12 ft (2-4 m) of chain and a minimum of 5:1 scope. Also, a minimum of 6 ft (2 m) of chain should be used for every 25 ft (8 m) of water depth. For storm conditions use an anchor one or two sizes larger.

Exclusively on Fortress...



FORTRESS SELECTION GUIDE

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
Boat Length	ft	16'-27	28'-32	33'-38	39'-45	46'-51	52'-58	59'-68	69'-150
	m	5-8	8-10	10-12	12-14	14-15	16-18	18-21	21-46
Weight	lb	4	7	10	15	21	32	47	69
	kg	1.8	3.2	4.5	6.8	9.5	14.4	21.2	31.1
Replaces Steel Anchors	lb	6-9	10-13	14-18	19-28	33-50	50-65	70-90	100-170
	kg	3-4	5-6	6-8	9-13	15-23	23-29	32-41	45-77

HOLDING POWER

Model	FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125

Working Load	lb	700	900	1.250	2,000	3,000	4,000	5,250	6,750
	kg	318	408	567	907	1,351	1,814	2,381	3,062
32 Degree Hard Sand Holding Power	lb	2,800	3,600	5,000	8,000	12,000	16,000	21,000	27,000
	kg	1,270	1,633	2,268	3,629	5,443	7,258	9,536	12,247
45 Degree Soft Mud Holding Power	lb	840	1,080	1,500	2,400	3,600	4,800	6,300	8,100
	kg	381	490	680	1,089	1,633	2,177	2,858	3,674
32 Degree Soft Mud Holding Power	lb	420	540	750	1,200	1,800	2,400	3,150	4,050
	kg	191	245	340	544	816	1,089	1,429	1,837

DIMENSIONS

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
"A" Shank Length [diagram]	in	24"	27"	31"	36"	40"	46"	51"	56"
	mm	610	685	787	914	1,016	1,168	1,295	1,422
"B" Fluke Length [diagram]	in	14"	16"	18"	21"	24"	27"	30"	33"
	mm	356	406	457	533	610	686	762	838
"C" Stock Length [diagram]	in	19"	22"	25"	29"	32"	37"	41"	45"
	mm	483	559	635	737	813	940	1,041	1,143

SUPPORT HARDWARE

Model		FX-7	FX-11	FX-16	FX-23	FX-37	FX-55	FX-85	FX-125
Proof Coil Chain	in	3/16"	1/4"	5/16"	3/8"	3/8"	1/2"	1/2"	1/2"
	mm	5	6	8	9	9	13	13	13
Nylon Rope**	in	3/8"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/4"
	mm	9	9	13	16	19	22	25	32
Shackle Size	in	1/4"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	5/8"
	mm	6	6	8	10	12	12	16	16

NOTE: Hard sand holding power figures above represent loads actually achieved on production FORTRESS and Guardian anchors under controlled horizontal pull conditions without dragging or resulting in disabling structural deformation.

** Rope recommendations are based on 25% of breaking strength. Rope must be in good condition.

Appendix 9.5

Memo on Lake Crossing Lowering Equipment, Experience and Planning

Project Memorandum

PCS Project No.	**10045**
Project	**Bakkenlink Pipeline Project**
Aspect	**Lake Sakakawea Crossing**
To	**Jarrett Davis**
From	**Terry Oram**
Subject	**Lake Crossing Lowering Equipment, Experience and Planning**

Submersible or slurry pumps are used by marine construction and diving groups to extract and/or relocate large volumes of seabed materials in a safe and controlled manner. The Toyo pump is one of the more commonly used and well known types of submersible pumps available to the marine construction industry for seabed material relocation solutions when diver operated air-lift equipment is inadequate. The pump is particularly effective when precise removal of materials is required in sensitive, confined and/or restricted locations.

The Toyo pump has been adapted and utilized to solve a wide range of subsea extraction and material transfer projects. The diversity of these applications and the importance of solving each situation in a timely manner provides evidence of the trust that international and domestic operators and contractors have of Toyo's effectiveness as a problem solving tool. Additional support for the Toyo pump is provided by the US Army Engineer Waterways Experiment Station document DRP 3-05 dated 1992 that reported on the results of full-scale field tests that "The Toyo pump performed the best overall and was only bettered by the Indian River Inlet educator when pumping wood debris". The reference to this report is made to illustrate the effectiveness of the Toyo pump in lifting and moving the type of soils that were found on the lake bottom and to the depth of the intended trench during the geotechnical investigations. In the report, sand, gravel, rip-rap, timber, plastic liners, aluminum cans were used as the "medium" for the trials. By comparison, the lake bed materials are more mundane and are described as *"The general soil profile consisted of lake sediment overlying alluvial soils. The lake sediment were encountered in four of the six borings and appeared to consist of 1 foot of "soil" that would classify as fat clay, however, the moisture content of the sediment was higher than the soils liquid limit. Therefore, this sediment was acting more as a fluid. Below the sediment, alluvial soils consisting of lean clay, silty sand, and poorly graded sand with silt and gravel were encountered. These alluvial soils are the native soils that were at this site prior to flooding of the lake. The cohesive portions of these soils generally were very soft to rather soft in consistency and the granular soils had a very loose to medium dense, relatively density"* Note 1.

Note 1

"Subsurface Evaluation for Bakkenlink Pipeline Crossing Lake Sakakawea, South of Tioga, North Dakota" by Braun Intertec Corporation

Lake Crossing Lowering, Equipment, Experience and Planning.

An unique aspect of dredging with the Toyo submersible pumps is the lack of turbidity. As the impeller rotates the slurry exits the pump discharge at a much higher velocity than the entry point. This creates a low pressure zone at the impeller eye and atmospheric pressure pushes more slurry into the pump. This is commonly referred to as the ability of the pump to create suction. In addition, the agitator directs flow away from the impeller creating an additional low pressure area between the agitator and the impeller. All the solids that are disturbed from their settled state are drawn into the low pressure area and through the pump - minimizing turbidity. Turbidity is further reduced due to the fact that the Toyo pump typically operates sub surface - below the mud line.

Most pipelines in the Gulf of Mexico (GOM) are lowered using jetting technology. In the jetting process, soils beneath the pipeline are fluidized with high pressure water and air-lifts remove the fluidized soil from beneath the pipe. As the jet sled is pulled forward, the pipeline astern of the sled settles into the jetted trench. Jetting has been used in the GOM since the 1950's after unburied pipelines were found to be susceptible to fishery operations and were unprotected during a storm events. The lowering of the pipeline with the top of pipeline three feet or more below the natural seabed, was introduced to protect and stabilize the pipeline and became a required standard by Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), for all new pipelines.

The concept of utilizing a submersible pump for lowering pipelines on a skid mounting straddling an installed pipeline is not new. Horizon Construction adapted a 1960's vintage conventional jet sled (see attachments) for use in the North East offshore environment. The design replaced the surface mounted jet pumps and compressors that are part of a normal marine jetting spread and concentrated the prime operating units at the immediate work area. The results from equipment trials prior to mobilization for the North East Gateway project offshore Boston proved the effectiveness of the new system.

The lack of marine equipment on Lake Sakakawea directed PCS to a pipe-pull methodology using a linear line pulling winch. With this winch mobilized and used to pull the pipeline across the lake, the use of the winch to progress a pipeline lowering sled and surface pontoons become the lake was reviewed. Each pipeline lowering project is unique and equipment is developed to solve the specific needs of the location, seabed conditions, environment and marine equipment availability. Utilizing experience gained from projects in Indonesia, Malaysia, Thailand and other locations where small sleds were utilized to lower pipelines using winches to progress the operation and divers to operate and monitor the progress, PCS developed a concept for a lighter model sled based on the seabed and environmental conditions and the lack of dedicated marine support and floating lifting equipment on Lake Sakakawea. Jeveler Construction Co. Inc. (Jeveler) has also developed a single Toyo sled unit (see attachments) that again minimizes the weight and subsequent transportation effort. Both designs will be reviewed and evaluated as the project progresses to construction with one of the designs being developed to a testing stage.

Lake Crossing Lowering, Equipment, Experience and Planning.

For the lake crossing, the pipeline trench length between the shorelines and outside the area lowered using land-based excavators is approximately 12,000 feet. The depth of trench is targeted for 6 feet. The width of the trench will vary (soil types) but is expected to be an 8 feet box cut with natural sloughing of the walls. This equates to an approximate 21,000 cubic yard trenching operation. Based on a conservative production rate of 250 cubic yards per hour (see report DRP 3-05) with an effective 10 hour day operation, the total duration is expected to be 9 days. The first pass is expected to lower the pipeline between 75% to 100% with subsequent lowering performed by divers if lowering is required in isolated locations or with another pass of the sled if extended sections require supplemental lowering. Rigging up for an additional pass of the sled will add approximately 2 days to the schedule to allow for relocation of the resources and rerunning the pull cable. The dive team will monitor the progress of the sled and the effectiveness of the operation. This monitoring will include increasing or decreasing the rate of travel as the lowering results are surveyed astern of the sled as the pipeline settles into the jetted trench. The divers will compare the natural lake bed (at an undisturbed offset) with the bottom of trench and top of pipe using depth (kluge) indicating hose or instrumentation similar to a C-Depth system (see attachments). Additionally, after the dive team has advised the Project Engineer that a section of the pipeline has been lowered to grade, a series of echo sounder cross sectional runs will be made at suitable spacing along the line by the Surveyors.

The pipeline applications for the Toyo pump over its 60 year plus life span are numerous and in some cases proprietary however some of its achievements are listed below:

1. Lowering of the shallow water section of a major 36-inch trunk line in the GOM in oyster bed areas (PCS was the Project Manager for this project)
2. Lowering of a 7,000 feet section of a 36-inch natural gas line in the GOM conducted under FERC jurisdiction (PCS personnel were part of the project team)
3. Used in the construction of a lowering tool as an alternative/back-up solution for several Atlantic seaboard pipeline projects (PCS was the Project Manager for this project)
4. Excavation of a pipeline trench adjacent to a producing trunk line in Sabah, Malaysia (PCS personnel were part of the project team)
5. Uncovering and exposing pipelines requiring repairs post Hurricane Rita (PCS was the Project Manager for this project)
6. Lowering of a 7,700 feet section of 30-inch natural gas pipeline displaced by a hurricane in the GOM under MMS jurisdiction (PCS personnel were part of the project team)
7. Maintenance of a dredged pipelines trench for a triple beach pulls in Sarawak, Malaysia (a PCS person was the Project Manager of this operation)
8. Lowering of several innershore pipelines in Taiwan. (PCS personnel were part of the project team)
9. Lowering of the innershore section of a 36-inch trunkline crossing the Tapti River in India (a PCS person was the Project Manager of this operation)

10. Lowering of multiple pipelines for a new pipeline crossing in the GOM (PCS personnel were part of the project team)
11. Excavation in the immediate shore crossing for an oil loading line at Map Ta Phut Thailand (a PCS person was the Project Manager of this operation)

For most of these pipeline projects, PCS personnel have played a senior role in either the design, the development of the application or the actual operation.

Jeveler Construction Co. Inc (Jeveler) is a Louisiana dredging contractor and equipment supplier that has participated and developed unique solutions to a wide range of subsea dredging projects using Toyo pumps. PCS has reviewed several projects with Jeveler and will most likely seek their input for the pipeline lowering of the Lake Sakakawea pipeline crossing. In addition to its participation in several of the named pipeline projects, Jeveler has a long list of non-pipeline accomplishments including the following where Toyo pumps were utilized:

1. Several large land developments in the Corpus Christi area (Padre Isles, Pelican Cove and Island Moorings).
2. Services in hazardous waste removal, wetland restoration, cofferdam dredging and other forms of environmental dredging. Our experience in moving materials has allowed us to modify the Toyo pumps to maximize their capabilities and minimize time and cost.
3. Dredging Contaminated Sediment - Along the bank of the Hylebos Waterway in Tacoma, Washington 32,000 cubic yards of contaminated sediment is being removed and treated, including some of the most dangerous chemicals in the Commencement Bay. The Toyo submersible dredge pump was specified as the preferred method of dredging due to the limited turbidity created when dredging as well as the high solids content when submerged in material. The treatment costs are considerable, so the focus is dredging at the highest solids content possible. Material is being pumped 2,000 feet to a treatment/dewatering process. The sediment is then trucked to a disposal site.
4. Wetland Restoration - This project was for marsh restoration near the mouth of the Neches River. A spoil disposal area was created from the dredging of a canal, a cooling water supply source for the power plant, was excavated down to natural marsh levels to create “coastal prairie” The excavated spoils were hauled to a centrally located pit, mixed with water from the canal to form slurry and pumped into the dead marsh area to form islands and higher elevations to promote growth of vegetation.
5. Filling Geotubes - beach stabilization project for NASA. 4,600 feet of 34’ circumference tubes filled up to 6’ in height with a medium grained sand. Excavators fed the sand to Javeler's hydraulic drive 75 hp submersible agitator pump which was placed in a 30' x 20' x 5' deep pit. The sand slurry was pumped through 2,300 feet of 8 inch HDPE pipe to fill the geotubes.

The following articles and brochures are attached to demonstrate the versatility and effectiveness of the Toyo pump that will be primary lowering tool for the Lake Sakakawea pipeline crossing

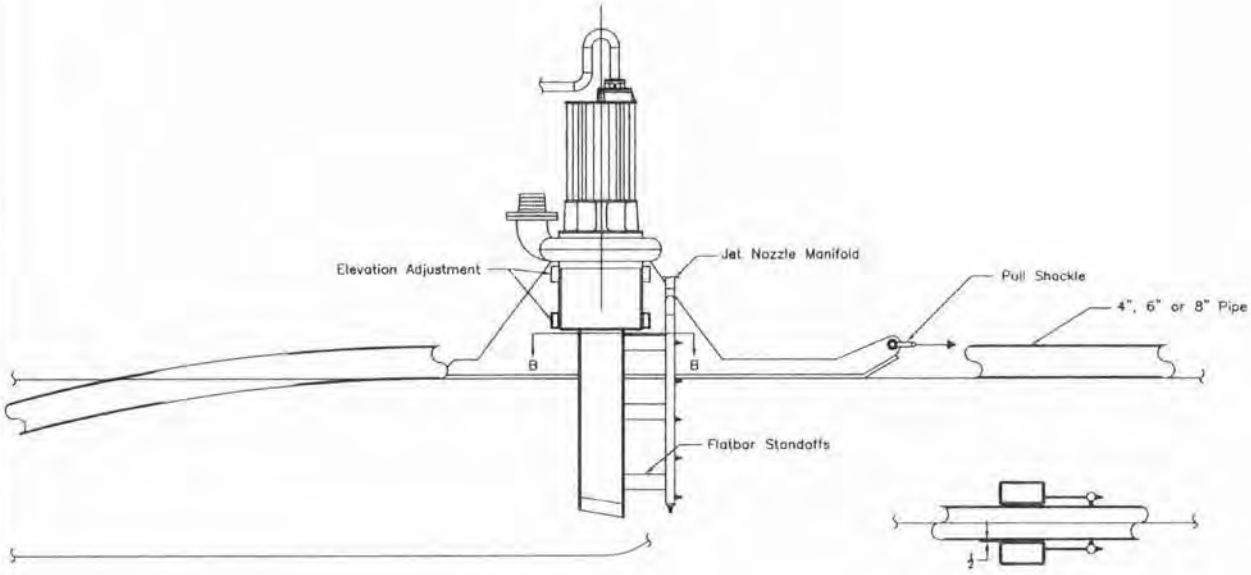
Lake Crossing Lowering, Equipment, Experience and Planning.

Attachments:

1. Alternative Pipeline Dredge Assembly (by Jeveler)
2. Javeler 75 converted Toyo pump (by Jeveler)
3. Toyo pumps incorporated in a jet sled (for NE application)
4. Description of the lowering the 7000 feet of 36-inch pipeline
5. Dredging Research Technical Notes (DRP-3-05)
6. Electronic Diver Depth Monitoring System

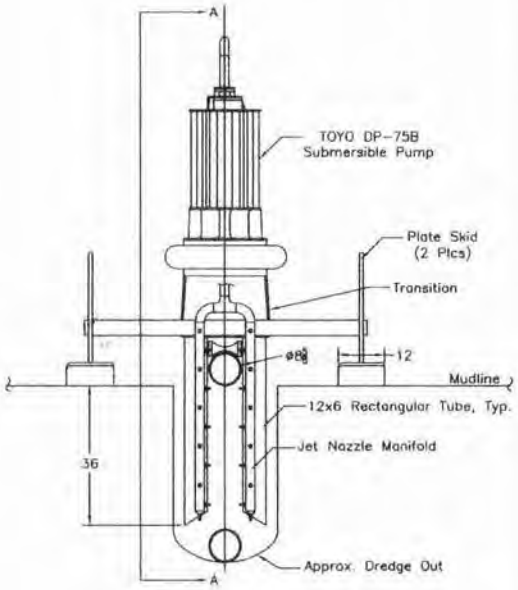
Revision 0
PCS 10045
October 18, 2011

ALTERNATIVE PIPELINE DREDGE DESIGN



Elevation – Section A–A

Plan – Section B–B



Elevation – View from Front

NOTES
Concept Drawing

ENGR RECORD	DATE	Javeler Construction	
		Pipeline Dredge Assembly	
DRAWN BY: RG	3/08		
CHECKED BY:		JOB NO.:	
APP. BY:		DRAWING NO.:	
APP. BY:			SHEET: 1 OF 3
SCALE: NTS			REV NO.: 0

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8" Discharge

75 PUMP SPECIFICATIONS

	Electric	Hydraulic
Discharge	8 inch	8 inch
Motor	75 hp	up to 150 hp
Capacity	1600 gpm	up to 2500 gpm
Head	96 feet	up to 170 feet
Production (based on free flowing sand)	75-150+ cy/hour	75-180+ cy/hour
Power Source	175 kw generator	HPU
Reel	static cable reel	hydraulic hose reel
Maximum Depth	150 feet	850+ feet (Greater depths with ROV)

*Pressure compensated for depths greater than 150 feet. A 75 hydraulic is also available for depths up to 150 feet

DIMENSIONS & WEIGHTS

	Electric	Hydraulic
Pump	6'H x 4'W x 3'D 2500 lbs.	6'H x 4'W x 3'D 2200 lbs.
Transport Skid (pump included)	13'L x 4'W x 5'H 4200 lbs.	6'L x 4'W x 8'H 3500 lbs.
Power Source	13'L x 4'W x 8'H 8600 lbs.	12'L x 5'W x 8'H 10,000 lbs.
Hydraulic Hose Reel	N/A	9'L x 7'W x 8'H 10,000 lbs.

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Salvage	Internal Pile Excavation
P&A Excavation	Jack Up Leg Excavation

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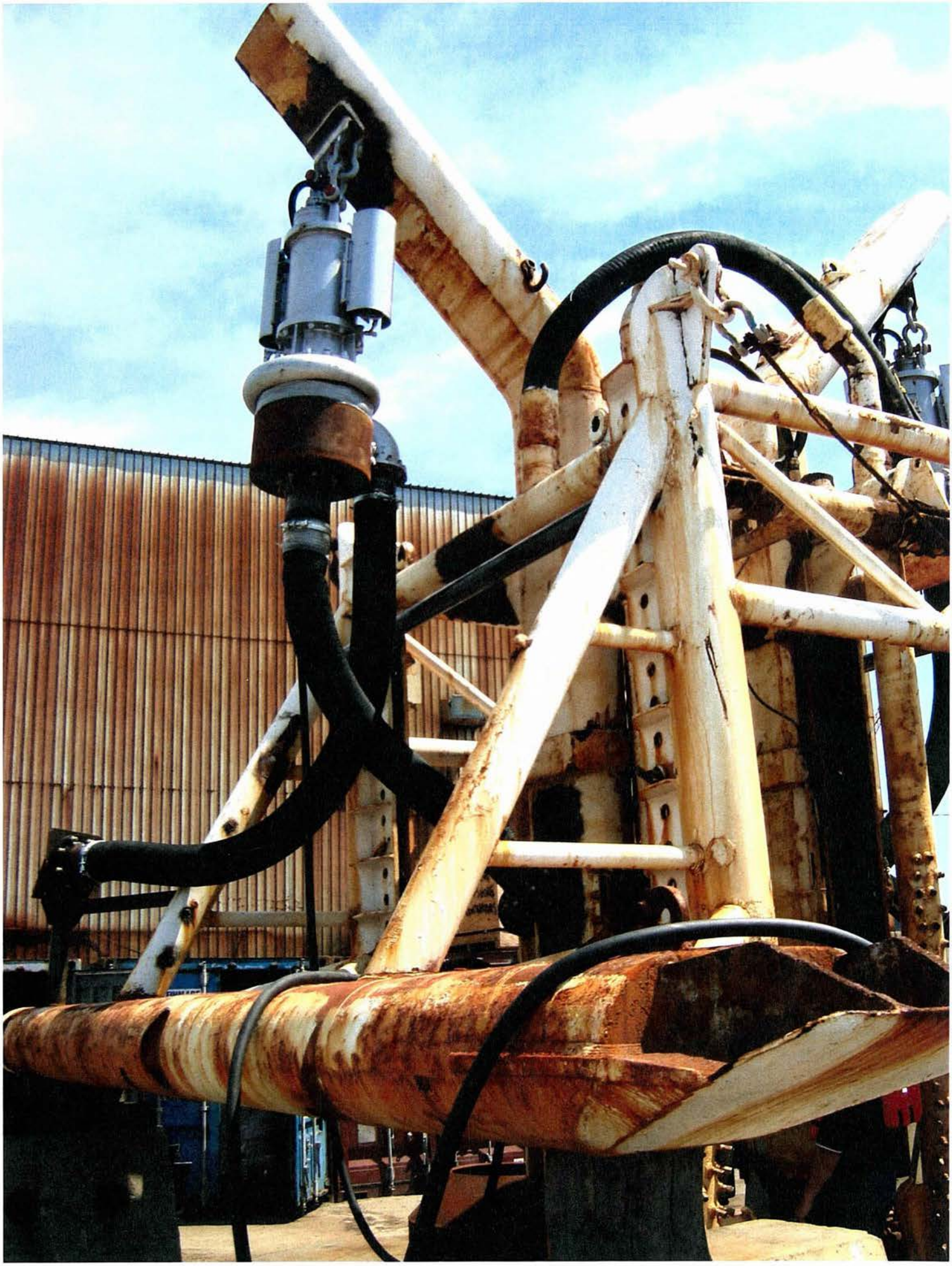
TOYO PUMPS INCORPORATED IN A JET SLED



LOWERING OF 7000 FEET OF 36-INCH PIPELINE

BP Pipeline Bury Project Summary

Oct 06

BP had to bury 7,000' of exposed 36 inch natural gas pipeline (10 miles offshore - Destin pipeline) with 6 feet of cover. The initial attempt to bury the pipe was with a Rotech 8000, but there were difficulties controlling the movement and placement of the sugar sand.

Chet Morrison was prime contractor with spud barges "Dolly" and the "14". Water depth of 15 feet.

Javeler rigged up two electric DP 150B pumps (8,000 lbs each), to straddle the pipe and bury it. The operation was carried out while the pipeline was under pressure and flowing natural gas.

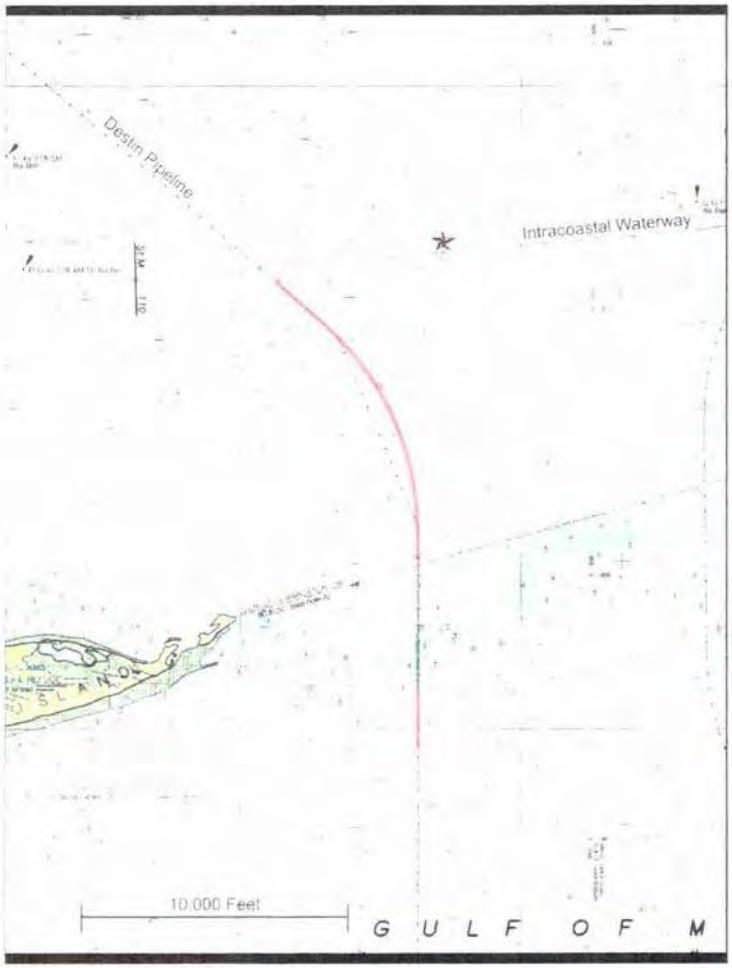
One barge carried all the equipment and backups, including generators and jet pumps, along with the crane to maneuver the twin dredge pump system. The second barge was outfitted with a second crane for handling the discharge lines and to house personnel.

The twin 150B dredge pump system was held in the vertical position at all times. Pumps were lowered (straddling the pipeline) and sand pumped through two separate floating 10 inch discharge lines approximately 200 feet away. The twin dredge pump system was continually raised and lowered, moving along the pipe, swinging in a 90 degree arc before barge was repositioned. Prior to repositioning, the dredge system was used to sweep the trench to excavate to grade. The pipeline lowered itself into the trench after excavating about 150 foot length.

An ROV was used to profile the pipe. Positioning was controlled via GPS and digging depth was monitored by metering the cable and sling. A tag line ran from the dredge pumps to a kevel on the deck of the barge.

Jetting was accomplished using a jet pump feeding water into the saddle, then branched off through 4 inch lines to each jet ring on the DP 150B pump. The saddle also had jets pointing inward.

Dredging activities lasted 2.5 weeks (single shift). ROV sweep revealed no damage to the pipeline coating.


Destin Pipeline
Intracoastal Waterway
10,000 Feet
G U L F O F M

DREDGING RESEARCH TECHNICAL NOTES (DRP-3-05)

DRP-3-05
May 1992

Dredging Research Technical Notes

Controlled Tests of Eductors and Submersible Pumps

Purpose

This technical note summarizes a series of full-scale tests on the US Army Engineer Waterways Experiment Station (WES) Dredging Research Program (DRP) eductor, a commercial eductor, and two commercial submersible pumps. The note covers test equipment, material, and procedures used to evaluate the performance of the eductors and submersible pumps in clean sand and a variety of debris types. Information provided will assist personnel in selecting equipment for specific dredging and sand bypassing applications.

Background

Eductors (jet pumps) are hydraulic pumps with no moving parts, relying instead on an exchange of momentum to entrain the slurry (Richardson and McNair 1981). Eductors have been used for sand bypassing at inlets since the early 1970s with varying degrees of success. Improvements in increased debris resistance and ease of deployment and retrieval were identified as items needed to make eductor sand bypassing more widely applicable, and resulted in the DRP work unit Improved Eductors for Sand Bypassing.

Additional Information

For additional information contact the authors, Mr. James E. Clausner, (601) 634-2009, Mr. Timothy L. Welp, (601) 634-2083, or Mr. Darryl Bishop, (601) 634-3004, or the manager of the Dredging Research Program, Mr. E. Clark McNair, Jr., (601) 634-2070.

Note: The contents of this technical note are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such products.

US Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

PRINTED ON RECYCLED PAPER

Description of Eductors and Submersible Pumps Tested

Through a series of contracts, the DRP eductor was designed, constructed, and tested. Some of the design features (Figures 1 and 2) include a smooth cylindrical outer shape to prevent debris (logs and sticks) from jamming in the eductor and making retrieval difficult, a series of fluidizing nozzles around the perimeter of the tip to fluidize the sand for removal and to allow heavy debris to sink below the eductors, a grate over the entrance to prevent debris from entering the suction chamber, and a ring jet to reduce pullout forces.

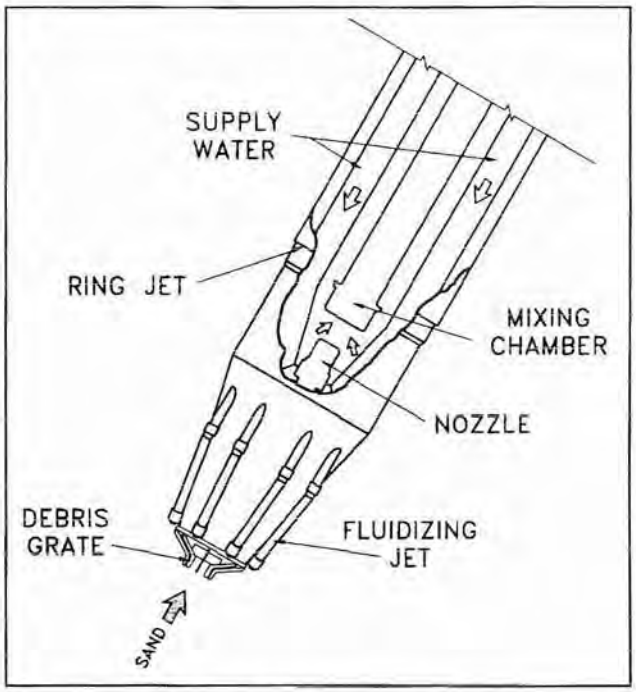


Figure 1. Schematic of DRP eductor

Figure 2. DRP eductor

As a baseline comparison, the eductor used at the Indian River Inlet, Delaware, Sand Bypass System also was tested; see *Dredging Research Technical Notes* DRP 3-03 (Clausner 1990a) for additional details. This eductor, built by Standard Gravel of Franklinton, Louisiana, has the same basic hydraulics as the DRP eductor. However, this eductor has a simple suction duct and a linear manifold of fluidizing nozzles (Figures 3 and 4). The Indian River Inlet eductor has been used successfully for over two years, bypassing over 150,000 cu yd before the test date (by January 1992 the bypass system had transferred over 200,000 cu yd). Testing of the Indian River Inlet eductor provided an excellent standard against which to compare the DRP eductor.

