PIPELINE ROUTING PERMIT

APPENDIX B

ENVIRONMENTAL MITIGATION PLAN

for

LSr PIPELINE PROJECT

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Enbridge Pipelines (Southern Lights) L.L.C.

Environmental Mitigation Plan

April 2007

ENBRIDGE PIPELINES (SOUTHERN LIGHTS) L.L.C.

ENVIRONMENTAL MITIGATION PLAN

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INTRODUCTION

This Environmental Mitigation Plan (EMP) outlines construction-related environmental policies, procedures, and mitigation measures developed by Enbridge Pipelines (Southern Lights) L.L.C. (Enbridge or Company) for its pipeline construction projects. The EMP was developed based on Enbridge's experience implementing best management practices during construction. It is intended to mesh with applicable federal, state and local environmental protection and erosion control specifications and practices. The EMP is designed to address typical circumstances and may be amended by Enbridge as necessary to address site-specific conditions. The measures described in the EMP are consistent with relevant portions of the State of Minnesota *Construction Site Erosion and Sediment Control Planning Handbook* and the Minnesota *Protecting Water Quality in Urban Areas Manual*. In addition, the EMP complies with the intent of the *Wisconsin Construction Site Best Management Practice Handbook* and Wisconsin technical standards, and North Dakota's *Guide to Temporary Erosion-Control Measures for Contractors, Designers, and Inspectors.*

This document includes the following sections:

- Section 1.0 of the EMP describes general mitigation measures, including soil erosion and sedimentation control procedures, to be implemented during construction;
- Section 2.0 discusses stream and river construction and crossing procedures;
- Section 3.0 describes practices for wetland construction and crossings;
- Section 4.0 discusses highway, road, and trail crossings;
- Section 5.0 discusses construction dewatering;
- Section 6.0 outlines water appropriation practices;
- Section 7.0 addresses restoration; and
- Section 8.0 addresses winter construction issues.

Alternative construction procedures implemented in lieu of EMP guidelines will provide an equal or greater level of protection to the environment, and must be approved in writing by Enbridge.

Unless otherwise specified, the construction contractor (Contractor) will be responsible for implementing the requirements of this EMP. Enbridge will make the requirements of the EMP and applicable environmental permits known to the contractor. If the contractor has questions concerning these environmental requirements, the contractor will contact an Enbridge representative.

Enbridge will provide appropriate construction oversight to confirm Company and Contractor compliance with the measures of this EMP and requirements of applicable federal, state, and local permits. Environmental Inspectors will assist the contractor in interpreting and implementing the requirements of the EMP, and verify compliance with these procedures for the company. The Environmental Inspector will be expected to use judgment in the field to interpret environmental conditions and requirements, but will not have the authority to authorize major modifications or changes without the prior written approval of Enbridge. The Environmental Inspector will have the authority to stop activities and order corrective mitigation for actions that are not in compliance with the measures in this EMP, Landowner agreements, or environmental

permit requirements. The Environmental Inspector will maintain appropriate records to document compliance with these and other applicable environmental permit conditions.

1.0 GENERAL MITIGATION MEASURES

1.1 TEMPORARY EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures include slope breakers, sediment barriers, trench breakers, and mulch. The goal of temporary erosion and sedimentation control measures is to prevent construction-related sediment from entering streams, wetlands, lakes, drainage ditches (dry or flowing), other waterbodies, or migrating offsite. The contractor will, at all times, maintain erosion and sedimentation control structures as effectively as possible. All non-functional erosion control features will be repaired, replaced, or supplemented with functional materials as soon as field conditions allow access, but no later than 24 hours after discovery. Additional information of the project erosion control measures are provided in the applicable sections below.

1.2 RIGHT-OF-WAY ACCESS

Access to the right-of-way will be from public roadways and Enbridge-approved access roads only. The contractor will be responsible for creating signs or other methods to identify approved access roads in the field and to ensure that access is confined to only the approved roads.

1.3 RIGHT-OF-WAY REQUIREMENTS

All construction equipment and vehicles will be confined to the approved right-of-way and extra workspace. Right-of-way requirements may vary between projects. For this project, construction activities will generally use a right-of-way as shown in Figure 1.1. This typical illustrates a Typical Right-of-Way Cross Section for the project.

Additional extra workspace adjacent to the temporary construction right-of-way may be necessary during construction in areas such as steep slopes and staging areas for stream, wetland, and road crossings, for safety reasons, to provide an area for prefabrication of sections of pipeline, or for storage of spoil material. Enbridge will acquire additional extra workspace from the landowner where necessary; use of unauthorized workspace is prohibited without Enbridge's approval. In all cases, the size of extra workspace will be kept to the minimum necessary to safely conduct work. Enbridge will conduct a preconstruction review of the entire project area to determine specific extra workspace locations.

Construction staging will not occur in wetlands unless necessary for safe work conditions.

1.4 LINE LIST AND PERMITS

Enbridge will provide the contractor with a construction line list that describes special requirements (e.g., timber salvage, topsoil segregation, restoration measures, fencing requirements, etc.) as agreed upon with Landowners. The contractor must comply with these special requirements, as well as take all appropriate precautions to protect livestock and crops affected by construction.

The line list reflects requirements and comments provided by Landowners; however it is not a comprehensive list of construction requirements. The line list must be considered in conjunction with other project documents. Any third party agreements between the contractor and the landowner must be pre-approved by Enbridge.

Enbridge will obtain the necessary permits (federal, state, local, county, watershed district, stream crossing, wetland crossing, and road crossing permits) for the installation of the pipeline. Permit requirements may be more stringent than the requirements of this EMP. In all cases the more restrictive requirements will apply.

1.5 CLEARING AND GRADING

The initial stage of construction involves the clearing of brush, trees, and vegetation from the right-of-way. Clearing may be accomplished with chain saws, brush hogs, and hydraulic tree-cutting equipment. The clearing crew will typically mow, chip, mulch and/or haul off all wood. Burning of wood may be allowed only where the contractor has acquired all applicable permits and approvals (e.g. agency and landowner) and in accordance with all state and local regulations. No burning will be allowed in wetlands.

Grading generally follows clearing and involves leveling and smoothing the construction right-of-way to create an even working surface for equipment and vehicles. Tree stumps outside the ditchline shall be ground no less than four-inches below normal ground surface or removed and hauled off to an approved disposal facility. Stumps in the ditch line shall be completely removed, ground, and/or hauled off to an approved disposal facility. Topsoil and subsoil disturbed during grading operations will not be mixed with foreign material (e.g., stumps and brush).

1.5.1 Disposal of Non-Merchantable Timber

Non-merchantable timber and slash will be disposed of by mowing, chipping, grinding, and/or hauling off site to an approved disposal facility. In no case will non-merchantable timber be disposed of by placing it off the right-of-way. Woody debris that is chipped or mulched on the right-of-way that will not be hauled off site for proper disposal may be wind-rowed if approved by Enbridge over the ditchline and raked along the ditchline for incorporation into the ditch spoil during excavation. No woody debris disposal will be allowed in agricultural areas or wetlands. Burning of non-merchantable wood may be allowed only where the contractor has acquired all applicable permits and approvals (e.g. Agency and Landowner) and in accordance with all federal, state and local regulations. No burning will be allowed in wetlands.

1.5.2 Disposal of Merchantable Timber

All merchantable timber will be the property of the company and the contractor will be responsible for merchandising all merchantable timber. If a commercial buyer cannot be found, the timber may be considered non-merchantable and disposed of as referenced in Section 1.5.1.

1.5.3 Fencing

Before or during clearing of the right-of-way, existing fences and livestock barriers will be cut as necessary to access the right-of-way. Existing fencing will be braced and secured prior to cutting to prevent the slacking of wires. Temporary gates and/or fencing will be installed where necessary to maintain existing access restrictions and contain livestock. These temporary measures will remain in place until construction is complete and permanent repairs or new fencing can be installed.

1.5.4 Trees and Shelterbelts

Care will be taken to minimize tree removal. To the extent possible, wind breaks and shelterbelts will be crossed by minimizing the width of the right-of-way to that necessary for the trench line and vehicle traffic. When clearing, trees will be felled onto the right-of-way to minimize damage to off-right-of-way vegetation.

1.5.5 Irrigation Systems

If pipeline construction activities interfere with the operation of spray irrigation systems, Enbridge will establish with the landowner or Tenant, an acceptable amount of time the irrigation system may be out of service. If feasible, temporary measures will be implemented to allow an irrigation system to continue to operate across the right-of-way during pipeline construction. Any damage to irrigation systems caused by construction-related activities will be repaired following backfilling.

1.5.6 Topsoil Segregation

Topsoil generally has physical and chemical properties that are conducive to good plant growth. Because subsoil properties are usually less favorable, mixing of topsoil and subsoil can result in lowering the overall productivity of soils. To prevent soil mixing during construction, topsoil will be segregated in selected areas where soil productivity is an important consideration. These areas include cropland, hay fields, pasture, golf courses, residential areas and other areas as requested by the landowner. Topsoil will not be used to construct trench breakers (see Section 1.8) or to pad the pipe.

Topsoil Segregation Methods

The following topsoiling methods may be employed during construction:

- Ditch Plus Spoil Side (see Figure 1.2)
- Full Right-of-Way (see Figure 1.3)
- Trench Line Only (see Figure 1.4)

Topsoil will be segregated from ditch plus spoil in active cropland unless full construction right-of-way width topsoil segregation is requested by the landowner. The trench-line-only method will be used in unsaturated wetlands or where the width of the construction right-of-way is insufficient for other methods to be used. In upland areas with a fairly thick sod layer such as hay fields, pasture, golf courses, and residential areas, the trench-line-only method will be used unless otherwise requested by the landowner.

Topsoil is not typically segregated in forested areas, saturated wetlands, and nonagricultural open areas. Segregated topsoil is usually stored on the spoil side, separate from subsoil, or on the working side of the right-of-way.

Depth of Topsoil Stripping

Topsoil will be stripped to a maximum depth of 12 inches in cultivated lands, unless otherwise requested by the landowner. Additional space may be needed for spoil storage if

more than 12 inches of topsoil are segregated. If less than 12 inches of topsoil are present, every effort will be made to segregate to the depth that is present.

1.5.7 Temporary Slope Breakers

Temporary slope breakers are to be installed to minimize concentrated or sheet flow runoff in disturbed areas in accordance with the following maximum allowable spacing.

Slope (%)	Approximate Spacing (ft)
1	300
2	200
3-5	150
>5	<100

If the length of the slope is less than the distance of the required spacing, slope breakers are not required. Temporary slope breakers will be constructed according to the following specifications:

- slope breakers may be constructed using earthen material, silt fence, or hay bales;
- earthen berms will be installed with a two to eight percent outslope, with a four foot base and a height of 1.5 feet (see Figures 1.5 and 1.6);
- earthen berms will be constructed of compacted subsoil where practicable;
- the outfall of temporary slope breakers will be directed to a well-vegetated area or an appropriate energy-dissipating device (e.g., silt fence, straw bales, rock aprons) and directed off the construction right-of-way if possible;
- slope breakers will be inspected daily and repaired as necessary within 24 hours after discovery to maintain operational integrity and prevent erosion in active construction areas;
- a hard plug will be left in place where a slope breaker crosses the open trench; and
- temporary slope breakers will not be installed on agricultural land unless specifically requested by the landowner.

1.5.8 Temporary Sediment Barriers

Temporary sediment barriers may be constructed with silt fence (36 inches high or greater) and/or staked straw bales (see Figures 1.7 and 1.8). If temporary sediment barriers are removed to allow equipment access, the barriers will be reinstalled at the end of the day.

Temporary sediment barriers will be installed after clearing and prior to grubbing and grading activities and maintained at the base of sloped approaches to streams, wetlands, and roads, and at the edge of the right-of-way as needed to prevent siltation of waterbodies and wetlands downslope or outside of the construction right-of-way (e.g., swales and side slopes).

When the depth of sediment reaches about one-third of the height of a sediment barrier, the barrier will be replaced and/or the sediment removed. Nonfunctional sediment-control measures will be repaired, replaced, or supplemented with functional structures as soon as possible, but no later than 24 hours after discovery.

1.5.9 Noise and Dust Control

The contractor will take all reasonable steps to control construction-related noise and dust near residential areas and other areas as directed by Enbridge. Control practices may include wetting the right-of-way, limiting working hours in residential areas, and/or additional measures as appropriate based on site-specific conditions.

1.6 PIPE DELIVERY, BENDING & WELDING

Before excavating the pipeline trench, individual joints of pipe will be strung along the construction right-of-way and arranged to be accessible to construction personnel. This operation typically involves specially designed stringing trucks to deliver pipe from pipe yards to the right-of-way

After pipe stringing is complete, the pipe will be bent, as necessary, to conform to changes in ground contour and pipeline alignment. Individual pipe joints will be welded together and the welds will be radiographically inspected. The welds will then be coated with a material to protect them from corrosion.

1.7 TRENCHING

Trenching in uplands consists of excavating the trench for the pipeline, and is typically accomplished with a backhoe excavator or a rotary wheel ditching machine. Excavated material will be sidecast within the approved construction right-of-way separate from topsoil (see section 1.4.6), and stored such that the area subject to erosion is minimized. Enbridge will coordinate with Landowners to minimize disruption of access caused by the trench during construction. Where appropriate, Enbridge will leave plugs of soil in the ditch or will construct bridges across the trench for the landowner to move livestock or equipment across the trench. Trenches will be sloped where started and ended to allow ramps for wildlife to escape.

1.7.1 Timing

The length of time a trench is left open will be minimized to ensure that installation of the pipe and restoration of the right-of-way occurs in a timely fashion. Typically, trenching will be conducted after pipe has been delivered and welded so that no trench location stays open more than two days, weather permitting.

1.7.2 Pipeline Depth

The pipeline will be buried in accordance with U.S. Department of Transportation regulations, which stipulate a minimum of three feet of topcover for normal excavations, and 18 to 30 inches of cover for rock excavations (depending on the location), to prevent damage to the pipeline from normal use of the land.

If a state-level agency specifies a more stringent requirement for pipeline depth, the Company may request a waiver of that requirement. Increased pipeline depth will result in

greater amounts of ditch spoil and, consequently, will require additional temporary workspace for storage of the spoil.

1.8 PIPE INSTALLATION

Once the trench has been inspected for proper depth, rocks, or other obstructions, the welded pipe is lowered into the trench. The pipe may be wrapped with a protective shielding if necessary to protect the pipe coating while backfilling.

1.9 TRENCH BREAKERS

After the pipe has been lowered into the trench, trench breakers (soft plugs) will be installed as needed in sloped areas. Trench breakers protect against subsurface water flow erosion along the pipe after the trench is backfilled. Trench breakers will be constructed with bags filled with rock-free subsoil or sand. They will be placed from the bottom of the trench to near the top of the trench, completely surrounding the pipe (see Figures 1.9 and 1.10). The following conditions apply to the placement and installation of trench breakers unless otherwise directed by the Environmental Inspector:

- Trench breakers will be spaced as described for permanent berms (see section 7.3) or as otherwise specified by Enbridge.
- Trench breakers will be installed on slopes greater than five percent adjacent to streams, wetlands, or other waterbodies.
- Topsoil will not be used to construct trench breakers.

1.10 DRAIN TILE REPAIR

Where drain tiles are cut during trenching, the locations will be flagged by the contractor. Prior to backfilling, drain tiles crossed by the trench will be probed with a sewer rod or pipe snake to determine if tiles were damaged during construction. Drain tiles damaged during construction will be repaired to their preconstruction condition or better.

1.11 BACKFILLING

Backfilling follows pipe installation and generally consists of replacing the material excavated from the trench. In areas where topsoil has been segregated, the subsoil will be replaced first, and the topsoil will be spread uniformly over the area from which it was removed. Prior to backfilling, the trench shall be dewatered in accordance with the methods discussed in section 5.1. An earth crown will be left over the trench line to allow for future settling of the backfill material. No crown will be left in swales, drains, or wetlands crossed by the right-of-way.

1.12 WET WEATHER SHUTDOWN

During construction, certain activities may be suspended in wet soil conditions, based on consideration of the following factors:

- plasticity of the surface soil to a depth of approximately four to eight inches;
- extent of surface ponding;
- extent and depth of rutting and mixing of soil horizons;

- aerial extent and location of potential rutting and compaction (i.e., can traffic be rerouted around wet area); and

- type of equipment and nature of the construction operations proposed for that day.

If the above factors cannot be achieved to the satisfaction of the Environmental Inspector, the contractor shall cease work in the applicable area until such a time that conditions allow work to continue. The contractor is responsible for appropriately planning for work and considering for the potential for wet conditions, and being prepared to implement mitigative measures in the event of wet weather conditions. This is particularly important when conducting work in unsaturated wetlands. If the contractor attempts to construct through the "dry" wetland without matting or an approved equivalent, the contractor is responsible for implementing any and all such corrective measures should conditions subsequently worsen where the above described criteria cannot be met.

1.13 CONTROLLING SPREAD OF UNDESIRABLE SPECIES

Enbridge will require that construction equipment be cleaned before arriving on site to prevent the introduction of undesirable species to the project area. If undesirable species such as purple loosestrife and/or others are determined to be present within the construction right-of-way, Enbridge will implement the following plans:

- Enbridge will make an effort to prevent the spread of noxious weed seeds during clearing and grading activities, and to use straw mulch and seed mix that are free of noxious weed seed to revegetate the right-of-way. Contractors and inspectors will receive information aiding in the identification of noxious weeds. Enbridge will also provide training to its Environmental Inspectors to identify and prevent the spread of undesirable species.

- During preconstruction walkovers, the Environmental Inspectors will flag and document areas containing noxious weeds. The construction crews will be informed of these areas. Enbridge will instruct the contractors to minimize the numbers of construction equipment and to limit the number of passes by this equipment through infested areas. Construction mats may be required to minimize the transport of weed seed or plant material via construction equipment.

- Equipment and construction mats will be cleaned immediately after passing through infested areas. Cleaning will consist of removing large soil clods and/or plant parts from the equipment and construction mats using shovels and brooms, and if necessary, washing the equipment with water or cleaning using compressed air. Soil and water from cleaning activities will not be allowed to flow to non-infested areas.

- Final seeding will be initiated within 24 hours of final grading, pending appropriate weather and soil conditions, to prevent the establishment of noxious weed seeds that may be present in the existing seed bed.

2.0 STREAM AND RIVER CROSSING GENERAL REQUIREMENTS

Pre-construction planning is an essential part of stream crossings. Stream crossing requirements, including construction methods, timing, erosion control, and restoration are described in this section and in the stream crossing permits issued by state and federal agencies. If the contractor considers certain parts of these procedures to be technically impractical due to site-specific engineering constraints, the contractor may seek modifications. Prior to construction, the contractor must identify alternative provisions that would provide an equal or greater level of protection to stream and river ecosystems. Enbridge will review the contractor's alternatives and consult with appropriate regulatory agencies. Crossings of perennial streams will generally be installed by a special tie-in crew.

The procedures in this section apply to streams, rivers, and other permanent waterbodies such as ponds and lakes. These procedures require that judgment be applied in the field and will be implemented under the supervision of the Environmental Inspector. The intent of the mitigation procedures is to minimize construction-related disturbance to streams and waterbodies by limiting the duration of construction in these areas and by minimizing erosion and sedimentation.

2.1 TIME WINDOW FOR CONSTRUCTION

In-stream trenching will be conducted during periods permitted by the appropriate regulatory agencies and applicable permits.

2.2 PRE-CONSTRUCTION CONSIDERATIONS

2.2.1 Hazardous Materials

Enbridge or its Contractors will not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities within 100 feet of streams and waterbodies. Refer to Enbridge’s Spill Prevention, Containment and Control Plan (Spill Plan) for additional requirements pertaining to hazardous materials.

2.2.2 Refueling/Equipment Care

Construction equipment will be refueled at least 100 feet from streams and waterbodies. Where conditions require construction equipment (e.g., barge-mounted backhoes, trench dewatering pumps) to be refueled within 100 feet of streams, the contractor must follow the procedures described in Enbridge's Spill Plan. No equipment will be washed, lubricated, or parked overnight within 100 feet of streams or waterbodies.

2.2.3 Alignment of Crossing

Stream crossings will be designed as close to perpendicular to the axis of the stream channel as engineering and routing constraints allow, creating the shortest crossing length.

2.3 CLEARING AND GRADING

The contractor will leave a 10-foot buffer (from the waterbody bank) of undisturbed vegetation on all stream banks during initial clearing, except where grading is needed for bridge installation. Woody vegetation within this buffer, less than four inches diameter-at-breast height, may be manually cut and removed during clearing. Non-woody vegetation and the soil profile will be left intact until the contractor is ready to begin trenching the stream crossing. The contractor will properly install and maintain sediment control measures adjacent to streams immediately after clearing and prior to initial ground disturbance (see Figures 2.1, 2.2, 2.3, and 2.4). This buffer should not be confused with the 50-foot setback required for extra workspace (see Section 2.4).

2.4 EXTRA WORKSPACE

Extra workspaces as defined in section 1.2 include work areas outside the boundary of the typical construction right-of-way. These spaces are used to assemble pipe segments and for temporary spoil storage. Extra workspaces will be constructed as follows:

- Extra workspaces will be located at least 50 feet away from waters edge if topographic or other physical conditions such as stream channel meanders permit (see Figures 2.1 and 2.2).
- If conditions do not allow for a 50-foot setback, extra workspaces should be located no closer than 10 feet from the waters edge, subject to site-specific approval by Enbridge.
- Extra workspaces will be limited to the minimum size needed to construct the stream crossing.

2.5 BRIDGES

Temporary bridges will be used where necessary to transport equipment across streams, except for drainage ditches, intermittent streams, and other non-fisheries waters (unless required by permit). Bridges will be constructed as described below. Bridges will not typically be installed at directionally drilled streams.

2.5.1 Types of Bridges

Equipment bridges will be constructed using one of the following techniques:

- Timber mats (see Figure 2.5)
- Clean rock and flume (see Figure 2.6)
- Railroad flat cars
- Flexi-floats
- Other methods as approved by Enbridge and appropriate agencies

2.5.2 Bridge Design and Maintenance

Equipment bridges will be designed to withstand the maximum foreseeable flow of the stream, and will be securely anchored with cables or cable-like material. Bridges will not restrict flow or pool water while the bridge is in place, and will be constructed with clean materials and maintained to minimize soil from equipment from falling into the water.

2.6 STREAM AND RIVER CROSSING CONSTRUCTION METHODS

The following stream and river crossing methods are typically used, subject to further restrictions by Enbridge and applicable permits. Clearing equipment will be allowed one opportunity to ford waters crossed by the project, unless otherwise stated in applicable permits.

2.6.1 Wet Trench Method

Installation

The wet trench method will be used to cross streams and rivers not scheduled to be flumed, dammed and pumped, or directionally drilled (see Figure 2.1). The following procedures will be used during wet trench crossings:

- Sediment control measures will be in place before grading from the 10-foot vegetative buffer left on each stream bank. Spoil containment structures made of silt fence and/or straw bales will be installed back from the stream bank so that spoil does not migrate into the stream. Grading will be directed away from the waterbody to reduce the risk of material entering the stream. Grading of stream banks will be restricted to the trench line and areas necessary for safe bridge installation, if required.

- After grading, backhoes or draglines will be used to excavate the trench. Excavating equipment will operate from one or both banks, without entering the stream. If equipment must encroach into the stream, it will operate on clean construction mats. Existing material will be segregated and placed within a spoil containment structure in approved construction work area limits.

- In-stream trenching and backfilling will typically be completed within 24 hours or less on minor waterbodies and forty eight hours or less on intermediate or major waterbodies (not including HDD crossings) or as directed by applicable permits.

- Earthen trench plugs (hard plugs) between the stream and the upland trench will be left undisturbed during excavation of the in-stream trench to prevent diversion of the stream flow into the open trench and to prevent water that may have accumulated in the adjacent upland trench from entering the waterbody. Trench plugs will be removed immediately prior to pipe placement, and then replaced when the pipe is in place.

- If trench dewatering is necessary, the pump intake will be suspended off the trench bottom and dewatering will take place into a sediment filter bag or a straw bale dewatering structure (see Figures 2.7 and 2.8). The trench will be dewatered in such a manner that no heavily silt-laden water flows into streams or wetlands (see section 5.1.3). Only non-woven fabric will be used for filter bags. It is the contractor's responsibility to meet applicable water quality standards.

- Backfilling will begin immediately after the pipe is positioned in the trench at the desired depth. Backfill material will consist of the spoil material excavated from the trench unless otherwise specified in state or federal permits. The in-stream trench will be backfilled so that the stream bottom is similar to its pre-construction contour, with no impediments to normal water flow.

Temporary Erosion Control

After pipe installation and backfilling, the stream banks will be shaped to their original contours or to a 3:1 slope, whichever is less steep. Approaches to streams will be restored to pre-construction contours. Temporary erosion control measures (e.g., straw bales, silt fence, etc.) will be installed within 24 hours of backfilling the crossing. Temporary slope breakers will be installed on all sloped approaches to streams in accordance with the spacing requirements outlined in Section 1.5.7.

2.6.2 Dam and Pump Method

Installation

The dam and pump method is a dry crossing method that is suitable for low flow streams and is a preferred alternative to fluming for crossing meandering channels. The dam and pump method involves damming of the stream with sandbags, inflatable dams, and/or steel plates upstream and downstream of the proposed trench before excavation (see Figure 2.2) and pumping water around the construction area. The following procedures will be used for dam and pump crossings:

- Pumping of the stream across the right-of-way will commence simultaneously with dam construction to prevent interruption of downstream flow. Stream flow will be pumped across the construction area through a hose and will be discharged onto an energy-dissipation device such as plywood boards to prevent scouring of the stream bed.

- The pumps will be located on the upstream side of the crossing and will be placed in impermeable, sided structures which will act as containment units for the pumps and fuel containers. Spill kits will be stored adjacent to pumps and fuel. Pumps will have a capacity greater than the anticipated stream flow. The pumping operation will be staffed at all times and pumping will be monitored and adjusted as necessary to maintain an even flow of water across the work area and near-normal water levels upstream and downstream from the crossing. A backup pump of equal or greater capacity will be on-site at all times in the event that the primary pump fails.

- Dams will be constructed of sandbags, inflatable dams, and/or steel plates. The dams will prevent the stream from flowing into the construction area. The dams will be continuously monitored for a proper seal. Adjustments to the dams will be made where necessary to prevent large volumes of water from seeping around the dams and into the construction work area.

- Backhoes located on one or both stream banks will excavate a trench across the stream bed. Spoil generated during trenching will be stored in a straw bale/silt

fence containment area set back from the stream banks. Existing streambed material will be segregated and placed within approved construction work area limits.

- Trench (earth) plugs between the stream and the upland trench will be used if necessary during excavation of the in-stream trench to prevent diversion of the seeped groundwater into the open trench. Trench plugs will be removed immediately before pipe placement, and then replaced when the pipe is in place.

- Standing water that is isolated in the construction area by the dams or any stream water that leaks around the dams or seeps from the ground into the trench during construction will be pumped into a sediment filter bag or a straw bale dewatering structure located in an upland area in such a manner that no heavily silt-laden water flows into streams or wetlands (see Section 5.0). Only non-woven fabric will be used for filter bags.

- Backfilling will begin immediately after the pipe is positioned in the trench to the desired depth. Backfill material will consist of the spoil material excavated from the trench unless otherwise specified in state or federal permits. The in-stream trench will be backfilled so that the stream bottom is similar to its pre-construction contour, with no impediments to normal water flow.

Temporary Erosion Control

Restoration of the right-of-way and the installation of temporary erosion controls will be similar to that described for the wet trench method above. Once the stream banks have been stabilized, the dams and pump will be removed.

2.6.3 Flume Method

Installation

The flume method is a dry crossing method that is suitable for crossing sensitive, relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing. This method involves placement of flume pipe(s) in the stream bed to convey stream flow across the construction area without introducing sediment to the water (see Figure 2.3). The procedures for using the flume method are described below.

- The flume(s) will be of sufficient diameter to transport the maximum flows anticipated to be generated from the watershed. The flume(s), typically 40 to 60 feet in length, will be installed before trenching and will be aligned so as not to impound water upstream of the flume(s) or cause downstream bank erosion. The flumes will not be removed until after the pipeline has been installed, trench has been backfilled, and the stream banks have been restored.

- The upstream and downstream ends of the flume(s) will be incorporated into dams made of sand bags and plastic sheeting (or equivalent). The upstream dam will be constructed first and will funnel stream flow into the flume(s). The downstream dam will prevent backwash of water into the trench and construction work area. The dams will be continuously monitored for a proper seal. Adjustments to the dams will be made where necessary to prevent large volumes

of water from seeping around the dams and into the trench and construction work area.

- After the stream bed is dewatered, backhoes located on one or both stream banks will excavate a trench across the stream bed. Spoil generated during trenching will be stored in a straw bale/silt fence containment area located away from the stream banks within approved construction work areas. Existing streambed material will be segregated and placed within approved construction work area limits.

- Trench (earth) plugs between the stream and the upland trench will be used if necessary during excavation of the in-stream trench to prevent diversion of the stream flow into the open trench. Trench plugs will be removed immediately before pipe placement, and then replaced when the pipe is in place.

- If trench dewatering is necessary to complete the installation of the pipe, the discharge will be pumped into a sediment filter bag or a straw bale dewatering structure located in an upland area in such a manner that no heavily silt-laden water flows into streams or wetlands (see Section 5.0). Only non-woven fabric will be used for filter bags.

- Backfilling will begin immediately after the pipe is positioned in the trench to the desired depth. Backfill material will consist of the spoil material excavated from the trench unless otherwise specified in state or federal permits. The in-stream trench will be backfilled so that the stream bottom is similar to its pre-construction contour, with no impediments to normal water flow.

Temporary Erosion Control

Restoration of the right-of-way and the installation of temporary erosion controls will be similar to that described for the wet trench method above. After the stream banks have been stabilized, the dams will be removed from the stream bed allowing water to resume its flow in the channel. The flume pipe(s) and dams will then be removed.

2.6.4 Directional Drill Method

Installation

Directionally drilling the pipe underneath a stream will involve placing a drill unit on one side of the stream (see Figure 2.4). A small-diameter pilot hole will be drilled under the stream along a prescribed profile. After the pilot hole has been completed, barrel reams will be used to enlarge the pilot hole to accommodate the desired pipeline diameter. Drilling mud (bentonite clay) will be necessary to remove cuttings and maintain the integrity of the hole. Water from an approved source (typically the river to be crossed) will be used to prepare the slurry of drilling mud, and will be appropriated according to applicable permits. The pipe section will be pulled through the hole by the drilling rig and welded to the adjoining sections of pipe on each side of the river.

Temporary Erosion Control

Directional drilling normally does not result in the disturbance of the stream banks or riparian vegetation, which reduces the potential for erosion and sedimentation at the stream crossing. Consequently, temporary erosion control measures that are installed at open-cut crossings typically are not necessary for drilled crossings.

During drilling operations, drilling mud and slurry will be stored back from the river bank in an earthen berm sediment control structure, in tanks, or by other methods so that it does not flow into the stream, adjacent wetlands or off the workspace.

Enbridge has developed a directional drill contingency plan to address measures to be performed in the event of a release of drilling fluid onto the ground surface or waterbody. See the Enbridge *Drilling Mud Containment, Response, and Notification Plan* for additional details.

After the pipe is in place, excess drilling mud and slurry will be spread over an upland area approved by Enbridge and the landowner, or hauled off site to an approved disposal location.

2.7 DRAINAGE DITCHES AND INTERMITTENT STREAMS

Intermittent streams and agricultural ditches will be crossed using the wet trench method (see section 2.6.1) if water is present and flowing. For dry intermittent streams and agricultural drainage ditches, standard upland construction procedures will be used, which involve stringing, welding, excavating the trench with backhoes, installing the pipe in the trench, and backfilling the trench with native material. As soon as practical, the banks of each crossing will be reshaped, mulched, and, if required, seeded with annual ryegrass to stabilize the crossing until permanent erosion control is implemented. No refueling or fuel storage will be allowed within 100 feet of a drainage ditch or intermittent stream. Where dry swales cross the right-of-way, silt fence or straw bales will be installed at the edge of the right-of-way to prevent the flow of sediment from the right-of-way.

3.0 WETLAND CROSSING GENERAL REQUIREMENTS

Typical pipeline construction in wetlands will consist of clearing, trenching, dewatering, installation, backfilling, final grading, cleanup, and revegetation. However, due to the unstable nature of some wetland soils, construction activities may differ somewhat from those described for upland areas. Construction activities will be minimized in wetlands and/or special construction techniques will be used to minimize the disturbance to plants and soils and to protect wetland hydrology.

Pre-construction planning is an essential part of wetland crossings. Wetland crossing requirements, including construction methods, timing, erosion control, and restoration, are described in this section and in the wetland crossing permits issued by state and federal agencies. If the contractor considers certain parts of these procedures to be technically impractical due to site-specific engineering constraints, the contractor may seek modifications. Prior to construction, the contractor must identify alternative provisions that would provide an equal or greater level of protection to wetland ecosystems. Enbridge will review the contractor's alternatives and consult with appropriate regulatory agencies. The contractor must receive approval from Enbridge prior to implementing the alternatives.

The procedures in this section apply to all jurisdictional wetlands that will be affected by the project. These procedures require that judgment be applied in the field and will be implemented under the supervision of the Environmental Inspector. The intent of these procedures is to minimize construction-related disturbance and sedimentation of wetlands and to restore wetlands as nearly as possible to pre-existing conditions.

3.1 WETLAND ACCESS

Unless otherwise approved by Enbridge, only the construction right-of-way and existing public roads can be used to access wetland areas.

3.2 SPILL PREVENTION

3.2.1 Storage of Fuels and Other Materials

No storage of hazardous materials, chemicals, fuels, and lubricating oils, and no concrete coating activities will be permitted in, or within 100 feet of, any wetland. All vehicles will be parked overnight 100 feet or more from delineated wetlands.

3.2.2 Refueling and Fuel Handling

Attempts will be made to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary. Where conditions require that construction equipment (e.g., pontoon-mounted backhoes, trench dewatering pumps) be refueled in a wetland or within 100 feet of any wetland boundary, these activities will be in accordance with Enbridge's Spill Plan, and in consultation with the Environmental Inspector.

3.3 CLEARING

Clearing the construction right-of-way in wetlands will be similar to clearing in uplands. For construction to proceed, obstructions (e.g., trees, brush, and logs) need to be removed. Typically, low ground pressure equipment will be used, limiting disturbance to the wetland. When clearing in wetlands, the following restrictions apply:

- The construction right-of-way width will typically be limited to 100 feet or less.

- Staging areas, additional spoil storage areas, and other additional work areas will be located in upland areas at least 50 feet away from wetland boundaries (see Figure 3.1), where topographic conditions permit. If topographic conditions do not permit a 50-foot setback, then these areas will be located as far away from the wetland as is practicable. Vegetation will not be cleared between these areas and the wetland in any event. This requirement will not apply where a wetland occurs within the extra workspace for a stream crossing.

- The size of the additional workspace areas will be limited to the minimum needed to construct the wetland crossing.

- Vegetation and trees within wetlands will be cut off at ground level, leaving existing root systems intact; clearing debris will generally be removed from the wetland for disposal. Chips, hydro-axe debris, or similar can be left in the wetland if spread evenly in the right-of-way, in a manner which will allow for normal revegetation.

3.4 GRADING

Grading activities will be confined to the area of the trench. Grading outside the trench is only permitted where required to ensure safety and restore contours after backfilling the trench.

Sedimentation control practices (e.g., silt fence) will be installed and maintained in proper working order to prevent the flow of sediment into wetlands from spoil piles or sloped approaches that are adjacent to the wetlands.

When the depth of sediment reaches one-third of the height of a sediment barrier, the barrier will be replaced and/or the sediment removed. Non-functional sediment-control measures will be repaired, replaced, or supplemented with functional features as soon as possible but in all cases within 24 hours of discovery.