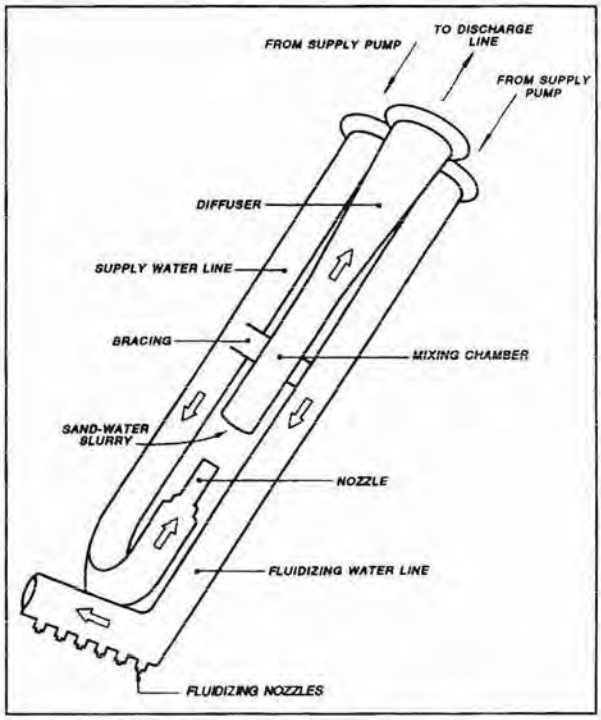


Figure 3. Schematic of Indian River Inlet eductor

Figure 4. Indian River Inlet eductor

Another facet of the Improved Eductor work unit is to investigate alternatives to eductors with submersible pumps being a likely alternative (Clausner 1990b). Consequently two submersible pumps were included in the testing program. The first pump tested was an H&H model PF50 x 8P 8-in. hydraulically powered submersible pump with a 75-gallon per minute (gpm) (M76 x 5.0) hydraulic motor (Figure 5). The final pump tested was a Toyo DP-150B electrically

Figure 5. H&H PF50 by 8P submersible pump

powered, 10-in. submersible pump (Figure 6). Table 1 summarizes the characteristics of the eductors and submersible pumps tested.

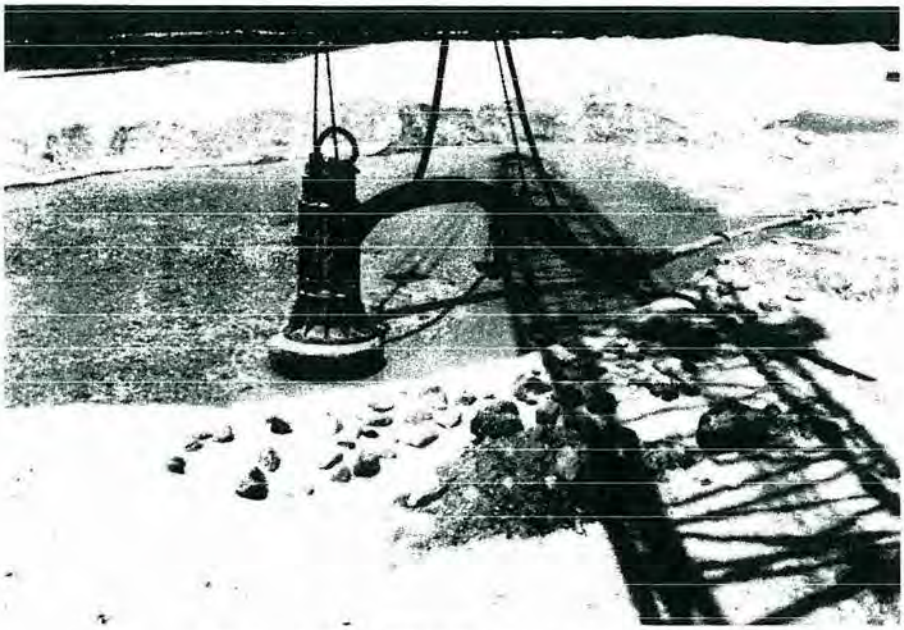


Figure 6. Toyo DP150B submersible pump

Table 1 Eductors and Submersible Pumps Tested*			
Item/ Manufacturer	**Physical Characteristics**	**Power Source Characteristics**	**Average Horsepower Consumed**
DRP Eductor/ Genflo Standard Gravel Company	20-ft-long, 9,000-lb, mixer, 6-in. discharge pipe, 10 in. long	450-hp diesel, pump, 3,300 gpm at 155 psi	300
Indian River Inlet Eductor/ Genflo - Standard Gravel Company	20-ft-long, 3,500-lb, mixer, 6-in. discharge pipe, 10 in. long	450-hp diesel, pump, 3,300 gpm at 155 psi	300
H&H Model PF 50 x 8 with 20 percent chrome and nickel inlay	3-ft-long, 3-ft-wide, 724-lb, max. spherical solid, 4-in. discharge pipe, 8 in. long	275-hp diesel, hydraulic pump, 75 gpm at 2,000 psi	150
Toyo DP-150B high chrome pump with external agitator	8-ft-long, 3-ft-diameter, 8,000-lb, max. spherical solid, 4-1/2-in. discharge pipe, 10 in. long	300-hp diesel, generator	150-200

* The last column is an estimate of the horsepower required from each power source by each pump during operation. The eductors only require about a 300-hp diesel for actual operation. The H&H pump used is normally supplied with a 150-hp power source; the larger unit used was only one available at the time of the test. The Toyo pump requires a high starting horsepower, but only consumes 150-200 hp during operation.

Test Location

The tests were conducted at Standard Gravel Company's Enon, Louisiana, gravel pit (approximately 65 miles north of New Orleans). The availability of support equipment and electrical power and the relatively close proximity to the US Army Engineer Waterways Experiment Station (WES) made this site attractive. This site was selected because it also closely simulates applicable conditions at coastal bypassing locations.

Test Layout and Equipment

The test location has a large area of clean sand (mean diameter, 0.3 mm, less than 5 percent fines) in excess of 25 ft thick that could be saturated to simulate sand bypassing at a coastal location. The test site setup was nearly identical for both the eductor and submersible pump tests (Figure 7). The site encompassed an area approximately 300 by 450 ft and had a portable building where instrumentation used to monitor performance and archive test data was housed. Table 2 gives characteristics of the pumps used during the tests. A large crane (110-ton, 100-ft-long boom) was used to deploy the eductors and submersible pumps. A 3-cu yd backhoe, an 18-ton boom crane, and a bulldozer were also used to move pipe, grade sand, and perform other operations.

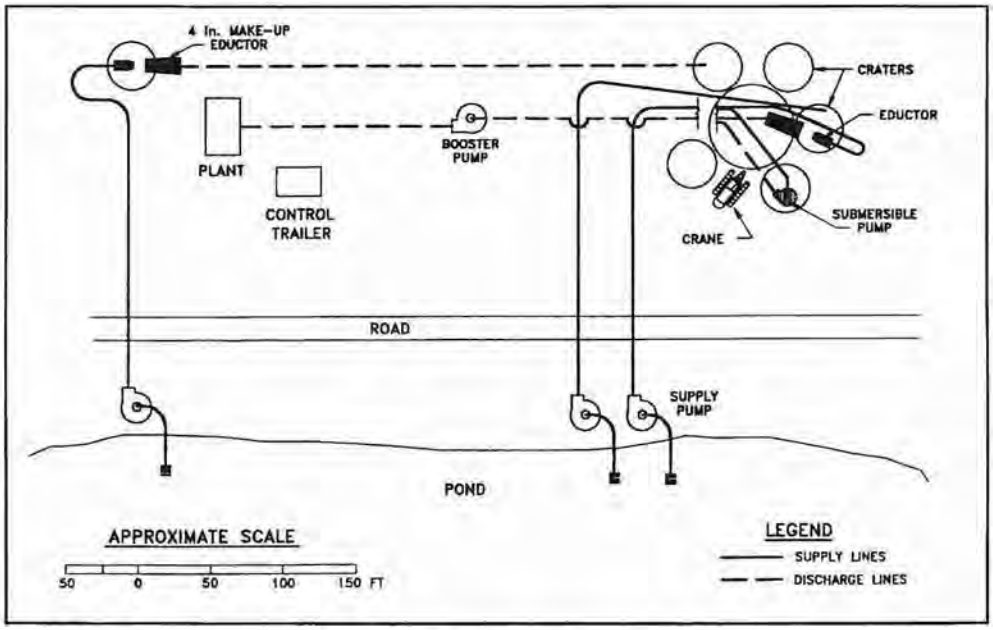


Figure 7. Test site configuration

Table 2
Water Pumps Used during Tests

Equipment	Horsepower	Flow Rate, gpm
Makeup water to crater	250	3,000
Inline booster	180	3,300
Supply pump for return eductor	180	1,500

Conditions at coastal sites were simulated by saturating the crater test area. This was done by pumping water to the crater before and during tests at a rate sufficient to keep the crater filled with water.

During the eductor tests, motive water to the eductors was provided by a supply pump from an adjacent pond through a 10-in. ID steel pipeline about 250 ft long. Slurry dredged by the eductors and submersible pumps flowed through an 11-in. ID high-density polyethylene (HDPE) pipeline to a booster pump. Discharge from the booster pump went through a 10-in. steel pipeline to a processing plant (classification tower with a 1-1/2 in. square grid grizzly), which was used to separate debris from the sand. The 30-ft tower minus the 10-ft drop in elevation from the booster pump to the bottom of the tower resulted in a 20-ft vertical lift. Sand separated by the processing plant was recycled back to the primary test area using a 4-in. eductor powered by a separate supply pump.

Instrumentation included pressure gages on the discharge side of the supply pump, at the inlet to the booster pump, and on the discharge side of the booster pump. A nuclear density meter and doppler flow meter were mounted on the vertical section of pipe attached to the processing plant. Pressure data, slurry velocity, slurry percent solids (by weight), and production (cubic yards per hour) were displayed and recorded on a personal computer after passing through a signal-conditioning unit. The hardware and software used to collect the data were originally developed under DRP work unit Production Meter Technology. For this test, the software was expanded considerably to allow display and user-friendly operation. WES Instrumentation Services Division developed the software and the signal-conditioning unit and installed the pressure transducers. Overall, the data collection system worked extremely well, with data being collected every 10 sec during the tests.

A video camera aimed at the test crater was used to document each test. A second video camera was focused on the computer screen as a backup in case of failure by the computer to record the test data.

Test Procedures

Pressure transducers were calibrated before testing (calibrations were stored in the computer) and the nuclear density meter was equalized daily (a two-hour warmup period). Predetermined motive water pump and booster pump pressures were established before the eductor test trials, as was the booster pump pressure for the submersible pump test trials. Each unit's production capacity was tested in "clean" sand and in sand-debris combinations for a 30-min duration of continuous performance in each test. Three separate trials were conducted for each combination in almost every case. For a limited number of cases only two runs were made.

The crane was used to deploy the eductor or submersible pump and reposition it as needed during each trial. The same crane operator was

used for all the tests conducted with different types of pumps and debris combinations. The debris combinations were laid on clean sand in a random pattern within a radius of approximately 15 ft around the point of application of the pump. As the unit excavated sand, the debris would "fall" into the crater. This method was used because debris in sand bypassing operations is encountered in a similar manner.

During the trial, when a substantial drop in percent solids was observed, the pump was lifted from the crater bottom and swung to the left or right approximately 5 ft and then set back on the bottom. This kept the pump in the debris field yet allowed it to possibly clear itself. During the stone debris trials it was observed that stones too large to enter the pump would accumulate in the bottom of the crater and form a barrier between the pump and sand, thus reducing production rates. The repositioning of the pump would allow it to excavate sand on the fringes of the consolidated barrier and pump slurry at higher rates until the process repeated itself. A video camera recorded the pump in the crater during the trial and documented debris accumulation at various locations (at the grizzly, in the booster pump stone box, or pump suction duct).

Under certain conditions, the submersible pumps could acquire slurry at very high percent solids concentrations (sometimes exceeding 60 percent solids by weight). At this point the discharge line was susceptible to being plugged if a slope cave-in temporarily choked the pump or if the pump momentarily lost power. At these times the operator would raise the submersible pump 1 or 2 ft to reduce solids concentrations. It was not always possible to give the operator sufficient notice to prevent plugging the line.

At the completion of each test with debris combinations, the crater area would be contaminated by debris that was too large to be transported by the system or that did not come into contact with the pump. Because of this, the contaminated area was surveyed by conventional methods, its position logged, and it was not used again. The flexible plastic HDPE pipe allowed the pumps to be redeployed in uncontaminated areas immediately adjacent to the previous debris trial.

The sand and debris combinations consisted of the following materials:

- Clean sand with a mean diameter of 0.3 mm and less than 5 percent fines.
- 16 cu ft of cut wood that varied in length from 1 to 3 ft with the diameters varying from 1 to 6 in. Before the tests, the wood pieces were soaked in water to produce a negative buoyancy which caused them to sink to the bottom of the crater during the trial.
- 16 cu ft of stone riprap ranging in size from 2 in. to 18 in. with a mean diameter of 7 in.

- 60 garbage-bag sized plastic liners (weighted with sand) and 15 "swim fins" fabricated from 3/4 in., 4-ply conveyor belt cut into 9- by 24-in. rectangular pieces.
- Aluminum beverage cans (punctured to sink). About 500 were tested in one jet pump trial with no apparent effect on production (minute pieces of shredded cans were observed at the grizzly) so the use of this debris was discontinued.
- Kelp. Kelp was donated by the San Diego Parks and Recreation Department, but the test runs with this debris were discontinued due to the kelp's increasing rate of deterioration and negligible effect on production rates. Had fresh kelp been available, it likely would have had a measurable impact on production.

In addition to the debris tests, the DRP eductor was tested for ease of deployment and retrieval. The deployment tests consisted of measuring the time required to sink the unit to a depth of 18 ft using only the fluidizing jets. By modifying the fluidizing jets so that the rear two jets pointed back toward the deployment frame with the remaining jets pointed straight down, the unit sunk to design depth in 90 sec.

During the retrieval tests, the deployment frame was removed to allow the eductor to sink vertically into the sand a distance of 18 to 20 ft. Then a series of pull tests were done with the crane acting through an inline load cell. Variables tested included the amount of time the unit was allowed to sit and the active assistance of the three hydraulic units — the fluidizing jets, the ring jet, and the eductor itself. Pullout loads ranged from 34,000 lb to 10,000 lb. The most important factor in keeping pullout forces to a minimum was allowing the sand around the whole unit to become fully fluidized, thereby reducing skin friction and preventing a vacuum. This was accomplished by operating the eductor and blocking the discharge line, and/or using the ring jet or fluidizers. The higher flows achieved by blocking the eductor discharge line (so all the water exits the open end of the eductor) provided the quickest saturation of the sand. However, the other two methods also were effective. It was concluded that the ring jet was not needed.

Results and Discussion

Sixty-one tests were conducted, with 48 of the tests meeting the WES criteria of 30 min of continuous performance. The average production rates for each set of tests are contained in Table 3. The DRP eductor and the Indian River Inlet eductor had very similar performance in clean sand, about 350 cu yd/hr. As expected, performance was reduced substantially in debris. The DRP eductor was measurably better in stone (244 versus 203 cu yd/hr) and garbage bags and swim fins (215 versus 186 cu yd/hr). The Indian River Inlet eductor was superior in wood (322 versus 269 cu yd/hr).

Table 3 Test Results Summary		
Equipment Tested	**Debris Type**	**Average Production Rate, cu yd/hr**
DRP eductor	Sand	355
	Stone	244
	Garbage bags and swim fins	215
	Wood	269
Indian River Inlet eductor	Sand	346
	Stone	203
	Garbage bags	186
	Wood	322
H&H submersible pump	Sand	221
	Stone	84
	Garbage bags and swim fins	188
Toyo submersible pump	Sand	375
	Stone	403
	Garbage bags and swim fins	322
	Wood	241

Of the two submersible pumps, the Toyo pump had consistently higher production in clean sand and all types of debris, while the H&H pump had the least amount of production of any unit tested. It should be noted that the H&H pump was an 8-in. pump, while the eductors and Toyo pump were 10 in. Had a 10-in. discharge coupling that attached directly to the pump housing been available for the H&H pump, an increase in production rate of up to 15 percent probably would have been possible (personal communication, Mr. Howard Stovall, Vice President, H&H Pump Company, January 24, 1992). This potentially would have raised production rates for the H&H pump to 254, 97, and 216 cu yd/hr in sand, stone, and garbage bags and swim fins, respectively. The H&H pump was more prone to plugging of the discharge line than any of the other units tested, having three instances where the line was plugged. A considerable amount of operator attention to raising and lowering the H&H pump to achieve maximum production and prevent plugging of the discharge line was required.

The Toyo pump was a much larger, heavier unit than the H&H pump. It also is much more expensive. Purchase price for the Toyo pump as tested was estimated at $73,300. The purchase price of the 8-in. H&H pump was approximately $15,300. The Toyo pump had the highest overall production of any unit tested, over 400 cu yd/hr. The improved production in stone versus sand was probably due to the operator gaining experience with the Toyo pump. The garbage bags and swim fins had an appreciable impact on production, reducing it to 322 and 241 cu yd/hr, respectively. The Toyo pump also was very sensitive to operator control, with relatively constant raising and lowering of the unit required to maintain high production and prevent plugging of the discharge line.

Conclusions

In clean sand, performance of the DRP eductor and the more conventional Indian River Inlet eductor are about the same. Performance in debris was a function of the type of debris. The grate on the DRP eductor keeps out stone and garbage bags/swim fins better than the Indian River Inlet eductor; however, the grate is more prone to clogging with wood. The Indian River Inlet eductor is more susceptible to stones entering into the suction chamber, thereby reducing performance.

The H&H pump in its present form is not well suited to the types of debris tested. It is very susceptible to both rocks and wood. A rock guard, relatively easily fabricated (and also available from the manufacturer), could help solve these problems, though probably reducing performance somewhat.

The Toyo pump performed the best overall and was only bettered by the Indian River Inlet eductor when pumping wood debris.

The lack of a requirement for constant operator control and the relative immunity to line plugging make the eductors well suited to long-term bypass operations. The choice of a particular eductor will depend on the type and amount of debris present. The Toyo pump's high production and apparent ruggedness make it a possible candidate for bypass operations (particularly those not suited for eductors), but the level of operator control required to achieve the high production rates and the potential for line plugging must be considered. The H&H pump's low cost and light weight (approximately 724 lb) make it well suited for smaller, aperiodic bypass and dredging jobs.

The Vicksburg District's Monroe Navigation Field Office used similar logic before purchasing a lightweight submersible pump to maintain locks and dams on the Red River. For small aperiodic dredging jobs, the purchase price can be a more important factor than production rate.

A detailed description of the tests will be published in a future DRP report.

Acknowledgements

The DRP acknowledges the cooperation of the following companies and agencies: H&H Pump Company, Toyo Pump Company, Javeler Construction Company, Delaware Department of Natural Resources and Environment Control, Standard Gravel Company, and the San Diego Parks and Recreation Department.

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C-DEPTH

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C-DEPTH

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Highly accurate Electronic Diver Depth monitoring system for up to Three Divers

The C-Depth 3 has been developed for electronic diver depth monitoring in Lightweight Diving Operations rather than using a pneumatic diving control panel. The system is ideal to give the Supervisor a surface read-out whilst air diving using tethered scuba diving, which utilises a rope or rope/comms line.

The C-Tecnics Electronic Pneumo System comprises a surface display indicating water depth, a power and signal cable from the surface to the operator/diver, and a highly accurate pressure transmitter. Three depths can be monitored simultaneously. The display meters feature push button switches for calibration of the unit prior to deployment, this allows for adjustments in ambient pressure when working at altitude for example in a lake or river.

The standard cables supplied are 75m in length, but longer are available. The small size of the transmitter allows it to be easily diver mounted for depth monitoring or hand-held as a bottom profiling device.

C-DEPTH SPECIFICATION

Dimensions

Surface Unit Exterior Dimensions (L x W x H)	299 x 248 x 195mm
Transducer Dimensions (L x Diameter)	125mm x 16mm

Electrical

Transducer Signal	4 – 20mA
Surface Unit	12vDC Rechargeable Battery
Battery Life	4 hours

Range

Depth Range	0-100m

Casing

Two press and pull latches, Double layered soft grip handle, Two padlockable hasps,
Vortex Valve, Lightweight Strong HPX Resin & Watertight

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LAKE SAKAKAWEA PIPELINE CROSSING REPORT

Construction Methodology Evaluation – Horizontal Directional Drilling

BakkenLink Pipeline Project
Western North Dakota

BakkenLink Pipeline, LLC

This report has been produced as a supplement to *Lake Sakakawea Pipeline Crossing Report* issued by BakkenLink November 2011

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Executive Summary

The crossing of Lake Sakakawea is a key logistical consideration for the routing the of the proposed BakkenLink Pipeline from Beaver Lodge to Fryburg in North Dakota that will provide much-needed transportation capacity for crude oil produced from the Bakken oil play. BakkenLink Pipeline LLC (BakkenLink) has evaluated several options for the proposed lake crossing route and selected a lake crossing north of Keene. This decision was a result of BakkenLink consultation with government agencies, discussions with industry professionals and contractors, and in line with commercial drivers. BakkenLink has provided information describing its preferred lake crossing location and method and its resulting impacts and mitigation techniques in its *Lake Sakakawea Pipeline Crossing Report*, dated November 3, 2011.

As part of the review of the lake crossing, federal agencies have requested additional rationale and background information about the Horizontal Directional Drilling (HDD) technique that was listed as an alternative method of installation to the Company preferred Pipeline-Pull method.

Horizontal Directional Drilling (HDD) is a growing pipeline installation technique that is used where traditional open trench construction is unfavorable. This technique, detailed in Section 3.1, has been growing in popularity and in capability in recent years. The lake geography in this area was concerning for BakkenLink's Engineer with regard to HDD installation. The lake's relatively flat shorelines span 12,000 feet and are surrounded by rolling hills and ravines that yield to high bluffs at the top of the lake valley. The expansive width of the lake would challenge HDD technology and the valley topography is not ideal for HDD operations. BakkenLink consulted with leading drillers to determine the feasibility of an HDD in the area of the lake crossing. The unprecedented 14,000-foot drilled crossing that would be required was considered to be at the outer limits of current equipment capabilities. Drilling contractors discussed with BakkenLink that an HDD of that magnitude would require extensive sub-surface investigations, described in Section 3.6, encounter large risks during construction, described in Section 3.4, and come with no guarantee of success. While a successful HDD would yield no environmental impacts to the lake and minimize pre-construction permitting, a failure of the HDD could put the crossing in jeopardy of large lake impacts, extensive construction and environmental mitigation, and increased costs and schedule delays.

The geotechnical and geophysical investigations required for a drill of this magnitude would likely only provide data suggesting the drill is relatively more or less feasible. Because a drill of this length and potential depth has never been performed, there is no data to support its absolute feasibility. The subsurface investigations may provide information about the most suitable substrata, the type of soils, the equipment that will be required, the potential risks, etc., but it cannot determine success of the operation.

In light of the risks inherent in an HDD of this magnitude, and based on the unique site conditions of the lake at the crossing, BakkenLink proposed a "pipeline-pull" as its preferred installation technique, detailed in Section 4. This method constructs the pipeline one segment at a time from one end of the shoreline, slowly pulling the pipe across the other shoreline using floatation devices. The pipe is sunk to the lake bottom and lowered into the lake sediment using a lowering sled, common in Gulf of Mexico and other international operations. This method is has low intrinsic risk and has been proven to succeed. The main concern involves the impact to the lake caused by operations within the lake itself. BakkenLink's Engineer has extensive experience with this technique and has provided turbidity and re-sedimentation mitigation measures that are commonly used and generally accepted by government agencies and industry standards in the Gulf of Mexico.

BakkenLink has provided additional information evaluating and comparing the risks and benefits of both the HDD and Pipeline-Pull methods, summarized in Section 5. With respect to the risks associated with the installation method, failure BakkenLink supports the preferred Pipeline-Pull method as it is confident that the construction technique will yield no significant impacts to the lake. Bakkenlink concludes that because costly geotechnical and geophysical investigations cannot determine the certainty of installation of this unprecedented drill, then geotechnical studies would not be necessary in the Company's evaluation of the riskier HDD method, particularly with a feasible, low impact, high success pipeline-pull option. This is especially relevant in light of a similar trenched technique being used in the lake within the last 5 years where no significant impacts were experienced in the lake.

1. Lake Sakakawea Crossing

1.1. Pipeline Routing

BakkenLink Pipeline LLC (BakkenLink) is planning to build a new crude oil pipeline to provide much needed capacity to transport the increasing supplies of crude oil produced from the Bakken oil play to multiple export outlets. The pipeline will consist of approximately 144 miles of 8-inch and 12-inch steel crude oil pipeline extending from Beaver Lodge, North Dakota to a proposed crude oil rail loading facility located near Fryburg, North Dakota (Rail Facility). .

The Lake Sakakawea crossing between Beaver lodge and Keene is a key logistical consideration for the routing of the pipeline. A crude oil pipeline across Lake Sakakawea will provide increased connectivity between oil production and shipping opportunities, allowing producers access to multiple export outlets on both north and south sides of the Lake Sakakawea. The crossing will significantly reduce the number of trucks required to move crude oil through Williston and New Town, North Dakota to get around this transportation barrier. BakkenLink's proposed pipeline would offers bi-directional flow depending on the commercial demands of the regional markets.

BakkenLink evaluated several options for the proposed lake crossing route. Each option was considered with respect to regional access to markets, economics, engineering design, construction feasibility, schedule and environmental impacts. As part of the project planning, regional US Army Corps of Engineers (USACE), Bureau of Land Management (BLM), US Forest Service (USFS), and US Fish & Wildlife Service (USFWS) agencies were consulted to obtain guidance with regard to the Lake crossing location and methodology in 2010 and 2011. These consultations were integral to selecting the proposed location for the crossing. A location north of Keene was selected and will have minimal effects on resources and residents in the proximity of the lake while meeting the necessary commercial commitments and construction requirements.

1.2. Lake Characteristics at the Proposed Crossing

The selected crossing location north of Keene is favored due to its optimized path between receipt points of the proposed BakkenLink system and the proximity to an existing pipeline corridor. However, this area entails a crossing along the relatively wide central section of the lake. The current crossing from shoreline to shoreline is approximately 12,150 feet. The width of the crossing and the lake water depth are key considerations for the construction method evaluation. At the time of the hydrographic survey performed in the early summer of 2011, the maximum water depth was approximately 50 feet and the bottom substrate is characterized by a 1-2-foot layer of fine silt and mud.

The immediate shorelines in the proposed corridor are characterized by relatively flat plains. However, within 2,000 feet from the water's edge, rolling hills and ravines yield to the high bluffs above the lake, constituting an approximately 450-foot elevation change within one mile from the shoreline. The bluffs rise to approximate elevations of 2,300 feet overlooking the shoreline with elevation about 1,860 feet above sea level.

1.3. Alternate Locations

During initial consultation in 2010, BakkenLink presented the different crossing location options for discussion at meetings with federal agencies. BakkenLink identified three potential alternate locations with various advantages and disadvantages as compared to the current location.

Between the area near Williston, where the Missouri River begins to widen into the lake, and a substantial narrowing of the lake near New Town, only one location along the central part of the lake provides a width that could reduce the 12,000-foot crossing length of the proposed location. Approximately 7-8 miles west

of the proposed location, a narrowing point in the lake reduces the shoreline width to approximately 8,000 feet. This area provides a reduction in lake width and more favorable terrain for construction, but also presents a higher concentration of endangered species.

Another crossing locale considered was near the village of Four Bears and New Town. This area is approximately 20 miles southeast of the proposed location and is along the same corridor as the Four Bears Bridge (ND HWY 23) crossing. After desktop studies, favorable locations for a potential drilled crossing were identified both north and south of the Four Bears Bridge. These crossings would be approximately 7,000 feet and 5,000 feet for the crossings north and south of the lake, respectively. These lengths are significantly more favorable for the success of a potential Horizontal Directional Drill (HDD), however, both locations increase the pipeline reroute length considerably (estimated to be an additional 30 miles of pipeline) between the proposed receipt points at Keene and Beaver Lodge in the BakkenLink system.

As a result of the meetings with the federal agencies and the commercial drivers for the project, the other crossing locations were eliminated in favor of the proposed route north of Keene. A summary of the meeting minutes concerning lake crossing locations and methods are available in BakkenLink's *Lake Sakakawea Pipeline Crossing Report* dated November 14, 2011.

1.4. Pipelines and Facilities in the Vicinity

As mentioned previously, the proposed crossing location is adjacent to an existing pipeline corridor. The following pipelines have been identified in the vicinity of the proposed lake crossing at the site north of Keene:

Pipeline Owner	Outer Diameter of Pipe	Number of Pipelines	Construction Method	Product
Amerada Hess	8"	3	Open cut – 1950s	Gas
Amerada Hess	16"	1	Open cut – 1950s	Gas
Amoco Pipeline (Tesoro)	12"	1	Open cut? – 1954	Crude Oil
Dakota Gasification Company (exposed and replaced 2007)	14"	1	Open cut -1999	CO_2
Dakota Gasification Company (Replaced 1999 line)	14"	1	Open cut with lay barge & controlled depth tow – (2007)	CO_2

The Hess gas and Tesoro oil pipelines predate the flooding of the lake in the mid-1950s and were installed utilizing open cut trenching methods. The Dakota Gasification Company (DGC) pipeline, also installed using open cut techniques, was constructed when the lake water level was only 10 feet deep in the center of the Missouri River Thalweg (old river channel). The alignment of the proposed pipeline is approximately 200 feet west of the existing DGC pipeline.