3.5 RIGHT-OF-WAY STABILIZATION

Tree stumps, brush riprap, imported soil, and rock fill will not be brought in to stabilize the right-of-way in wetlands. Where a wetland cannot support construction equipment, and low-ground-weight equipment is not used, construction activities will be accomplished from timber construction mats (see Figure 3.1). The contractor is responsible for having a sufficient number of construction mats to perform the work. Timber riprap (also known as corduroy road) cannot be used without prior written approval from the company. Subsoil from the pipeline trench within the immediate wetland may be placed on top of equipment mats for additional stabilization. Timber mats are the only materials that can be brought into a wetland and placed on the working side. Timber mats may be placed over the ditch line to facilitate trench excavation. All timber mats will be removed during cleanup of wetlands.

3.6 TRENCHING

Excavation of the pipeline trench in wetlands typically will be accomplished using backhoe excavators. The duration of open trench will be minimized to the extent possible, but typically not longer than 24 hours.

3.6.1 Topsoil Segregation

Where feasible (normally in wetland areas without standing water or saturated soils), up to 12 inches of topsoil will be stripped from the trench line and stockpiled separate from trench spoil (see Figure 3.1).

3.6.2 Trench Breakers

Where the pipeline trench has the potential to partially drain a wetland, trench breakers will be installed as necessary to maintain the original wetland hydrology.

3.7 PIPELINE INSTALLATION

The following procedures are intended to minimize siltation and disturbance to wetlands during installation.

3.7.1 Construction Matting

If the wetland right-of-way is stable (dry work area or construction mats), the pipe may be strung, welded, and lowered into the trench as in upland areas. Supplemental equipment supports, such as timber mats, will be used in wetlands to provide temporary portable support for heavy construction equipment to reduce ground pressure and minimize soil compaction and/or soil mixing.

3.7.2 Push/Pull Method

Large wetlands with standing water and saturated soils cannot be crossed with typical crossing methods. In these areas, the pipeline will be assembled in an upland area and positioned in the trench using the “push-pull" and/or "float" techniques.

Usually this fabrication requires use of extra temporary workspace adjacent to the right-of-way. The trench will be dug by a backhoe supported on timber mats. The prefabricated section of pipeline will then be pushed-pulled into position or floated across the wetland. When the pipeline is in position, floats, if used, will be removed and the pipeline will sink into position. The trench will then be backfilled and the original contours will be restored by a backhoe working from construction mats.

3.7.3 Sediment Controls

Sediment control practices will be installed as described in Section 1.5.8, according to the specifications presented on Figures 1.7 and 1.8.

3.7.4 Concrete Coating

Mixing concrete and washing equipment used for mixing, pouring, casting, or coating will not be conducted within 100 feet of any wetland. Concrete coating on the pipe will be cured for a minimum of three days prior to installation in a wetland to prevent potential toxic effects on wetland and aquatic biota.

3.8 BACKFILLING

During backfilling of wetland areas, subsoil material removed from the trench during construction will be replaced so that no crown remains. Any excess backfill material will be removed to an upland area approved by Enbridge. Segregated topsoil will not be used as padding and will be returned to its original horizon over the backfilled trench.

3.9 ROUGH GRADING, CLEANUP, AND TEMPORARY RESTORATION

Cleanup and rough grading activities may take place simultaneously. Cleanup typically will involve removing construction debris and replacing fences removed during construction. Rough grading will include restoring original contours and installing or repairing temporary erosion control measures. Temporary slope breakers will be installed near the boundary between the wetland and adjacent sloped approaches, to prevent sediment flow into the wetland.

3.9.1 Timing

Every effort will be made to begin cleanup and rough grading (including installation of temporary erosion control measures) as soon as practical after the trench is backfilled, weather permitting.

3.9.2 Temporary Revegetation

Unsaturated wetlands will be revegetated with annual rye unless standing water is prevalent or unless permanent planting or seeding with native wetland vegetation is required. No fertilizer, lime, or mulch will be applied in wetlands.

4.0 HIGHWAY, ROAD AND RAIL CROSSINGS

4.1 ADDITIONAL WORKSPACE

Additional workspaces for bored road and railroad crossings and open-cut road crossings will be determined on a site-specific basis. These workspaces will be adjacent to the road or railroad and limited to the size needed to contain spoil from the crossing.

4.2 MAINTENANCE

Roadway crossings will be maintained in a condition that will prevent tracking of mud onto the roadway. If mud is tracked onto a roadway, it will be shoveled or swept off the road and placed within a sediment barrier as soon as possible, but in no circumstances more than 24 hours after discovery.

In the case of mud incorporation into the aggregate road surface, the fouled surface aggregate will be removed or covered with an equal layer of new aggregate (not less than six inches compacted depth). The new aggregate will be consistent with the existing road surface and must be approved by the landowner.

4.3 SEDIMENT BARRIERS

Temporary sediment barriers (e.g., silt fence and/or double-staked straw bales) will be installed on sloped approaches to road crossings where vegetation has been disturbed (see Figure 4.1).

5.0 CONSTRUCTION DEWATERING

5.1 TRENCH DEWATERING

Before the pipe is lowered into the trench, dewatering may be necessary to visually inspect the trench bottom for the presence of rocks. Trench dewatering may also occur where tie-in welds are necessary, at road-boring sites adjacent to wetlands or waterbodies where groundwater has seeped into the trench, locations where set-on weights are placed over the pipe, and in other areas where increased visibility or physical access to the trench is needed. Dewatering pumps and equipment placement are discussed in Figures 2.7 and 2.8. Dewatering will be performed in accordance with applicable appropriation and discharge permits, but at a minimum, will comply with the following procedures:

- The trench will be dewatered into a well-vegetated upland area with an appropriate energy-dissipation device (See Figure 2.7). Whenever possible, the slope at the point of discharge will be away from any streams or wetlands.

- If the flow of a discharge cannot be kept out of streams, wetlands, drainage ditches, etc, the discharge shall be filtered by one of the methods described below. Dewatering discharge will be directed into a sediment filter bag or a straw bale/silt fence dewatering structure which discharges into a vegetated area to prevent heavily silt-laden water from flowing into wetlands and waterbodies (see Figures 2.7 and 2.8).

- Only non-woven fabric filter bags will be used for dewatering.

- Filter bags and dewatering structures must be maintained in a functional condition throughout dewatering activity (e.g., clogged or ripped bags must be replaced) and will be attended at all times during active pumping. Accumulated sediment from the filter bags shall be spread in an approved upland location.

- The contractor will assist Enbridge in complying with applicable permit requirements, including tracking volumes of water pumped, obtaining water samples (if needed) for testing, and taking necessary measures to meet effluent limitations.

5.1.1 Flow Measurement

At no time will the discharge rate exceed the applicable discharge rates specified in state-issued or other discharge permits. Discharge rate must be monitored and adjusted as necessary to prevent failure of the filtration structure.

The discharge rate and total volume of water discharged will be determined with a flow meter (or equivalent), or as required by the National Pollutant Discharge Elimination System (NPDES) permit. The total volume of water discharged will not exceed the volume specified in the NPDES permit.

5.1.2 Erosion Control

Dewatering of the trench will be conducted in a manner which will prevent soil erosion. Discharge rates will be monitored and regulated to prevent erosion. Energy-dissipation devices

(i.e., filter bags or straw bale structures) will be used to prevent sediment discharge into a wetland or waterbody.

5.1.3 Regulatory Notification and Reporting

Enbridge will notify appropriate state agencies prior to each discharge in accordance with its NPDES permit.

Reports regarding the volume and quality of the water withdrawn will be submitted by Enbridge, as required by the state NPDES permit. The contractor will assist Enbridge in collecting appropriate data and any water samples required or in determining volumes of water appropriated.

5.1.4 Water Sampling

Water discharged from trench dewatering locations may need to be sampled as required by the state-issued NPDES discharge permit. The construction contractor will assist Enbridge in obtaining these samples and will be responsible for complying with the permit limitations.

5.2 HYDROSTATIC TEST DISCHARGES

Hydrostatic testing involves filling the new pipeline segments with water acquired in accordance with applicable permits (See Section 6.0), raising the internal pressure level, and holding that pressure for a specific period of time per federal Department of Transportation specifications. Hydrostatic testing will be done to verify that there are no flaws in the pipe or welds. Pre-built sections may be hydrostatically tested prior to installation at significant streams and wetland crossings. Water used for hydrostatic testing typically will be taken from, and returned to, local streams and rivers. After the hydrostatic test is completed, the line will be depressurized and the water expelled. During withdrawal and discharge, the water will be sampled as required by permits to determine if contaminants are present.

If site conditions or engineering constraints make adhering to these hydrostatic testing procedures and documentation impractical, Enbridge will propose alternative provisions to the regulatory agency issuing the NPDES permit. Any such alternative will provide an equal or greater level of protection to the environment than the condition from which Enbridge or its Contractor seeks relief.

5.2.1 Refueling

The operation and refueling of hydrostatic test equipment will be in accordance with the conditions outlined in Enbridge's Spill Plan.

5.2.2 Permit Requirements

Hydrostatic testing will be conducted in accordance with applicable appropriation and discharge permits obtained by Enbridge.

5.2.3 Siting of Test Manifolds

Where practicable, hydrostatic test manifolds will be located outside of wetlands and riparian areas.

5.2.4 Water Sampling

Water discharged from hydrostatic tests will be sampled as required by state-issued appropriation or discharge permits. The contractor will assist Enbridge in obtaining these samples and will be responsible for complying with the permit limitations.

6.0 WATER APPROPRIATION

6.1 GENERAL

After the pipeline has been installed and the trench backfilled, the entire pipeline system will be hydrostatically tested to ensure its integrity. Water used to conduct hydrostatic testing may need to be appropriated from nearby waterbodies. The following outlines the procedures that will be performed for water appropriation. Intake hoses will be suspended off of the stream or lake bottom and will be screened to prevent entrainment of fish. During withdrawal, adequate flow rates will be maintained to protect aquatic life and allow for downstream uses.

6.2 WATER SOURCES

Water will only be withdrawn from sources approved by Enbridge and in accordance with applicable permits. No additives to the water are permitted unless written approval is received from Enbridge and applicable permits authorize such additives.

If appropriation is scheduled to occur during possible periods of low flow, including frozen conditions, a backup source will be identified.

6.3 FLOW MEASUREMENT

At no time will the withdrawal rate for the water source exceed the rate specified in the applicable permits.

The withdrawal rate and total volume of water appropriated for hydrostatic testing will be determined with a flow meter (or equivalent) as required by the state-issued permit.

6.4 WATER SAMPLING

Water withdrawn for hydrostatic testing may be sampled by Enbridge during appropriation. The contractor will assist Enbridge in obtaining these samples.

6.5 REGULATORY NOTIFICATION AND REPORTING

Enbridge will notify appropriate state agencies of the time of appropriations if required by the state appropriations permits. Reports regarding the volume and quality of the water withdrawn will be submitted by Enbridge if required by the state permit.

7.0 RESTORATION

Permanent soil erosion and sediment control will begin as soon as soil conditions permit seed bed preparation and seed germination. Agricultural lands will be restored but will not be reseeded unless requested by the landowner.

7.1 ROUGH GRADING AND CLEANUP

Cleanup and rough grading activities may take place simultaneously. Cleanup involves removing construction debris (including litter generated by construction crews and excess rock) and replacing fences removed during construction. Rough grading includes restoring the original contours, and installing or repairing temporary erosion control measures.

7.1.1 Timing

Every effort will be made to begin cleanup and rough grading (including installation of temporary erosion control measures) within 24 hours after backfilling.

7.2 FINAL CLEANUP AND FINAL GRADING

Permanent erosion and sediment control will begin with general cleanup of the construction area. Extraneous material that would impede seed bed preparation will be removed from the right-of-way. Final grading will restore the disturbed areas as near as practicable to the contours of the land that existed before construction.

If not previously removed during rough grading, all construction-related debris and material that are not an integral part of the pipeline (including litter generated by pipeline crews) will be removed from the landowner's property.

7.3 PERMANENT EROSION CONTROL MEASURES

After final grading, slopes in areas other than cropland will be stabilized with erosion control structures (see Figure 7.1). Erosion control treatments of specific physical land features are described below.

7.3.1 Slopes

Permanent berms (diversion dikes or slope breakers) will be installed on all slopes, according to the following maximum spacing requirements:

Slope (%)	Approximate Spacing (ft)
<5	125
5-10	100
10-20	75
20-30	50
>35	25

Permanent berms will be constructed according to the following specifications:

- Permanent berms will be installed with a two to eight percent outslope.
- Permanent berms will be constructed of compacted earth.

- The outfall of berms will be directed toward appropriate energy-dissipating devices, and off the construction right-of-way if possible

- Permanent berms will be inspected and repaired as necessary to maintain function and prevent erosion. Figures 1.5 and 1.6 illustrate berm specifications.

- Erosion control blankets (Curlex, jute, or equivalent) will be placed on slopes over 30 percent (see Figure 7.2).

7.3.2 Stream Banks

Stream banks will be permanently restored with erosion control fabric and permanent seeding or with rock riprap as specified by Enbridge and/or state and federal permits.

Berms or other sediment filter devices will be installed at the base of sloped approaches to streams greater than five percent, and the outlet of the berm will be directed away from the stream into a well vegetated area (see Figures 1.5 and 1.6).

Rock Riprap Bank Restoration

When backfilling is complete, a backhoe or other suitable equipment will be used to shape the stream banks to their original contours, or to a 3:1 slope, whichever is less steep. Geotextile fabric and rock riprap will be placed immediately thereafter according to site and permit conditions (see Figure 7.3). Soil upslope from the riprap will be prepared for seeding.

Vegetative Bank Restoration

Stream banks that are not lined with rock riprap will be shaped with a backhoe or other appropriate equipment after backfilling is complete, then seeded with the specified seed mix and, finally, covered with an erosion control blanket.

Bridge Removal

Equipment bridges will be removed before final cleanup or, if necessary, after final cleanup and initial permanent seeding. Upon bridge removal, any final restoration and seeding will be completed. Bridges must be removed prior to freezing conditions. Bridges installed for winter construction will be removed before spring break up.

7.3.3 Swales

Swales across the right-of-way will be restored during cleanup to original contours as near as practicable. Swales will be seeded and mulched with straw for the width of the right-of-way.

7.3.4 Drainage Ditches and Intermittent Streams

Drainage ditches and intermittent streams will be permanently restored and stabilized with erosion control blanket, permanent seeding, or other appropriate measures.

7.4 SOIL COMPACTION TREATMENT

Cultivated fields and any other severely compacted or rutted areas will be tilled with a deep tillage device or chisel plowed to loosen compacted soils. If subsequent construction and

cleanup activities result in further compaction, additional measures will be undertaken to reduce soil compaction.

7.5 STONE REMOVAL

A diligent effort will be made to remove excess stones larger than four inches in diameter from the upper 12 inches of soil. Stone removal efforts will cease when the size and density of stones on the right-of-way are similar to undisturbed areas adjacent to the right-of-way.

7.6 OFF-ROAD VEHICLE BARRIERS AND FENCES

Off-road vehicle control measures will be installed as requested by Landowners or as directed by land management agencies. All fences and gates removed or damaged will be repaired or replaced.

7.7 REVEGETATION

General guidance regarding revegetation efforts is provided in this section. See the Enbridge Revegetation Plan for specific information.

Permanent revegetation will involve preparing the seedbed and seeding disturbed, non-agricultural areas. The right-of-way will be seeded as soon as possible after backfilling, weather and soil conditions permitting. With the exception of wetland areas, fertilizer and pH modifying agents (e.g., lime) will be applied as specified by Enbridge, in consultation with appropriate state and federal agencies and Landowners.

The following steps will be taken to establish permanent vegetation in those portions of the site where the landowner does not plan to plant a crop during the next growing season.

- Seed will be purchased in accordance with Pure Live Seed (PLS) specifications for the seed mix.

- Seed will be used within 12 months of testing.

Legume seed will be treated with an inoculant specific to the species. When hydroseeding, four times the manufacturer's recommended rate of inoculant will be used. Inoculated seed will not be held in a slurry with fertilizer for more than one hour.

A seed drill equipped with a cultipacker is preferred for applying seed, but broadcast or hydroseeding methods may be used at double the recommended seeding rate. When broadcast seeding, the seedbed will be firmed with a cultipacker or roller after seeding.

Specific seed mixes, application rates, and seeding dates will be specified by Enbridge, and will take into account recommendations of appropriate state and federal agencies and Landowner requests as appropriate.

Mulch will not be applied to cropland unless specifically requested by the landowner. In other areas, mulch will be applied according to the following specifications:

- After seeding, slopes greater than five percent or dry, sandy areas will be mulched with two tons per acre of straw or hay or as specified by Enbridge.

- All areas of dormant seeding must be mulched with two tons per acre of hay or straw or as specified by Enbridge.

Mulch will be anchored after placement to minimize loss by wind and water. If soil conditions allow, a mulch anchoring tool or farm disc set in the straight position will be used to crimp the mulch to a depth of two to three inches. Liquid tackifiers may be used with advance written approval from Enbridge.

Where conditions allow (e.g., unsaturated and unponded areas), wetlands will be revegetated after final grading with annual ryegrass and then allowed to revegetate naturally. The natural revegetation process will be encouraged by the seeds and rhizomes in the topsoil spread back over the right-of-way after pipe installation.

Permanent revegetation at stream crossings will be as specified by Enbridge, and will take into account recommendations of appropriate state and federal agencies and Landowner requests.

7.8 ROAD REPAIR

The contractor will repair private roads and lanes damaged when moving equipment or obtaining access to the right-of-way.

7.9 REPAIR OF DAMAGED CONSERVATION PRACTICES

All soil conservation practices (such as terraces, grassed waterways, etc.) that are damaged by the pipeline construction will be restored to preconstruction conditions to the extent practicable.

7.10 LAND LEVELING FOLLOWING CONSTRUCTION

Following the completion of the installation of the pipeline, the right-of-way will be restored to its preconstruction elevation and contour as practical. Should uneven settling or documented surface drainage problems occur following the completion of pipeline construction, Enbridge will take appropriate steps to remedy the issue.