2. Construction Methodology Evaluation

2.1. Construction Methods

During the project planning stages, several crossing construction methodologies were evaluated. The evaluated options include:

1. Conventional offshore pipelay from a marine barge accompanied by trenching to lower the pipeline and tie-in operations at the north and south shores of the lake;

2. Horizontal Directional Drill (HDD) Options:
    a) a single HDD across the entire lake crossing from a single onshore location;
    b) a dual HDD from both shores toward the center of the lake, also referred to as a "intersect method" with drills intersecting under the lake;
    c) a dual HDD from the shores of the lake to the center of the lake with an intermediate underwater tie-in operation utilizing a dredge and barge;
3. Pipeline-Pull Methods:
    a) perform a pipeline-pull operation with a buoyant pipeline constructed on a stationary offshore barge positioned midstream and then pull the line toward each shore line in sequence. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the intermediate tie-in operation from the vessel;
    b) perform a pipeline-pull operation with the pipeline made entirely from one shoreline and then pull the line across the water. When the pipe is within the trenched corridor, remove floats and lower pipeline. Conduct the tie-in operations from each shoreline.

2.2. Method Evaluations

The conventional marine pipelay, dual HDD with marine vessels, and the pipeline-pull from a stationary marine barge are not favored options due to the necessity of offshore equipment. Although the lay barges, stationary jack-up barges and other support vessels and equipment are plentiful in the Gulf of Mexico and other coastal areas, mobilization of such large and specialized equipment to this region is not feasible and is cost prohibitive . Additionally, the water depth conditions of the lake increase vessel susceptibility to weather.

The plausible HDD options, the single HDD and dual HDD intersect methods, both involve drilling beneath the lake to depths ranging from 50 to 300 below the lake bottom to install the pipe. The length and depth of the crossing introduce engineering and construction risks and a drill of this magnitude is unprecedented exceeding the current world and US domestic HDD records in length (12,000 and 10,000 feet, respectively) and depth. Although HDD is a proven and effective solution to pipeline installation, it is not without limitations.

The pipeline-pull method from the shoreline is a common installation technique used in similar shallow water conditions in the Gulf of Mexico and internationally; however, the disadvantage to this method is that lowering of the pipe requires a lowering method that fluidizes lake sediments where lake turbidity could be experienced. With proven equipment and mitigation measures, turbidity and re-sedimentation issues can be mitigated during construction activities.

BakkenLink engaged the expertise of qualified industry consultants to evaluate methodologies. With the construction and environmental risks and costs considered, BakkenLink selected the pipeline-pull method from a single shoreline (Option 3b) as the most favorable option, consistent with the company's risk tolerances and environmental strategies. More information about the HDD and pipeline-pull methods, supplemental to BakkenLink's *Lake Sakakawea Pipeline Crossing Report* is presented in the following sections.

3. Horizontal Directional Drilling (HDD) Methodology

3.1. Typical HDD Construction

In general, horizontal directional drilling is a trenchless technique for installing pipelines or other linear utilities to minimize surface or sensitive area disruptions and install pipe where conventional installation techniques are not favorable. The first phase consists of drilling a directionally controlled pilot hole along a predetermined path extending from grade at one end to grade at the opposite end. The entry and exit holes for the HDD are typically designed to be set-back from the area of avoidance to allow for the geometry of the drill to reach a desired target depth. For example, entry and exit holes for a river crossing may be set-back an additional 50 feet from the river banks to allow for the geometry of the drill to reach the designed depth. In the case of the Lake Sakakawea crossing, the set-back from the shoreline for drill entry and exit could range between 200 and 1700 feet depending on the required drill depth beneath the lake bed.

The second phase consists of enlarging the pilot hole to a size that will accommodate pulling the pipeline through the enlarged hole. Generally, the hole should be 1.5 to 2 times the outer diameter of the pipe. Preliminary analysis of the HDD of the Lake Sakakawea crossing indicates a 24 inch hole would be recommended for the 12-inch pipeline. The enlargement of the pilot hole, or reaming, is accomplished by pulling reaming heads of specific diameters through the hole, in stages if necessary, to create a wider hole. All stages of HDD involve circulating drilling fluid from equipment on the surface through the drill pipe to a downhole bit or reamer, and back to the surface through the annular space between the pipe and the wall of the hole. The drill mud serves several purposes: to control the frictional heating of the drilling components, remove large cuttings, and keep the drilling equipment lubricated. In a separate operation, while the hole is being drilled, the pipe is being welded to the length of the HDD and tested in one piece along the construction easement. Once the drilled hole is prepared and stable, the welded pipeline, or drill string, is pulled. Generally the pipe string is laid out and welded on the exit side of the drill. The drill string can be assembled in segments instead of a continuous length; however pipe pulling operations will cease while the segments are being welded together. This cessation of pull back activities can lead to the drilled hole seizing up or even collapsing depending on subsurface conditions. To minimize the risk of the drilled hole failing, a continuous drill string fabrication is preferred, provided enough workspace/acreage exists.

The major advantage of the HDD technique is the minimal effects on sensitive surface areas and temporary surface impacts during construction activities. Additional workspace is required at the drill entry and exit locations, generally 300 feet by 300 feet as well an area to string, weld and leak test the pipe prior to pull back. This drill stringing area is essential for proper alignment of the pipeline as it is pulled through the hole.

The HDD technique does have limitations and significant risks that could outweigh the benefits. Extensive subsurface evaluations and explorations must first be performed to determine if suitable conditions exist to support the drilling operations. Should the geotechnical investigations shows unfavorable subsurface conditions, drill failure could result in the inability to properly steer the drill head, inability to maintain the hole integrity, excessive drill stresses on the pipe, and/or inability for drill equipment to deliver the torque capacity necessary for extensive drilling operations. Additionally, drilling fluid will be under great pressures during drilling operations and when expended down-hole, it will flow in the path of least resistance. In the drilled annulus, this path may be an existing fracture or fissure in the substrata, a high porosity streak, and/or a pocket of incompetent substrate material being penetrated. These paths could lead to the surface and unplanned releases of drilling fluid (“frac out”) can occur. Although the fluid is not considered hazardous, may result in environmental impacts to the lake if drilling fluid returns to the surface... Thus, the feasibility of successful HDDs are highly dependent on the geotechnical characteristics of the area being drilled.

3.2. Single HDD Method

Because of the lake width at the crossing of 2.3 miles (12,150 feet), a single HDD operation across the entire lake would require an unprecedented drill and pipe string of an estimated 14,000 feet to include the set-back distances. This length would exceed both world and domestic HDD record lengths as mentioned in Section 2.2. Although such a lengthy HDD operation could be theoretically feasible under optimal circumstances, many unfavorable risks are involved. As drill lengths increase, so will drilling fluid pressures which will increase the likelihood of an inadvertent return, even in considerably competent substrates. As pipe lengths increase, the tensile and axial forces acting on the drill pipe and pipe string can become uncontrollable and cause bending or buckling of the pipeline, adding considerable difficulty and potential failure of the HDD operation. Additionally, as the pressures and lengths increase, additional pumping and support equipment are required, increasing the construction footprint and complexity of the project and pushing drilling equipment beyond its upper limits.

3.3. Dual HDD Intersect Method ("Intersect Method")

A dual HDD intersect method would utilize two drilling rigs operating on both the north and south shores of the lake that drill toward each other and intersect forming a continuous drill hole. Advances in drill head controlling and positioning systems have allowed drillers to intersect pilot passes from opposite ends of a proposed HDD. Once the intersected pilot hole has been drilled, reaming operations begin and the process reverts to traditional single HDD operations, where reaming and pulling occurs from one end of the drill. This method is more feasible than the single HDD method because the initial pilot hole drills are more manageable in length. Additionally, longer successful drills have been completed using the dual method over the single drill method. Again, even while this option may be technically achievable, the method's success greatly depends on the subsurface conditions. Like the single HDD method, this option would still involve very high drilling fluid pressures, the potential for frac out, and difficulties when trying to pull the pipe back through the pilot hole.

3.4. HDD Construction Risk

At the initial stages of the Lake crossing construction method evaluation, the BakkenLink team consulted with prominent drilling contractors in the pipeline industry regarding the feasibility of the HDD method for crossing the lake. Although the dual HDD intersect method is more feasible, the consulting contractor advised that a 14,000-foot drill is still on the outer limits of the equipment capabilities. This length has not yet been proven under these conditions and introduces extensive risk to the project. The current world record for such a drill is 12,000 feet performed in the United Kingdom and the current United States domestic record is approximately 10,000 feet, both performed in recent years. Despite the evidence that the industry is moving toward longer successful drills, this 14,000-foot drill, under the site-specific circumstances, would be unprecedented. The high level of risk for a failed drill in these soils, the loss of pipe due to sticking or buckling, and the increased potential for inadvertent returns make the odds of completing this specific HDD very risky.

In addition to the limitations of the HDD technology, the surface conditions for this operation are not ideal. As previously discussed, a pipe is typically strung and welded along the construction easement to the full length of the drill and properly aligned prior to pull-back. The pull-back string for this project would be the entire estimated 14,000 feet of drill length. Yet, the surface topography along the shoreline of the lake does not allow for a full length pipe string. The rolling nature of the lake valley and large elevation changes caused by the lake bluffs prohibit the continuous stringing of pipe. Consequently, multiple shorter strings must be laid out as the topography allows. This allows the pipe to be aligned properly during pull-back but requires that the pull be stopped incrementally to allow for welding of each pipe string that is welded to the tail of the pipe in the hole. This start and stop technique will greatly increase the chances of hole collapse and pipe sticking or buckling.

Other negative scenarios for HDD installation include drill pipe or pipe string buckling or sticking, inadvertent return of drilling mud, or failure to accomplish a drill. In the event of drill pipe buckling or shearing during drilling operations, the contractor would need to pull back the drill string and replace the damaged pipeline. If the issue is severe enough, the contractor may recommend or require alternate methods to complete the drill that can add substantial costs or schedule delays. In the event of inadvertent returns, drilling operations would halt and drilling mud pressures would be reduced to moderate surface returns. In order to prevent subsequent returns, the area of fracture would need to be grouted or otherwise mitigated in some manner depending on the circumstances of the release prior to recommencing of drilling operations. If the pipe string gets stuck or buckles during pull-back operations, the pipe string would likely be required to be completely removed, inspected and repaired before reattempting installation. In the case of a failure to accomplish the drill path or repeated failures in the pull-back, the contractor may recommend an alternate depth or alternate location to provide a higher likelihood of drill success. If this should result, the costs and delays in construction would be substantial. If the drill is deemed "failed," the pipeline installation method would need to revert to another method, most likely the well proven pipeline-pull method or an open-cut method.

3.5. Key Feasibility Information – Geological Conditions

Characterization of the subsurface conditions across the lake would be required to determine the feasibility on an HDD operation, should that be the selected method, and help to quantify the severity of some of the risks associated with an HDD of 14,000 feet. It should be noted that the performeance subsurface investigations cannot provide conclusive proof for the success of an HDD, only whether more or less favorable conditions exist. For an unprecedented drill of this length, best management practices necessitate a comprehensive campaign employing geotechnical corings up to 50 foot below the intended drill depth and at intervals of 500 to 1000 feet across the lake. Additionally, geophysical soundings would be used to verify the corings. The geotechnical and geophysical data would allow for a continuous horizontal and vertical characterization of the lake crossing substrate to assess whether substrate would support HDD operations at all. Essentially, the more information obtained about the subsurface conditions, the better quantification of feasibility and risk can be determined concerning an HDD of subject length. Additionally, should the drill be determined to be feasible, the subsurface conditions will drive the drilling equipment employed and specific drilling techniques that may affect cost and scheduling.

BakkenLink did not feel that conducting an extensive subsurface investigation would be beneficial when compared to other methods, particularly the favored pipeline-pull method, where less extensive surficial geotechnical surveys could be undertaken with more surety and less cost.

3.6. Non-Construction Related Risk

The preceding sections describe the technical advantages and disadvantages associated with performing an HDD to accomplish the lake crossing from a construction standpoint. In addition to the risks mentioned for construction feasibility, this method can also affect the logistics and scheduling of the project that were considered by BakkenLink.

Cost is a major concern for any project, particularly as it relates to risk. Investors, designers and builders all prefer a level confidence and stability while minimizing risk where possible. BakkenLink, in its due diligence, assessed the risks and benefits of an HDD and deemed them to have high costs and high risks. As compared to alternatives that were considered, the HDD option was found to be much more costly to construct and have a greater chance for schedule creep and cost increases. From the beginning, costly and timely geotechnical and geophysical investigations would be required to properly determine feasibility, design and mitigation techniques. Should the HDD be successful as designed, the Company would have higher initial costs but would have avoided environmental mitigation costs and additional permitting. However, should the HDD frac out during the drill, or fail due to pipe buckling or sticking, the Company would face large expenses in the form of increased contractor costs due to

redrilling or lost equipment retrieval, substantial environmental mitigation costs, the risk of a recurrence of failure and schedule delays. Schedule delays could push construction operations to encroach on nesting seasons, creating a situation where demobilization and remobilization of construction equipment could cause additional ground disturbances.

When assessing the risks, potential mitigation procedures and potential for cost and schedule creep, the HDD option was not the preferred construction methodology. The most favorable method, as described in the BakkenLink *Lake Sakakawea Pipeline Crossing Report*, is the pipeline-pull method, which involves the highest potential for success, fewest unknown risks, insignificant environmental impacts, manageable mitigation factors, and minimal potential for cost and schedule creeping.

4. Preferred Methodology – Pipeline-Pull

BakkenLink has provided additional information about its preferred method in its *Lake Sakakawea Pipeline Crossing Report*, which was provided to the relevant federal agencies for review. The report details the evaluated methodologies and outlined the selection process. The preferred "Pipeline-Pull" method, as described by BakkenLink, is summarized below.

The Pipeline-Pull method is a common pipeline installation technique used in various construction circumstances and is adaptable to meet the site specific construction requirements. In the case of the Lake Sakakawea crossing, this method would require work sites at both shorelines. At one end, a high powered winch will be stationed and aligned to pull the assembled pipeline originating from the opposite shore. On the other side, a construction "assembly line" is constructed that will allow for the systematic assembly of the pipeline. The pipeline is welded and tested along this assembly line until it is ready to begin crossing the lake. As new pipe is added to the end of the pipe string, the winch slowly pulls the pipe across the lake one pipe length at a time. As the completed pipe is pulled across, floatation devices are used to keep the pipe a certain distance above the lake bottom as to not impede surface traffic. After the pipeline has fully crossed the lake, the floatation devices are removed and the pipeline is lowered to the lake bottom.

Once the assembly and positioning of the pipeline is complete, it must be lowered below the lake bottom for additional protection and positioning as required by federal regulations. BakkenLink has proposed using a common jetting technique that has been adapted for the site specific conditions of the lake. A customized lowering sled will use fluid jets and suction pumps to fluidize the lake bottom under the pipeline, causing the pipeline to sink into the fluidized substrate as the sled is pulled along the lake bottom. This proven technique will be adapted from typical Gulf of Mexico practices to minimize the turbidity of the sled. A slurry diffuser and turbidity mats are part of the adapted design of the jetting sled to mitigate turbidity and re-sedimentation in the lake. In addition to the jetting sled modifications to reduce turbidity, other mitigative measures can be employed to ensure minimal and localized effects to the lake, including turbidity monitoring and turbidity curtains.

During the evaluation process, BakkenLink conducted subsurface investigations of the lake sediments to determine the feasibility of lowering operations any effects that turbidity and re-sedimentation may have based on the components of the sediment. After initial concerns with re-sedimentation, the North Dakota Department of Health – Water Quality Division analyzed the sediment findings and during additional discussions with BakkenLink, expressed confidence in this lowering method.

Negative effects toward the pallid sturgeon were also considered by BakkenLink. The proposed crossing location is not within designated critical spawning habitat. The construction schedule BakkenLink is proposing for the lake crossing would avoid the spawning periods for the pallid sturgeon. Additionally, turbidity is not perceived to be an issue affecting the sturgeon, as they prefer turbid flowing water. Any

impacts will be insignificant, short lived and should not exceed the impacts of the DGC installation in 2007.

BakkenLink is confident that, in the unlikely event of pipeline leaks or spills, the pipeline-pull method will allow quick and reliable access to the damaged portion of pipeline for immediate mitigation and repair. Contrastingly for HDD, in the unlikely event of leaks or spills, the depth of the pipeline as a result of HDD installation will not allow access to any localized damaged area.

In addition to the above considerations, installation of the pipeline employing the pipeline-pull method has supplementary advantages to the regional infrastructure. The system in-service date would be sooner than if an HDD method were employed and would remove significant traffic and wear for regional infrastrucure currently used for oil transportation activities. With an initial oil transportation capacity of 65,000 BPD, this translates into removing upwards of 400 truckloads of oil per day from roads and highways transporting Bakken crude between lease and tank batteries around Johnson's Corner and multiple pipeline and rail destinations in Ross/Stanley/Berthold in western North Dakota.

5. Method Comparison –Push-Pull vs. HDD

	Pipeline-Pull Method	**HDD Intersect Method**
Installation Technique	• Method proven in Gulf of Mexico. High percentage success rate with minimum long term impacts. (Examples provided in *Lake Sakakawea Pipeline Crossing Report)*	• Installation success rate undetermined as drill length and application are unprecedented. • Finding suitable subsurface strata to support drilling activities. • Increased pipe stress during installation activities. • Bore hole collapse during drilling operations. • Contingency plan/alternative installation technique recommended in case of failure.
Installation Schedule	• Current schedule estimates construction August thru December 2012. • Approximately 115 day duration • Low risk of schedule creep	• Current schedule estimates construction August 2012 thru January 2013. • Approximately100 day duration. • Winter installation preferred to be able to field verify drill head locations and increase odds of pilot hole intersection on frozen lake. • Potential for schedule creep dependent on success of drilling operations

System In-Service Schedule *(BakkenLink System – Beaver Lodge to Fryburg)*	• System in-service by December 2012 (pending permit issuance). • In service sooner (than HDD method), resulting in more oil transportation being removed from regional infrastructure.	• Earliest in service date March 2013 (pending permit issuance).
Subsurface Exploration Requirements	• Hydrographic/hazard survey characterizing soils along the route. • Performed July 2011. 6 bore samples taken at roughly 1800-foot intervals to 10 foot depth.	• Extensive subsurface evaluation with core drills up to 300 feet at 500-1000 foot intervals with geophysical data to tie in subsurface geological strata for continuous horizontal characterization for determining drill depth, external pipe stresses during installation and equipment requirements. • Schedule estimates exploration not complete until June 2012 (best-case)
Environmental Impact	• Mild to insignificant turbidity expected during pipeline lowering activities. • Mitigated by turbidity screens (approved and successful mitigation technique used in Gulf of Mexico) • Use of USACE approved hydraulic excavators in operation	• If drill successful, no environmental impacts • Hydraulic fracturing/high permeability streaks/inadvertent returns during drilling process resulting in drilling mud (bentonite) release in Lake
Temporary Workspace Requirements	• 330 by 1150 feet workspace on North and 400 by 680 feet South shores of lake • Approximately 652,000 sq.ft. total	• 300 by 300 feet workspace on North and South Shores of lake plus drill string pull back area of 14,000' X 25' • Approximately 530,000 sq.ft. total
Pipe Stringing	• Ability to install pipe segments ("pipe joint") segments to pipe string during pipeline "assembly line" installation activities with minimal risk to success of installation.	• Recommend to have single 14,000' drill string to minimize potential for pipe getting stuck during pull back operations. • Workspace limited on North and South shores of lake for continuous drill string fabrication. • Topography also prohibits single pipe string. • Drill string segmentation will be required, which increases the chances of pipe seizing during pull-back operations.
Pipe Stresses during Installation	• Minimal axial and tensile stresses experienced during push-pull and lowering	• Length of drill exposes drill pipe and pipe string to high torque and risks buckling and sticking during drilling and/or pull-back

Operations/Maintenance	• Easily access to pipeline following installation for quick identification of failure, mitigation and repair damage	• Inability to locate point of leak and repair. Pipeline would require re-installation resulting in abandonment of installed pipe.
Pipeline Protection/Cover	• Lowering to 3-4 feet below lake bed per Federal regulations • Concrete weight coating for additional protection	• Depth of drill provides protection to pipeline
Cost	• Reduced costs for surveys, installation costs and turbidity mitigation compared to HDD • In unlikely event of damage to pipeline, cost to access and repair pipeline minimal (compared to HDD pipe)	• Expensive subsurface explorations and installation method • Mitigation measures may be substantial based on conditions of surface returns • In unlikely event of damage to pipeline, cost to access and repair pipeline substantial (including redrill and abandonment of pipe)

6. Conclusion

In summation, with all data available under consideration, BakkenLink, in its due diligence, advocates the pipeline-pull installation methodology over HDD installation at the Corps designated crossing location. The advantages of this method include a higher installation success with a proven methodology, reduced installation and subsurface investigation costs, and proven experience in managing and implementing this technique. Its main disadvantage includes the creation of minimal turbidity and re-sedimentation but which can be successfully mitigated during construction activities. Consequently, this technique was considered the best Risk- Reward scenario, with reward being confidence of a successful installation and risk being short term turbidity mitigation and cost contingencies. Contrastingly, the HDD Risk-Reward profile, where the reward of possibility no impact to the lake is not considered to outweigh the risks of HDD uncertainties, frac out impacts to the lake, and drilling or installation failures, does not support this method.

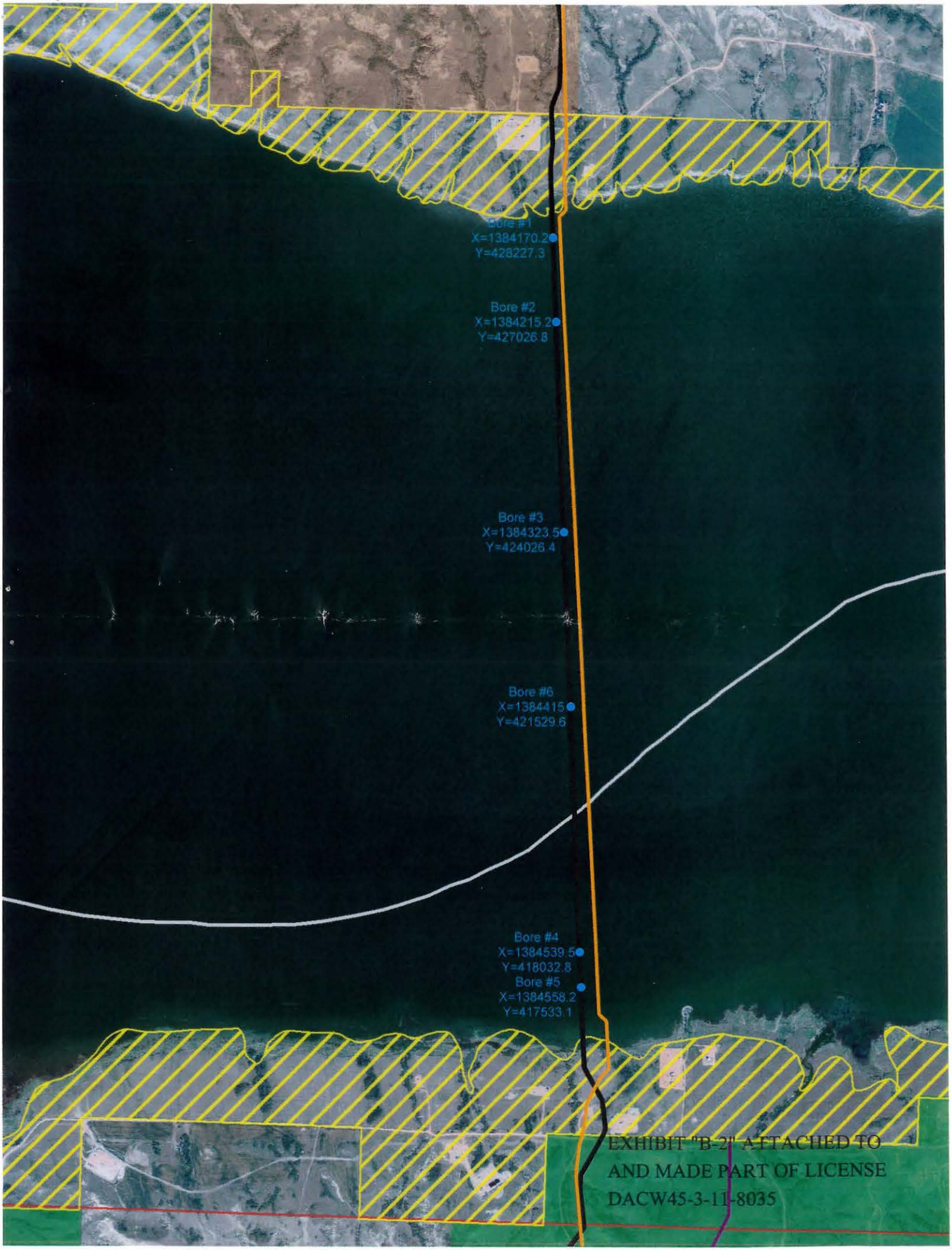


EXHIBIT "B-2" ATTACHED TO
AND MADE PART OF LICENSE
DACW45-3-11-8035

Appendix XI

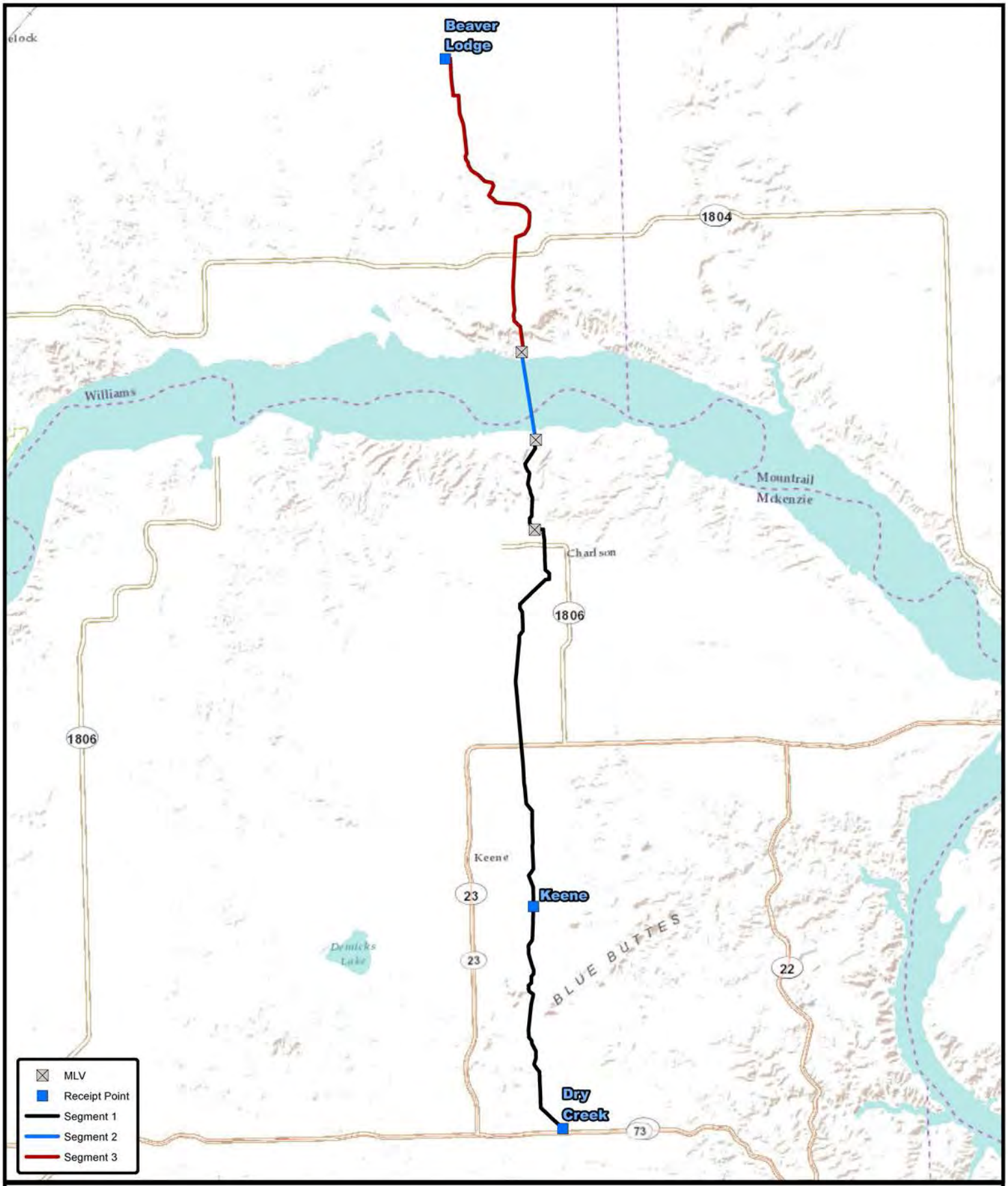
Access Road and Improvements Table

BAKKEN LINK NORTH- ACCESS ROADS								
NAME	SURFACE	TYPE	CONDITION	TWN	R	S	LENGTH	IMPROVEMENT
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	150	96	1	1051	NONE
30TH ST	GRAVEL	COUNTY	IMPROVED	150	96	**1**	1713	NONE
32ND ST	PAVED	FEDERAL	PAVED	151	96	25	4728	NONE
33RD ST	GRAVEL	COUNTY	IMPROVED	151	96	13/24	4799	NONE
34TH ST	GRAVEL	COUNTY	IMPROVED	151	96	12/13	5280	NONE
38TH ST	GRAVEL	COUNTY	IMPROVED	152	96	24/25	5753	NONE
40TH ST	GRAVEL	COUNTY	IMPROVED	152	96	12/13	3254	NONE
41ST ST	TRAIL	COUNTY	2-TRACK(N.I.)	152	96	1/12	2920	GRAVEL
42ND ST	GRAVEL	COUNTY	IMPROVED	152	96	1	2382	NONE
43RD ST	GRAVEL	COUNTY	IMPROVED	153	95	28/33	2228	NONE
44TH ST	GRAVEL	COUNTY	IMPROVED	153	95	22/27	2379	NONE
104TH AVE	GRAVEL	COUNTY	IMPROVED	153	95	16/15	2285	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	154	95	15/16	5574	NONE
52ND ST	GRAVEL	COUNTY	IMPROVED	154	95	9/16	3831	NONE
53RD ST	TRAIL	PRIVATE	2-TRACK(N.I.)	154	95	4/9	270	GRAVEL
53RD ST	2-TRACK	COUNTY	GRADED & DRAINED	154	95	4/9	2726	NONE
56TH ST(MOE 2)	GRAVEL	PRIVATE	IMPROVED	155	95	29	1730	NONE
57TH ST	GRAVEL	COUNTY	IMPROVED	155	95	20	4286	NONE
59TH ST	GRAVEL	COUNTY	IMPROVED	155	95	6/7	1295	NONE
36TH ST	TRAIL	PRIVATE	2-TRACK(N.I)	152	96	36	4046	GRAVEL
37TH ST	TRAIL	PRIVATE	FENCE LINE(N.I.)	152	96	25/36	4996	GRAVEL
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	16	703	NONE
46TH ST	GRAVEL	COUNTY	IMPROVED	153	95	9/10	1111	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	3/4	1162	NONE
48TH ST	GRAVEL	COUNTY	IMPROVED	154	95	34	2262	NONE
PRIVATE ROAD	GRAVEL	PRIVATE	IMPROVED	155	95	8	396	NONE
28TH ST	GRAVEL	COUNTY	IMPROVED	150	96	12	1199	NONE
OIL PAD ROAD	TRAIL	PRIVATE	2-TRACK(MAT)	153	95	4	397	MAT
102ND RD	GRAVEL	COUNTY	IMPROVED	154	95	16	1637	NONE
60TH ST	GRAVEL	COUNTY	IMPROVED	155	95	6	1477	NONE
104TH AVE	GRAVEL	COUNTY	IMPROVED	155	95	8	1279	NONE
103RD AVE	GRAVEL	COUNTY	IMPROVED	155	95	20	985	NONE
1804	PAVED	STATE	PAVED	155	95	33	3417	NONE
MOE 1	GRAVEL	PRIVATE	IMPROVED	155	95	27	903	NONE
MOE 4	GRAVEL	PRIVATE	IMPROVED	155	95	17	2800	NONE
MOE 3	GRAVEL	PRIVATE	IMPROVED	155	95	20	1317	NONE
MOE 4	GRASS	PRIVATE	UNIMPROVED(MAT)	155	95	17	134	NONE
MOE 3	TRAIL	PRIVATE	2-TRACK(N.I.)	155	95	20	2824	GRAVEL
OIL PAD ROAD	TRAIL	PRIVATE	2-TRACK(N.I.)	154	95	16	368	GRAVEL
MOE 5	GRAVEL	PRIVATE	IMPROVED	155	95	34	1736	NONE
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	150	96	1	589	NONE
FROM OIL PAD	GRASS	PRIVATE	UNIMPROVED(MAT)	153	95	4	305	MAT

DRILL ACCESS	GRASS	PRIVATE	UNIMPROVED(MAT)	155	95	17	551	MAT
38TH ST	GRASS	PRIVATE	UNIMPROVED(MAT)	152	96	24	456	MAT
MOE 1	TRAIL	PRIVATE	2-TRACK(MAT)	155	95	27	2217	MAT
OIL PAD ROAD	GRAVEL	PRIVATE	IMPROVED	153	95	4	579	NONE
108TH AVE	TRAIL	COUNTY	UNIMPROVED	151	96	12	715	NONE
KEENE	FIELD	PRIVATE	UNIMPROVED	151	96	12	381	GRAVEL
TOTAL ACCESS ROADS = 48								

Appendix XII

Construction Segment Map



NORTH

0 6,000 12,000 24,000

Feet

UTM 13N FT

BAKKENLINK NORTH PIPELINE PROJECT
CONSTRUCTION SEGMENTS

BakkenLink

BARTLETT & WEST

Route is not final and is subject to change.

Date: 10/8/2015

Appendix XIII

Construction Mitigation Reclamation Plan (CMRP)

BAKKENLINK PIPELINE PROJECT

CONSTRUCTION, MITIGATION, AND RECLAMATION PLAN

May 2015
Rev. 1

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1.0 INTRODUCTION

The construction, mitigation, and reclamation requirements described in this Plan apply to work on all of BakkenLink Pipeline, LLC's (BakkenLink's) BakkenLink Pipeline Project (Project) lands, including the following;

- uplands, including agricultural (cultivated or capable of being cultivated) lands, pasture lands; range lands; grass lands; forested lands; lands in residential, commercial, or industrial areas; lands in public rights of way; and lands in private rights-of-way;
- wetlands; and
- waterbodies and riparian areas.

BakkenLink, during the construction, operation, and maintenance of the Project, shall implement the construction, mitigation, and reclamation actions contained in this Plan to the extent that they do not conflict with the requirements of any applicable federal, state, or local rules and regulations, or other permits or approvals that are applicable to the Project. Additionally, BakkenLink may deviate from specific requirements of this Plan on specific private lands as agreed to by landowners or as required to suit actual site conditions as determined and directed by BakkenLink. All work must be in compliance with federal, state, and local permits.

The Project will be designed, constructed, operated and maintained in a manner that meets or exceeds applicable industry standards and regulatory requirements.
BakkenLink's Pipeline Operation and Maintenance Plan and Emergency Response Plan will outline the preventative maintenance, inspection, line patrol, leak detection systems, SCADA, and other pipeline integrity management procedures to be implemented during operation of the Project.

2.0 GENERAL CONDITIONS

2.1 Training

Experienced, well-trained personnel are essential for the successful implementation of this Plan. BakkenLink and its Contractors shall undergo prevention and response, as well as safety training. The program shall be designed to improve awareness of safety requirements, pollution control laws and procedures, and proper operation and maintenance of equipment.

The construction contractor (Contractor), and all of his subcontractors shall ensure that persons engaged in Project construction are informed of the construction requirements and that they attend and receive training regarding these requirements as well as all laws, rules and regulations applicable to the work. Prior to construction, all Project personnel will be trained on environmental permit requirements and environmental specifications, including fuel handling and storage, cultural resource protection methods, stream and wetland crossing requirements, and sensitive species protection measures.

Contractor personnel shall attend a training session before the beginning of construction and during construction as environmental issues and incidents warrant. Additional training sessions shall be held for newly assigned personnel prior to commencing work on the Project.

All Contractor personnel shall attend the training session prior to entering the construction right-of-way. All Contractor personnel shall sign an acknowledgement of having attended the appropriate level of training. In order to ensure successful compliance, Contractor personnel shall attend repeat or supplemental training if compliance is not satisfactory or as new, significant new issues arise.

All visitors and any other personnel without specific work assignments shall be required to attend a safety and environmental awareness orientation prior to being granted access to any construction sites.

2.2 Environmental Inspection

BakkenLink will use Environmental Inspectors on each construction spread. The Environmental Inspectors will review the Project activities daily for compliance with state, federal and local regulatory requirements. The Environmental Inspectors will have the authority to stop specific tasks as approved by the Chief Inspector. They can also order corrective action in the event that construction activities violate the provisions of this Plan, landowner requirements, or any applicable permit requirements.

2.3 Advance Notice of Access to Property Prior to Construction

Prior to initially accessing landowners' property, BakkenLink shall provide the landowner or tenant with a minimum of 24 hours prior notice unless otherwise negotiated with the landowner and as described in the Project line list. Contractor shall give BakkenLink 48 hours of prior notice regarding the need for access. Additionally, the landowner or tenant shall be provided with BakkenLink contact information. Landowners may utilize contact information to inform BakkenLink of any concerns related to construction.

Prior notice shall consist of a personal contact, a telephone contact, or delivery of written notice to the landowner to inform the landowner of whereby the landowner or tenant is informed of BakkenLink's intent to initially access the land. The landowner or tenant need not acknowledge receipt of written notice before BakkenLink can enter the landowner's property.

BakkenLink will coordinate with managers of public lands to reduce conflicts between construction activities and recreational uses. BakkenLink will consult with land managers on state and federal lands regarding any necessary construction and maintenance restrictions consistent with management and use of such lands. Damages from disruption of recreational uses of private lands will be the subject of compensation negotiations with individual landowners.

2.4 Other Notifications

The Contractor shall notify, in writing, both BakkenLink and the authority having jurisdiction over any road, railroad, canal, drainage ditch, river, foreign pipeline, or other utility to be crossed by the pipeline at least 48 hours (excluding Saturdays, Sundays, and statutory holidays), or as specified on the applicable permit(s), prior to commencement of pipeline construction, in order that the said authority may appoint an inspector to ensure that the crossing is constructed in a satisfactory manner.

The Contractor shall notify BakkenLink of any spill of a potentially hazardous substance in accordance with the Spill Prevention, Containment, and Coutermeasure Plan (SPCC Plan). The Contractor shall notify BakkenLInk immediately of any spill of any substance to a wetland or waterbody.

The Contractor shall notify BakkenLink of any existing soil contamination discovered during construction.

The Contractor shall immediately notify BakkenLink of the discovery of previously unreported historic property, other significant cultural materials, or suspected human remains uncovered during pipeline construction.

The Contractor shall immediately notify BakkenLink of a Project-related injury or mortality of a threatened or endangered species.

Additional guidelines are detailed in the Summary of Environmental Protection Measures for the Project (Appendix 9.1)

2.5 Damages to Private Property

Pipeline construction activities shall be confined to the construction right-of-way, temporary work space, additional temporary work space, and approved access routes.

BakkenLink shall reasonably compensate landowners for any construction-related damages caused by BakkenLink which occur on or off of the established pipeline construction right-of-way.

BakkenLink shall reasonably compensate landowners for damages to private property caused by BakkenLink beyond the initial construction and reclamation of the pipeline, to include those damages caused by BakkenLink during future construction, operation, maintenance, and repairs relating to the pipeline.

2.6 Appearance of Worksite

The construction right-of-way shall be maintained in a clean, neat condition at all times. At no time shall litter be allowed to accumulate at any location on the construction right-of-way. The Contractor shall provide a daily garbage detail with each major construction crew to keep the construction right-of-way clear of trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, defective materials and all construction and other debris

immediately behind construction operations unless otherwise approved by BakkenLink. Paper from wrapping or coating products or lightweight items shall not be permitted to be scattered by the wind.

The traveled surfaces of roads, streets, highways, etc. (and railroads when applicable) shall be cleaned free of mud, dirt, or any debris deposited by equipment traversing these roads or exiting from the construction right-of-way.

2.7 Access

Prior to the pipeline's installation, BakkenLink and the landowner shall reach a mutually acceptable agreement on the route that shall be utilized by the Contractor for entering and exiting the pipeline construction right-of-way should access to the construction right-of-way not be practicable or feasible from adjacent segments of the pipeline construction right-of-way, public road, or railroad right-of-way.

All construction vehicles and equipment traffic shall be confined to the public roads, private roads acquired for use by BakkenLink, and the construction right-of-way. Table 2 includes a list of all access roads, ownership, necessary improvements and width of disturbance. If temporary private access roads are constructed, they shall be designed to maintain proper drainage and shall be built to minimize soil erosion.

Sufficiently sized gaps shall be left in all spoil and topsoil wind rows and a hard or soft plug shall be left in the trench at all temporary private access roads and obvious livestock or wildlife trails unless the landowner agrees prior to construction that these access points can be blocked during construction.

All construction-related access roads to the right-of-way shall be marked with signs. Any private roads not to be utilized during construction shall also be marked.

2.8 Aboveground Facilities

Locations for aboveground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to ongoing agricultural or other landowner activities occurring on the lands adjacent to the facilities. If it is not feasible, to avoid interference, such activities shall be located so as to incur the least hindrance to the adjacent agricultural operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes) provided the location is consistent with the design constraints of the pipeline. Aboveground facilities shall avoid floodplains and wetlands to the maximum extent possible. Additionally, they shall be located to avoid existing drain tile systems to the extent possible. To further reduce visual impacts from aboveground pipeline facilities and structures, BakkenLink will comply with standard industry painting practices with respect to aboveground facilities. BakkenLink will address any visual aesthetics issues with landowners through individual consultations.

2.9 Minimum Depth of Cover

The pipeline shall be installed so that the top of the pipe and coating is a minimum depth of 5 feet below the bottom of waterbodies including rivers, creeks, streams, ditches, and drains. This depth shall normally be maintained over a distance of 15 feet on each side of the waterbody measured from the top of the defined stream channel. If concrete weights or concrete coated pipe is utilized for negative buoyancy of the pipeline, the minimum depth of cover shall be measured from the top of the concrete to the original ground contour. The following table indicates standard depths that would apply to pipeline construction.

Location	Excavation (inches)
Undeveloped Section Line crossing	72
Rangeland and cultivated lands	48
Industrial, commercial, and residential areas	48
Crossings of inland bodies of water with a width of at least 100 ft from high water mark to high water mark	60
Drainage ditches at public roads and railroads	60

Depth of cover requirements may be modified by BakkenLink based on site-specific conditions. However, all depths shall be in compliance with all established codes.

2.10 Non-Hazardous Waste Disposal

Non-hazardous pipeline construction wastes include human waste, trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, cleared vegetation, stumps, and rock.

All waste which contains (or at any time contained) oil, grease, solvents, or other petroleum products falls within the scope of the oil and hazardous substances control, cleanup, and disposal procedures. This material shall be segregated for handling and disposal as hazardous wastes.

The Contractor shall be responsible for ensuring that human wastes are handled and disposed of exclusively by means of portable, self-contained toilets during all construction operations. Wastes from these units shall be collected by a licensed contractor for disposal only at licensed and approved facilities.

The Contractor shall remove all trash from the construction right-of-way on a daily basis unless otherwise approved or directed by BakkenLink.

The Contractor shall dispose of HDD drill cuttings and drilling mud at an agency approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by BakkenLink, or hauling to an approved licensed landfill or other site approved by BakkenLink.

The Contractor shall remove all extraneous vegetative, rock, and other natural debris from the construction right-of-way by the completion of cleanup

The Contractor shall remove all trash and wastes from Contractor yards, and Pipe Yards, and staging areas when work is completed at each location.

The Contractor shall dispose of all waste materials at licensed waste disposal facilities. Wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

2.11 Hazardous Wastes

The Contractor shall ensure that all hazardous and potentially hazardous materials are transported, stored, and handled in accordance with all applicable regulations. Workers exposed to or required to handle dangerous materials shall be trained in accordance with the applicable regulations and the manufacturer's recommendations.

The Contractor shall dispose of all hazardous materials at licensed waste disposal facilities. Hazardous wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

All transporters of oil, hazardous substances, and hazardous wastes shall be licensed and certified according to the applicable state vehicle code. Incidents on public highways shall be reported to the appropriate agencies.

All hazardous wastes being transported off-site shall be manifested. The manifest shall conform to requirements of the appropriate state agency. The transporter shall be licensed and certified to handle hazardous wastes on the public highways. The vehicles as well as the drivers must conform to all applicable vehicle codes for transporting hazardous wastes. The manifest shall conform to 49 CFR Parts 172.101, 172.202, and 172.203.

If toxic or hazardous waste materials or containers are encountered during construction, the Contractor shall stop work immediately to prevent disturbing or further disturbing the waste material and shall immediately notify BakkenLink. The Contractor shall not restart work until clearance is granted by BakkenLink.

2.12 Noise Control

The Contractor shall minimize noise during non-daylight hours and within 1 mile of residences or other noise-sensitive areas such as hospitals, motels or campgrounds. BakkenLink shall abide by all applicable noise regulations regarding noise near residential and commercial/industrial areas. The Contractor shall provide notice to BakkenLink if noise levels are expected to exceed bylaws for a short duration. BakkenLink will give advanced notice to landowners within 500 feet of right-of-way prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, coordinate work schedules, and ensure that construction proceeds quickly through such areas.

The Contractor shall minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise.

2.13 Weed Control

The Contractor shall thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site to limit the potential for the spread of noxious weeds, insects and soil-borne pests. The Contractor shall clean the equipment with high-pressure washing equipment.

Prior to construction, BakkenLink will mark all areas of the right-of-way which contain infestations of noxious, invasive species or soil-borne pests. Such marking will clearly indicate the limits of the infestation along the right-of-way. During construction, the Contractor shall clean the tracks, tires, and blades of equipment by hand (track shovel) or compressed air to remove excess soil prior to movement of equipment out of weed or soil-borne pest infested areas or utilize cleaning stations to remove vegetative materials using water under high pressure.

The Contractor shall use mulch and straw or hay bales that are Certified Weed Free in the State of North Dakota for temporary erosion and sediment control.

The Contractor shall implement pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, trenching, or other soil disturbing work at locations identified in the construction drawings.

BakkenLink will implement mitigation or protection measures for conducting vegetation control where necessary before and after construction. Typical agricultural herbicides, developed in consultation with county or state regulatory agencies, will be used. Herbicide types will be determined based on the weed species requiring control. The Contractor shall apply herbicides, where required, within one week, or as deemed necessary for optimum mortality success, prior to disturbing the area by clearing, grading, trenching, or other soil disturbing work. Herbicides shall be applied by applicators appropriately licensed or certified by the state in which the work is conducted. All herbicides applied prior to construction shall be non-residual or shall have a significant residual effect no longer than 30 days. Herbicides applied during construction shall be non-residual. BakkenLink will implement mitigation or protection measures in the use of pesticides and herbicides along the pipeline corridor to reduce potential impacts to avian and wildlife species.

The Contractor shall not use herbicides in or within 100 feet of a wetland or waterbody.

After completion of pipeline construction, on any construction right-of-way over which BakkenLink will retain control over the surface use of the land after construction (i.e., valve sites, metering stations, pump stations, etc.), BakkenLink shall provide for weed control to limit the potential for the spread of weeds onto adjacent lands. Any weed control spraying performed by BakkenLink shall be done by a state-licensed pesticide applicator.

BakkenLink shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must control weeds on their land which can be reasonably determined to have spread from land occupied by BakkenLink's aboveground facilities.

2.14 Dust Control

The Contractor shall at all times control airborne dust levels during construction activities. The Contractor shall employ water trucks, sprinklers or other approved chemical applications as necessary to reduce dust to acceptable levels. Utilization of chemical applications is limited to roads.

Dust shall be strictly controlled where the construction work approaches dwellings, farm buildings, and other areas occupied by people and when the pipeline parallels an existing road or highway. This shall also apply to access roads where dust raised by construction vehicles may irritate or inconvenience local residents. The speed of all Contractor vehicles shall be controlled in these areas. Emissions from construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks will be controlled to the extent required by state and local agencies through the permit process.

The Contractor shall take appropriate precautions to prevent fugitive emissions caused by sand blasting from reaching any residence or public building. The Contractor shall place curtains of suitable material, as necessary, to prevent wind-blown particles from sand blasting operations from reaching any residence or public building.

Additional measures may be required by state regulations or local ordinances. The Contractor will comply with all applicable state regulations and local ordinances with respect to truck transportation and fugitive dust emissions.

2.15 Off Road Vehicle Control

BakkenLink shall offer to landowners or managers of forested lands to install and maintain measures to control unauthorized vehicle access to the construction right-of-way where appropriate. These measures may include the following unless otherwise approved or directed by BakkenLink based on site specific conditions or circumstances:

- signs;
- fences with locking gates;
- slash and timber barriers, pipe barriers, or boulders lined across the construction right-of-way; and
- conifers or other appropriate trees or shrubs across the construction right-of-way.

2.16 Fire Prevention and Control

The Contractor shall comply with all federal, state, county and local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following mitigation measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate fire fighting equipment shall be available on site in accordance with the applicable regulatory requirements shall be available on site.
- The level of fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level and related implications.
- The Contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks; portable water pumps; chemical fire extinguishers; hand tools such as shovels, axes, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed.
- Specifically, the Contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, grinding, and burning of brush or vegetative debris.
- In the event of a fire, the Contractor shall immediately use resources necessary to contain the fire. Contractor shall simultaneously notify local emergency response personnel.
- All tree clearing activities are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be done in compliance with state, county, or local applicable regulations.
- Any burning will be done within the right-of-way. Only small piles shall be burned to avoid overheating or damage to trees or other structures along the right-of-way.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking shall be prohibited around flammable materials.
- Smoking shall be prohibited on the entire construction site when the fire hazard is high.

2.17 Road and Railroad Crossings

Construction across paved roads, highways, and railroads will be in accordance with the requirements of the road and railroad crossing permits and approvals

obtained by BakkenLink. In general, all major paved roads, all primary gravel roads, highways, and railroads will be crossed by boring beneath the road or railroad. Boring requires the excavation of a pit on each side of the feature, the placement of boring equipment in the pit, and boring a hole under the road at least equal to the diameter of the pipe. Once the hole is bored, a prefabricated pipe section will be pulled through the borehole. For long crossings, sections can be welded onto the pipe string just before being pulled through the borehole. Boring will result in minimal or no disruption to traffic at road or railroad crossings. Each boring will be expected to take 1 to 2 days for most roads and railroads and up to 10 days for long crossings such as interstate or four-lane highways.

Most smaller, unpaved roads and driveways will be crossed using the open-cut method where permitted by local authorities or private owners. The open-cut method will require temporary closure of the road to traffic and establishment of detours. If no reasonable detour is feasible, at least one lane of traffic will be kept open, except during brief periods when it is essential to close the road to install the pipeline. Most open-cut road crossings can be finished and the road resurfaced in 1 or 2 days. Contractor will take measures, such as posting signs at open-cut road crossings, to ensure safety and minimize traffic disruptions.

2.18 Adverse Weather

The Contractor shall restrict certain construction activities and work in excessively wet soil conditions to minimize rutting and soil compaction. In determining when or where construction activities should be restricted or suspended during wet conditions, the Contractor shall consider the following factors:

- the extent that rutting may cause mixing of topsoil with subsoil layers or damage to tile drains;
- excessive buildup of mud on tires and cleats;
- excessive ponding of water at the soil surface; and
- the potential for excessive soil compaction.

The Contractor shall implement mitigative measures as directed by BakkenLink in order to minimize rutting and soil compaction in excessively wet soil conditions which may include:

- restricting work to areas on the spread where conditions allow;
- using low ground weight, wide-track equipment, or other low impact construction techniques;
- limiting work to areas that have adequately drained soils or have a cover of vegetation ,such as sod, crops or crop residues, sufficient to prevent mixing of topsoil with subsoil layers or damage to drain tiles; and
- installing geotextile material or construction mats in problem areas.

"Stop work" authority will be designated to the Chief Inspector but will be implemented when recommended by the Environmental Inspector.

2.19 Cultural Resources

BakkenLink intends to avoid cultural resources to the extent practicable by rerouting the pipeline corridor and related appurtenances, avoiding construction activities on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) or those whose eligibility for listing have not been determined, as well as boring or using HDD through culturally sterile soils. Avoidance will be in accordance to guidance provided by the State Historical Society of North Dakota, the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS).

The Contractor shall implement the measures outlined in the Unanticipated Discovery Plan to minimize disturbance to cultural sites and shall take immediate action as outlined if any unanticipated cultural discovery is encountered during construction.

The preferred treatment of any historical property or culturally significant site is avoidance. Where necessary, BakkenLink will monitor the construction spread using a cultural resource monitor working under the direction of a professional who meets the standards of the *Professional Qualification Standards in Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines*(48 FR 44716, September 29, 1983).

Prior to commencing construction, BakkenLink also will provide an appropriate level of training to all construction personnel so that the requirements of any unanticipated discovery plan are understood and unanticipated discoveries are quickly identified.

The contractor shall implement the measures outlined in the Unanticipated Discovery Plan that has been adopted to minimize disturbance to cultural sites and shall take immediate action as outlined if any unrecorded cultural resource is encountered during construction. In the event an unanticipated cultural discovery is made, the Contractor will immediately halt all construction activities within a 100-foot radius, including construction related traffic; notify BakkenLink's consulting archaeologist; and implement interim measures to protect the discovery from looting or vandalism according to the Unanticipated Discovery Plan. The BLM, SHPT, and local and tribal authorities, as appropriate, will be notified immediately upon encountering the discovery. Construction will not proceed within the 100-foot radius of a discovery site until all consulting parties agree that the terms of the Unanticipated Discovery Plan are satisfied and BakkenLink receives notification from the appropriate agencies. No work or activity within the 100-foot buffer area may take place until approvals are communicated at the spread level by the lead Environmental Inspector.

3.0 SPILL PREVENTION AND CONTAINMENT

Spill prevention and containment applies to the use and management of hazardous materials on the construction right-of-way and all ancillary areas during construction.

This includes the refueling or servicing of all equipment with diesel fuel, gasoline, lubricating oils, grease, and hydraulic and other fluids during normal upland applications and special applications within 100 feet of perennial streams or wetlands.

BakkenLink will prepare a project-specific Spill Prevention Containment and Countermeasure (SPCC) Plan. The Contractor shall provide additional information to complete the SPCC Plan for each construction spread, and shall provide site-specific data that meets the requirements of 40 CFR Part 112 for every location used for staging fuel or oil storage tanks and for every location used for bulk fuel or oil transfer. Each SPCC Plan will be prepared prior to introducing the subject fuel, oil, or hazardous material to the subject location.

3.1 Spill Prevention

3.1.1 Staging Areas

Staging areas (including pipe stockpile sites) shall be set up for the construction spreads. No bulk fuel and storage tanks will be placed in the construction ROW. Hazardous materials at staging areas shall be stored in compliance with federal and state laws. The following spill prevention measures shall be implemented by the Contractor:

- Contractor fuel trucks shall be loaded at existing bulk fuel dealerships or from bulk tanks set up for that purpose at the staging area. In the former case, the bulk dealer is responsible for preventing and controlling spills.
- The Environmental Inspector shall inspect the tank site for compliance with the 100-foot setback requirement and approve the tank site prior to installing bulk fuel or storage tanks on the construction yard.
- Fuels and lubricants shall be stored only at designated staging areas. Storage of fuel and lubricants in the staging area shall be at least 100 feet away from the water's edge. Refueling and lubrication of equipment shall be restricted to upland areas at least 100 feet away from perennial streams and wetlands.
- Contractors shall be required to perform all routine equipment maintenance at the staging area and recover and dispose of wastes in an appropriate manner.
- Fixed fuel dispensing locations will be provided with secondary containment to capture fuel from leaks, drips, and overfills.
- Temporary liners, berms, or dikes (secondary containment) shall be constructed around the aboveground bulk tanks, providing 110 percent containment volume of the largest storage tank or trailer within the containment structure, so that potential spill materials shall be contained and collected in specified areas. Tanks shall not be placed in areas subject to periodic flooding or washout.
- Drivers of tank trucks are responsible for safety and spill prevention during tank truck unloading. Procedures for loading and unloading tank trucks shall meet the minimum requirements established by the

Department of Transportation.

- Drivers of tank trucks are responsible for setting brakes and chocking wheels prior to off loading. Warning signs requiring drivers to set brakes and chock wheels shall be displayed at all tanks. Proper grounding of equipment shall be undertaken during fuel transfer operations. Drivers shall observe and control the fueling operations at all times to prevent overfilling the temporary tank.
- Prior to departure of any tank truck, all vehicle outlets shall be examined closely by the driver for leakage, tightened, adjusted or replaced to prevent leakage while in transit.
- A supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of spills shall be maintained at each construction staging area. Sorbent and barrier materials shall also be utilized to contain runoff from contaminated areas.
- Shovels and drums shall be kept at each of the individual staging areas. In the event that small quantities of soil become contaminated, shovels shall be utilized to collect the soil and the material shall be stored in 55-gallon drums. Large quantities of contaminated soil may be bio-remediated on site or disposed in an approved landfill, subject to government approval, or collected utilizing heavy equipment, and stored in drums or other suitable containers prior to disposal. Should contamination occur adjacent to staging areas as a result of runoff, shovels or heavy equipment shall be utilized to collect the contaminated material. Contaminated soil shall be disposed of in accordance with state and federal regulations.
- Temporary aboveground tanks shall be subject to visual inspection on a monthly basis and when the tank is refilled. Inspection records shall be maintained. Operators shall routinely keep tanks under close surveillance and potential leaks or spills shall be quickly detected.
- Visible fuel leaks shall be reported to the Contractors' designated representative and corrected as soon as conditions warrant. BakkenLink's designated representative shall be informed.
- Drain valves on temporary tanks shall be locked to prevent accidental or unauthorized discharges from the tank.
- Oil and other hazardous materials stored in 350-gallon totes, 55-gallon drums, 5-gallon pails, smaller retail-size containers or other portable containers will be staged or stored in areas with a secondary temporary containment structure. Secondary containment structures may consist of temporary earthen berms with a chemical resistant liner, or a portable containment system constructed of steel, PVC, or other suitable material. The secondary containment structure will be capable of containing 110 percent of the volume of material stored in these areas.

BakkenLink may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.1.2 Construction Right-of-Way

The Contractor will ensure that all equipment is free of leaks prior to use on the Project and prior to entering or working in or near waterbodies or wetlands. Throughout construction, the Contractor will conduct regular maintenance and inspections of the equipment to reduce the potential for spills or leaks.

Rubber-tired vehicles (pickup trucks, buses) normally shall refuel at the construction staging areas or commercial gas stations. Tracked machinery (backhoes, bulldozers) shall be refueled and lubricated on the construction right-of-way. Equipment maintenance shall be conducted in staging areas when practical. When impractical, repairs to equipment can be made on the construction right-of-way when approved by BakkenLink's representative.

Each fuel truck that transports and dispenses fuel to construction equipment or Project vehicles along the construction ROW or within equipment staging and material areas shall carry an oil spill response kit and spill response equipment onboard at all times. In the event that response materials are depleted through use or their condition is deteriorated through age, the materials will be replenished prior to placing the fueling vehicle back into service.