8.0 WINTER CONSTRUCTION

8.1 EROSION CONTROL

During frozen conditions, the following procedures will apply to construction in uplands, unless otherwise directed by Enbridge:

- Temporary slope breakers will not be installed unless snow melt and runoff are likely during construction.
- Installation of temporary sediment barriers (silt fence and staked straw bales) will be delayed until final grading and cleanup, unless snow melt and runoff are likely during construction.
- If final grading and/or cleanup is not completed until the following spring, temporary slope breakers and sediment barriers will be installed during rough grading and subject to the same inspection and repair requirements.
- Mulch will be applied and anchored to all slopes greater than eight percent. The mulch will be applied as soon as practical after the last grading operation of winter construction. Mulch can be applied to snow covered ground. Mulch will not be applied by hand, nor will the application rate exceed two tons per acre, as it may have to be removed the following spring during preparation of a seed bed.
- Steel reinforcing rods will be used to stake straw bales if frozen conditions make wooden stakes impractical.
- Topsoil will be segregated from the trench line only.

8.2 STREAM CROSSING CONSTRUCTION

During frozen conditions, the following procedures will apply to construction at stream crossings, unless otherwise directed by Enbridge:

- Erosion control measures at stream crossings during frozen conditions will be the same as for summer construction.
- All temporary construction bridges will be removed before spring breakup. They can be replaced after breakup if needed for access during final seeding.
- Except with prior written approval from Enbridge, additives will not be used to prevent drilling mud from freezing.

8.3 CONSTRUCTION IN WETLANDS

During frozen conditions, the following procedures will apply to construction in wetlands, unless otherwise directed by Enbridge:

- As soon as wetlands are sufficiently frozen to support light construction equipment, snow will be removed from the entire construction right-of-way. This

will result in a greater depth of freezing than would normally occur. Progressively heavier equipment will then be driven over the working side to further encourage the depth of freezing.

- If sufficient frost depth is obtained, construction mats may not be needed to support construction equipment.

- Snow berms will be used at the edge of the right-of-way to contain spoil during construction. Silt fence or hay bales will be installed if snow berms are infeasible or ineffective.

- The original contours of the wetlands will be restored after backfilling. If a crown is left over the trench in wetlands to account for settling of frozen backfill, the contractor will be required to restore the original contours during the following spring or summer.

- If feasible (i.e., no snow cover) annual oats will be applied as a dormant seeding. If dormant seeding is not feasible, annual oats will be seeded during the next growing season in those wetlands that are sufficiently dry to support appropriate equipment.

8.4 RESTORATION

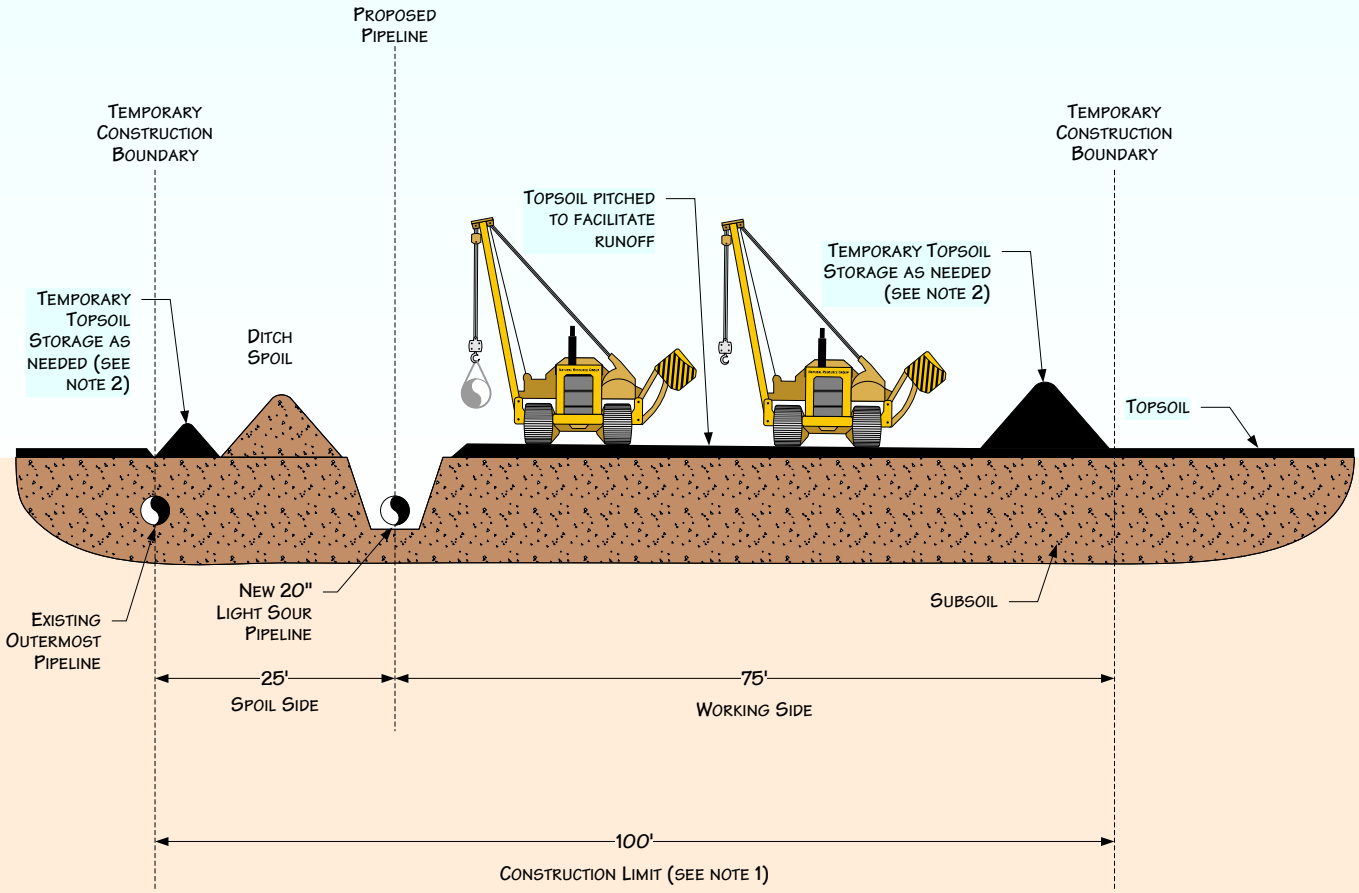
During frozen conditions, the following procedures will apply, unless otherwise directed by Enbridge:

- Permanent revegetation of the right-of-way after winter construction will be accomplished by dormant seeding or seeding during the next growing season.

- Temporary bridges will be removed before spring break up.

Environmental Mitigation Plan

Figures



Profile

Notes:

1. Construction Limits will typically be 100' wide. Spoil side will be approximately 25' wide.
2. This drawing reflects "Ditch Plus Spoil" side topsoil stripping procedure. Stockpile topsoil separately from ditch spoil shown or in other configuration approved by company.
3. The offset from outermost existing pipeline will be 25' for most locations but may be increased or decreased depending on the site specific construction requirements.

For environmental review purposes only.

ENBRIDGE

Figure 1.1

Environmental Mitigation Plan

Typical Construction Layout

DATE:	7/9/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

Natural Resource Group, Inc.

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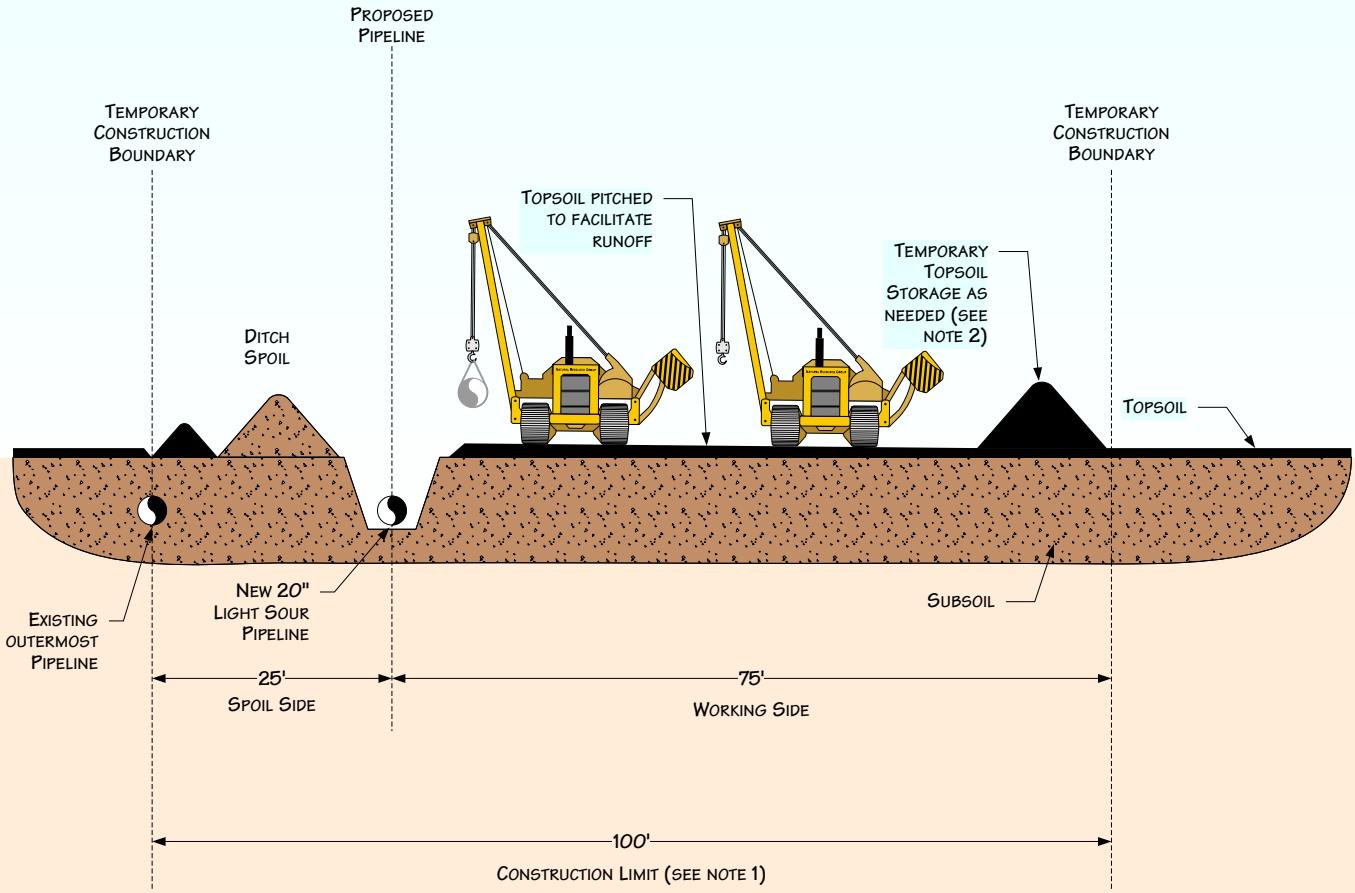

Profile

Notes:

1. Construction Limits will typically be 100' wide. Spoil side will be approximately 25' wide.
2. This drawing reflects "Ditch Plus Spoil" side topsoil stripping procedure. Stockpile topsoil separately from ditch spoil shown or in other configuration approved by company.
3. The offset from outermost existing pipeline will be 25' for most locations but may be increased or decreased depending on the site specific construction requirements.

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Figure 1.2

Environmental Mitigation Plan

Typical Topsoil Segregation

Ditch Plus Spoil Side

DATE:	7/9/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

Natural Resource Group, Inc.

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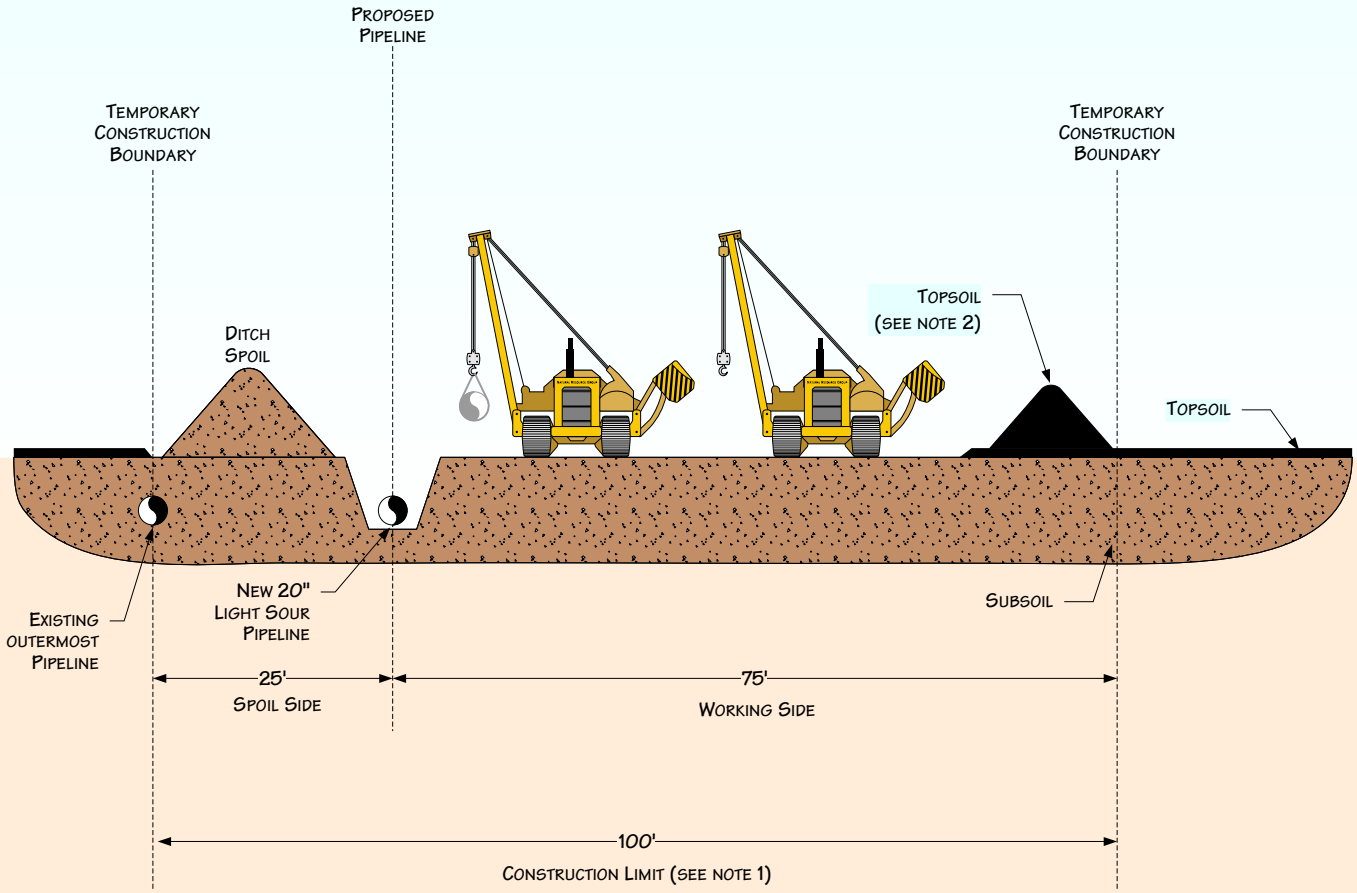

Profile

Notes:

1. Construction Limits will typically be 100' wide. Spoil side will be approximately 25' wide.
2. This drawing reflects "Full Right of Way" topsoil stripping procedure. Stockpile topsoil separately from ditch spoil shown or in other configuration approved by company.
3. The offset from outermost existing pipeline will be 25' for most locations but may be increased or decreased depending on the site specific construction requirements.

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Figure 1.3

Environmental Mitigation Plan

Typical Topsoil Segregation
Full Right-of-Way

DATE:	7/9/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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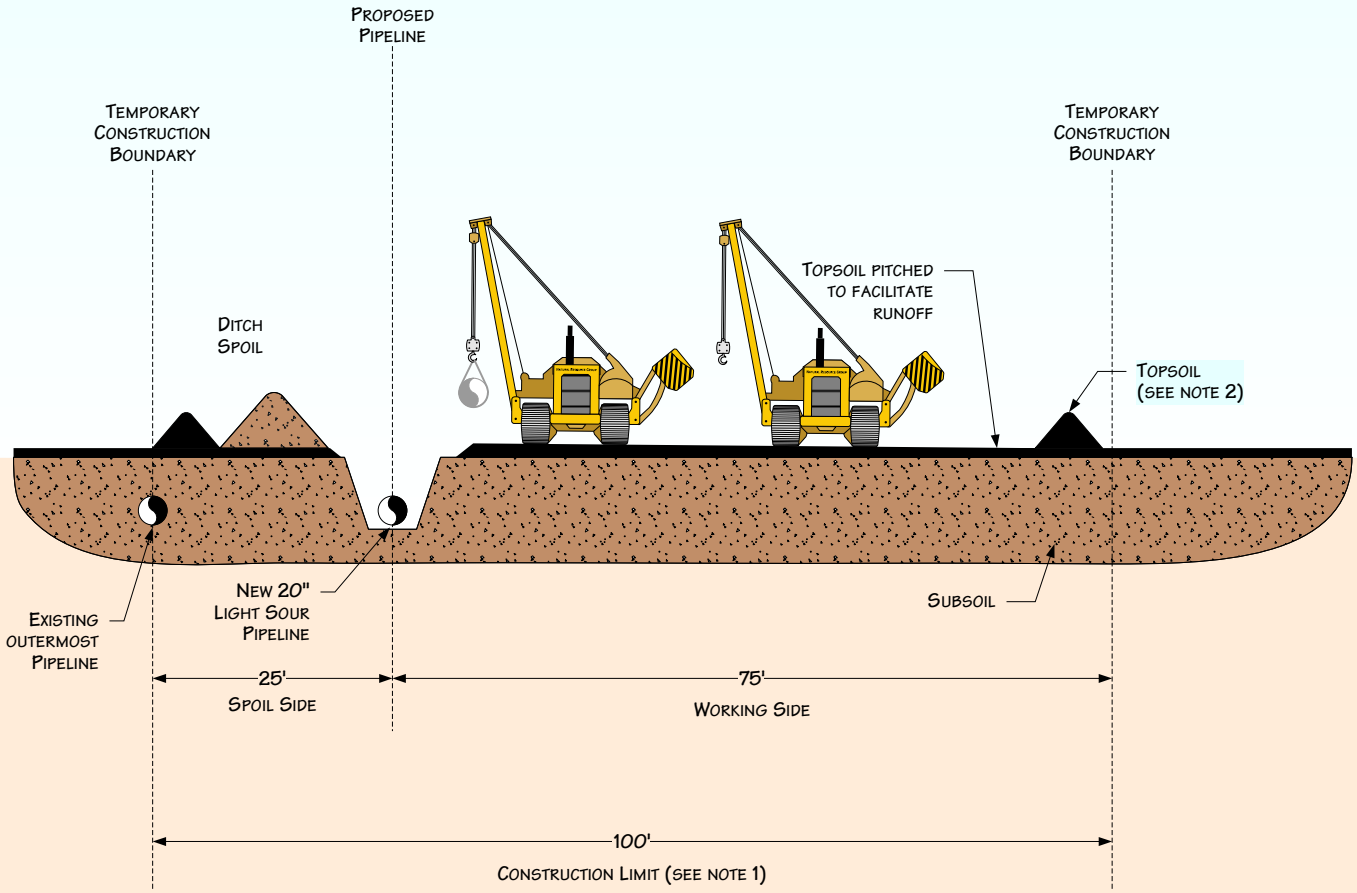

Profile

Notes:

1. Construction Limits will typically be 100' wide. Spoil side will be approximately 25' wide.
2. This drawing reflects "Trench line only" topsoil stripping procedure. Stockpile topsoil separately from ditch spoil shown or in other configuration approved by company.
3. The offset from outermost existing pipeline will be 25' for most locations but may be increased or decreased depending on the site specific construction requirements.