The following preventive measures apply to refueling and lubricating activities on the construction right-of-way:

- Construction activities shall be conducted to allow for prompt and effective cleanup of spills of fuel and other hazardous materials. Each construction crew, including cleanup crews shall have on hand sufficient tools and material to stop leaks and supplies of absorbent and barrier materials to allow rapid containment and recovery of spilled materials. Crew members must know and follow the procedure for reporting spills.
- Refueling and lubricating of construction equipment shall be restricted to upland areas at least 100 feet away from perennial streams and wetlands. Where this is not possible (e.g., trench dewatering pumps), the equipment shall be fueled by designated personnel with special training in refueling, spill containment, and cleanup. The Environmental Inspector shall ensure that signs are installed identifying restricted areas.
- No fuel, oil or hazardous material storage, staging, or transfer other than refueling will occur within 100 feet of any storm drain, drop inlet, or high consequence area (HCA).
- Spent oils, lubricants, filters, etc. shall be collected and disposed of at an approved location in accordance with state and federal regulations.
- Equipment shall not be washed in streams.

- Stationary equipment will be placed within a secondary containment if it will be operated or require refueling within 100 feet of a wetland or waterbody boundary.

BakkenLink may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.2 Contingency Plans

The Contractor shall develop emergency response procedures for all incidents (e.g., spills, leaks, fires) involving hazardous materials which could pose a threat to human health or the environment. The procedures shall address activities in all work areas, as well as during transport to and from the construction right-of-way and to any disposal or recycling facility.

3.3 Equipment

The Contractor shall retain emergency response equipment in all areas where hazardous materials are handled or stored. This equipment shall be readily available to respond to a hazardous material emergency. Such equipment shall include, but not be limited to, the following:

- first aid supplies;
- phone or communications radio;
- protective clothing (Tyvek suit, gloves, goggles, boots);
- hand-held fire equipment;
- absorbent material and storage containers;
- non-sparking bung wrench and shovel; and
- brooms and dust pan.

Hazardous material emergency equipment shall be carried in all mechanic and supervisor vehicles. This equipment shall include, at a minimum:

- first aid supplies;
- phone or communications radio;
- 2 sets of protective clothing (Tyvek suit, gloves, goggles, boots);
- 1 non-sparking shovel;
- 6 plastic garbage bags (20 gallon);
- 10 absorbent socks and spill pads;
- Hand-held fire extinguisher;
- barrier tape; and
- 2 orange reflector cones.

Fuel and service trucks shall carry a minimum of 20 pounds of suitable commercial sorbent material.

The Contractor shall inspect emergency equipment weekly, and service and maintain equipment regularly. Records shall be kept of all inspections and services.

3.4 Emergency Notification

Emergency notification procedures between the Contractor and BakkenLink shall be established in the planning stages of construction. A BakkenLink representative shall be identified to serve as contact in the event of a spill during construction activities. In the event of a spill meeting government reporting criteria, the Contractor immediately shall notify the BakkenLink representative who, in turn, shall notify the appropriate regulatory agencies.

Any material released into water that creates a sheen must be reported immediately to BakkenLink. The Contractor is required to notify BakkenLink immediately if there is any spill of oil, oil products, or hazardous materials that reaches a wetland or waterbody. Incidents on public highways shall be reported to BakkenLink and the appropriate agencies by BakkenLink.

If a spill occurs on navigable waters of the United States, BakkenLink shall notify the National Response Center (NRC) at 1-800-424-8802. For spills that occur on public lands, into surface waters, or into sensitive areas, the appropriate governmental agency's district office also shall be notified.

3.5 Spill Containment and Countermeasures

In the event of a spill of hazardous material, Contractor personnel shall:

- notify the appointed BakkenLink representative;
- identify the product hazards related to the spilled material and implement appropriate safety procedures, based on the nature of the hazard;
- control danger to the public and personnel at the site;
- implement spill contingency plans and mobilize appropriate resources and manpower;
- isolate or shutdown the source of the spill;
- block manholes or culverts to limit spill travel;
- initiate containment procedures to limit the spill to as small an area as possible to prevent damage to property or areas of environment concern (e.g., watercourses); and
- commence recovery of the spill and cleanup operations.

When notified of a spill, the BakkenLink representative shall immediately ensure that:

- Action is taken to control danger to the public and personnel at the site.

- Spill contingency plans are implemented and necessary equipment and manpower are mobilized.
- Measures are taken to isolate or shutdown the source of the spill.
- All resources necessary to contain, recover and clean up the spill are available.
- Any resources requested by the Contractor from BakkenLink are provided.
- The appropriate agencies are notified. For spills which occur on public lands, into surface waters or into sensitive areas, the appropriate federal or state managing office shall also be notified and involved in the incident.

For a land spill, berms shall be constructed with available equipment to physically contain the spill. Personnel entry and travel on contaminated soils shall be minimized. Sorbent materials shall be applied or, if necessary, heavily contaminated soils shall be removed to an approved facility. Contaminated sorbent materials and vegetation shall also be disposed of at an approved facility.

For a spill threatening a waterbody, berms or trenches shall be constructed to contain the spill prior to entry into the waterbody. Deployment of booms, skimmers, and sorbent materials shall be necessary if the spill reaches the water. The spilled product shall be recovered and the contaminated area shall be cleaned up in consultation with spill response specialists and appropriate government agencies.

4.0 UPLANDS (AGRICULTURAL, FOREST, PASTURE, RANGE AND GRASS LANDS)

4.1 Interference with Irrigation Systems

If existing irrigation systems (flood irrigation, ditch irrigation, pivot, wheel, or other type of spray irrigation systems), irrigation ditches, or sheet flow irrigation shall be impacted by the construction of the pipeline, the following mitigation measures shall be implemented unless otherwise approved or directed by BakkenLink:

- If it is feasible and mutually acceptable to BakkenLink and the landowner or landowner's designate, temporary measures shall be implemented to allow an irrigation system to continue to operate across land on which the pipeline is being constructed.
- If the pipeline or temporary work areas intersect an operational (or soon to be operational) pivot or other spray irrigation system, BakkenLink shall establish with the landowner or landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.
- If the pipeline or temporary work areas intersect an operational sheet flow irrigation system, BakkenLink shall establish with the landowner or

landowner's designate an acceptable amount of time the irrigation system may be out of service. If an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the landowner shall be compensated reasonably for all such crop damages.

- Irrigation ditches that are active at the time of construction shall not be stopped or obstructed except for the length of time to install the pipeline beneath the ditch (typically, one day or less) unless otherwise approved or directed by BakkenLink.

4.2 Clearing

The objective of clearing is to provide a clear and unobstructed right-of-way for safe and efficient construction of the pipeline. The following mitigation measures shall be implemented:

- Construction traffic shall be restricted to the construction right-of-way, existing roads, and approved private roads.
- Construction right-of-way boundaries including pre-approved temporary workspace shall be clearly staked to prevent disturbance to unauthorized areas.
- If crops are present, they shall be mowed or disced to ground level unless an agreement is made for the landowner to remove.
- Burning is prohibited on cultivated land.
- Construction right-of-way at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline.

4.3 Topsoil Removal and Storage

The objective of topsoil handling is to maintain topsoil capability by conserving topsoil for future replacement and reclamation and to minimize the degradation of topsoil from compaction, rutting, loss of organic matter, or soil mixing so that successful reclamation of the right-of-way can occur. The following mitigative measures shall be implemented during topsoil removal and storage unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- In cultivated and agricultural lands, the actual depth of the topsoil, to a maximum depth of 12 inches, will be stripped from:
    - The area excavated above the pipeline
    - The area above the pipeline plus the spoil storage
- As required by applicable permit agreements with the landowner or as dictated by site-specific conditions.

- Stripped topsoil is to be stockpiled in a windrow along the edge of the right-of-way. The Contractor shall perform work in a manner to minimize the potential for subsoil and topsoil to be mixed.
- Under no circumstances shall the Contractor use topsoil to fill a low area.
- If required due to excessively windy conditions, topsoil piles shall be tackified using either water or a suitable tackifier (liquid mulch binder).
- Gaps in the rows of topsoil will be left in order to allow drainage and prevent ponding of water adjacent to or on the right-of-way.
- Topsoil shall not be utilized to construct ramps at road or waterbody crossings.

4.4 Grading

The objective of grading is to develop a right-of-way that allows the safe passage of equipment and meets the bending limitations of the pipe. The following mitigative measures shall be implemented during grading unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- All grading shall be undertaken with the understanding that original contours and drainage patterns shall be re-established to the extent practicable..
- Agricultural areas that have terraces shall be surveyed to establish pre-construction contours to be utilized for restoration of the terraces after construction.
- On steep slopes, or wherever erosion potential is high, temporary erosion control measures shall be implemented.
- Bar ditches adjacent to existing roadways to be crossed during construction shall be adequately ramped with grade or ditch spoil to prevent damage to the road shoulder and ditch.
- Where the construction surface remains inadequate to support equipment travel, timber mats, timber riprap, or other method shall be used to stabilize surface conditions.

The Contractor shall limit the interruption of the surface drain network in the vicinity of the right-of-way using the appropriate methods:

- providing gaps in the rows of subsoil and topsoil in order to prevent any accumulation of water on the land;
- preventing obstructions in furrows, furrow drains, and ditches;
- installing flumes and ramps in furrows, furrow drains, and ditches to facilitate water flow across the construction right-of-way and allow for construction equipment traffic; and

installing flumes over the trench for any watercourse where flow is continuous during construction.

4.5 Temporary Erosion and Sediment Control

4.5.1 General

Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil, maintained throughout construction (on a daily basis), and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction right-of-way is complete.

Specifications and configurations for erosion and sediment control measures may be modified by BakkenLink as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

The Contractor shall inspect all temporary erosion control measures at least daily in areas of active construction or equipment operation, weekly in areas with no construction or equipment operation, and within 24 hours of each significant rainfall event of 0.5 inches or greater. The Contractor shall repair all ineffective temporary erosion control measures as expediently as practicable.

4.5.2 Sediment Barriers

Sediment barriers shall be constructed of silt fence, staked hay or straw bales, compacted earth (e.g., drivable berms across travel lanes), sand bags, or other appropriate materials.

The Contractor shall install sediment barriers in accordance with Company specifications or as otherwise approved or directed by BakkenLink. The Contractor is responsible for properly installing, maintaining, and replacing temporary and permanent erosion controls throughout construction and cleanup. In wetland or riparian zones, the Contractor will install sediment control structures along the construction right-of-way edges prior to vegetation removal where practicable. The aforementioned sediment barriers may be used interchangeably or together depending on site-specific conditions. In most cases, silt fence shall be utilized where longer sediment barriers are required.

Sediment barriers shall be installed below disturbed areas where there is hazard of offsite sedimentation. These areas include:

- the base of slopes adjacent to road crossings;
- the edge of the construction right-of-way adjacent to and upgradient of a roadway, flowing stream, spring, wetland, or impoundment;
- trench or test water discharge locations where required;
- where waterbodies or wetlands are adjacent to the construction right-of-way; (the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way)

- across the entire construction right-of-way at flowing waterbody crossings;
- right-of-way immediately upslope of the wetland boundary at all standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland; (Sediment control barriers are not required at “dry” wetlands.)
- along the edge of the construction right-of-way within standard (saturated or standing water) wetland boundaries as necessary to contain spoil and sediment within the construction right-of-way. Sediment control barriers are not required at “dry” wetlands

Sediment barriers placed at the toe of a slope shall be set a sufficient distance from the toe of the slope, if possible, in order to increase ponding volume.

Sediment control barriers shall be placed so as not to hinder construction operations. If silt fence or straw bale sediment barriers (in lieu of driveable berms) are placed across the entire construction right-of-way at waterbodies, wetlands, or upslope of roads, a provision shall be made for temporary traffic flow through a gap for vehicles and equipment to pass within the structure. Immediately following each day’s shutdown of construction activities, a row of straw bales or a section of silt fence shall be placed across the upgradient side of the gap with sufficient overlap at each end of the barrier gap to eliminate sediment bypass flow, followed by bales tightly fitted to fill the gap. Following completion of the equipment crossing, the gap shall be closed using silt fence or straw bale sediment barrier.

The Contractor shall maintain straw bale and silt fence sediment barriers by removing collected sediment and replacing damaged bales. Sediment shall be removed and placed where it shall not reenter the barrier when sediment loading is greater than 40 percent or if directed by BakkenLink. If straw bale filters cannot be cleaned out due to access problems, the Contractor shall place a new row of sediment barriers upslope.

The Contractor shall use mulch and straw bales that are free of noxious weeds. Mulch or straw bales that contain evidence of noxious weeds or other undesirable species shall be rejected by the Contractor.

The Contractor shall remove sediment barriers, except those needed for permanent erosion and sediment control, during clean up of the construction right-of-way.

4.5.3 Trench Plugs

The Contractor shall use trench plugs at the edge of flowing waterbody crossings and at the edge of wetlands with standing water to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs shall be of sufficient size to withstand upslope water pressure.

4.5.4 Temporary Slope Breakers (Water Bars)

The Contractor shall install temporary slope breakers on slopes greater than 5% on all disturbed lands at the following recommended spacing:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

The gradient of each slope breaker shall be 2 to 4 percent.

If so directed by the landowner, the Contractor may not install temporary slope breakers (water bars) in cultivated land.

Temporary slope breakers shall be constructed of soil, silt fence, staked straw bales, sand bags, or similar materials authorized by BakkenLink.

The Contractor shall direct the outfall of each temporary slope breaker to a stable, well-vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way as shown in Detail 3. The outfall of each temporary slope breaker shall be installed to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

Specifications and configurations for temporary slope breakers may be modified by BakkenLink as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

4.5.5 Drainage Channels or Ditches

Drainage channels or ditches shall be used on a limited basis to provide drainage along the construction right-of-way and toe of cut slopes as well as to direct surface runoff across the construction right-of-way or away from disturbances and onto natural undisturbed ground. Channels or ditches shall be constructed by the Contractor during grading operations. Where there is inadequate vegetation at the channel or ditch outlet, sediment barriers, check berms, or other appropriate measures shall be used to control erosion.

4.5.6 Temporary Mulching

Unless otherwise directed by BakkenLink, the Contractor shall apply temporary seed and/or mulch on disturbed construction work areas that have been inactive for one month or are expected to be inactive for a month or more. The Contractor shall not apply temporary mulch in cultivated areas unless specifically requested by the landowner. The Contractor shall not apply mulch within wetland boundaries.

Temporary mulch of straw or equivalent applied on slopes shall be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. Mulch application on slopes within 100 feet of waterbodies and wetlands shall be increased to an approximate rate of 3 tons per acre.

4.5.7 Tackifier

When wetting topsoil piles with water does not prevent wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer.

Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create a potential for wind erosion, additional tackifier shall be applied by the Contractor.

4.6 Stringing

The objective of stringing is to place the line pipe along the construction right-of-way for bending and welding in an expedient and efficient manner.

The Contractor shall utilize one or more of the following mitigation measures as applicable and when necessary to reduce compaction on the working side of the right-of-way or as directed by BakkenLink. However, all work shall be conducted in accordance with applicable permits.

- prohibiting access by certain vehicles;
- using only machinery possessing low ground pressure (tracks or extra-wide tires);
- limiting access and thus minimizing the frequency of all vehicle traffic;
- digging ditches to improve surface drainage;
- using timber riprap, matting, or geotextile fabric overlain with soil; and
- stopping construction for a period of time.

4.7 Trenching

The objective of trenching is to provide a ditch of sufficient depth and width with a bottom to continuously support the pipeline. During trenching operations, the following mitigation measures shall be implemented unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Subsoil shall be segregated from topsoil in separate, distinct rows with a separation that shall limit any admixing of topsoil and subsoil during handling.

- Gaps must be left in the spoil piles that coincide with breaks in the strung pipe to facilitate natural drainage patterns and to allow the passage of livestock or wildlife.
- Trenching operations shall be followed as closely as practicable by lower in and backfill operations to minimize the length of time the ditch is open.
- Construction debris (e.g., welding debris) and other garbage shall not be deposited in the ditch.

Should blasting be necessary for removal of rock, the following mitigation measures may be implemented:

- The Contractor shall use non-electric initiation systems for all blasting operations. If required by the blasting plan, blasting will be monitored for vibration levels and peak particle velocity. This work shall be performed by a third-party vibration monitoring consultant hired by and reporting to the Constructor Representative. The Contractor shall arrange for detonations to be carried out in cooperation with this consultant.
- Prior to using explosives, the Contractor shall advise residents of the immediate area, in order to prevent any risk of accidents or undue disturbances.
- No blasting shall be done without approval of the Constructor Representative. Prior to any detonation of explosives in the vicinity of a loaded line, dwelling, structure, overhead or underground utility, farm operation, or public crossings, a minimum of 48 hours notice shall be given to the Constructor Representative, in order that the appropriate people can be notified and the upstream and downstream mainline valves can be staffed.
- The Contractor shall obtain all necessary permits and shall comply with all legal requirements in connection with the use, storage, and transportation of explosives.
- Blasting mats or subsoil may be piled over the trench line to prevent rock from being blown outside the construction right-of-way.
- Each blasting location shall be cleared and cleaned up before and after all blasting operations.
- Blasting shall be carried out during regular, daylight working hours.
- The Contractor shall at all times protect his workers and the public from any injury or harm that might arise from drilling dust and the use of explosives.
- Only workers thoroughly experienced in handling explosives shall be permitted to supervise, handle, haul, load or shoot explosives. In those jurisdictions where the licensing of blasters is mandatory, the Contractor shall provide the Constructor Representative with proof of the required certification for every person so required.
- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as

possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications.

- Blasting testing of surface-water resources and water wells within 150 feet of the centerline will be performed in compliance with all applicable permits.

4.7.1 Trench Dewatering/Well Points

The Contractor shall make all reasonable efforts to discharge trench water in a manner that avoids damage to adjacent agricultural land, crops, and pasture. Damage includes, but is not limited to, the inundation of crops for more than 24 hours, deposition of sediment in ditches, and the deposition of gravel in fields or pastures.

If trench dewatering is necessary in an area where salt damage to adjacent crops is evident, the Environmental Inspector shall conduct a field conductivity test on the trench water before it is discharged. If the conductivity of the trench water is determined to potentially affect soil quality, it shall not be discharged to areas where salt damage to crops is evident, but shall be directed as feasible so that water flows over a well vegetated, non-cropland area or through an energy dissipater and sediment barrier, then directed to nearby ditches or brackish wetlands or waterbodies.

When pumping water from the trench for any reason, the Contractor shall ensure that adequate pumping capacity and sufficient hose is available to permit dewatering as follows:

- No heavily silt-laden trench water shall be allowed to enter a waterbody or wetland directly but shall instead be diverted through a well vegetated area, a geotextile filter bag, or a permeable berm (straw bale or BakkenLink approved equivalent).
- Trench water shall not be disposed of in a manner which could damage crops or interfere with the functioning of underground drainage systems.

The Contractor shall screen the intake hose and keep the hose either one foot off the bottom of the trench or in a container to minimize entrainment of sediment.

4.8 Welding, Field Joint Coating, and Lowering In

The objectives of welding, field joint coating, and lowering in are to provide continuous segments of pipeline, to provide corrosion protection to the weld areas of the pipeline, and to place the pipeline in the center of the trench, without stress, at the required depth of cover. The following mitigation measures shall be followed during pipe welding, field joint coating, and lowering in, unless otherwise specified by BakkenLink in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Shavings produced during beveling of the line pipe are to be removed immediately following this operation to ensure that livestock and wildlife do not ingest this material. When welding operations create a continuous line of pipe that may be left in the right-of-way for an extended period of time due to construction or weather constraints, a gap in the welded pipe shall be provided to allow for access at farm road crossings and for passage of livestock and wildlife.
- Prior to the application of epoxy powder, urethane epoxy, or other approved pipe coatings, a tarp shall be placed underneath the pipe to collect any overspray of epoxy powder and liquid drippings. Excess powder, liquid, or other hazardous materials (e.g. brushes, rollers, gloves) shall be continuously collected and removed from the construction right-of-way and disposed of in a manner appropriate for these materials.

4.9 Padding and Backfilling

The objective of padding and backfilling is to cover the pipe with material that is not detrimental to the pipeline and pipeline coating. The following mitigative measures shall be utilized during backfilling, unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Excessive water accumulated in the trench shall be eliminated prior to backfilling.
- In the event it becomes necessary to pump water from open trenches, the Contractor shall pump the water and discharge it in accordance with the requirements of the Stormwater Pollution Prevention Plan (SWPPP) in order to avoid damaging adjacent agricultural land, crops, and pasture. Detail 5 and Detail 6 provide typical examples of dewatering structures.
- If it is impossible to avoid water-related damages (including inundation of crops for more than 24 hours, deposition of sediment in ditches and other water courses, and the deposition of gravel in fields, pastures, and any water courses), BakkenLink shall reasonably compensate the landowners for the damage and/or shall correct the damage so as to restore the land, crops, pasture, water courses, etc. to their pre-construction condition.
- All pumping of water shall comply with existing drainage laws and local ordinances relating to such activities and provisions of the Clean Water Act.
- Prior to backfilling, all drain tile shall be permanently repaired, inspected, and the repair documented as described in Section 5.5.
- Prior to backfilling, trench breakers shall be installed on slopes where necessary to minimize the potential for water movement down the ditch and potential subsequent erosion.
- During backfill, the stockpiled subsoil shall be placed back into the trench before replacing the topsoil.
- Topsoil shall not be utilized for padding the pipe.

- Backfill shall be compacted to a minimum of 90% of pre-existing conditions where the trench line crosses tracks of wheel irrigation systems (pivots).
- To reduce the potential for ditch line subsidence, spoil shall be replaced and compacted by backhoe bucket or by the wheels or tracks of equipment traversing down the trench.
- The lesser of 4 feet or the actual depth of topsoil cover, shall not be backfilled with soil containing rocks of any greater concentration or size than existed prior to pipeline construction in the pipeline trench, bore pits, or other excavations.

4.10 Cleanup

The objective of cleanup activities shall be to prepare the right-of-way and other disturbed areas to approximate pre-activity ground contours where appropriate and to replace spoil and stockpiled material in a manner which preserves soil capability and quality to a degree reasonably equivalent to the original or that of representative undisturbed land. The following mitigation measures shall be utilized during cleanup, unless otherwise approved or directed by BakkenLink based on specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Cleanup shall occur immediately following backfilling operations when weather or seasonal conditions allow.
- All garbage and construction debris (e.g., lathing, ribbon, welding rods, pipe bevel shavings, pipe spacer ropes, end caps, pipe skids) shall be collected and disposed of at approved disposal sites.
- The right-of-way shall be re-contoured with spoil material to approximate pre-construction contours and as necessary to limit erosion and subsidence. Loading of slopes with unconsolidated spoil material shall be avoided during slope re-contouring. Topsoil shall be replaced after re-contouring of the grade with subsoil. The topsoil shall be replaced on the subsoil storage area and over the trench so that after settling occurs, the topsoil's approximate original depth and contour (with an allowance for settling) shall be achieved.
- Subsoil shall not be placed on top of topsoil.
- Surface drainage shall be restored and re-contoured to conform to the adjacent land drainage system.
- Erosion control structures such as permanent slope breakers and cross ditches shall be installed on steep slopes where necessary to control erosion by diverting surface run-off from the right-of-way to stable and vegetated off right-of-way areas.
- During cleanup, temporary sediment barriers such as silt fence and hay bale diversions will be removed; accumulated sediment will re-contoured with the rest of the ROW; and permanent erosion controls will be installed as necessary.

- After construction, all temporary access shall be returned to prior construction conditions unless specifically agreed with the landowner or otherwise specified by BakkenLink.
- Warning signs, aerial markers, and cathodic protection test leads shall be installed in locations that shall not impair farming operations and are acceptable to the landowner.
- All bridges, fences and culverts existing prior to construction shall be restored to meet or exceed approximate pre-construction conditions. Caution shall be utilized when re-establishing culverts to ensure that drainage is not improved to a point that would be detrimental to existing waterbodies and wetlands.
- All temporary gates installed during construction shall be replaced with permanent fence unless otherwise requested by the landowner.

4.11 Reclamation and Revegetation

The objectives of reclamation and revegetation are to return the disturbed areas to approximately pre-construction use and capability. This involves the treatment of soil as necessary to preserve approximate pre-construction capability and the stabilization of the work surface in a manner consistent with the initial land use.

The following mitigation measures will be utilized unless otherwise approved or directed by BakkenLink based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

4.11.1 Relieving Compaction

- Compacted cropland compacted shall be ripped a minimum of 3 passes at least 18 inches deep and all pasture shall be ripped or chiseled a minimum of three passes at least 12 inches deep before replacing topsoil.
- Areas of the construction right-of-way that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns, as practical) prior to topsoil replacement. The approximate depth of ripping shall be 18 inches (or a lesser depth if damage may occur to existing drain tile systems). After ripping, the subsoil surface shall be graded smooth and any subsoil clumps broken up (disc and harrow) in an effort to avoid topsoil mixing.
- The de-compacted construction right-of-way shall be tested by the Contractor at regular intervals for compaction in agricultural and residential areas. Tests shall be conducted on the same soil type under similar moisture conditions in undisturbed areas immediately adjacent to the right-of-way to approximate pre-construction conditions. Penetrometers or other appropriate devices shall be used to conduct tests

- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete up to a maximum of 12 inches. Topsoil compaction on cultivated fields shall be alleviated by cultivation.
- If there is any dispute between the landowner and BakkenLink as to what areas need to be ripped or chiseled, the depth at which compacted areas should be ripped or chiseled, or the necessity or rates of lime and fertilizer application, the appropriate NRCS shall be consulted by BakkenLink and the landowner.

Plowing under of organic matter including wood chips and manure, or planting of a green crop such as alfalfa to decrease soil bulk density and improve soil structure or any other measures in consultation with the Natural Resource Conservation Service (NCRS) shall be considered if mechanical relief of compaction is deemed not satisfactory.

In the first year after construction, BakkenLink will inspect the ROW to identify areas of erosion or settling. Subsequently, BakkenLink will monitor erosion and settling through aerial patrols, which are part of BakkenLink's Integrity Management Plan, and through landowner reporting. Landowner reporting will be facilitated through use of BakkenLink's toll-free telephone number, which will be made available to all landowners on the ROW. Landowner reporting also may be facilitated through contact with BakkenLink's field offices.

BakkenLink plans to minimize impacts on soil productivity that may result from construction activities, but recognizes that some short- to long-term decreases in agricultural productivity are possible. BakkenLink recognizes its responsibility to restore agricultural productivity on the pipeline ROW and to compensate landowners for demonstrated decreases in productivity that may result from any degradation of agricultural soils along the ROW.

4.11.2 Rock Removal

- On agricultural land, rocks that are exposed on the surface due to construction activity shall be removed from the right-of-way prior to and after topsoil replacement This effort will result in an equivalent quantity, size and distribution of rocks to that found on adjacent lands.
- Clearing of rocks may be carried out with a mechanical rock picker or by manual means, provided that preservation of topsoil is assured. Rock removed from the right-of-way shall be hauled off the landowner's premises or disposed of on the landowner's premises at a location that is mutually acceptable to the landowner and to BakkenLink.

4.11.3 Soil Additives

If site-specific conditions warrant and if agreed to by the landowner, the Contractor shall apply amendments (fertilizer and soil pH modifier materials and formulations) commonly used for agricultural soils in the area and in accordance with written recommendations from the local soil

conservation authority, land management agencies, or landowner. Amendments shall be incorporated into the normal plow layer as soon as possible after application.

4.11.4 Seeding

- The final seed mix shall be based on input from the local Natural Resource Conservation Service and the availability of seed at the time of reclamation, detailed seeding guidelines can be found in Appendix 9.2. The landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis are required for all seed mixes to limit the introduction of noxious weeds.
- Seed not utilized within 12 months of seed testing shall be approved by BakkenLink prior to use. Seeding shall follow cleanup and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (except cultivated fields unless requested by the landowner) as indicated on the construction drawings
- If mulch was applied prior to seeding for temporary erosion control, the Contractor shall remove and dispose of the excess mulch prior to seedbed preparation to ensure that seedbed preparation equipment and seed drills do not become plugged with excess mulch; and to support an adequate seedbed; and to ensure that seed incorporation or soil packing equipment can operate without becoming plugged with mulch.
- The Contractor may evenly re-apply and anchor (straw crimp) the removed temporary mulch on the construction right-of-way following seeding.
- Identified seeding areas shall be seeded at a rate appropriate for the region and stability of the reclaimed surface. Seeding rates shall be based on pure live seed.
- Weather conditions, construction right-of-way constraints, site access, and soil type shall influence the seeding method to be used (i.e., drill seeding versus broadcast seeding). All areas seeded by the Contractor, except for temporary cover crops, shall be drill seeded unless the right-of-way is too steep to facilitate drill seeding. Temporary cover crop seed shall be broadcast.
- The Contractor shall delay seeding as necessary until the soil is in the appropriate condition for drill seeding.
- The Contractor shall use a Truax brand or equivalent-type drill seeder equipped with a cultipacker designed and equipped to apply grass and grass-legume seed mixtures with mechanisms such as seed box agitators to allow even distribution of all species in each seed mix, with an adjustable metering mechanism to accurately deliver the specified seeding rate and with a mechanism such as depth bands to accurately place the seed at the specified depth.

- The Contractor shall operate drill seeders at an appropriate speed so the specified seeding rate and depth is maintained.
- The Contractor shall calibrate drill seeders so that the specified seeding rate is planted. The row spacing on drill seeders shall not exceed 8 inches.
- The Contractor shall plant seed at depths consistent with the local or regional agricultural practices.
- Broadcast or hydro seeding, used in lieu of drilling, shall utilize double the recommended seeding rates. Where seed is broadcast, the Contractor shall use a harrow, cultipacker, or other equipment immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- The Contractor shall delay broadcast seeding during high wind conditions if even distribution of seed is impeded.
- The Contractor shall hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked in order to incorporate the broadcast seed to the specified depth.
- Hydro seeding may be used, on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods. Fertilizer, where specified, may be included in the seed, virgin wood fiber, tackifier, and water mixture. When hydro-seeding, virgin wood fiber shall be applied at the rate of approximately 3,000 pounds per acre on an air-dry weight basis as necessary to provide at least 75% ground cover. Tackifier shall consist of biodegradable, vegetable-based material and shall be applied at the rate recommended by the manufacturer. The seed, mulch, and tackifier slurry shall be applied so that it forms a uniform, mat-like covering of the ground.
- BakkenLink shall work with landowners to discourage intense livestock grazing of the construction right-of-way during the first growing season by utilization of temporary fencing or deferred grazing, or increased grazing rotation frequency.

4.11.5 Permanent Erosion and Sediment Control

The Contractor shall restore all existing landowner soil conservation improvements and structures disturbed by pipeline construction to the approximate pre-construction line and grade. Soil conservation improvements and structures include, but are not limited to, grassed waterways, toe walls, drop inlets, grade control works, terraces, levees, and farm ponds.

4.11.5.1 Trench Breakers

The Contractor shall install trench breakers in steep terrain where necessary to limit the potential for trench line erosion and at the base of slopes adjacent to waterbodies and wetlands.

Trench breakers shall be constructed of materials such as sand bags, sand/cement bags, bentonite bags, or other suitable materials by the Contractor (Detail 7). The Contractor shall not use topsoil in trench breakers.

4.11.5.2 Permanent Slope Breakers (Water Bars)

Permanent slope breakers (water bars) shall be constructed of soil or, in some instances, sand bags.

The Contractor shall construct permanent slope breakers on the construction right-of-way where necessary to limit erosion, except in cultivated and residential areas. Slope breakers shall divert surface runoff to adjacent stable vegetated areas or to energy-dissipating devices as shown on Detail 3. In general, permanent slope breakers should be installed immediately downslope of all trench breakers. Permanent slope breakers shall be installed as specified on the construction drawings or generally with a minimum spacing as shown on the following table:

Slope (%)	Spacing (feet)
5 - 15	300
>15 – 30	200
>30	100

The gradient (fall) for each slope breaker shall be two percent to four percent unless otherwise approved by BakkenLink based on site-specific conditions.

The Contractor shall construct slope breakers to divert surface flow to a stable, well-vegetated area. In the absence of a stable area, the Contractor shall construct appropriate energy-dissipating devices at the end of the slope breaker and beyond the area disturbed by construction.

4.11.5.3 Mulching

The Contractor shall apply mulch on all areas with high erosion potential and on slopes greater than 8 percent unless otherwise approved by BakkenLink based on site-specific conditions or circumstances. The Contractor shall spread mulch uniformly over the area to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per acre of straw or its equivalent. The Environmental Inspector may reduce the application rate or forego mulching an area altogether if there is an adequate cover of rock or organic debris to protect the slope from erosion.

Mulch application includes straw mulch or hydro mulch and tackifier. The Contractor shall not apply mulch in cultivated areas unless deemed necessary by BakkenLink.

The Contractor shall use mulch that is free of noxious weeds.

The Contractor shall apply mulch immediately following seeding. The Contractor shall not apply mulch in wetlands.

If a mulch blower is used, the majority of strands of the mulching material shall not be shredded to less than 8 inches in length to allow anchoring. The Contractor shall anchor mulch immediately after application to minimize loss by wind and water.

When anchoring (straw crimping) by mechanical means, the Contractor shall use a tool specifically designed for mulch anchoring with flat, notched disks to properly crimp the mulch to a depth of 2 to 3 inches. A regular farm disk shall not be used to crimp mulch. The crimping of mulch shall be performed across the slope of the ground, not parallel to it. In addition, in areas of steep terrain, tracked vehicles may be used as a means of crimping mulch (equipment running up and down the hill to leave crimps perpendicular to the slope), provided they leave adequate coverage of mulch.

In soils possessing high erosion potential, the Contractor may be required to make two passes with the mulch-crimping tool; passes must be as perpendicular to the others as possible.

When anchoring with liquid mulch binders (tackifiers), the Contractor shall use a biodegradable tackifier derived from a vegetable-based, organic source. The Contractor shall apply mulch binders at rates recommended by the manufacturer.

The Contractor shall limit the use of tackifiers for anchoring straw and the use of hydromulch and tackifier to areas that are too steep or rocky to safely or effectively operate mechanical mulch-anchoring tools. No asphalt-based tackifiers shall be used on the Project.

4.11.5.4 Erosion Control Matting

Erosion control matting shall be applied where shown on the construction drawings as shown on Detail 4. The Contractor shall anchor the erosion control matting with staples or other approved devices.

The Contractor shall use erosion control matting made of biodegradable, natural fiber such as straw or coir (coconut fiber).

The Contractor shall prepare the soil surface and install the erosion control matting to ensure it is stable and the matting makes uniform contact with the soil of the slope face or stream bank with no bridging of rills, gullies, or other low areas.

4.11.5.5 Riprap and Stream Bank Stabilization

Disturbed banks of streambeds and waterbodies shall be restored to their approximate original contours unless otherwise directed. Erosion protection shall be applied as specified in the construction drawings.

Most restored banks will be protected through the use of flexible channel liners.

If the original stream bank is excessively steep and unstable and/or flow conditions are severe, a more stable final contour may be specified and alternate stabilization measures may be installed.

Alternate stabilization measures may consist of rock riprap, bio-stabilization, or engineered structures such as brush layering, logwalls, cribwalls, or vegetated geo-grids.

Stream bank riprap structures shall consist of a layer of stone underlain with approved filter fabric or a gravel filter blanket. Riprap shall extend from the stabilized streambed to the top of the stream bank. Native rock shall be utilized wherever practicable.

4.11.6 Fences

Upon completion of all backfilling, cleanup, and restoration, including mulching and seeding of the construction right-of-way, permanent repairs shall be made to all fences by using either the original material or good quality new material similar to existing fences.

Historic fences shall be carefully reassembled by hand from the original material. Where the original material has deteriorated to a state that makes it unsalvageable, replacement material similar to the original shall be used if possible.

4.11.7 Farm Terraces

BakkenLink will work with landowners and farm service agencies to ensure restoration of farm terraces to their pre-construction function. BakkenLink may elect to negotiate a fair settlement with the landowner to employ a local land leveling contractor to restore the terrace.

Before any groundwork is performed in areas with farm terraces, BakkenLink will conduct a civil survey and photograph each terrace from two to three perspectives to document the location and contours of each terrace. Both the channel contour and the terrace berm will be surveyed within the construction right-of-way and up to 100 feet on either side of the ROW boundaries. The pre-construction survey and photographs will provide a baseline to ensure the proper restoration of the terrace following construction.

The Contractor will maintain the pre-disturbance drainage of water along the terrace channel and will install temporary flume pipe for this purpose. As necessary, temporary erosion control measures such as water bars and sediment barriers will be installed and maintained throughout construction to reduce the potential for soil erosion along or off the construction ROW.

Following installation of the pipe, the trench will be backfilled, and the Contractor will restore the terrace contours as agreed to with the landowner.

Should the landowner agree to have a local contractor restore the terraces, the Contractor will backfill the trench and restore the terrace using typical compaction methods for pipeline construction with the understanding that the landowner's contractor will re-excavate the location and re-install the terrace utilizing land levelling equipment and special compaction methods.

Should the landowner desire the Contractor to restore the terraces, the pipeline contractor will compact the trench before the terrace berm is replaced. Following restoration of the terraces, final contours and grades will be re-surveyed and documented with survey notes. Photographs will be taken from a minimum of two or three perspectives to document that the cross-section profile matches the adjacent undisturbed grades. BakkenLink will perform post-construction monitoring and inspection with the landowner's concurrence. Should the terraces require further work, BakkenLink will either compensate the landowner to perform the work or arrange for a local contractor to perform the work.

4.11.8 Right-of-Way and Pipeline Markers

Upon completion of all backfilling, cleanup and restoration, including mulching and seeding of the construction right-of-way, and during the time when the Contractor is making permanent repairs to fences, the Contractor shall install pipeline markers on each side of all roads, railroads, fence lines, stream crossings, and other areas where the pipeline markers do not conflict with intended land use.

4.12 Pasture and Range Lands

The following mitigation measures shall be implemented in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Access across the right-of-way during construction shall be provided at locations requested by landowners, if practicable.
- Shavings produced during pipe bevel operations are to be removed immediately to ensure that livestock and wildlife do not ingest this material.
- Litter and garbage shall be collected and removed from the construction site at the end of the day's activities.
- Temporary gates shall be installed at fence lines for access to the construction right-of-way. These gates shall remain closed at all times. Upon completion of construction, the temporary gates shall be removed and the permanent fence replaced.
- Feeding or harassment of livestock or wildlife is prohibited.
- Construction personnel shall not be permitted to have firearms or pets on the construction right-of-way.
- All food and wastes shall be stored and secured in vehicles or appropriate facilities.
- Areas of disturbance in native range shall be seeded with a native seed mix after topsoil replacement.
- Improved pasture shall be seeded with a seed mix approved by individual landowners.

4.13 Forested Lands

Mitigation measures are required to ensure that pipeline construction activities have a minimal impact on forested lands.

Clearing, grubbing, and grading of trees, brush, and stumps shall be performed in accordance with the following mitigation measures in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved or directed by BakkenLink based on site-specific conditions or circumstances. BakkenLink will address mitigation, reclamation and

remediation measures with individual landowners and comply with any applicable state requirements. These measures include non-vegetative remediation to reverse impacts on windbreaks, shelterbelts, and living snow fences. Where the pipeline follows an existing ROW in forested areas, BakkenLink attempted to route the pipeline as close as practical to the existing ROW. All work shall be conducted in accordance with applicable permits.

- Prior to the start of clearing activity, right-of-way boundaries, including pre-approved temporary workspaces, shall be clearly staked to prevent disturbance of unauthorized areas.
- If trees are to be removed from the construction right-of-way, BakkenLink shall consult with the landowner or landowner's designate to see if there are trees of commercial or other value to the landowner. Timber shall be salvaged as per landowner request.
- If there are trees of commercial or other value to the landowner, BakkenLink shall allow the landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing and included in the easement agreement.
- If not performed by the landowner, the construction right-of-way Contractor may salvage all marketable timber from designated areas.
- Tree stumps shall be grubbed to a maximum of 5 feet on either side of the trench line and where necessary for grading a level surface for pipeline construction equipment to operate safely.
- BakkenLink shall follow the landowner's or landowner designee's desires as stated in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the landowner by burning, burial, etc., or complete removal from any affected property.
- Timber salvage operations shall use cut-off-type saw equipment. Felling shall be undertaken in a manner that minimizes butt shatter, breakage, and off ROW disturbance. Skidders or alternate equipment shall be used to transport salvaged logs to stacking sites.
- Trees shall be felled to fall toward the center line of the right-of-way to avoid breaking trees and branches off ROW. Leaners (felled trees that inadvertently fall into adjacent undisturbed vegetation) shall be salvaged.
- Trees and slash falling outside the right-of-way shall be recovered and disposed..
- Salvaged logs shall be limbed and topped before removal from the construction right-of-way. Log decks (if required) shall be oriented to best facilitate loading by picker trucks and be located adjacent to the working side of the right-of-way, where possible.
- The Contractor shall not be allowed to dispose of woody debris in wooded areas along the pipeline right-of-way.
- Pruning of branches hanging over the right-of-way shall be done only when necessary for construction. Any branch that is broken or seriously damaged should be cut off near its fork and the collar of the branch preserved.

- All tree wastes, stumps, tree crowns, brushes, branches, and other forest debris shall be either burned, chipped (using a mobile chipper), or removed from the right-of-way according to BakkenLink instructions contained in the specific mitigation measures. Burial of this waste material on the site by the Contractor shall require the landowner's authorization. Chips must not be spread over cultivated land. However, they may be spread and incorporated with mineral soil over the forest floor at a density that shall not prevent revegetation of grass.
- Stump removal and brush clearing shall be done with bulldozers equipped with brush rakes to preserve organic matter.
- Decking sites shall be established: (1) approximately 2000 feet apart in timbered areas; (2) on sites located on approved temporary workspace in existing cleared areas; (3) in non-merchantable stands of timber; or (4) if no other options are available, in merchantable timber stands. Deck sites shall be appropriately sized to accommodate the loading equipment.
- If the landowner does not want the timber, the Contractor shall remove decked timber from the construction right-of-way and transport it to a designated all-weather access point or mill

4.14 Residential and Commercial/Industrial Areas

4.14.1 Residential and Commercial Areas

The principal measures that shall be used to mitigate impacts on existing residential and commercial areas include the following unless otherwise directed or approved by BakkenLink based on site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- notifying landowners prior to construction;
- posting warning signs as appropriate;
- reducing the width of construction right-of-way, if practicable, by eliminating the construction equipment passing lane, reducing the size of work crews, or utilizing the "stove pipe" or "drag section" construction techniques;
- removing fences, sheds, and other improvements as necessary for protection from construction activities;
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;
- fencing the edge of the construction work area adjacent to a residence for a distance of 100 feet on either side of the residence to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area;
- limiting the hours during which operations with high-decibel noise levels (i.e., drilling and boring) can be conducted;
- limiting dust impact through prearranged work hours and by utilizing dust minimization techniques;

- ensuring that construction proceeds quickly through such areas, thus minimizing exposure to nuisance effects such as noise and dust;
- maintaining access and traffic flow during construction activities, particularly for emergency vehicles;
- cleaning up construction trash and debris daily;
- fencing or plating open ditches during non-construction activities;
- if the pipeline centerline is within 25 feet of a residence, ensuring that the trench is not excavated until the pipe is ready for installation and that the trench shall be backfilled immediately after pipe installation; and
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences, and other structures within the construction work area to its pre-construction appearance or the requirements of the landowner. Restoration work shall be done by personnel familiar with local horticultural and turf establishment practices.
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;

4.14.2 Site-Specific Plans

For any commercial/industrial building closer than 25 feet to the construction work area, BakkenLink shall prepare a site-specific construction plan. The plan shall include:

- a description of construction techniques to be used;
- a dimensioned site plan that shows, at a minimum:
  - the location of the residence or commercial/industrial area in relation to the new pipeline;
  - the edge of the construction work area;
  - the edge of the new permanent construction right-of-way; and
  - other nearby topographical obstacles including landscaping, trees, structures, roads, parking areas, ditches, and streams; and
- a description of how BakkenLink would ensure that the trench is not excavated until the pipe is ready for installation and that the trench is backfilled immediately after pipe installation.

4.14.3 Landowner Complaint Resolution Procedure

BakkenLink shall implement a landowner complaint procedure as follows:

- Landowners should first contact the construction spread office to express their concern over restoration or mitigation of environmental damages on their property. The Construction Manager or his designated representative shall respond to the landowner within 24 hours of receipt of the phone call.

- If the landowner has not received a response or is not satisfied with the response, he can contact BakkenLink's representative at Don Metzger at 701-390-7392. The landowner should expect a response within 48 hours.

4.15 Operations and Maintenance

Operations and maintenance programs, such as vegetation management, pipeline maintenance, integrity surveys, and hydrostatic testing, may have an impact on the final reclamation of the right-of-way. To ensure the integrity of the facility and land surface reclamation of the right-of-way is maintained after completion of construction and that regulatory requirements are adhered to during operations, the following measures shall be implemented unless otherwise directed by BakkenLink in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- BakkenLink shall monitor the pipeline right-of-way and all stream crossings for erosion or other potential problems that could affect the integrity of the pipeline. Any erosion identified shall be reclaimed as expediently as practicable by BakkenLink or by compensating to the landowner to reclaim the area.
- Trench depressions on ditch line that may interfere with natural drainage, vegetation establishment, or land use shall be repaired as expediently as practicable by BakkenLink or by compensating the landowner to repair the area.
- Post-construction monitoring inspections shall be conducted after the first growing season to determine the success of revegetation. Areas which have not been successfully re-established shall be revegetated by BakkenLink or by compensation of the landowner to reseed the area. If, after the first growing season, revegetation is successful, no additional monitoring shall be conducted.
- In non-agricultural areas, revegetation shall be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands.
- In agricultural areas, revegetation shall be considered successful if crop yields are similar to adjacent undisturbed portions of the same field.
- Restoration shall be considered successful if the surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the landowner or land managing agency), revegetation is successful, and drainage has been restored.
- Weed control measures shall be implemented as required by any applicable plan and in conjunction with the landowner.
- BakkenLink shall be responsible for correcting tile line or irrigation system repairs that fail, provided those repairs were made by BakkenLink. BakkenLink shall not be responsible for tile line or irrigation system repairs which BakkenLink compensated the landowner to perform.

- When requested by owners in cultivated land, BakkenLink shall monitor the yield of land impacted by construction with the help of agricultural specialists. If yield deficiencies are indicated compared to yields on unaffected land, BakkenLink will compensate the landowner for reduced yields and shall implement procedures to return the land to equivalent capability.
- In residential areas, landowners may use the right-of-way provided they do not interfere with the rights granted to BakkenLink. Trees, bushes, structures, including houses, tool sheds, garages, poles, guy wires, catch basins, swimming pools, trailers, leaching fields, septic tanks, and any other objects not easily removable, shall not be permitted on the permanent construction right-of-way without the written permission of BakkenLink, because they could impair access for maintenance of the pipeline.
- BakkenLink shall maintain communication with the landowner and tenant throughout the operating life of the pipeline to allow expedient communication of issues and problems as they occur. BakkenLink shall provide the landowner with corporate contact information for these purposes. BakkenLink shall work with landowners to prevent excessive erosion on lands disturbed by construction. Reasonable methods shall be implemented to control erosion. These may not be implemented if the property across which the pipeline is constructed is bare cropland which the landowner intends to leave bare until the next crop is planted.
- If the landowner and BakkenLink cannot agree upon a reasonable method to control erosion on the landowner's property, the recommendations of the appropriate NRCS office shall be considered by BakkenLink and the landowner.

5.0 DRAIN TILE SYSTEMS

5.1 General

If underground drainage tile is damaged by the pipeline installation, it shall be repaired in a manner that ensures the tile line's proper operating condition at the point of repair. BakkenLink may elect to negotiate a fair settlement with the affected county or landowner for repair of the damaged drain tile. In the event the landowner chooses to have the damaged tile repaired by BakkenLink, the Contractor shall follow these guidelines and procedures to identify the location of drain tiles, to mitigate damages to drain tiles prior to and during construction, to repair drain tiles damaged during installation of the pipeline, to inspect the proper repair of drain tiles, and to provide post-construction monitoring to determine any impacts caused by repair of drain tiles. Since all public and private drain tile systems are unique, i.e., varying age, depth of cover, type of material, geometry on the land, etc., it is not possible to develop a standard procedure for resolving each county’s or landowner’s drain tile issues. These guidelines provide a basis on which to develop site specific methodology to mitigate damage and to repair drain tiles affected by construction of the Project. Actual measures will be developed based on site-specific information unique to specific installations. However, all work will be conducted in accordance with applicable permits.

5.2 Identification and Classification of Drain Tile Systems

Personnel shall attempt to identify and classify existing drain tile systems by meeting with local public officials and county engineers, and individual private landowners and tenants.

5.2.1 Publicly Owned Drain Tiles

Personnel shall identify and meet with the responsible county or local authority responsible for publicly owned drain tiles. Publicly owned drain tiles shall be identified and documented on the Project's 1" = 2000' USGS quad strip maps and additional data collected for input into an electronic spreadsheet by county, township, range, and section; responsible agency; and size, type, and depth of cover (if known). This data shall be cross-referenced to the centerline survey to be completed by BakkenLink. Additionally, any public records including maps or easement instruments on the drain tiles shall be acquired as well as any requirements of the local authority for installation of the pipeline.

5.2.2 Privately Owned Drain Tiles

Right-of-way agents shall meet with landowners and tenants of privately owned land along the route. As a minimum, the right-of-way agents shall ascertain the data concerning drain tiles outlined in a landowner questionnaire. The questionnaire requests data concerning: type of drain tile system; size, type of material, and depth of cover; preference for repair of drain tiles; and identification of local drain tile contractors. These data shall be collected into an electronic spreadsheet for utilization by right-of-way personnel in negotiating payments for easements and damages and by engineering or construction personnel for inclusion in specifications for the construction Contractor.

5.3 Mitigation of Damage to Drain Tile Systems

BakkenLink shall undertake mitigation measures to reduce damage to publicly and privately owned drain tile systems prior to and during installation of the pipeline.

5.3.1 Non-interference with Drain Tile

The Project shall be installed at a depth of cover and elevation so as not to interfere with the elevation and grade of existing drain tiles where practicable. Where not practicable, BakkenLink shall pursue alternative mitigation measures mutually acceptable to the landowner and jurisdictional agencies. Typically, the pipeline shall be installed below the elevation of drain tiles with a minimum clearance of 12 inches.

5.3.2 Non-disturbance of Drain Tile Mains

Publicly owned and privately owned drain tile mains shall be identified through the processes identified in Section 5.2. Drain tile mains are essential to the overall drainage system of a land area and if disturbed, may

require excessive pumping/dewatering of the pipe trench unless temporarily repaired and maintained until permanently repaired.

BakkenLink shall review drain tile mains and consider their size, flow rate, type of material, depth of cover, and geographic location. If determined to be practicable and reasonable for construction, the drain tile main shall not be cut and repaired during mainline installation (a pipe section shall be left out and installed by a tie-in crew without damaging the drain tile main).

5.3.3 Relocation or Replacement of Existing Drain Tiles Prior to Construction

In many instances, drain tile systems that have been installed after the installation of adjacent existing pipelines were installed with “headers” parallel to the existing pipeline with periodic jumpovers. The distance of these headers from the existing pipeline may vary.

Some of these drain tile headers may be most effectively relocated and/or replaced to the east of the Project. The existing header will be capped and made into a single drain. This could reduce the number of drain tile crossings on a particular landowner’s property by a significant quantity, thereby reducing the risk that repairs will fail.

5.3.4 Future Drain Tiles/Systems

BakkenLink shall attempt to determine where public agencies and private landowners or tenants are proposing to install drain tile systems in the future. These locations shall be input into an electronic spreadsheet by county, township, range, and section; landowner or responsible public agency; and proposed size and depth of cover. BakkenLink shall endeavor to construct the pipeline at a depth and elevation to accommodate the future installation of the proposed drain tile systems.

5.3.5 Other Mitigation Measures

Other mitigation measures that may be implemented during installation of the pipeline are as follows:

- not removing topsoil from the working side of the construction right-of-way to prevent crushing of drain tile by heavy equipment;
- spreading ditch and spoil side topsoil (not subsoil) over the working side to provide additional soil depth to protect existing drain tiles;
- restricting the work of the pipe lower in crew if ground conditions are too wet to adequately support the heavy equipment;
- limiting travel of heavy equipment the working lane of the construction right-of-way where possible;
- limiting travel of heavy equipment to one pass over the drain tile per work crew where possible; and

- removing and replacing topsoil during drain tile replacement should tile be crushed on the working side of the right-of-way.

5.4 Responsibility for Repair of Drain Tile Systems

Temporary and permanent drain tile repairs shall be the responsibility of the Contractor. The physical repairs shall be made by qualified and experienced drain tile repair personnel.

5.4.1 Local Drain Tile Contractor Repair

BakkenLink shall identify and qualify local drain tile contractors in the geographical area of the pipeline route from interviews with local public officials, landowners, tenants, and drain tile contractors. The preferred responsibility for permanent repair of drain tiles shall be for the pipeline Contractor to subcontract the supervision and repair to local reputable drain tile contractors acceptable to the landowners and tenants.

5.4.2 Pipeline Contractor Repair

In the event local drain tile contractors are not available to subcontract the supervision and repair, permanent repair shall be made with the Contractor's supervision, equipment, and labor.

5.4.3 Landowner/Tenant Repair

The landowner or tenant may agree to take responsibility for the permanent repair of his drain tiles if not precluded by regulatory agency. The landowner or tenant shall be requested to ensure his ability to coordinate and complete the drain tile repair in a timely manner to allow the pipeline Contractor to completely backfill the damaged drain tile for repair by landowner/tenant in the immediate future. BakkenLink shall require that its representative be present to ensure the permanent drain tile repairs are made in accordance with the minimum requirements of this manual.

5.5 Drain Tile Repairs

The Contractor shall endeavour to locate all tile lines within the construction right-of-way prior to and during installation so repairs can be made if necessary.

5.5.1 Temporary Repairs During Construction

Drain tiles damaged or cut during the excavation of the trench shall be marked with a lath and ribbon in the spoil bank. Care shall be taken to locate markers where the chance of disturbance shall be minimized and a written record maintained of each drain tile crossing. A work crew following the pipeline trench crew shall complete a temporary repair to allow continuing flow. If a drain tile line shall not be temporarily repaired, the open ends of the drain tile shall be screened to prevent entry of foreign materials and small animals.

5.5.2 Permanent Repairs

Permanent repairs shall be made for all drain tiles damaged by installation of the pipeline.

5.5.2.1 Ditch Line Only Repairs

If water is flowing through a damaged tile line, the tile line shall be immediately and temporarily repaired until such time that permanent repairs can be made. If tile lines are dry and water is not flowing, temporary repairs are not required if the permanent repair is made within 7 days of the time damage

occurred. The temporary repair shall be removed just prior to lowering in the pipeline.

Drain tiles must be permanently repaired before the pipeline trench is backfilled and within 14 days of construction completion, weather and soil conditions permitting. All tile lines shall be repaired with materials of the same or better quality as that which was damaged. The drain tile marker shall not be removed until the tile repairs have been inspected, approved, and accepted by BakkenLink's inspectors, the county inspectors, where applicable, and the landowner or tenant.

5.5.2.2 Ditch Line and Temporary Work Space Repairs

Prior to making the permanent drain tile repair, the Contractor shall probe a segmented sewer rod with a plug that is not more than 15% smaller than the internal diameter of the drain tile to determine if additional damage has occurred to the drain tile. If the probe does not freely insert into the drain tile across the temporary workspace of pipeline construction, the Contractor shall excavate, expose, and repair the damaged drain tile to its original or better condition.

5.6 Inspection/Acceptance of Drain Tile Repairs

Drain tile repairs shall be inspected by BakkenLink construction inspectors, county inspectors, as applicable, and the landowner or tenant or his representative.

BakkenLink shall designate inspector(s) for the sole purpose and responsibility for inspection of all repairs of drain tiles. These inspectors shall be, if possible, employed from local drain tile installation contractors, local farmers with extensive drain tile experience, or previously employed or retired employees of local jurisdictions familiar with drain tile installation and repair. In the event that a sufficient quantity of inspectors from these sources is not available, BakkenLink shall conduct in-the-field training seminars on drain tile repair for additional inspection personnel.

Inspection personnel shall observe the permanent repair of all drain tiles to ensure the replacement drain tile is: (1) the proper size and type; (2) installed at the proper grade; (3) properly supported and backfill beneath the drain tile is properly placed and compacted; and (4) properly tied into the existing drain tile. The inspection shall be documented on the Drain Tile Inspection Report Form.

A drain tile repair shall not be accepted until BakkenLink's construction inspector and the landowner or tenant or designated representative approves the inspection form.

6.0 WETLAND CROSSINGS

6.1 General

Aboveground facilities shall not be located in a wetland, except where the location of such facilities outside of wetlands would preclude compliance with US Department of Transportation pipeline safety regulations.

Wetland boundaries shall be clearly marked in the field with signs and/or highly visible flagging during construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the measures of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Lands shall be implemented to the extent practicable.

A dry wetland typically has groundwater level some depth below the surface. Trench excavations typically are stable and normal in width. Equipment can traverse the wetland without the support of mats or timber riprap.

A standard wetland environment typically has soils that are saturated and non-cohesive. Difficult trenching conditions are likely resulting in excessively wide trenches. In these wetland environment types, supplemental support in the form of timber riprap or prefabricated equipment mats may be required for construction equipment to safely and efficiently operate.

A flooded wetland involves the presence of standing water over much of the wetland area. Equipment typically cannot traverse the wetland and must generally move around that portion of the area. Access is typically limited to marsh backhoes or equipment working from flexifloats or equivalents.

BakkenLink may allow modification of the following specifications as necessary to accommodate site-specific conditions or procedures. Any modifications must still comply with all applicable regulations and permits.

6.2 Easement and Workspace

The Contractor shall maintain wetland boundary markers during construction in all areas and until permanent seeding is complete in non-cultivated areas.

The width of the construction right-of-way shall be reduced to 75 feet or less in standard wetlands unless non-cohesive soil conditions require utilization of a greater width.

The Contractor shall locate extra work areas (such as staging areas and additional spoil storage areas) shall be at least 100 feet away from wetland boundaries, where topographic conditions permit.

The Contractor shall limit clearing of vegetation between extra work areas and the edge of the wetland to the construction right-of-way and limit the size of extra work areas to the minimum needed to construct the wetland crossing.

6.3 Vehicle Access and Equipment Crossing

The only access roads, other than the construction right-of-way, that the Contractor shall use in wetlands are those existing public roads and private roads acquired by BakkenLink from the landowner shown on the construction drawings.

To the extent practicable, the Contractor's construction equipment operating in saturated wetlands or wetlands with standing water shall be limited to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way.

If equipment must operate within a wetland containing standing water or saturated soils, the Contractor shall use the following methods for equipment access unless otherwise approved by BakkenLink based on site-specific conditions:

- wide-track or balloon-tire construction equipment; and
- conventional equipment operated from timber and slash (riprap) cleared from the right-of-way, timber mats, or prefabricated equipment mats.

6.4 Temporary Erosion and Sediment Control

The Contractor shall install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all standard wetland crossings, as necessary, to prevent sediment flow into the wetland. Sediment barriers must be properly maintained by the Contractor throughout construction and reinstalled as necessary. In the travel lane, these may incorporate removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but shall be re-installed after construction has stopped for the day or when heavy precipitation is imminent. The Contractor shall maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. The Contractor shall not install sediment barriers at wetlands designated as "dry" unless otherwise specified by BakkenLink.