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Figure 1.4

Environmental Mitigation Plan

Typical Topsoil Segregation
Trench Line Only

DATE:	7/9/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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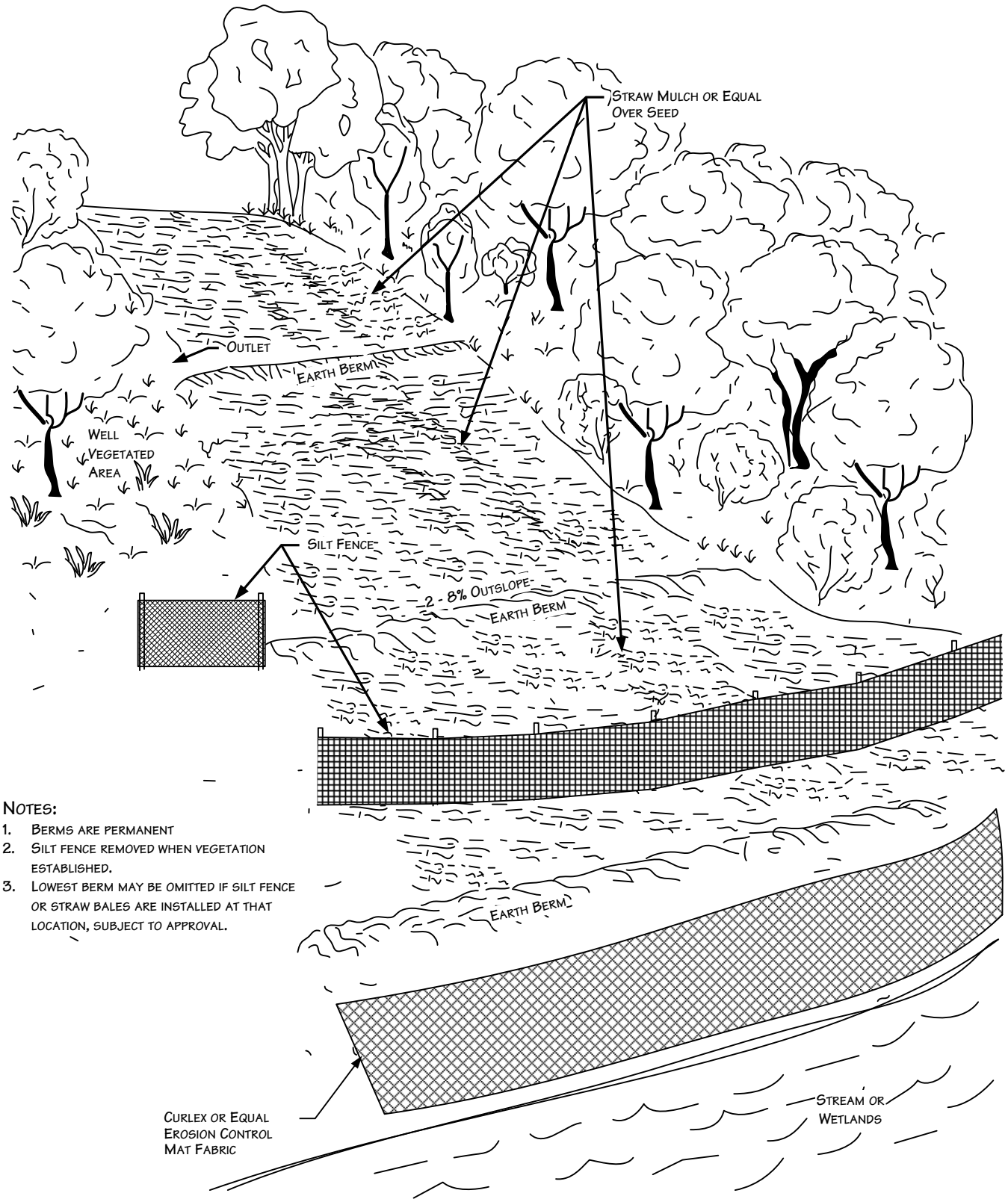

Notes:

1. Berms are permanent
2. Silt fence removed when vegetation established.
3. Lowest berm may be omitted if silt fence or straw bales are installed at that location, subject to approval.

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Figure 1.5

Environmental Mitigation Plan

Typical Temporary or Permanent Berms
Perspective View

DATE:	11/14/2000
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

NATURAL RESOURCE GROUP, INC.

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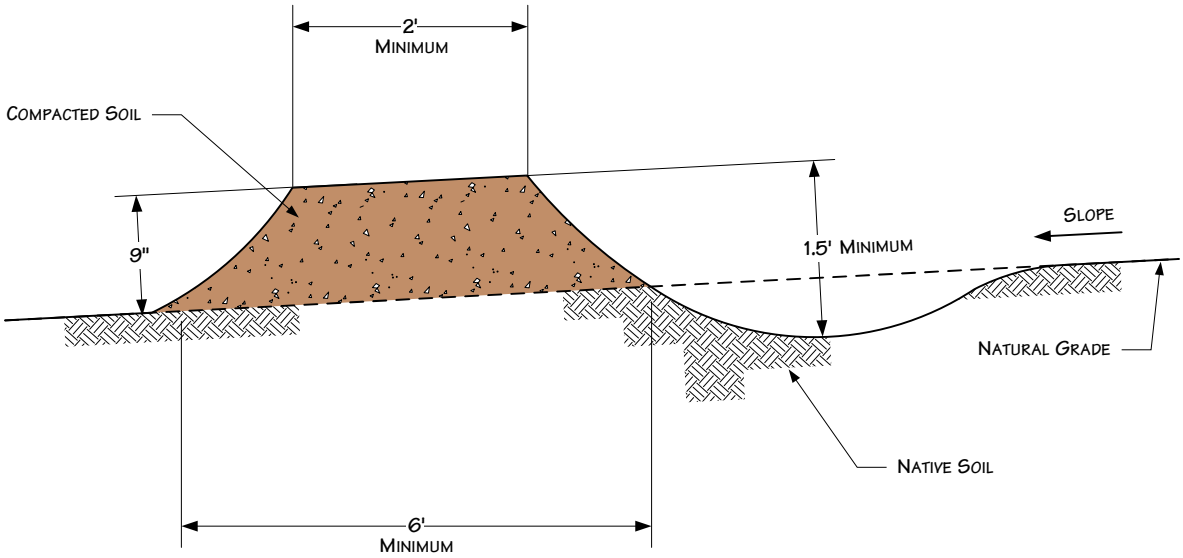

NOTES

1. Berms shall be constructed with 2 to 8 percent outslope.
2. Berms shall be outleted to well vegetated stable areas, silt fences, straw/hay bales or rock aprons.
3. Berms shall be spaced as described in construction specifications.
4. Additional information included on other drawings.

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Figure 1.6
Environmental Mitigation Plan
Typical Temporary or Permanent Berms
Elevation View

DATE:	5/25/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL
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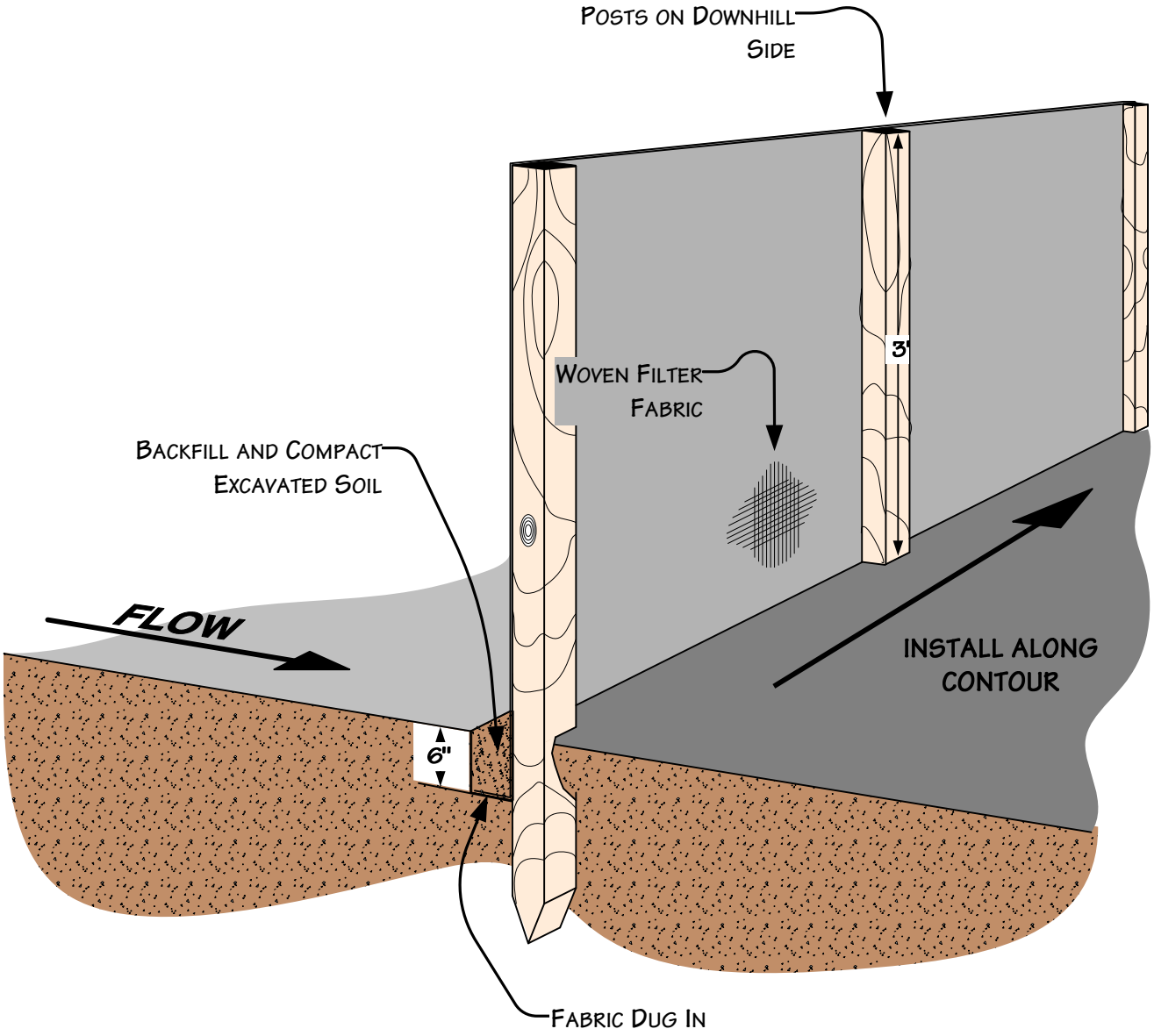

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Figure 1.7
Environmental Mitigation Plan
Typical Silt Fence Installation

DATE:	5/25/2001
REVISED:	08/02/06
SCALE:	NTS
DRAWN BY:	KMKENDALL
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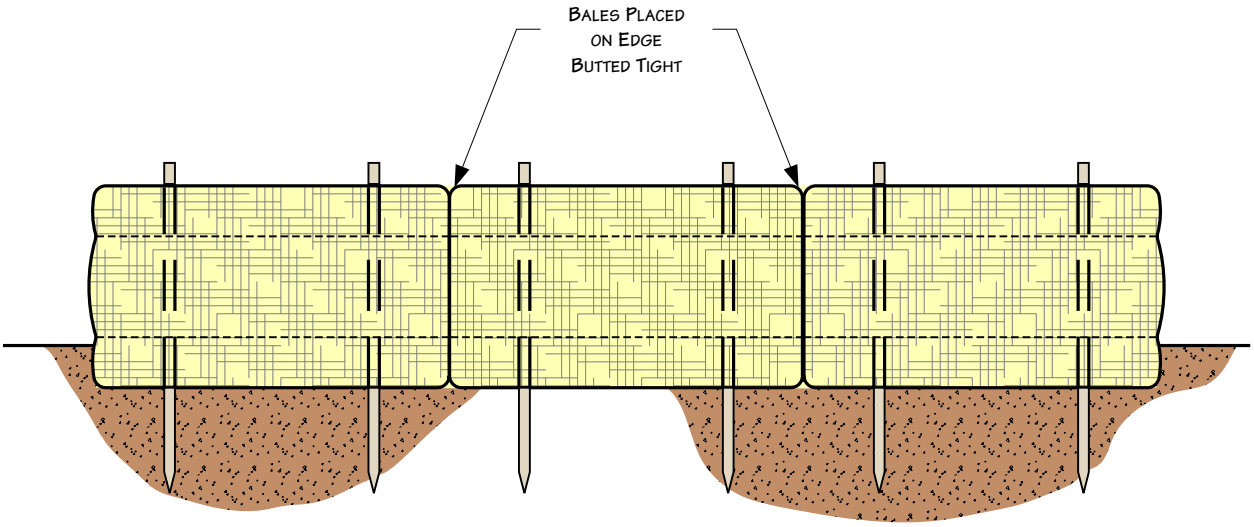
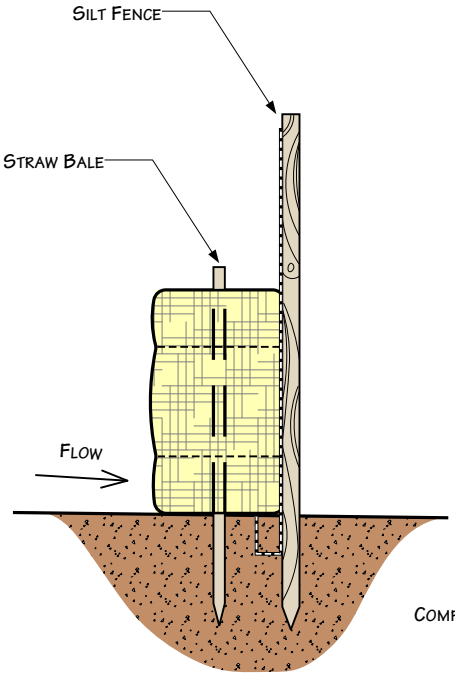
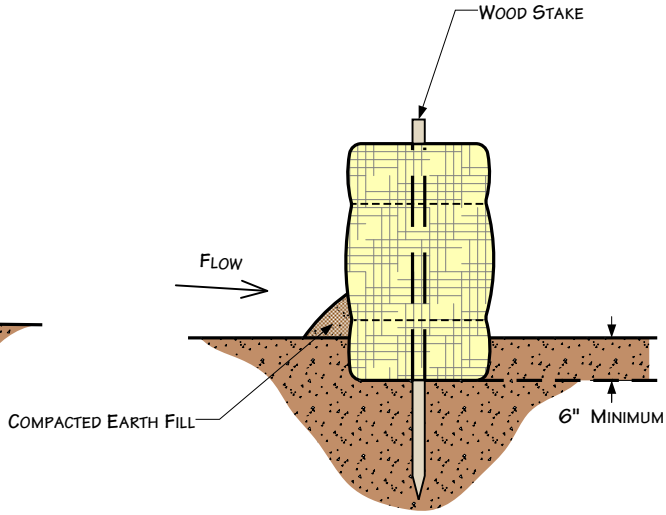




Straw/Hay Bales & Silt Fence



Straw/Hay Bales Only

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Figure 1.8
Environmental Mitigation Plan
Typical Straw Bale Installation

DATE:	5/25/01
REVISED:	3/14/07
SCALE:	Not to Scale
DRAWN BY:	KMKENDALL
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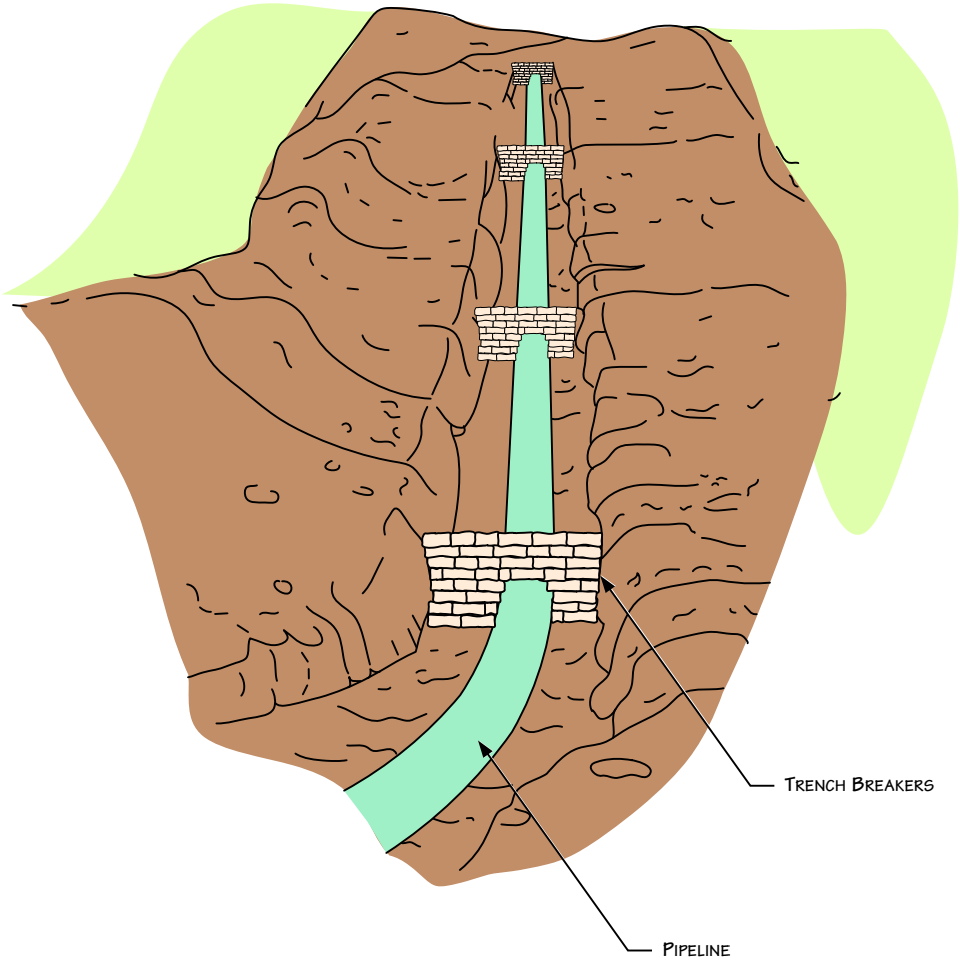
NATURAL RESOURCE GROUP, INC.



Notes

1. Bags will not be filled with topsoil.
2. Additional information included on other drawings.

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ENBRIDGE

Figure 1.9
Environmental Mitigation Plan
Typical Trench Breakers - Perspective View

DATE:	5/25/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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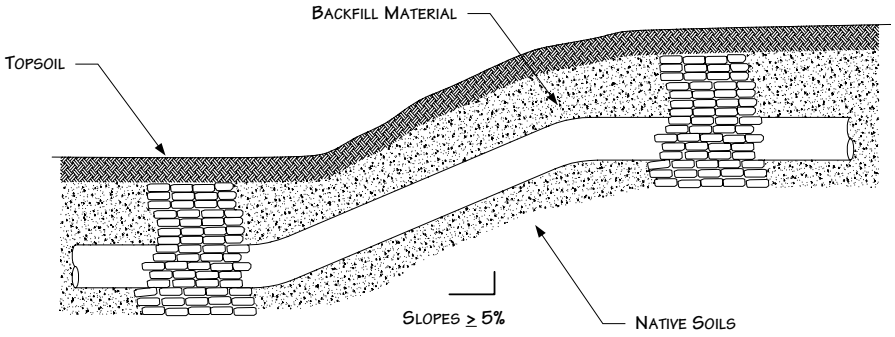
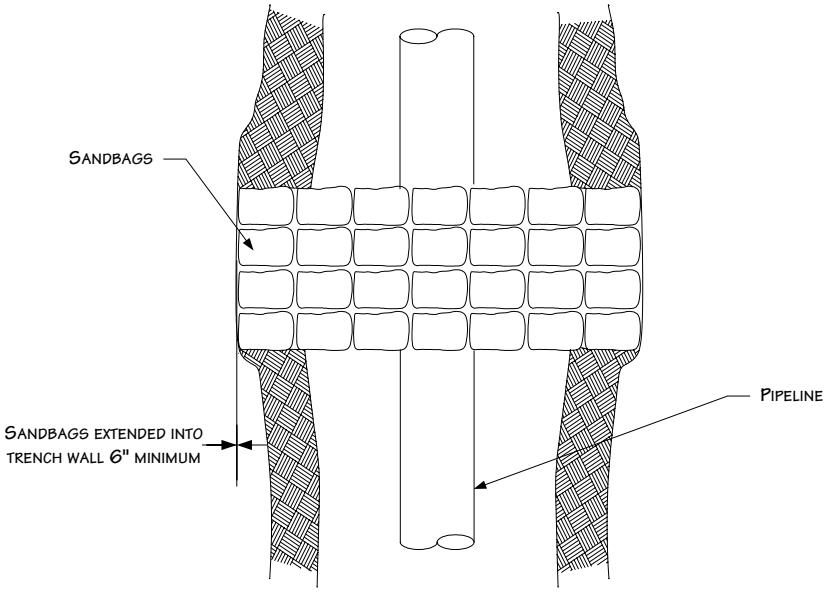
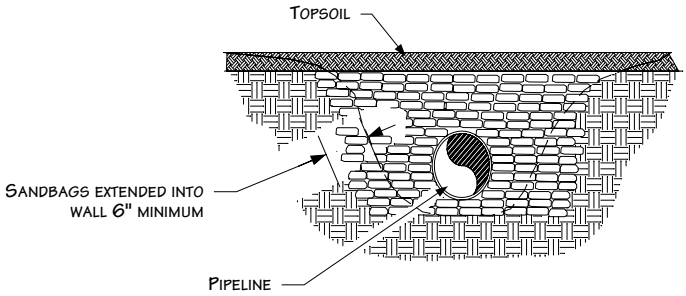


Profile View
(Not to Scale)



Plan View
(Not to Scale)



Face View
(Not to Scale)

Notes

1. Bags will not be filled with topsoil
2. Additional information included on other drawings

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ENBRIDGE

Figure 1.10
Environmental Mitigation Plan
Typical Trench Breakers – Plan & Profile View

DATE:	11/15/2000
REVISED:	5/19/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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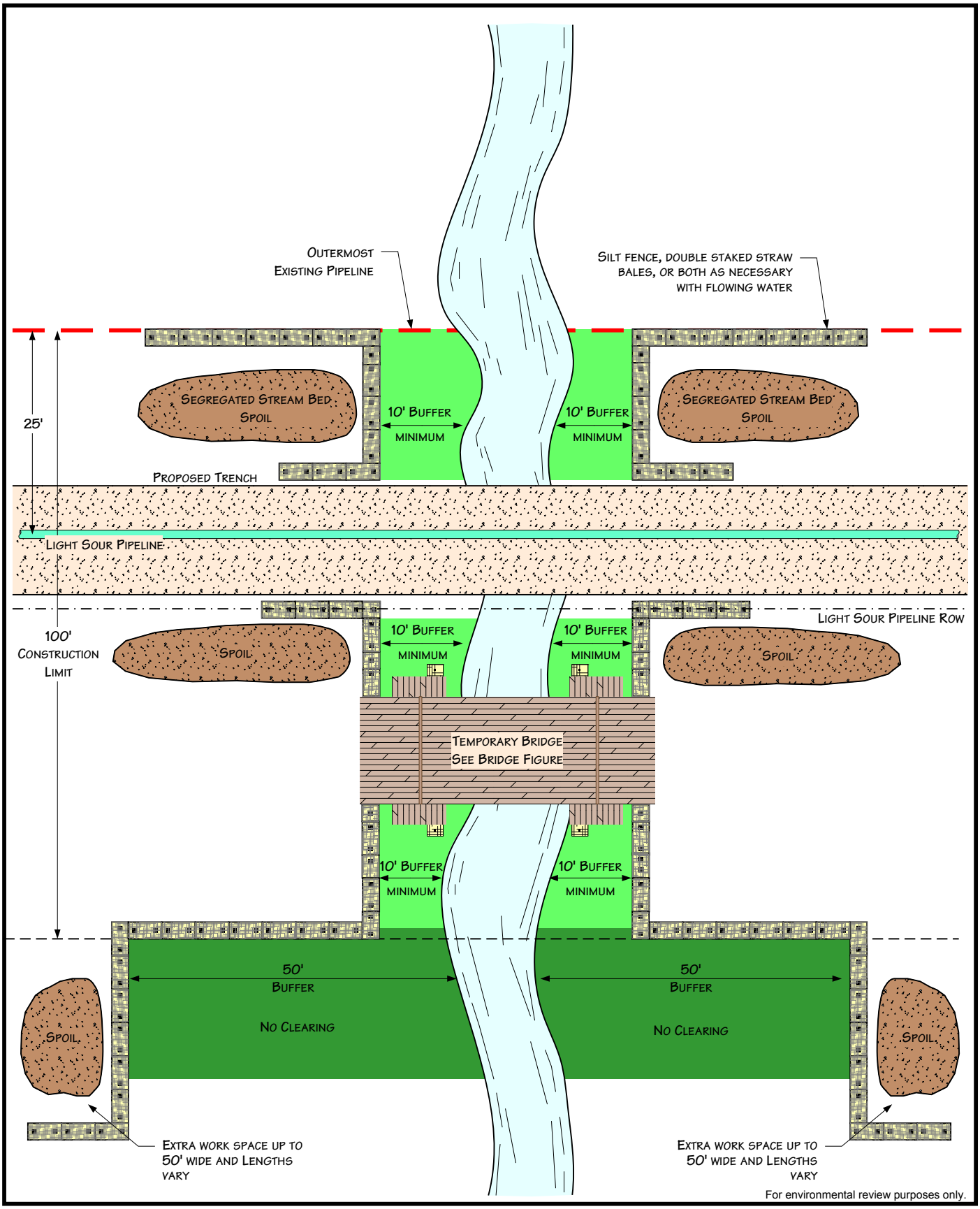

ENBRIDGE

Figure 2.1

Environmental Mitigation Plan

Typical Waterbody Crossing
Wet Trench Method

DATE:	11/29/2005
REVISED:	08/02/06
SCALE:	NTS
DRAWN BY:	KJA

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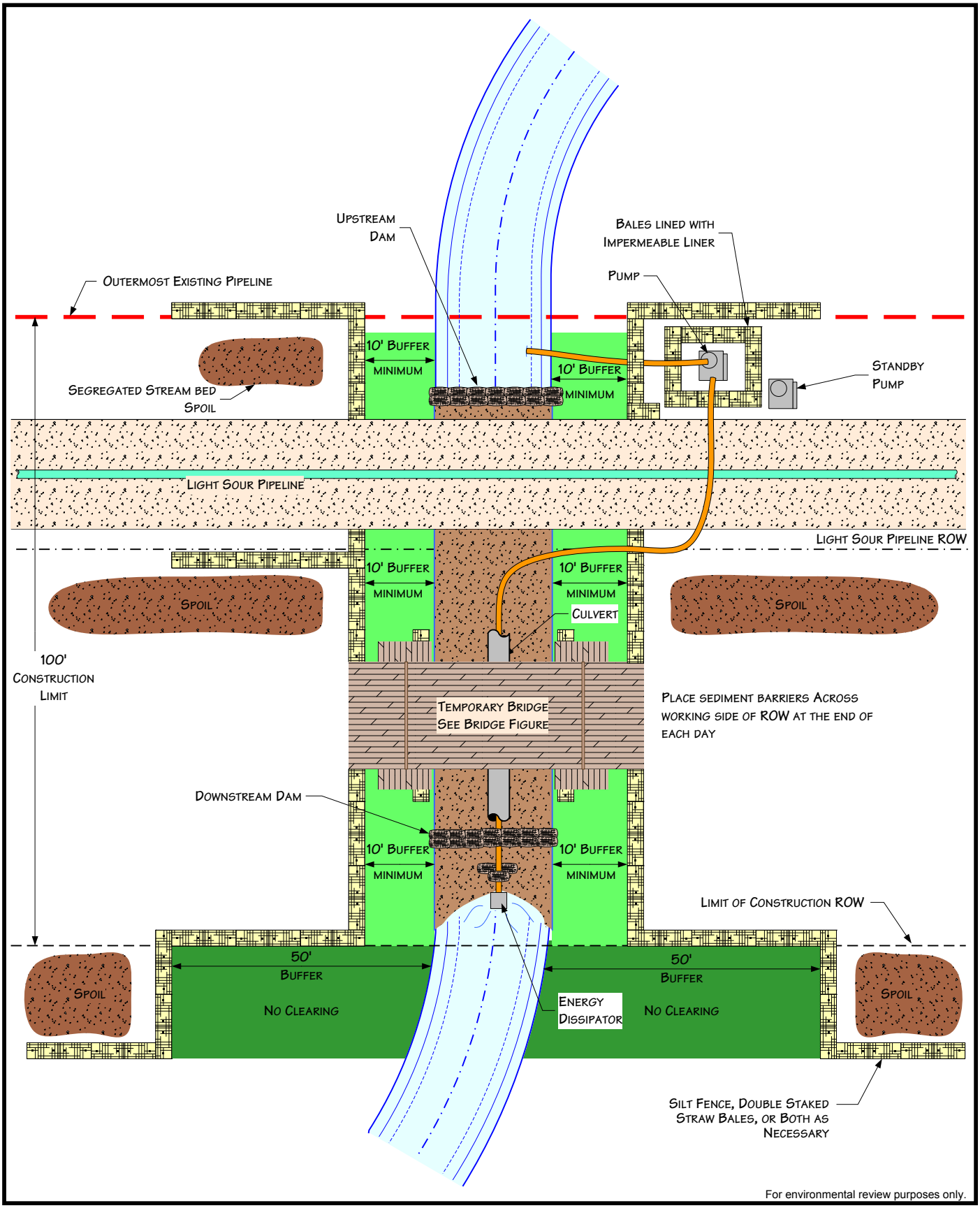

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Figure 2.2
Environmental Mitigation Plan
Typical Waterbody Crossing
Dam and Pump Method

DATE:	11/29/2005
REVISED:	08/02/06
SCALE:	NTS
DRAWN BY:	KJA

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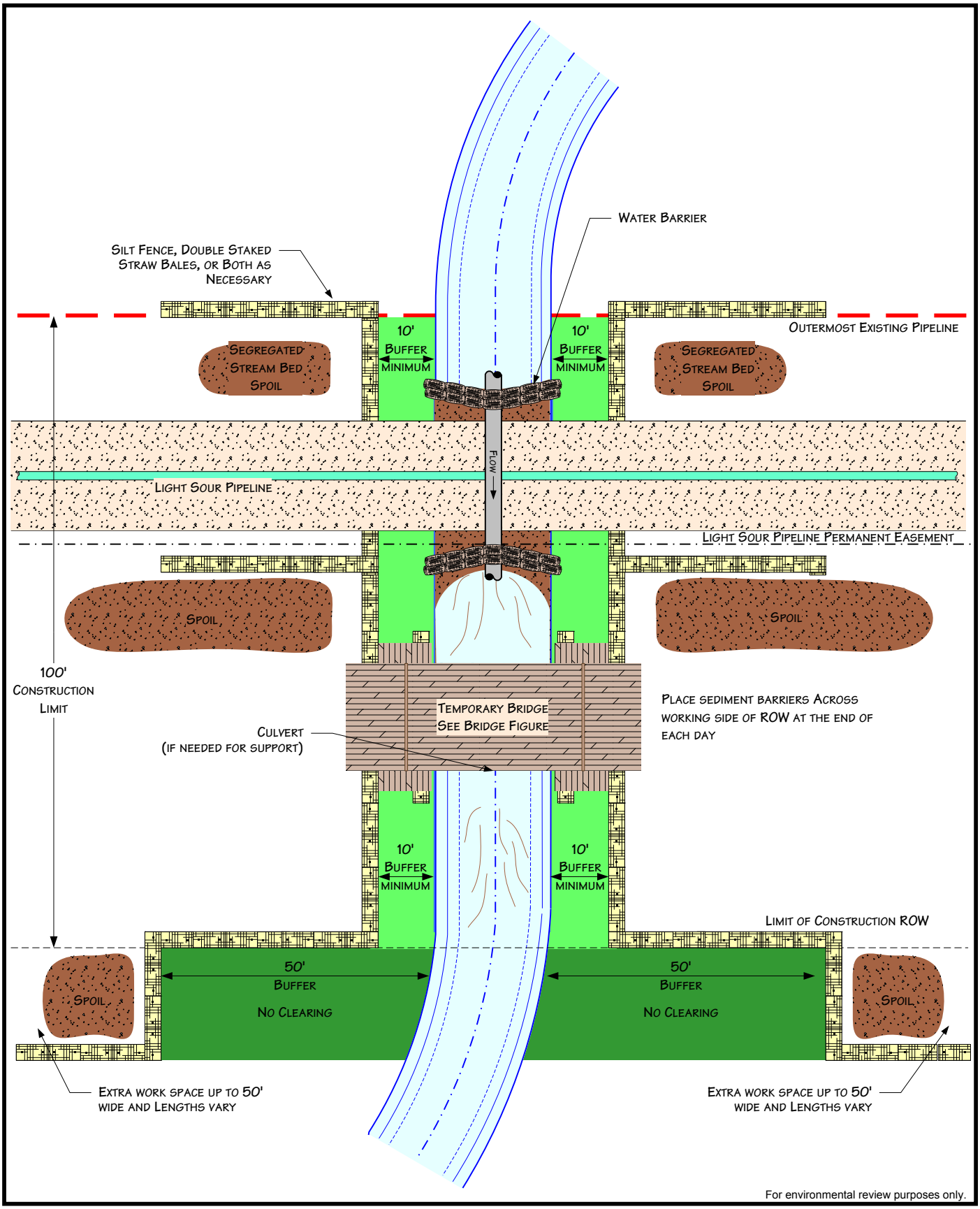

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Figure 2.3
Environmental Mitigation Plan
Typical Waterbody Crossing
Flume Method