Where standard wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to prevent a sediment flow into the wetland.

6.5 Wetland Crossing Procedures

The following general mitigation procedures shall be followed by the Contractor in all wetlands unless otherwise approved or directed by BakkenLink based on site-specific conditions. All work shall be conducted in accordance with applicable permits.

- limit the duration of construction-related disturbance within wetlands to the extent practicable;
- use no more than two layers of timber riprap to stabilize the construction right-of-way;
- cut vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal;
- limit pulling of tree stumps and grading activities to directly over the trench line unless safety concerns require the removal of stumps from the working-side of the construction ROW;
- segregate a maximum of 12 inches of topsoil from the area disturbed by trenching in dry wetlands, where practicable;
- restore topsoil to its approximate original stratum, after backfilling is complete;
- dewater the trench in a manner to prevent erosion and heavily silt-laden flowing directly into any wetland or waterbody;
- remove all timber riprap and prefabricated equipment mats upon completion of construction;
- locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable;
- prohibit storing hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary;
- perform all equipment maintenance and repairs upland locations at least 100 feet from waterbodies and wetlands;
- avoid parking equipment overnight within 100 feet of a watercourse or wetland;
- prohibit washing equipment in streams or wetlands;
- install trench breakers and/or seal the trench to maintain the original wetland hydrology, where the pipeline trench may drain a wetland;
- attempt to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary (otherwise follow the procedures outlined in Section 3); and
- avoid sand blasting in wetlands to the extent practicable. If sandblasting is performed within a wetland, the Contractor shall place a tarp or suitable material in such a way as to collect as much waste shot as possible and

dispose of the collected waste. The Contractor shall clean up all visible deposits of wastes and dispose of the waste at an approved disposal facility.

Specific procedures for each type of wetland crossing method are listed below and shall be designated on the construction drawings but may be modified depending on site conditions at the time of construction. All work shall be conducted in accordance with applicable permits.

6.5.1 Dry Wetland Crossing Method

Topsoil shall be segregated. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace.

The dry wetland crossing procedure as depicted in Detail 8 shall be used where this type of wetland is identified on the construction drawings. The following are exceptions to standard wetland crossing methods:

- The width of the construction right-of-way for upland construction is maintained through the wetland.
- Where extra work areas (such as staging areas and additional spoil storage areas) are designated on the construction drawings, they may be placed no closer than 100 feet from the wetland's edge.
- If the wetland is cultivated, the topsoil shall be stripped using the trench and spoil side method at the same depth as the adjacent upland areas.
- Seeding requirements for agricultural lands shall be applied to farmed wetlands.

6.5.2 Standard Wetland Crossing Method

Topsoil stripping is impracticable due to the saturated nature of the soil. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace. Based upon the length of a standard wetland crossing and presence of sufficient water to float the pipe, the Contractor may elect to install a standard wetland crossing utilizing the “push/pull” method.

The standard wetland crossing procedure as depicted in Detail 8 shall be used where this type of wetland is identified on the construction drawings.

Procedures unique to standard wetlands include:

- limiting construction right-of-way width to a maximum of 75 feet unless site conditions warrant a wider width;
- utilizing low-ground-pressure construction equipment or support equipment on timber riprap or timber mats; and

- installing sediment barriers across the entire right-of-way where the right-of-way enters and exits the wetland.

6.5.3 Flooded Push/Pull Wetland Crossing Method

Where standing surface water or high groundwater levels make trenching difficult, trench widths up to 35 feet are common. Topsoil stripping is impossible due to the flooded conditions. Pipe stringing and fabrication is required adjacent to the wetland in a designated extra workspace. Using floatation devices, the pipe string is pushed and pulled from the extra workspace to the trench.

The Push/Pull wetland crossing procedure as depicted in Detail 9 shall be used where water is sufficient to float the pipeline in the trench and other site conditions allow.

Clean metal barrels or Styrofoam floats may be used to assist in the flotation of the pipe. Metal banding shall be used to secure the barrels or floats to the pipe. All barrels, floats, and banding shall be recovered and removed upon completion of lower in. Backfill shall not be allowed before recovery of barrels, floats, and banding.

6.6 Restoration and Reclamation

All timber riprap, timber mats, and prefabricated equipment mats and other construction debris shall be removed upon completion of construction. As much as is feasible, the Contractor shall replace topsoil and restore original contours with no crown over the trench. Any excess spoil shall be removed from the wetland. The Contractor shall stabilize wetland edges and adjacent upland areas by establishing permanent erosion control measures and revegetation, as applicable, during final clean up.

In the absence of detailed revegetation plans or until the appropriate seeding season for permanent wetland vegetation in standard wetlands, the Contractor shall apply a temporary cover crop of annual ryegrass or oats on the construction right-of-way at a rate adequate for germination and ground cover unless standing water is present. The Contractor shall apply the temporary cover crop during final cleanup. For farmed wetlands, the Contractor shall apply seeding requirements for agricultural lands or as required by the landowner.

The Contractor shall not use fertilizer, lime, or mulch in wetlands unless required in writing by the appropriate land management agency.

All wetland areas within conservation lands or easements will be restored to a level consistent with any additional criteria established by the relevant managing agency.

7.0 WATERBODIES AND RIPARIAN AREAS

7.1 General

The Contractor shall comply with requirements of all permits issued for the waterbody crossings by federal, state or local agencies.

Waterbody includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

- Minor Waterbody includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of construction.
- Intermediate Waterbody includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of construction.
- Major Waterbody includes all waterbodies greater than 100 feet wide at the water's edge at the time of construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the Contractor, to the extent practicable, shall implement the provisions of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Areas.

The Contractor shall supply and install advisory signs in a readily visible location along the construction right-of-way at a distance of approximately 100 feet on each side of the crossing and on all roads which provide direct construction access to waterbody crossing sites. Signs shall be supplied, installed, maintained, and then removed upon completion of the Project. Additionally, signs shall be supplied and installed by the Contractor on all intermediate and major waterbodies accessible to recreational boaters warning boaters of pipeline construction operations.

The Contractor shall not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating within 100 feet of any waterbody. The Contractor shall not refuel construction equipment within 100 feet of any waterbody. If the Contractor must refuel construction equipment within 100 feet of a waterbody, it must be done in accordance with the requirements outlined in Section 3. All equipment maintenance and repairs will be performed in upland locations at least 100 feet from waterbodies and wetlands. All equipment parked overnight shall be at least 100 feet from a watercourse or wetland, if possible. Equipment shall not be washed in streams or wetlands.

Throughout construction, the Contractor shall maintain adequate flow rates to protect aquatic life and to prevent the interruption of existing downstream uses.

BakkenLink may allow modification of the following specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits. BakkenLink will complete site-specific

crossing plans for certain waterbody crossings if required by the applicable regulatory agencies during federal or state permitting processes.

7.2 Easement and Work Space

The permanent easement, temporary work space, additional temporary work space, and any special restrictions shall be depicted on the construction drawings. The work shall be contained within these areas and be limited in size to the minimum required to construct the waterbody crossing.

The Contractor shall locate all extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet from the water's edge if practicable.

At all waterbody crossings, the Contractor shall install flagging across the construction right-of-way at least 10 feet from the water's edge prior to clearing and ensure that riparian cover is maintained where practicable during construction.

7.3 Vehicle Access and Equipment Crossings

The Contractor shall inspect equipment for fluid leaks prior to entering or crossing over waterbodies.

Equipment bridges shall be installed at all flowing waterbodies. Equipment crossings shall be constructed as described in Details 15, 16 and/or 17.

Equipment crossings shall be perpendicular to drainage bottoms wherever possible.

Erosion and sediment control barriers will be installed and maintained around vehicle access points as necessary to prevent sediment from reaching the waterway.

The Contractor shall be responsible for the installation, maintenance, and removal of all temporary access crossings including portable bridges, bridges made from timber or mats, flumes, culverts, sand bags, subsoil, coarse granular material, and riprap.

The Contractor shall ensure that culverts and flumes are sized and installed of sufficient diameter to accommodate the existing flow of water and those that may potentially be created by sudden runoffs. Flumes shall be installed with the inlet and outlet at natural grade if possible.

Where bridges, culverts or flumes are installed across the work area, the Contractor shall be responsible for maintaining them (e.g. preventing collapse, clogging or tilting). All flumes and culverts shall be removed as soon as possible upon completion of construction.

The width of the temporary access road across culverts and flumes and the design of the approaches and ramps shall be adequate for the size of vehicle and equipment access required. The ramps shall be of sufficient depth and constructed to prevent collapse of the flumes, and the approaches on both sides of the flume shall be feathered.

Where culverts are installed for access, the culvert shall be of sufficient length to convey the stream flow through the construction zone.

The Contractor shall maintain equipment bridges to prevent soil from entering the waterbody.

7.4 Waterbody Crossing Methods

Construction methods pertinent to waterbody crossings are presented below. Selection of the most appropriate method at each crossing shall be depicted on the construction drawings but may be amended or changed based on site-specific conditions (i.e., environmental sensitivity of the waterbody, depth, and rate of flow, subsurface soil conditions, and the expected time and duration of construction) at the time of crossing. Construction will involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive waterbodies, as determined by the appropriate regulatory authority. Where required, horizontal directional drilling (HDD) will be used at designated major and sensitive waterbodies crossings. Each waterbody crossing shall be accomplished using one of the following construction methods:

- Non-flowing Open Cut Crossing Method - (Detail 10)
- Flowing Open Cut Crossing Method – Minor, Intermediate or Major Waterbody - (Detail 11)
- Flowing Stream Crossing – Dry Flume Method - (Detail 12)
- Flowing Stream Crossing – Dry Dam-and-Pump Method - (Detail 13)
- Horizontal Directional Drill Crossing - (Details 14a and 14b)
- Horizontal Bore Crossing - (Detail 20)

In conjunction with the appropriate jurisdictional agency, BakkenLink will develop specific crossing plans for major water bodies that contain recreationally or commercially important fisheries, or are classified as special use. BakkenLink will consult with state fisheries agencies with respect to applicable construction windows for each crossing and develop specific construction and crossing methods for open cuts in conjunction with USACE permitting and USFWS consultation.

7.4.1 Non-flowing Open Cut Crossing Method

The Contractor shall utilize the Non-flowing Open Cut Crossing Method (Detail 10) for all waterbody crossings (ditches, gullies, drains, swales, etc.) with no perceptible flow at the time of construction. Should site conditions change and the waterbody is flowing at the time of

construction, the Contractor shall install the crossing utilizing the Flowing Open Cut Crossing Method (Detail 11) unless otherwise approved by BakkenLink.

7.4.2 Flowing Open Cut Crossing Method of Minor, Intermediate, and Major Waterbodies

For minor waterbody crossings, except where the flume method is used, the Contractor shall complete construction in the waterbody (not including blasting, if required) as shown on Detail 11 within 24 hours if practicable.

For intermediate waterbodies, the Contractor shall attempt to complete trenching and backfill work within the waterbody (not including blasting if required) within 48 hours if practicable as shown on Detail 11.

The Contractor shall construct each major waterbody crossing in accordance with a site-specific plan as shown in the construction drawings. The Contractor shall complete in-stream construction activities as expediently as practicable.

7.4.3 Flowing Stream Crossing – Dry Flume Method

Where required, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Flume Method as shown on Detail 12 with the following "dry ditch" techniques:

- Flume pipe shall be installed after blasting (if necessary), but before any trenching.
- Sand bag, sand bag and plastic sheeting diversion structure, or equivalent shall be used to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required in order to achieve an effective seal).
- Flume pipe(s) shall be aligned to prevent bank erosion and streambed scour.
- Flume pipe shall not be removed during trenching, pipe laying, or backfilling activities, or initial streambed restoration efforts.
- All flume pipes and dams that are not also part of the equipment bridge shall be removed as soon as final clean up of the stream bed and bank is complete.

7.4.4 Flowing Stream Crossing – Dry Dam-and-Pump Method

Where specified in the construction drawings, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Dam-and-Pump Method as shown on Detail 13. The dam-and-pump crossing method shall meet the following performance criteria:

- sufficient pumps to maintain 1.5 times the flow present in the stream at the time of construction;

- at least one back up pump available on site;
- dams constructed with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
- screen pump intakes installed;
- streambed scour prevented at pump discharge; and
- dam and pumps shall be monitored to ensure proper operation throughout the waterbody crossing.

7.4.5 Horizontal Directional Drill Crossings

Where required, the horizontal directional drill method as shown on Details 14a and 14b shall be utilized for designated major and sensitive waterbodies. The Contractor shall construct each directional drill waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

Drilling fluids and additives utilized during implementation of a directional drill shall be non-toxic to the aquatic environment.

The Contractor shall develop a contingency plan to address a frac-out during a directional drill. The plan shall include instructions for monitoring during the directional drill and mitigation in the event that there is a release of drilling fluids. Additionally, the waterbody shall be monitored downstream by the Contractor for any signs of drilling fluid.

The Contractor shall dispose of all drill cuttings and drilling mud at a BakkenLink-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by BakkenLink or hauling to an approved licensed landfill or other site approved by BakkenLink.

7.4.6 Horizontal Bore Crossings

Where required, the horizontal bore method as shown on Detail 20 shall be utilized for crossing waterbodies. The Contractor shall construct each horizontal bore waterbody crossing in accordance with a site specific plan as shown in the construction drawings.

7.5 Clearing

Except where rock is encountered and at non-flowing open cut crossings, all necessary equipment and materials for pipe installation must be on site and assembled prior to commencing trenching in a waterbody. All staging areas for materials and equipment shall be located at least 10 feet from the waterbody edge. The Contractor shall preserve as much vegetation as possible along the waterbody banks while allowing for safe equipment operation.

Clearing and grubbing for temporary vehicle access and equipment crossings shall be carefully controlled to minimize sediment entering the waterbody from the construction right-of-way.

Clearing and grading shall be performed on both sides of the waterbody prior to initiating any trenching work. All trees shall be felled away from watercourses.

Plant debris or soil inadvertently deposited within the high water mark of waterbodies shall be promptly removed in a manner that minimizes disturbance of the waterbody bed and bank. Excess floatable debris shall be removed above the high water mark from areas immediately above crossings.

Vegetation adjacent to waterbody crossings by horizontal directional drill or boring methods shall not be disturbed except by hand clearing as necessary for drilling operations.

7.6 Grading

The construction right-of-way adjacent to the waterbody shall be graded so that soil is pushed away from the waterbody rather than towards it whenever possible.

In order to minimize disturbance to woody riparian vegetation within extra workspaces adjacent to the construction right-of-way at waterbody crossings, the Contractor shall minimize grading and grubbing of waterbody banks. To the extent practicable, grubbing shall be limited to the ditch line plus an appropriate width to accommodate safe vehicle access and the crossing.

7.7 Temporary Erosion and Sediment Control

The Contractor shall install and maintain sediment barriers across the entire construction right-of-way at all flowing waterbody crossings.

The Contractor shall install sediment barriers immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

Where waterbodies are adjacent to the construction right-of-way, the Contractor shall install and maintain sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way.

7.8 Trenching

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

All equipment and materials shall be on site before trenching in the active channel of all minor waterbodies containing state-designated fisheries, and in

intermediate and major waterbodies. All activities shall proceed in an orderly manner without delays until the trench is backfilled and the stream banks stabilized. The Contractor shall not begin in-stream activity until the in-stream pipe section is complete and ready to be installed in the waterbody.

The Contractor shall use trench plugs at the end of the excavated trench to prevent the diversion of water into upland portions of the pipeline trench and to keep any accumulated upland trench water out of the waterbody. Trench plugs must be of sufficient size to withstand upslope water pressure.

The Contractor shall conduct as many in-stream activities as possible from the banks of the waterbodies. The Contractor shall limit the use of equipment operating in waterbodies to that needed to construct each crossing.

The Contractor shall place all spoil from minor and intermediate waterbody crossings and upland spoil from major waterbody crossings in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas. No trench spoil, including spoil from the portion of the trench across the stream channel, shall be stored within a waterbody unless the crossing cannot be reasonably completed without doing so.

The Contractor shall install and maintain sediment barriers around spoil piles to prevent the flow of spoil into the waterbody.

Spoil removed during ditching shall be used to backfill the trench usually with a backhoe, clamshell, or a dragline working from the waterbody bank. Sand, gravel, rockshield, or fill padding shall be placed around the pipe where rock is present in the channel bottom.

7.9 Pipe Installation

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

A "free stress" pipe profile shall be used at all minor, intermediate, and major waterbodies with gradually sloping stream banks. The "box bend" pipe profile shall be used for intermittent and major waterbodies with steep stream banks.

The trench shall be closely inspected to confirm that the specified cover and adequate bottom support can be achieved, and shall require BakkenLink approval prior to the pipe being installed. Such inspections shall be performed by visual inspection and/or measurement by a BakkenLink representative. In rock trench, the ditch shall be adequately padded with clean granular material to provide continuous support for the pipe.

The pipe shall be pulled into position or lowered into the trench and shall, where necessary, be held down by suitable negative buoyancy control, as-built recorded and backfilled immediately to prevent the pipe from floating.

The Contractor shall provide sufficient approved lifting equipment to perform the pipe installation in a safe and efficient manner. As the coated pipe is lowered in,

it shall be prevented from swinging or rubbing against the sides of the trench. Only properly manufactured slings, belts, and cradles suitable for handling coated pipe shall be used. All pipes shall be inspected for coating flaws and/or damage as it is being lowered into the trench. Any damage to the pipe or coating shall be repaired.

7.10 Backfilling

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

Trench spoil excavated from waterbodies shall be used to backfill the trench across waterbodies.

After lowering in is complete, but before backfilling, the line shall be re-inspected to ensure that no skids, brush, stumps, trees, boulders, or other debris is in the trench. If discovered, such materials or debris shall be removed from the trench prior to backfilling.

For each major waterbody crossed, the Contractor shall install a trench breaker at the base of slopes near the waterbody unless otherwise directed by BakkenLink based on site specific conditions. The base of slopes at intermittent waterbodies shall be assessed on site and trench breakers installed only where necessary.

Slurred muck or debris shall not be used for backfill. At locations where the excavated native material is not acceptable for backfill or must be supplemented, the Contractor shall provide granular material approved by BakkenLink.

If specified in the construction drawings, the top of the backfill in the stream shall be armored with rock riprap or bio-stabilization materials as appropriate.

7.11 Stabilization and Restoration of Stream Banks and Slopes

The Contractor will restore the contours of the bed and banks of waterways immediately after pipe installation and backfill, except over the travel lane. Travel lanes and bridges may stay in place until hydrostatic testing and cleanup are complete. All materials used to support construction activities will be removed from waterbodies and wetlands, including, but not limited to, flumes, mats, plastic sheeting, and sandbags.

The stream bank contour shall be re-established. All debris shall be removed from the streambed and banks. Stream banks shall be stabilized and temporary sediment barriers shall be installed within 24 hours of completing the crossing if practicable.

Approach slopes shall be graded to an acceptable slope for the particular soil type and surface run off controlled by installation of permanent slope breakers. Where considered necessary, the integrity of the slope breakers shall be ensured by lining with erosion control blankets.

Immediately following reconstruction of the stream banks, the Contractor shall install seed and flexible channel liners on waterbody banks as shown in Detail 18.

If the original stream bank is excessively steep and unstable or flow conditions are severe, or if specified on the construction drawings, the banks shall be stabilized with rock riprap, gabions, stabilizing cribs, or bio-stabilization measures to protect backfill prior to reestablishing vegetation.

Stream bank riprap structures shall consist of a layer of stone, underlain with approved filter fabric or a gravel filter blanket in accordance with Detail 19. Riprap shall extend from the stabilized streambed to the top of the stream bank. Where practicable, native rock shall be utilized.

Bio-stabilization techniques which may be considered for specific crossings are shown in Details 21 and 22.

The Contractor shall remove equipment bridges as soon as possible after final clean up.

8.0 HYDROSTATIC TESTING

8.1 Testing Equipment Location

The Contractor shall provide for the safety of all pipeline construction personnel and the general public during hydrostatic test operations by placing warning signs in populated areas.

The Contractor shall locate hydrostatic test manifolds 100 feet outside wetlands and riparian areas to the maximum extent practicable.

8.2 Test Water Source and Discharge Locations

BakkenLink is responsible for acquiring all permits required by federal, state and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation. BakkenLink shall provide the Contractor with a copy of the appropriate withdrawal/discharge permits for hydrostatic test water. The Contractor shall keep water withdrawal/discharge permits on site at all times during testing operations.

Any water obtained or discharged shall be in compliance with permit notice requirements and with sufficient notice for BakkenLink's Testing Inspector to make water sample arrangements prior to obtaining or discharging water. BakkenLink will obtain water samples for analysis from each source before filling the pipeline. In addition, water samples will be taken prior to discharge of the water, as required by state and federal permits.

In some instances sufficient quantities of water may not be available from the permitted water sources at the time of testing. Withdrawal rates may be limited as stated by the permit. Under no circumstances shall an alternate water source be used without prior authorization from BakkenLink.

The Contractor shall be responsible for obtaining any required water analyses from each source to be used in sufficient time to have a lab analysis performed prior to any filling operations. The sample bottle shall be sterilized prior to filling with the water sample. The analysis shall determine the pH value and total suspended solids. Each bottle shall be marked with:

- source of water with pipeline station number;
- date taken;
- laboratory order number; and
- name of person taking sample.

Staging/work areas for filling the pipeline with water will be located a minimum of 100 feet from the waterbody or wetland boundary if topographic conditions permit. The Contractor will install temporary sediment filter devices adjacent to all streams to prevent sediments from leaving the construction site.

The Contractor shall screen the intake hose to prevent the entrainment of fish or debris. The hose shall be kept at least 1 foot off the bottom of the waterbody. Refueling of construction equipment shall be conducted a minimum distance of 100 feet from the stream or a wetland. Pumps used for hydrostatic testing within 100 feet of any waterbody or wetland shall be operated and refueled in accordance with Section 3.

During hydrostatic test water withdrawals, the Contractor will maintain adequate flow rates in the waterbody to protect aquatic life and provide for downstream uses, in compliance with regulatory and permit requirements.

The Contractor shall not use chemicals in the test water. The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film or sheen on the surface of the receiving water.

Selected road, railroad, and river crossing pipe sections may be specified to be pre-tested for a minimum of 4 hours. The water for pre-testing of any road and railroad crossings shall be hauled by a tanker truck from an approved water source. Water for pre-testing of a river crossing may be hauled or taken from the respective river if it is an approved water source. Since the volume of water utilized in these pre-tests shall be relatively small, the water shall be discharged overland along the construction right-of-way and allowed to soak into the ground utilizing erosion and sediment control mitigative measures.

Selection of final test water sources will be determined based on site conditions at the time of construction and applicable permits.

8.3 Filling the Pipeline

After final positioning of the pipe, the Contractor shall fill the pipe with water. Pipe ends shall not be restrained during the fill. The fill pump shall be set on a

metal catch pan of sufficient dimensions to contain all leaking lubricants or fuel and prevent them from entering the water source. The suction inlet must be placed in a screened enclosure located at a depth that shall not allow air to be drawn in with the water. The screened enclosure shall be such that the fill water is free of organic or particulate matter.

The Contractor shall provide a filter of the backflushing or cartridge type with a means of cleaning without disconnecting the piping. The filter shall have the specifications of 100 mesh screen. If the cartridge type is used, a sufficient quantity of cartridges shall be on hand at the filter location. The Contractor shall install the filter between the fill pump and the test header. The Contractor shall be responsible for keeping the backflush valve on the filter closed during the filling operation. The Contractor shall be responsible for the proper disposal of materials backflushed from the filter or filter cartridges. The Contractor shall not be allowed to backflush the filter into the stream or other water source.

8.4 Dewatering the Pipeline

The Contractor shall comply with state-issued NPDES permits for discharging test water.

The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film on the surface of the receiving water.

The Contractor shall not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission. To avoid impacts from introduced species, no inter-basin transfers (discharge) of hydrostatic test water will occur.

The discharge operation will be monitored and water samples will be taken prior to the beginning of the discharge to ensure that it complies with the Project and permit requirements. If required by state permits, additional water quality testing will be conducted during discharge, in accordance with permit conditions.

The Contractor shall calculate, record, and provide to BakkenLink the day, date, time, location, total volume, maximum rate, and methods of all water discharged to the ground or to surface water in association with hydrostatic testing.

The Contractor shall regulate the pig velocity discharge rate (3000 gpm maximum), use energy dissipation devices, and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive stream flow. Water must be disposed of using good engineering judgment so that all federal, state, and local environmental standards are met. Dewatering lines shall be of sufficient strength and be securely supported and tied down at the discharge end to prevent whipping during this operation.

To reduce the velocity of the discharge, The Contractor shall utilize an energy-dissipating device described as follows:

8.4.1 Splash Pup

A splash pup consists of a piece of large diameter pipe (usually over 20" outside diameter) of variable length with both ends partially blocked that is welded perpendicularly to the discharge pipe. As the discharge hits against the inside wall of the pup, the velocity is rapidly reduced and the water is allowed to flow out either end. A variation of the splash pup concept, commonly called a diffuser, incorporates the same design, but with capped ends and numerous holes punched in the pup to diffuse the energy.

8.4.2 Splash Plate

The splash plate is a quarter section of 36-inch pipe welded to a flat plate and attached to the end of a 6-inch discharge pipe. The velocity is reduced by directing the discharge stream into the air as it exits the pipe. This device is also effective for most overland discharge.

8.4.3 Plastic Liner

In areas where highly erodible soils exist or in any low flow drainage channel, it is a common practice to use layers of visqueen (or any of the new construction fabrics currently available) to line the receiving channel for a short distance. One anchoring method may consist of a small load of rocks to keep the fabric in place during the discharge. Additional mitigation or protection measures, such as the use of plastic sheeting or other material to prevent scour, will be used as necessary to prevent excessive sedimentation during dewatering.

8.4.4 Straw Bale Dewatering Structure

Straw bale dewatering structures are designed to dissipate and remove sediment from the water being discharged. Straw bale structures are used for on land discharge of wash water and hydrostatic test water and in combination with other energy dissipating devices for high volume discharges. A straw bale dewatering structure is shown In Detail 6. A dewatering filter bags may be sued as an alternative to show bale dewatering structures. A dewatering filter bag is shown in Detail 5.

9.0 Appendix

9.1 Table 2-4 Summary of Environmental Protection Measures for the Project

Resource	Environmental Protection Measures As Design Features
Air Quality	Water or chemical soil binders would be used to control dust along the ROW and access roads during construction in accordance with federal, state, and local requirements.
Geology and Minerals	The HDD construction method would be used to avoid impacts to landslide areas associated with the bluffs on the north and south sides of Lake Sakakawea.
Soils	Soil erosion would be minimized by implementing procedures described in the Storm Water Pollution Prevention Plan (SWPPP), and the Construction, Mitigation, and Reclamation Plan (CMRP).
	If construction is planned during a storm event, vehicle traffic and equipment would be restricted to prevent excessive rutting.
	Use of temporary roads across agricultural lands may result in some compaction and seasonal loss of crops. When necessary, compacted soils would be disked following Project completion and landowners would be compensated for any crop loss.
	During reclamation, compacted areas (typically any area that received repeated traffic or three or more passes by heavy equipment) would be decompacted, to the depth of compaction, by subsoiling or ripping to the depth of compaction. This would help prepare the seed bed, encourage infiltration, and help to prevent accelerated runoff and erosion. Where topsoil has been salvaged and segregated, decompaction would occur prior to respreading topsoil. Scarification would be used only on shallow soils.
	Salvaged topsoil would be protected from wind and water erosion at all times. To ensure proper erosion control of topsoil piles, all sediment and erosion control measures would be inspected after large rain events and repairs would be performed as needed.
Water Resources and Wetlands	The SWPPP would be implemented to minimize storm water transport of sediment from disturbed areas to streams, wetlands, and Lake Sakakawea. All Project-related storm water and hydrostatic test water discharges would be in compliance with a NPDES permit.
	No aboveground facilities or staging areas would be constructed/located within wetlands, riparian areas, or other WUS.
	Biologists familiar with wetland and riparian area identification would post signs at the edges of the wetland/waterbody features prior to construction to avoid surface disturbance and resource impacts.
	ATWSs would be located a minimum of 50 feet outside wetland boundaries. Protection measures (including installation of erosion control devices) would be utilized at all wetland and waterbody crossings to minimize sedimentation. For areas where additional setbacks are deemed necessary to protect the resource, the applicability of the appropriate setback would be determined in consultation with agencies on a site-specific basis.
	No refueling or lubricating would occur within 100 feet of wetlands and/or perennial/intermittent waterbodies. Hazardous materials, chemicals, fuels, etc., would not be stored within 100 feet of wetlands or perennial/intermittent waterbodies.
	Application of herbicides or pesticides in the vicinity of wetlands and waterbodies would follow pesticide use protocol, label instructions, and restrictions outlined in the Noxious Weed and Aquatic Nuisance Species Control Plan.
	For dry crossings, topsoil within the trench line would be segregated from subsoil in wetland and riparian areas for use in reclamation as specified in the CMRP.
	For standard wetland or riparian area crossings, topsoil stripping is impractical due to the saturated nature of the soil as specified in the CMRP.
	Where crossings of wetland or riparian areas cannot be reasonably avoided, the construction ROW width would be reduced to approximately 75 feet or less in standard wetlands and measures would be taken to minimize impacts. The construction ROW width would be reduced to approximately 50 feet or less on all federal lands.
	To control aquatic nuisance species, equipment and boats would be washed to remove all vegetative matter and aquatic nuisance species prior to arrival at the construction site and after constructing through waterbody crossings (e.g., Lake Sakakawea), where water is evident.

Resource	Environmental Protection Measures As Design Features
	Water used for hydrostatic testing, dust control during construction, etc., would be obtained from municipal or other permitted water supply wells. The installation or abandonment of any wells is not anticipated. Surface water or non-permitted groundwater appropriation is not anticipated.
	Sensitive areas would be marked and flagged as an "environmental sensitive area."
	Pipeline crossings of any surface waterway would be scheduled at times of minimal rainfall to minimize the risk of construction-related sediment sources being washed into waterbodies or wetlands.
	A Section 404 permit would be obtained and mitigation would be required in consultation with the USACE. Mitigation areas would need to be monitored for a minimum of 5 years. Annual reports would have to be submitted to the North Dakota USACE regulatory office. Successful performance criteria would need to be developed in a mitigation and monitoring plan that should be submitted with a completed 404 permit application. North Dakota USACE regulatory staff would be able to provide additional guidance as necessary.
Vegetation	The USFS-approved revegetation seed mix for native prairie would be applied on federal lands. The USFS-approved seed mix will be applied on state and private lands unless state and private landowners request a different seed mix. The CMRP outlines the procedures to be followed for returning the land to pre-existing vegetative cover and land uses. All seed would be certified or registered by the State of North Dakota or the state of origin.
	Trees and shrubs would be replaced in accordance with the PSC's tree and shrub mitigation specifications. BakkenLink would coordinate with the appropriate agencies to identify efficient restoration and mitigation measures following construction.
	Post-construction monitoring of reclaimed areas would be conducted for 3 to 5 years following the first growing season, depending on land ownership, to determine the success of revegetation focusing on vegetative cover, noxious weeds, and invasive species cover. On private lands, if revegetation is successful after the third growing season, no additional monitoring would be conducted. On USFS, State, and USACE-managed lands, if revegetation is successful after the fifth growing season, no additional monitoring would be conducted. Reclamation success would be based on the revegetation to at least 70 percent of the background cover. On USFS lands, if revegetation is successful at any time during the 5-year monitoring period, no additional monitoring would be conducted.
	In grasslands identified as high and moderate quality Dakota Skipper habitat, post-construction monitoring inspections would be conducted for 5 years following the first growing season to determine the success of revegetation focusing on vegetative cover and noxious weeds and invasive species establishment. The monitoring period may be shortened to 3 years upon request if located on private land. If 2 consecutive years of successful revegetation is not documented, additional mitigation measures (e.g., reseeding) and extended monitoring may be required. Additional mitigation measures will be determined in consultation with the BLM, landowner/manager, and the USFWS.
	Sensitive areas would be marked and flagged as an "environmental sensitive area."
Noxious Weeds	The Project's Noxious Weed and Aquatic Nuisance Species Control Plan would be implemented to minimize the spread of noxious weeds.
	Noxious weed monitoring and control would continue for any ROW over which BakkenLink would retain control over the land surface use after construction.
	ROW monitoring for noxious weeds and invasive species would be conducted following reclamation in conjunction with ROW monitoring of reclamation success. BakkenLink would be responsible for noxious weed control within the permanent ROW for the life of the Project.
Wildlife and Fisheries	BakkenLink would construct escape ramps every 0.5 mile to reduce the potential for livestock and wildlife becoming trapped in the pipeline trench.
	To the extent practicable, mowing, clearing, and grubbing of the Project ROW would occur in the fall or winter (i.e., outside of migratory bird nesting season [February 1 through July 15]) to minimize disturbance to nesting birds.
	If construction occurs during migratory bird breeding season (February 1 to July 15), BakkenLink would conduct pre-construction surveys for active nests, including raptor nests, in order to avoid disrupting migratory birds during the breeding season. BakkenLink would have a qualified biologist survey the proposed route for nesting migratory birds within 5 days of any ground disturbing activity.

Resource	Environmental Protection Measures As Design Features
	To minimize impacts to migratory birds (including some game birds, waterfowl, and raptors), active nests would be avoided during construction and maintenance activities, in coordination with USFWS. If surveys or other available information indicate a potential for take of migratory birds, their eggs, or active nests, BakkenLink would suspend activities and contact the USFWS for further coordination on the extent of the impact and the long-term implications of the intended use of the Project on migratory bird populations.
	Any open posts (1.5-inch-diameter or greater), which may be utilized in pipeline construction or operation (such as markers, signs, stacks, etc.), would be permanently covered or filled with sand or gravel. This is necessary to prevent wildlife mortalities by entrapment.
	To avoid/minimize impacts to nesting bald eagles from construction activities, BakkenLink would: 1) maintain a minimum 0.5-mile buffer between the activity and any bald eagle nest if no landscape buffer exists; 2) maintain a minimum 660-foot buffer and landscape buffer or natural area between the activity and around the nest tree; and 3) avoid activities during the bald eagle nesting season (February 1 to July 15).
	To avoid/minimize impacts to golden eagles, BakkenLink would conduct surveys prior to any on-the-ground activities to determine the extent of any golden eagle breeding territories in the area that may be impacted by the Project. BakkenLink would conduct an aerial nest survey (preferably by helicopter) within 1 mile of the Project ROW to identify any occupied and unoccupied golden eagle nest sites in proximity to the Project area. Aerial surveys would be conducted between March 1 and May 15, before leaf-out, so that nests are visible and their status (active or inactive) can be determined. A nesting territory or inventoried habitat would be designated as unoccupied by golden eagles only after at least two complete aerial surveys in a single breeding season. Aerial surveys would include the following: 1. Due to the ability to hover and facilitate observations of the ground, helicopters are preferred over fixed-wing aircraft, although small aircraft also may be used. BakkenLink would report any golden eagle nests, as well as other nests of any other raptors found during the survey. Where possible, BakkenLink would utilize two observers to conduct the surveys. 2. BakkenLink would record any observations of golden eagle nest sites using a global positioning system. The date, location, nest condition, activity status, and habitat would be recorded for each sighting. 3. BakkenLink would share the qualifications of the biologist(s) conducting the survey, method of survey, and results of the survey with the USFWS. Alternatively, BakkenLink may conduct ground surveys to identify golden eagle nests within 1 mile of the Project ROW between March 1 and May 15. However, ground surveys are much less reliable than aerial surveys, even during leaf-off conditions, and 75 percent of golden eagle nests present may be missed. BakkenLink would conduct at least two ground observation periods lasting at least 4 hours or more per linear mile to designate inventoried habitat or territory as unoccupied as long as all potential nest sites and alternate nests are visible and monitored. If a golden eagle nest is observed, BakkenLink would contact the USFWS for further consultation to determine appropriate protection measures and possible “take” permit implications.
Special Status Species	Prior to the initiation of construction, applicable biological surveys would be conducted through areas of suitable habitat for specific species during the appropriate season, as determined by the jurisdictional agencies (e.g., BLM, USFS, USACE, and USFWS) and survey results reported in compliance with Section 7 of the ESA.
	If threatened, endangered, candidate, or sensitive plant species are identified in proposed disturbance areas prior to construction, appropriate protection measures would be determined in consultation with agencies.
	Surface use is prohibited from March 1 through June 15 within 1 mile (line of sight) of active sharp-tailed grouse leks.

Resource	Environmental Protection Measures As Design Features
	The loss of special status plant species individuals or populations may occur as a result of adjacent noxious weed-related herbicide application treatments. To effectively mitigate this impact, consultation between the special status plant species jurisdictional agency and the weed control specialists would be completed prior to treatments. The location of known special status plant species and noxious weed species individuals and populations would be confirmed prior to treatments. In addition, techniques for special status plant species avoidance via direct and indirect applications would be developed.
	To prevent the spread of aquatic nuisance species during construction and operation, BakkenLink would remove aquatic plants and animals from equipment prior to entering and before leaving any waterbody. Project staff would spray/wash equipment with high pressure hot water when leaving a wetland/waterbody, or would dry equipment for at least 5 days before use at a different wetland/waterbody.
	The revegetation plan would include a commitment to reseed disturbed native prairie with USFS-approved seed mixture and planting a diverse mixture of native cool- and warm-season grasses and forbs.
	BakkenLink would obtain a seed source that is as local as possible to ensure the particular cultivars are well adapted to the local climate.
	Disturbed native prairie would be reclaimed to its original condition using USFS-approved seed mixes specified by applicable state and federal agencies. The objective is for no net loss of native prairie habitat to occur. Where avoidance of native prairie is not feasible, the following protection measures would be implemented to minimize impacts to the Dakota skipper, regal fritillary, Ottoe skipper, and tawny crescent: 1) Restrict workspaces where the ROW crosses native prairie habitat; 2) Salvage and segregate topsoil in native prairie to maintain the native seed sources for re-vegetation of the ROW in native prairie; and 3) Eliminate herbicide and pesticide use where Dakota skippers, regal fritillaries, Ottoe skippers, and tawny crescents are found.
	If construction occurs during spring or fall migration, BakkenLink would provide whooping crane monitors in suitable habitat along the ROW. If a whooping crane is sighted within 1 mile of a pipeline or associated facilities during construction, all work would cease within 1 mile of the area and the USFWS would be contacted immediately. In coordination with the USFWS, work would resume after the bird(s) leave the area.
	If construction were to occur during the rufa red knot migration period (Fall: July 15 through November 15; Spring: March 15 through June 15), BakkenLink would conduct surveys in suitable habitat within 0.5 mile of the Lake Sakakawea crossing location. Surveys would be conducted by a qualified wildlife biologist who is able to identify rufa red knots and would occur daily before and after construction activities. Surveys would last for at least 2 hours prior to the start of construction each day and continue for at least 1 hour after construction has finished each day. If rufa red knots are observed within line-of-sight of the Project area, no work would begin or continue and the BLM and USFWS would be contacted within 24 hours. In coordination with the USFWS, work may resume after the bird(s) leave the area. Similar constraints may apply to pipeline maintenance activities if conducted within 0.5 mile of suitable habitat.
	If construction were to occur during the interior least tern or piping plover breeding season (April 1 through August 31), BakkenLink would conduct surveys in suitable habitat within 0.5 mile of the Lake Sakakawea crossing location. A qualified biologist would survey no more than 5 days prior to construction-related activities to identify occupied breeding territories and/or active nest sites. If occupied breeding territories and/or active nest sites are identified, the USFWS would be notified. Appropriate protection measures, such as seasonal constraints and the establishment of a spatial buffer area, would be implemented on a site-specific basis in coordination with the USFWS. Similar constraints and/or mitigation measures may apply to pipeline maintenance activities if conducted during the breeding season within 0.5 mile of the Project area.
Land Use	Any range improvements such as fences, gates, cattle guards, and developed water sources located within disturbance or access routes would be repaired to the satisfaction of the agency or private landowner.

Resource	Environmental Protection Measures As Design Features
	If construction would disturb or destroy a natural barrier used for livestock control, the opening would be temporarily closed during construction and permanently closed following construction, as required by the agency or private landowner.
	BakkenLink would coordinate with landowners to minimize impacts to their lands. Lands would be restored to cropland and farming use following the construction phase of the Project.
	In cultivated areas, the depth of cover may be increased to avoid interference with land use activities.
Recreation and Visual Resources	Measures would be implemented to minimize the visual effects of construction on high value road, river, and trail crossings as identified by the BLM, USFS, or USACE.
	To prevent unauthorized use of the ROW by off-road vehicles and subsequent potential impacts to soil, vegetation, and wildlife resources, access would be blocked at locations specified by agencies and/or private landowners.
	Aboveground structures would be painted with BLM-approved environmental colors to minimize contrasts with surrounding landscapes.
Transportation	All major highway and improved gravel or scoria road crossings would be bored to limit traffic interruptions.
	Placement of temporary access would be designed to avoid sensitive features such as wetlands. Areas used for temporary roads or working areas during construction would be restored to their original condition to the extent practicable.
Cultural and Paleontological Resources	Prior to the Project construction, cultural and paleontological resource inventories would be conducted on all proposed disturbance areas not previously inventoried. All cultural resources recorded during the inventories would be evaluated for eligibility to the National Register of Historic Places (NRHP). Avoidance would be recommended for cultural resources listed on the NRHP or evaluated as eligible for listing on the NRHP. If avoidance is not possible, a treatment plan would be developed by the BLM in consultation with the North Dakota State Historic Preservation Office (SHPO), USFS/USACE (if on their lands), and interested tribes. The treatment plan would be implemented prior to Project construction.
	To minimize indirect impacts to cultural and paleontological resources, Project-related personnel would be educated as to the sensitive nature of the resources; a strict policy of prohibiting collecting of these resources would be implemented.
	Sensitive areas would be marked and flagged as an “environmental sensitive area.”
	If cultural resources, including human remains, are discovered during Project construction, all work would stop in the area of the discovery and the procedures outlined in the Unanticipated Discoveries Plan would be followed. Written permission stating that work in this area no longer presents a hazard to cultural resources would be required before work could resume in the area of the discovery. If paleontological resources are discovered during Project construction, all work would cease, the Unanticipated Discoveries Plan for Paleontological Resources would be followed, and a certified paleontologist permitted by the State of North Dakota and the BLM would be contacted to determine appropriate resource identification and protection procedures.
Noise	The proposed route would be at least 500 feet from occupied houses and structures. At this distance, noise created during construction should be below ambient background levels, especially near highways and railroad lines.
	Construction would occur Monday through Saturday for approximately 10 hours/day.
Health and Safety	The Project would be located a minimum distance of 500 feet from residences to minimize hazards to human health and safety. Also, isolation valves would be installed along the pipeline in accordance with federal regulations to isolate the pipeline during a potential leak to minimize the release.
	A Spill Risk Assessment (**Appendix A**) has been completed to identify HCAs and potential impacts as a result of an accidental release of crude oil during pipeline operation.
	Any burning during the Project would comply with all federal, state, county, and local fire regulations pertaining to burning permits.
	All hazardous and potentially hazardous materials would be transported, stored, and handled in accordance with applicable regulations.
	If toxic or hazardous waste materials are encountered during construction, construction would stop immediately, and would not restart until clearance is granted by the appropriate agency.

Resource	Environmental Protection Measures As Design Features
USFS Specific Mitigation Measures	Keep disturbance to a minimum to reduce impacts to suitable sensitive species habitat and native vegetation communities in general, and also to reduce spread of invasive species.
	Where the disturbance area would intersect noxious weeds or patches of invasive species, treat the noxious weeds or invasive species at least 2 weeks prior to construction, or salvage and stockpile the topsoil from these sites separately to isolate the vegetative propagules and seed. These areas should be identified to ensure they are monitored after reclamation.
	Use a USFS-approved native seed mix for reclamation; monitor to ensure proper establishment. Monitor annually for 5 years following reclamation to ensure reclamation success and to identify noxious weeds and invasive species establishment. If revegetation is deemed successful by the USFS at any time during the 5-year monitoring period, no additional monitoring would be conducted.
	If invasive species are found on reclaimed sites that are in areas mostly dominated by native species, treat the invasive species sites and reseed if necessary.
	If noxious weeds are found on reclaimed sites, treat the weeds and reseed if necessary.
	Clean vehicles and equipment used for construction at approved water or air wash stations (monitored by an EI) prior to entering the National Grassland to remove all seeds and plant propagules (seeds and vegetative parts that may sprout) in order to prevent the potential spread of noxious weeds and invasive species. Approved wash stations would include commercial car washes and on-site locations. This mitigation would be applied when moving equipment from an area containing invasive species to an area that does not contain invasive species.
	Clearly mark (stake/fence/flag) sensitive plant populations within or very near the ROW prior to construction and note them on alignment sheets to ensure that they are avoided. Ensure that such marking is still visible prior to reclamation activities.
	Any discovery of sensitive or watch plants within the Project area should be reported to the McKenzie Ranger District Office. Sensitive plant populations discovered after Project approval should be protected; therefore, last-minute alterations of the Project design or access route may be requested in order to avoid negative impacts to such populations.
USACE Specific Mitigation Measures	Drilling mud pits would not be constructed on lands administered by the USACE.
	Use the USFS-approved native seed mix for reclamation unless the USACE requests a different seed mix; monitor to ensure proper establishment. Monitor annually for 5 years following reclamation to ensure reclamation success and to identify noxious weeds and invasive species establishment. If revegetation is deemed successful by the USACE at any time during the 5-year monitoring period, no additional monitoring would be conducted.

9.2 Reclamation Seed Mix for the Project

Forest Service Seed Mixture and Seeding Guidelines
Scenario #13 All Sites (revised June 2014)

			A	B	C	D	E
Species	**Required Cultivar, Ecotype, or Germplasm[1]**	**Common Name**	**% of Mix**	**Number Seed per lb.**	**Number Seed per ft^2**	**Number Seed per acre**	**Drilled PLS lb./acre**
Cool Season Grasses:							
Elymus canadensis	Mandan	Canada wildrye	0.15	115,000	7.5	326,700	2.8
Nassella viridula	Lodorm	Green needlegrass	0.20	180,000	10.0	435,600	2.4
Pascopyrum smithii	Rosana	Western wheatgrass	0.25	112,000	12.5	544,500	4.9

Warm Season Grasses							
Bouteloua gracilis	Bad River	Blue grama	0.10	750,000	5.0	217,800	0.3
Calamovilfa longifolia	Goshen *or* Bowman	Prairie sandreed	0.10	275,000	5.0	217,800	0.8
Schizachyrium scoparium	Badlands	Little bluestem	0.10	286,000	5.0	217,800	0.8
Alternate Warm Season (for one of above species)							
Bouteloua curtipendula	Pierre *or* Killdeer	Sideoats grama	0.10	180,000	5.0	217,800	1.2
Forbs							
Dalea purpurea	Bismarck or Local	Purple prairieclover	0.04	290,000	1.8	78,408	0.25
OR							
Dalea candida	Antelope or Local	White prairieclover	0.04	278,000	1.8	78,408	0.3
Helianthus pauciflorus	Bismarck or Local	Stiff sunflower	0.03	85,000	1.4	60,984	0.7
OR							
Solidago rigida	Local	Stiff goldenrod	0.03	656,000	1.4	60,984	0.1
Echinacea angustifolia	Bismarck or Local	Purple coneflower	0.03	120,000	1.4	60,984	0.5
OR							
Ratibida columnifera	Stillwater or Local	Prairie coneflower	0.03	737,000	1.4	60,984	0.1
Totals			100%		49.6	Forbs Alternate Forbs	13.4 (12.5)

[1]Cultivars listed in the second column are required; however, "local" seed collections grown for harvest are acceptable if performance and origin are certified or documented.

- Seed origins and growing locations should be as close to western North Dakota as possible, and/or with similar climatic conditions. To meet this criteria, seed should be grown in ND, SD, MT, MN, WY, or Canada.
- A wholesale grower of 'local' forbs in North Dakota is Prairies Diversified located in Bismarck, ND (Roger Rostvet, 701-258-0181).

Seeding Rates Formulas

A - % of Mix
B - Number of seeds per lb.
C - Number of seeds per ft^2 (C = A x 50)
D - Number of seeds per acre (D = C x 43560)
E - Drilled Pure Live Seed (PLS) lb./acre (E = D / B)

(Continue for additional information)

Forest Service Seeding Guidelines, Scenario #13

- Use of Pure Live Seed (PLS) for calculating seed mixtures:
  - Planting is based on approximately 50 seed per square foot and/or 12-16 pounds PLS per acre.
  - All of the seed mixtures in this guide give the rate of PLS for each species per acre. These rates were derived using three basic figures: percent of each species desired by composition, number of seeds per pound according to species, and total number of PLS per square foot.

- The following equation should be used to calculate how much seed is needed to provide the required pounds of PLS needed.

% Purity x Germination Rate % = % PLS
Pounds of PLS Desired divided by % PLS = Pounds of Seed Required

An example of this is: 10 lbs. of PLS is required. The given seed lot for this species has a purity of 95% and a germination of 85%. How many pounds of seed will be necessary to have 10 lbs. PLS?

.95 (Purity) x .85 (germination rate) = .81 (% PLS)
10 (required poundage) divided by .81 (% PLS) = 12.3
12.3 pounds of seed will be necessary to provide 10 lbs. PLS of seed.

- Seeding depth should be one-half inch or less for drilled seed.
- For broadcast seeding, multiply pounds of each species seeded by 1.5. Seed bed should be thoroughly worked and firm.
- Best average seeding dates for this mix, because it includes both cool and warm season plant species, is April 20 – June 15. Earlier or later seeding is likely to result in poor establishment of warm season species and is therefore discouraged.

Seeding Dates for Cool Season/Warm Season Mix on the Little Missouri National Grassland

Spring (recommended)	**April 20 to June 15** (Seeding may be extended with adequate soil moisture and when favorable precipitation and temperatures are forecasted.)
Late Summer	**Not Recommended** (Only if weather and soil moisture conditions are favorable. If soil moisture levels and forecasted precipitation amounts are not favorable, this time period of seeding is not recommended. There is greater risk for seeding failure during late summer.)
Late Fall (dormant)	**Not Optimum** (Seed after October 10 when ground temperatures have reached 45°F and cooler temperatures are forecasted.)

- With prior approval by the Forest Service, seed mix may need to be adjusted due to site characteristics and/or lack of available seed for some species. In the latter case, adjust species seeding rates by formulas below table to obtain approximately 50 seed per square foot and/or 12-16 lbs. of PLS per acre for drilled seed and 18-24 lbs. per acre for broadcast seeding.
- Note: The following are required as per Conditions of Approval #28 B, Certification & Reporting
  1. Report of Seeding (#37-28B)
  2. Consider submitting a copy of the seed mix you plan to purchase to ensure it meets Forest Service requirements. Certification of Seed Mixture from Seed Company and seed tags from bags or copy of seed tags for all material to be planted must be submitted to the appropriate Medora or McKenzie Ranger District ***prior to seeding***. Inappropriate seed mixes may be rejected by the Forest Service.
- Call the appropriate Medora or McKenzie Ranger District if there are any questions.

Medora Ranger District: 701-227-7800 McKenzie Ranger District: 701-842-2393

Appendix XIV

Hydrostatic Test Plan

1.0 Introduction

This Hydrostatic Test Plan (Plan) identifies measures to be taken by BakkenLink Pipeline, LLC (BakkenLink) and its contractors to ensure pipeline integrity and conform to regulatory requirements. The Plan will be carried out in accordance with the federal, state and local agency regulations. Measures identified in this Plan apply to work within the project area defined as the right-of-way and other areas used during hydrostatic pressure testing of the pipeline and facilities. BakkenLink and its contractor personnel will be thoroughly familiar with this Plan and its contents prior to initiating hydro-testing operations on the project.

1.1 Purpose

The purpose of this Plan is to define the necessary measures that are to be implemented during pipeline integrity testing to ensure the safety of pipeline construction personnel and the general public. This Plan describes safety standards and practices that will be implemented during construction of the project to minimize health, safety, and environmental (particularly water quality) concerns related to hydro-testing procedures throughout the project.

2.0 Hydrostatic Testing Procedures

The following procedures would be implemented by the Contractor during hydrostatic testing operations. This section of the Plan describes pre-testing requirements, the typical sequence of activities associated with the hydrostatic testing operations, and notifications required by BakkenLink and its Contractor.

BakkenLink will be responsible for securing the necessary permits and approvals from the governing authorities for the use of, and disposal of test water. BakkenLink will also comply with the rules and regulations from any relevant agencies. BakkenLink will provide the contractor with a copy of the withdrawal and discharge permits and the contractor will keep copies onsite at all times during the testing operations.

2.1 Water Discharge and Use Regulations

The hydrostatic test water discharge locations for this project will be selected to avoid direct discharge into wetlands or waterways. If this becomes unavoidable, alternate water discharge method will be vetted with the appropriate agencies, the required permits will be attained, and best practices procedures will be used. If the water discharge has to be made into streams, ephemeral drainages, or wetlands, BakkenLink's Environmental Inspector on site will ensure that any required water sampling will be performed in accordance with state regulations for water quality sampling procedures. The contractor will notify BakkenLink's Inspector at least 72 hours prior to obtaining water and/or discharging water. Analysis of the samples would be in accordance with permit requirements. Test water will not be discharged onto USACE land.

2.2 Facility Segments and Potential Water Uses

The pipeline will be constructed in three (3) segments. The pipeline segments will be hydrostatically tested once each segment is installed and mechanically completed. The anticipated in-service date for the Lake Sakakawea portion of the Project is Q3/Q4 2016. The anticipated in-service date for the Dry Creek Terminal to Beaver Lodge portion of the Project is Q3/Q4 2016. The hydrostatic test segments are broken down as shown in Table 2-1 below. Three (3) Horizontal Directional Drills (HDDs) will be employed to install pipe in sensitive areas. Additionally, hydrostatic testing will occur for each HDD fabricated pipe

string prior to its pull through the hole. The HDDs are provided in Table 2-2 Below. The approximate locations, length and estimated volumes of water for the pipeline segments and HDD segments as well as the proposed discharge locations are also provided in the tables.

Table 2-1. Pipeline Segments and Hydrostatic Test Water Requirements

Seg. #	Pipeline Sections	Approx. MP		Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
1	Dry Creek to South Lake	0	22.8	120,384	1,161,217	Local rural water cooperative or a municipal water system	MP 0
2	Lake Sakakawea	22.8	25.6	14,784	140,278	Local rural water cooperative or a municipal water system	MP 25.6
3	North Lake to Beaver Lodge	25.6	37.1	60,720	585,702	Local rural water cooperative or a municipal water system	MP 37.1
	Total			**195,888**	**1,887,201**		

Table 2-2. HDD Segments and Hydrostatic Test Water Requirements

HDD Sections	Approx. MP	Segment length (ft)	Water Volume (gal)	Source	Proposed Discharge Locations (MP)
Lake Sakakawea – North Bluff	25.6	3,050	28,940	Local rural water cooperative or a municipal water system	26.17
Lake Sakakawea – South Bluff	22.01	3,767	35,743	Local rural water cooperative or a municipal water system	22.01
United States Forest Service	20.24	4,183	39,690	Local rural water cooperative or a municipal water system	20.24
Totals		**11,000**	**104,373**		

All water obtained, used and discharged during the construction and testing of the pipeline will be pursuant to government regulations and appropriate permits. These sources will be further refined as the project develops.

2.3 Pumps

If pumps for hydrostatic testing are to be used within 100 feet of any waterbody or wetland, secondary containment measures (such as bermed depressions lined with plastic sheeting, plastic troughs, or other containment structure) would be implemented to prevent any spilled fuels or oils from reaching the waterbody or wetland, in accordance with BakkenLink's Spill Prevention, Containment and Countermeasures (SPCC) Plan and Construction Mitigation and Reclamation Plan (CMRP).

2.4 Safety Measures

The Contractor will be responsible for the safety of pipeline construction personnel and the general public during hydrostatic testing. The contractor will develop a site specific test plan for each test section and at minimum address the following safety measures:

- Place warning signs in or near populated areas.
- Restrict access to the area involving the hydrostatic test (i.e. test shelter, manifolds, pressure pumps, instruments, etc.) to only those personnel engaged in the testing operations.
- Prohibit major pipeline work not directly associated with the test operations around the pipeline sections being tested.
- Provide and maintain a reliable transportation and communication system during the test operations whereby personnel directly involved in the test will be able to communicate test status or issues that develop during the test.
- Check hoses, fittings, connectors and valves for proper pressure rating.
- Restrain and secure fill and discharge lines/hoses.

2.5 Test Sections and Pressures

Each pipeline section will be pressure tested to prove its integrity and substantiate the Maximum Allowable Operating Pressure (MAOP). All pressure tests will meet the requirements of 49 CFR Part 195, Subpart E. The minimum test pressure will be 1850 psig. The maximum pressure will be limited to 95% of the Specified Minimum Yield Strength (SMYS) of the steel, which is 2408 psig.

2.7 Cleaning the Pipeline

Upon completion of the pipe lowering and backfilling operations and prior to filling the pipeline segment for a hydrostatic test, the pipeline will be cleaned of any residual construction debris and particles by running multiple combinations of abrasive and swab pigs such that all mill scale, dirt, dust, and other solid or liquid materials are removed from the pipe. Cleaning activities will be governed by BakkenLink's general pipeline construction specifications.

2.8 Testing the Pipeline

The duration of the test will be not less than 8 hours as specified in 49 CFR Part 195.304. The pressure will be maintained at or above the minimum test pressure at all points in the pipeline segment. Temperature and pressure will be allowed to stabilize prior to beginning the test period. Temperature and pressure will be recorded every 30 minutes in a manner approved by BakkenLink. The test will be accepted upon proof of no leakage when no pressure changes are detected over the test period where changes cannot be attributed to temperature affects. In the event of a leak during testing, the leak would be repaired and the above test repeated until a satisfactory test is obtained on the segment.

2.9 Depressurizing the Pipeline

After the test has been presented by the contractor as a successful test and accepted by BakkenLink's Inspector; the pipeline would be depressurized as soon as practical.

2.10 Dewatering the Pipeline

Discharge points will be selected to avoid waterways and wetlands. Landowners and/or land management agency will be consulted when finalizing discharge points. All discharge points would utilize discharge dispersion devices provided in BakkenLink's construction typical drawings. The devices are designed to capture discharge water to limit erosion, scour, and filter contaminants. These devices are typically constructed of geotextile fabric, silt fence/filter cloth and straw bales. The rate of discharge will be monitored to prevent the device from being ineffective or overwhelmed by the volume of water.

3.0 Records

In accordance with applicable regulations and BakkenLink's pipeline construction specifications, the contractor will maintain complete and comprehensive records of all hydrostatic tests and of related activities such as filling, pressuring, stabilizing, dewatering, etc. Records will be clearly identified with respect to the specific piping systems to which they apply and records will be accurately dated. In addition to the general requirements above such forms will, at a minimum, include:

- Date and time of test
- Identification of piping system
- Test medium pressure and duration
- Automatic 24 hour pressure-time and temperature-time recording chart, including manual recording of pressure gauge readings at each additional station, test medium temperature at definite time intervals
- Test medium temperature at definite time intervals
- Summary of leaks and repair methods
- Names and company affiliation of persons recording the test data
- Pressure and temperature recorder charts showing the date and time stop and start of recording
- Weather conditions during testing
- Elevation variations, whenever significant for the particular test (over 100' for liquids line)
- Calibration certificates for dead weight gauges and records of field calibrations of pressure and temperature instruments
- Make, style number, and condition of pigs used in filling and dewatering and any remarks pertinent to any phase of the test
- Results of the hydrostatic test will be provided to the BLM upon request at the conclusion of the project