DATE:	11/29/2005
REVISED:	08/02/06
SCALE:	NTS
DRAWN BY:	KJA

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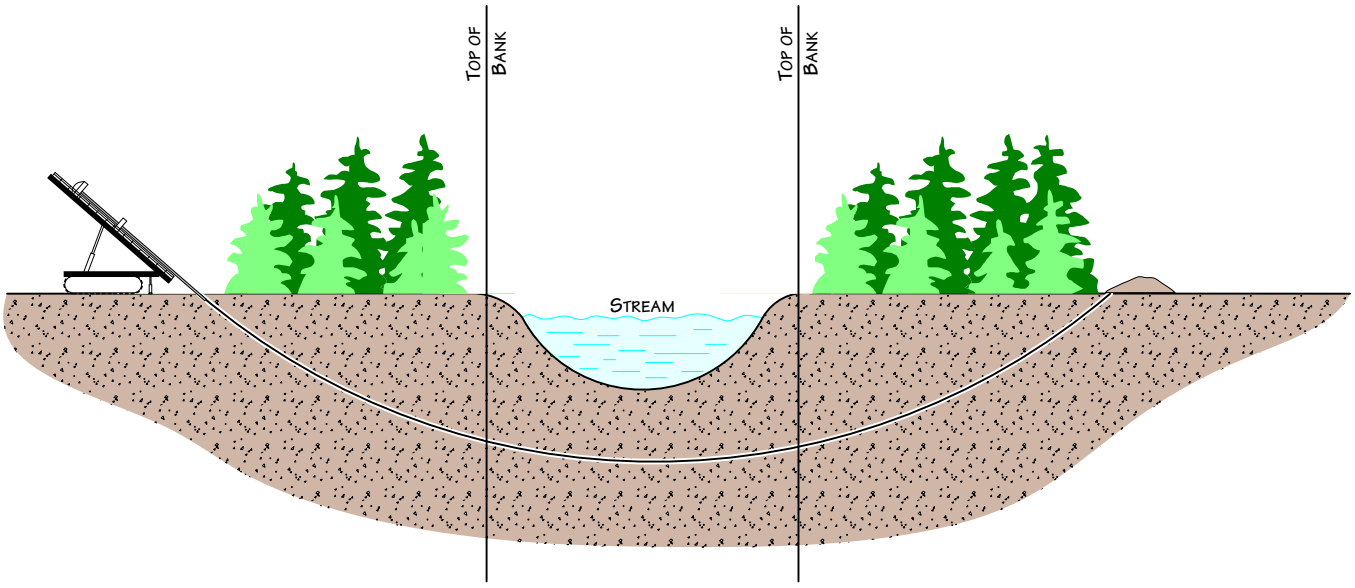

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ENBRIDGE

Figure 2.4
Environmental Mitigation Plan
Typical Waterbody Crossing
Directional Drill Method

DATE: 7/14/2000
REVISED: 12/21/05
SCALE: NTS
DRAWN BY: KMKENDALL
K:\335\2006-135\060\2.4.VSD

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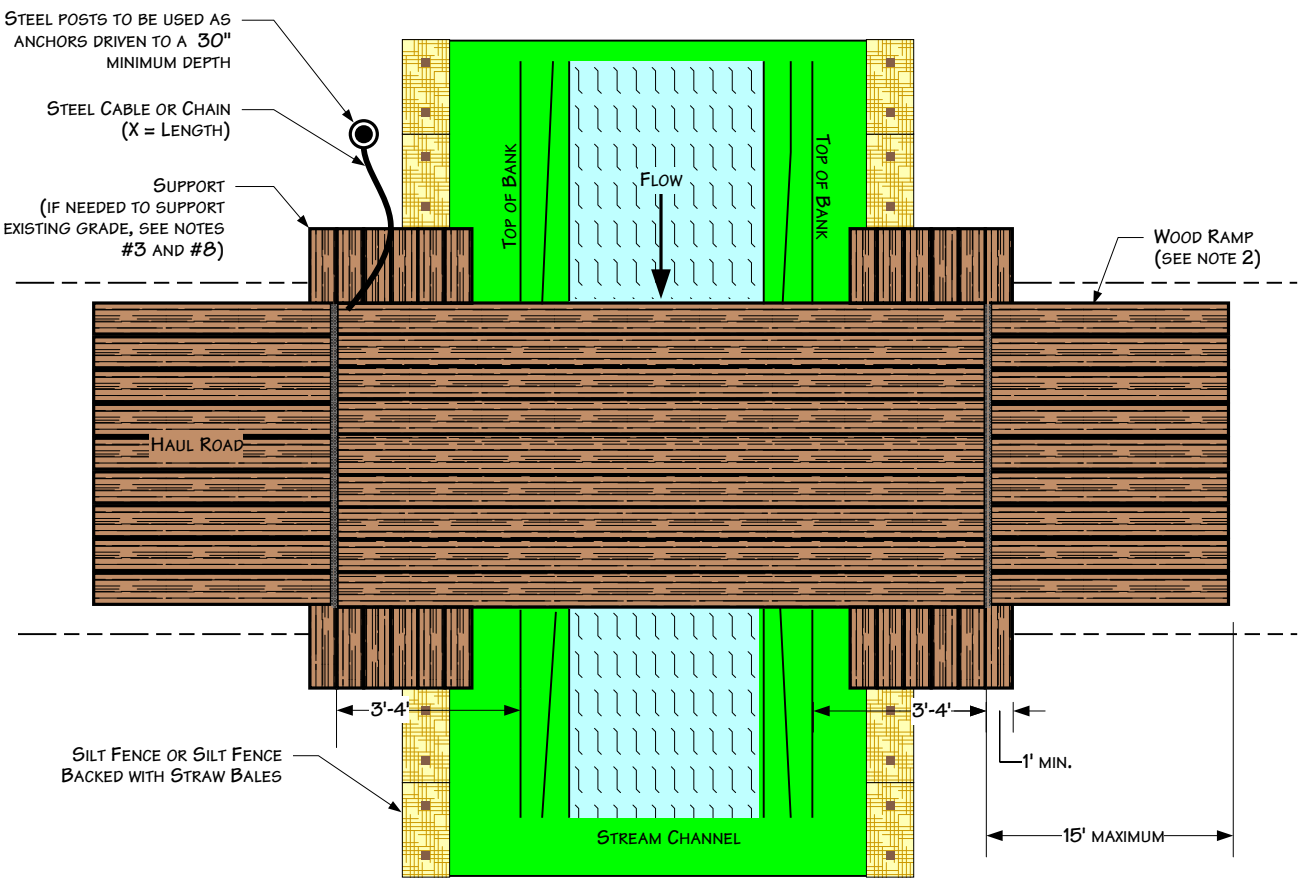
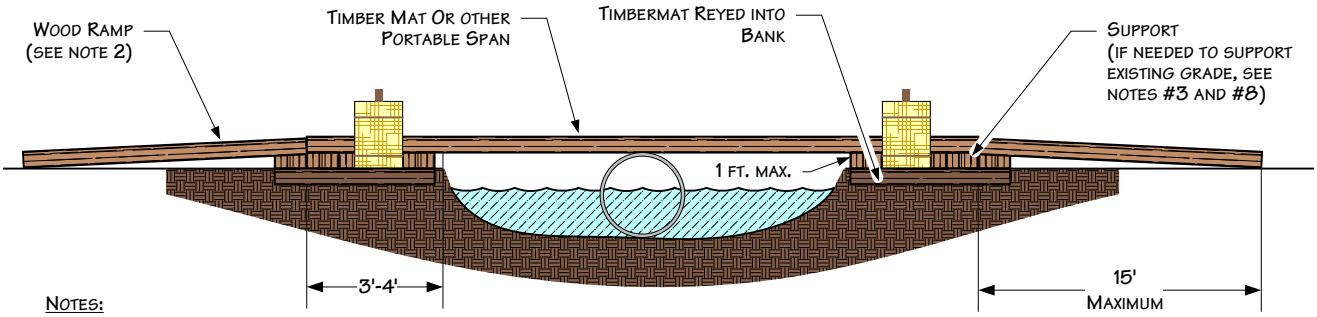
Plan View



Profile View



Notes:

1. Inspect bridge opening periodically and following rainfalls of over ½". Remove any debris restricting flow and deposit it at an upland site outside of floodplain.
2. If physical circumstances prohibit wood or metal ramps, earthen ramps may be used as approved.
3. Inspect bridge elevation so bridge remains supported above high bank and does not sink into bank.
4. The culvert support must be anchored to the stream bottom and may not be supported with fill.
5. Earthen ramp cannot be taller than 1' and cannot extend for more than 15' on either side of the crossing.
6. The bridge must span from top of bank to top of bank.
7. The bridge must be firmly anchored to prevent it from being transported downstream during high flow.
8. Additional support must be added on top of bank and under span if initial support starts to settle.
9. Erosion and sedimentation control measures shall be inspected and maintained in accordance with the company's Environmental Mitigation Plan

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ENBRIDGE

Figure 2.5

Environmental Mitigation Plan

Typical Span Type Bridge
With or Without Instream Support

DATE:	3/11/2003
REVISED:	3/14/2007
SCALE:	NTS
DRAWN BY:	KMK6792
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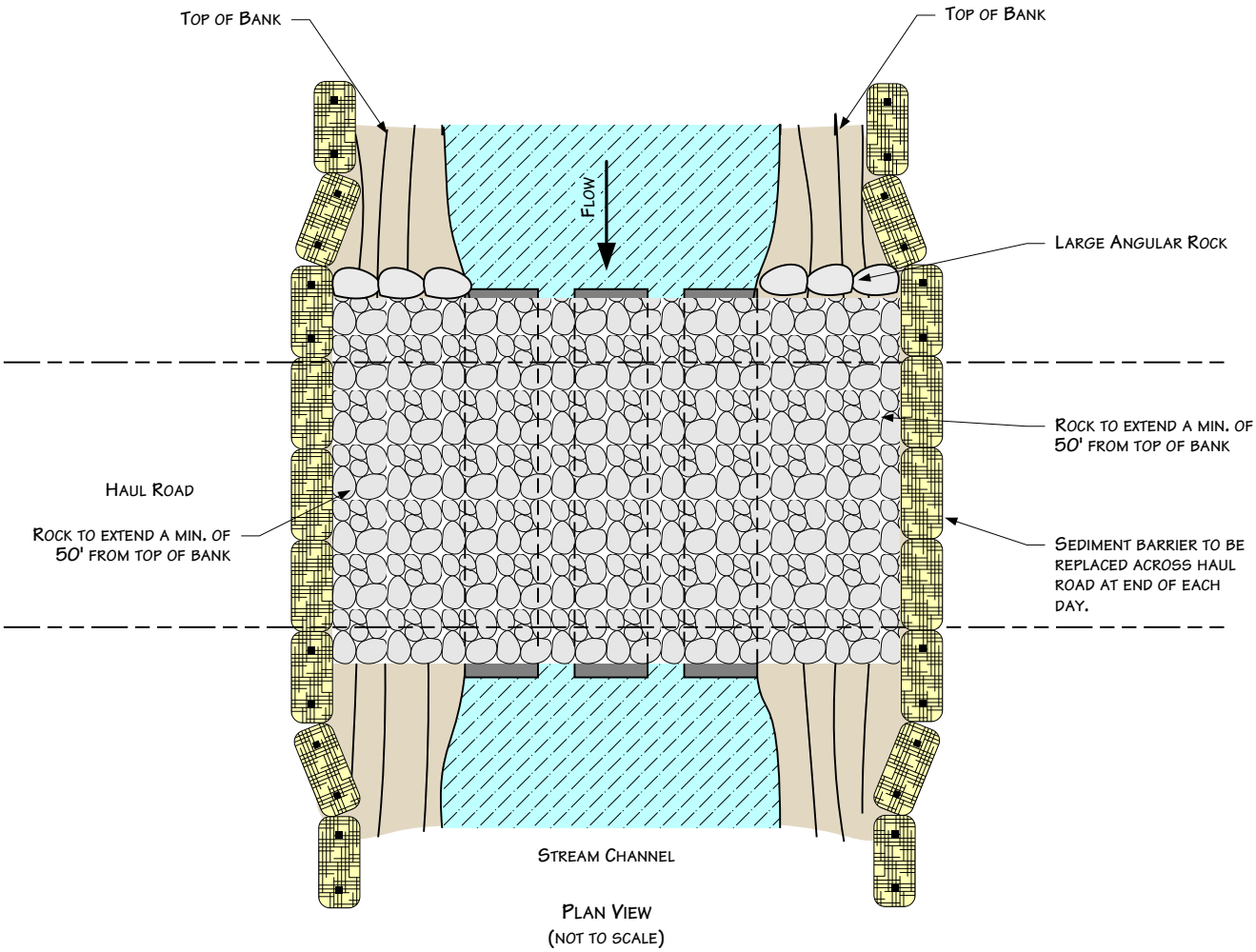

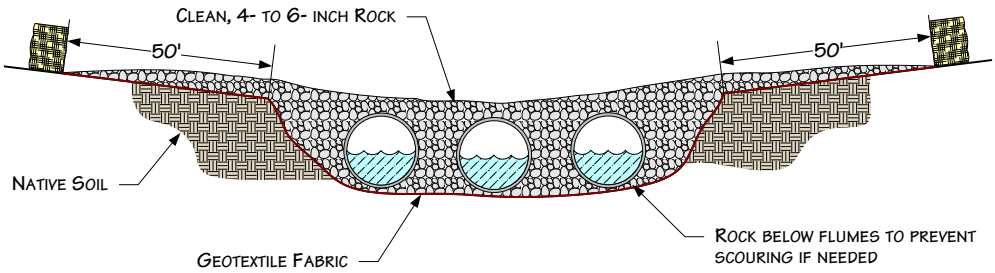

NOTES:

1. Steel flume pipe(s) sized to allow for stream flow and equipment load.
2. Straw bales shall be placed across bridge entrance every night.
3. Additional information included on other Drawings.

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ENBRIDGE

Figure 2.6
Environmental Mitigation Plan
Typical Rock Flume Bridge

DATE:	5/25/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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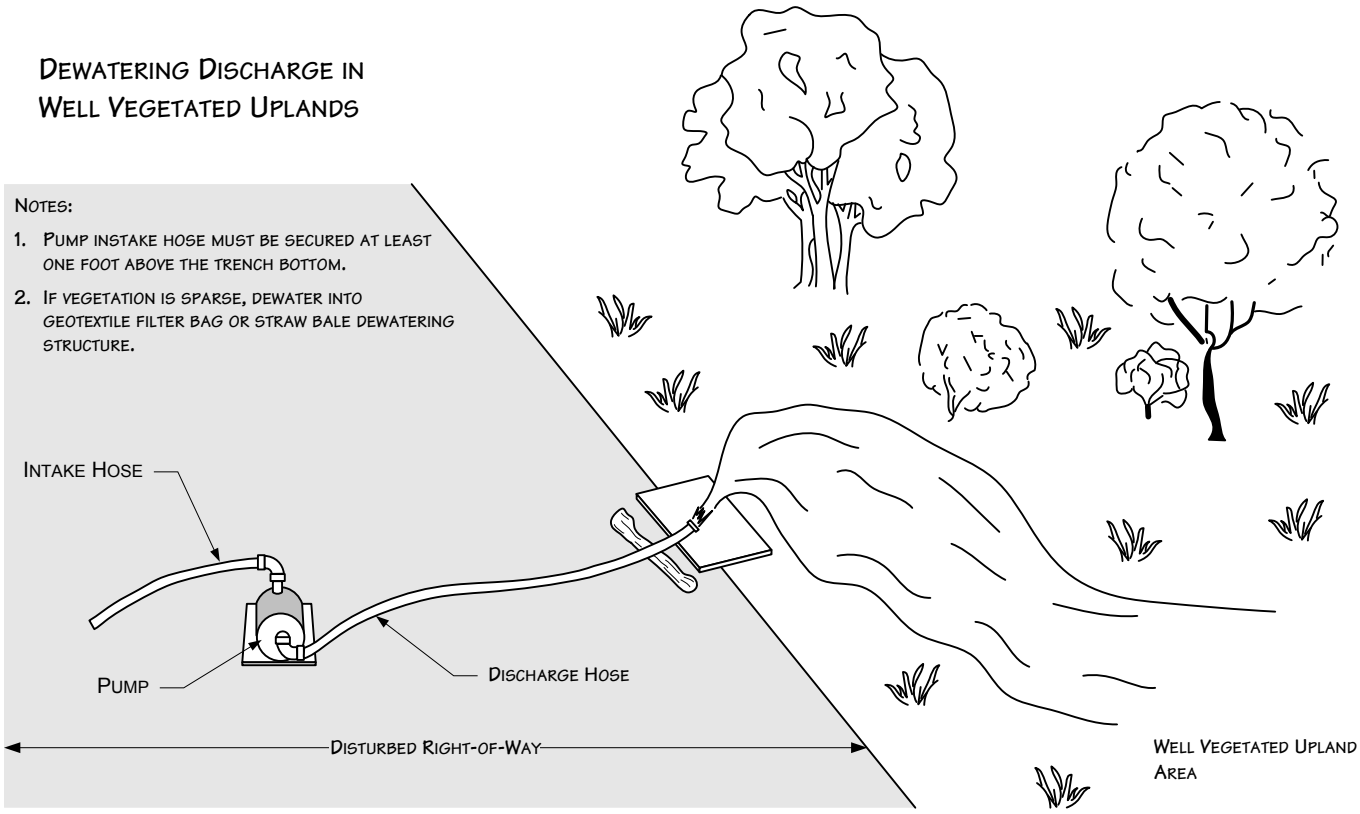
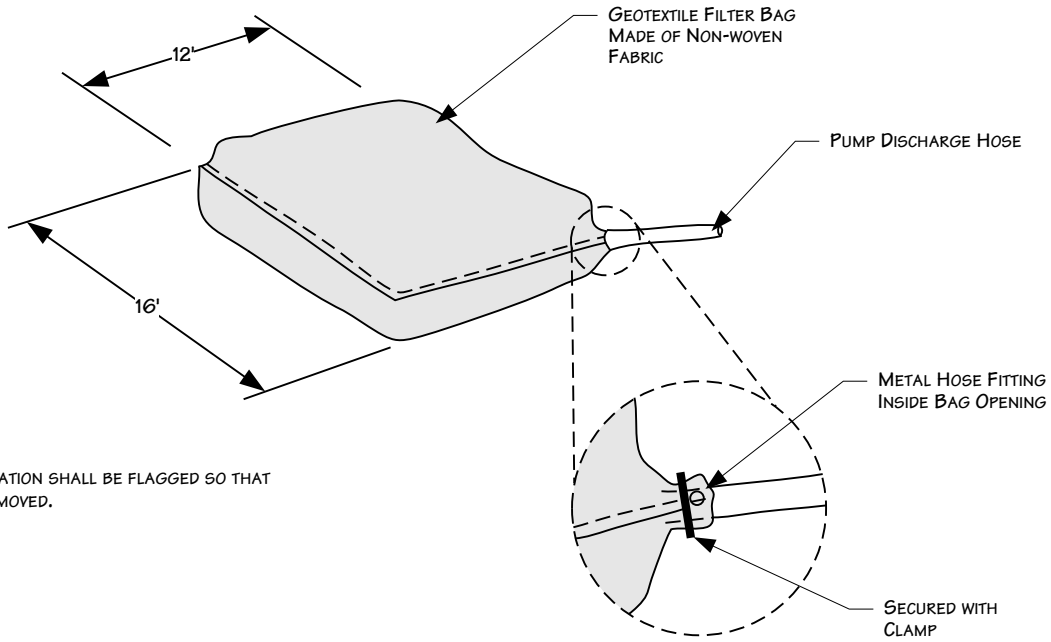
Dewatering Discharge in Well Vegetated Uplands



Notes:

1. Pump intake hose must be secured at least one foot above the trench bottom.
2. If vegetation is sparse, dewater into geotextile filter bag or straw bale dewatering structure.

Geotextile Filter Bag



Note:

1. Filter bag location shall be flagged so that bag can be removed.

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ENBRIDGE

Figure 2.7
Environmental Mitigation Plan
Typical Dewatering Measures

DATE:	5/25/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

NATURAL RESOURCE GROUP, INC.

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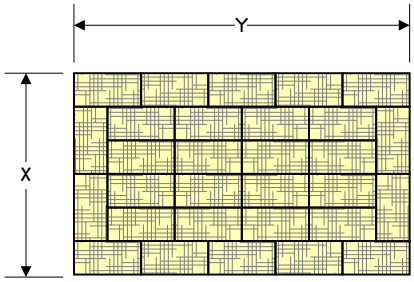
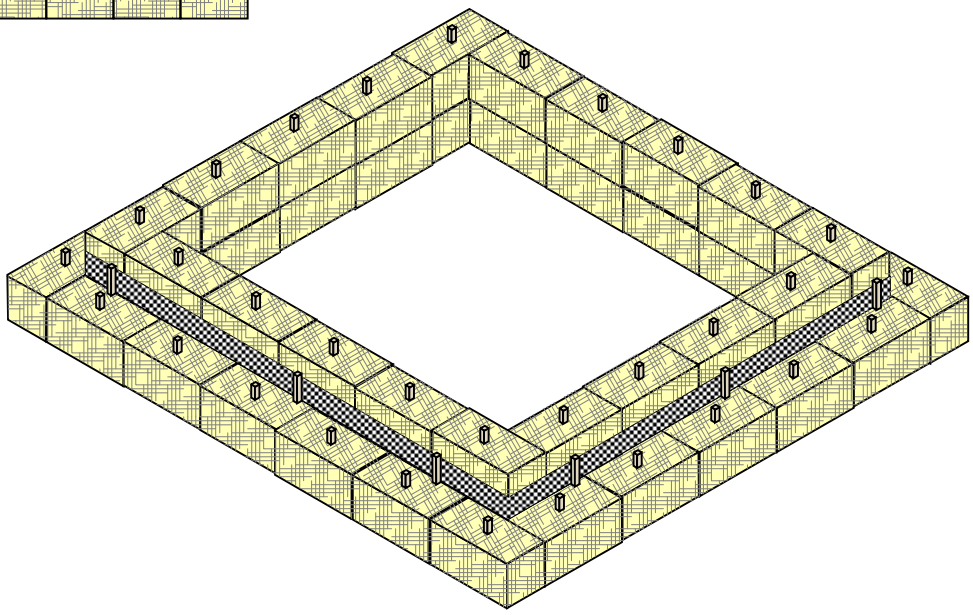
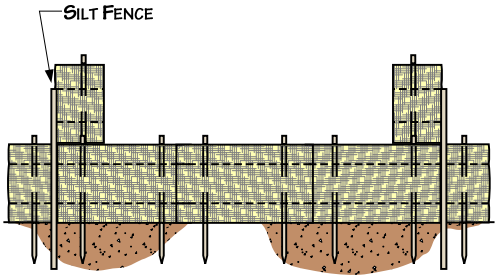


NOTES

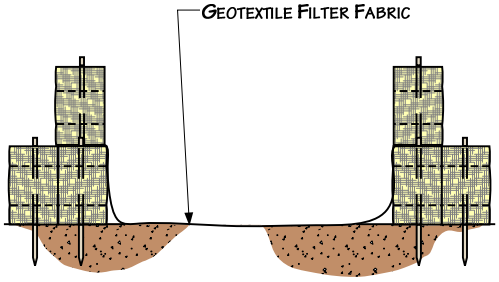
1. ARRANGE THE STRAW BALES TO THE X AND Y DIMENSIONS AS SPECIFICIED BELOW.
2. IF BOTTOM OF STRUCTURE IS NOT LINED WITH STRAW BALES (OPTION 1), LINE ENTIRE STRUCTURE WITH GEOTEXTILE FILTER FABRIC.



PERSPECTIVE VIEW



OPTION 1



OPTION 2

MINIMUM SUMP DIMENSIONS (FEET) X	Y	MAXIMUM PUMPING RATE GALLONS PER MINUTE
10	20	300
15	20	350
20	20	400
20	25	450
25	25	500
25	30	550
30	30	660

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ENBRIDGE

Figure 2.8
Environmental Mitigation Plan
Typical Straw-Bale Dewatering Structure

DATE: 5/25/2001
REVISED: 05/29/02
SCALE: NTS
DRAWN BY: KMKENDALL
K:\335\2006-135\060\2.8.VSD

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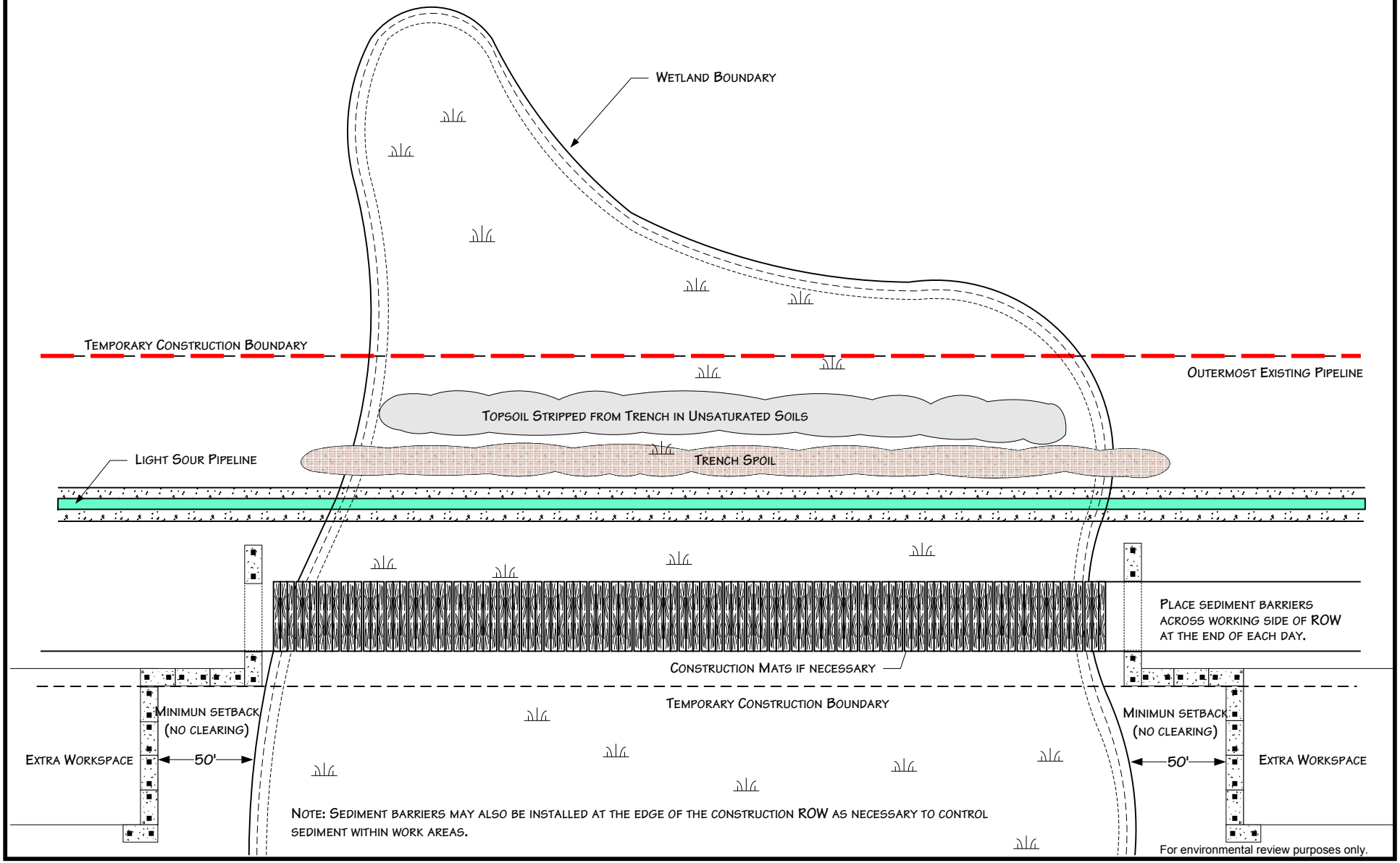


ENBRIDGE

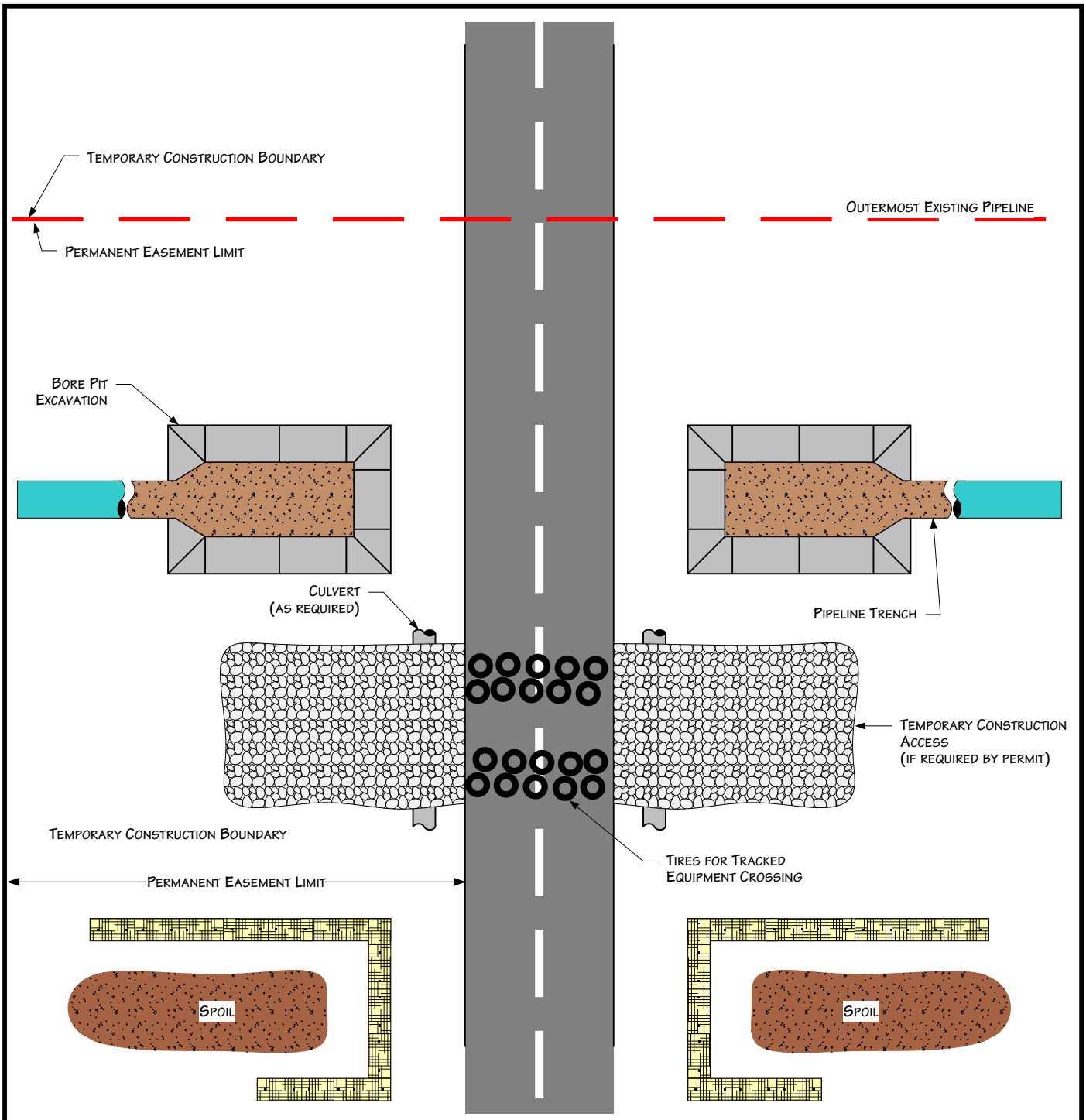
Figure 3.1

Environmental Mitigation Plan

Typical Wetland Crossing Method

DATE:	5/25/2001
REVISED:	04/19/06
SCALE:	NTS
DRAWN BY:	KMKENDALL
K:\335\2006-135\060\3.1.VSD	

NATURAL RESOURCE GROUP, INC.



Plan View

Notes

1. Procedures shown in this drawing apply to improved roads.
2. Roads must be cleaned after equipment crosses and dirt placed in spoil containment areas.
3. Temporary access materials must be removed upon project completion.
4. Additional information included on other drawings or permits.
5. Construction areas located outside road ROW.

For environmental review purposes only.

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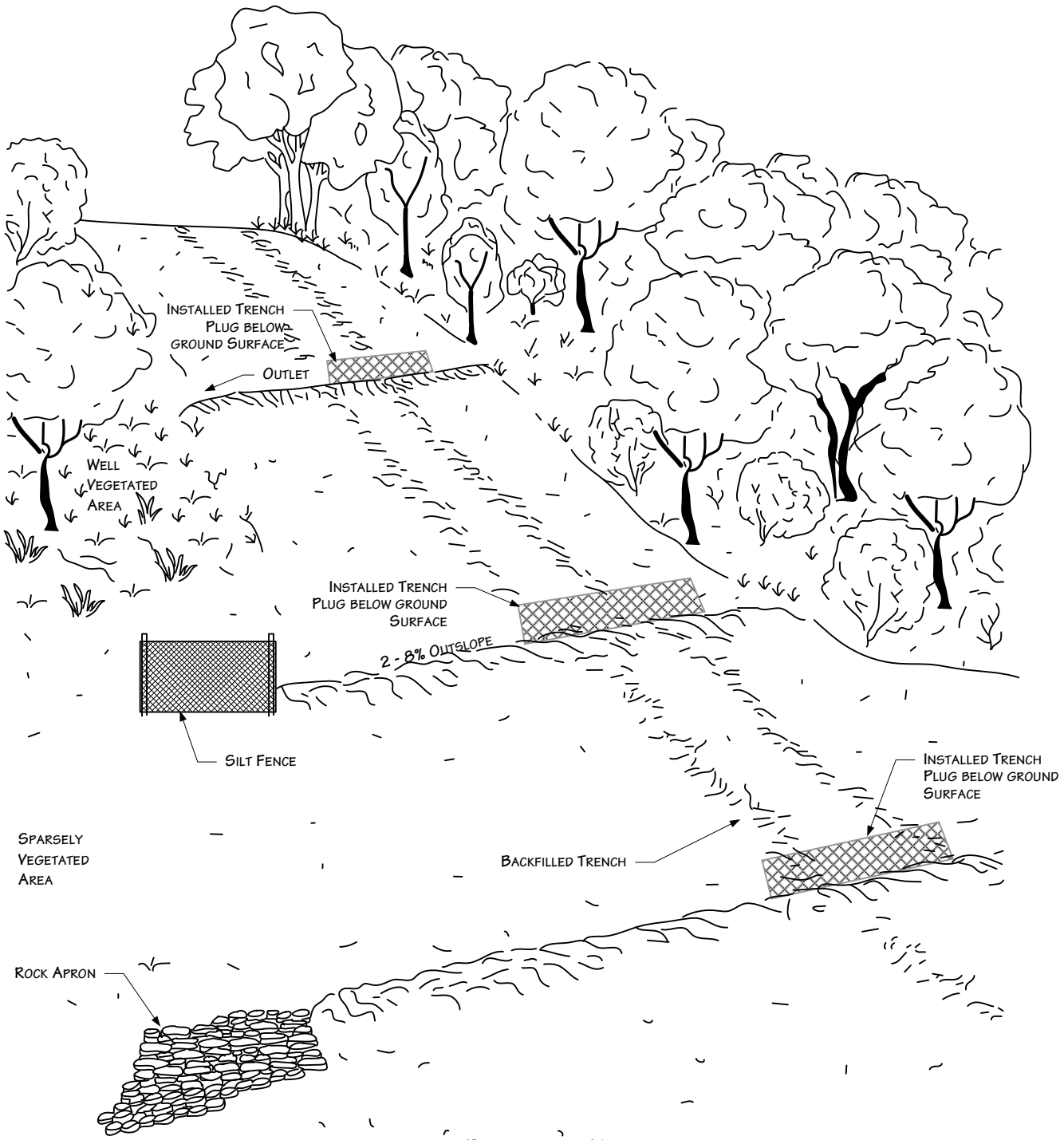
Figure 4.1
Environmental Mitigation Plan
Typical Improved Road Crossing
Directional Bore Method

DATE: 7/13/1999
REVISED: 3/14/2007
SCALE: NTS
DRAWN BY: KMKENDALL
K:\335\2006-135\060\4.1.VSD



Perspective View
(not to scale)

For environmental review purposes only.

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Figure 7.1
Environmental Mitigation Plan
Permanent Slope Breakers - Perspective View

DATE:	5/25/2001
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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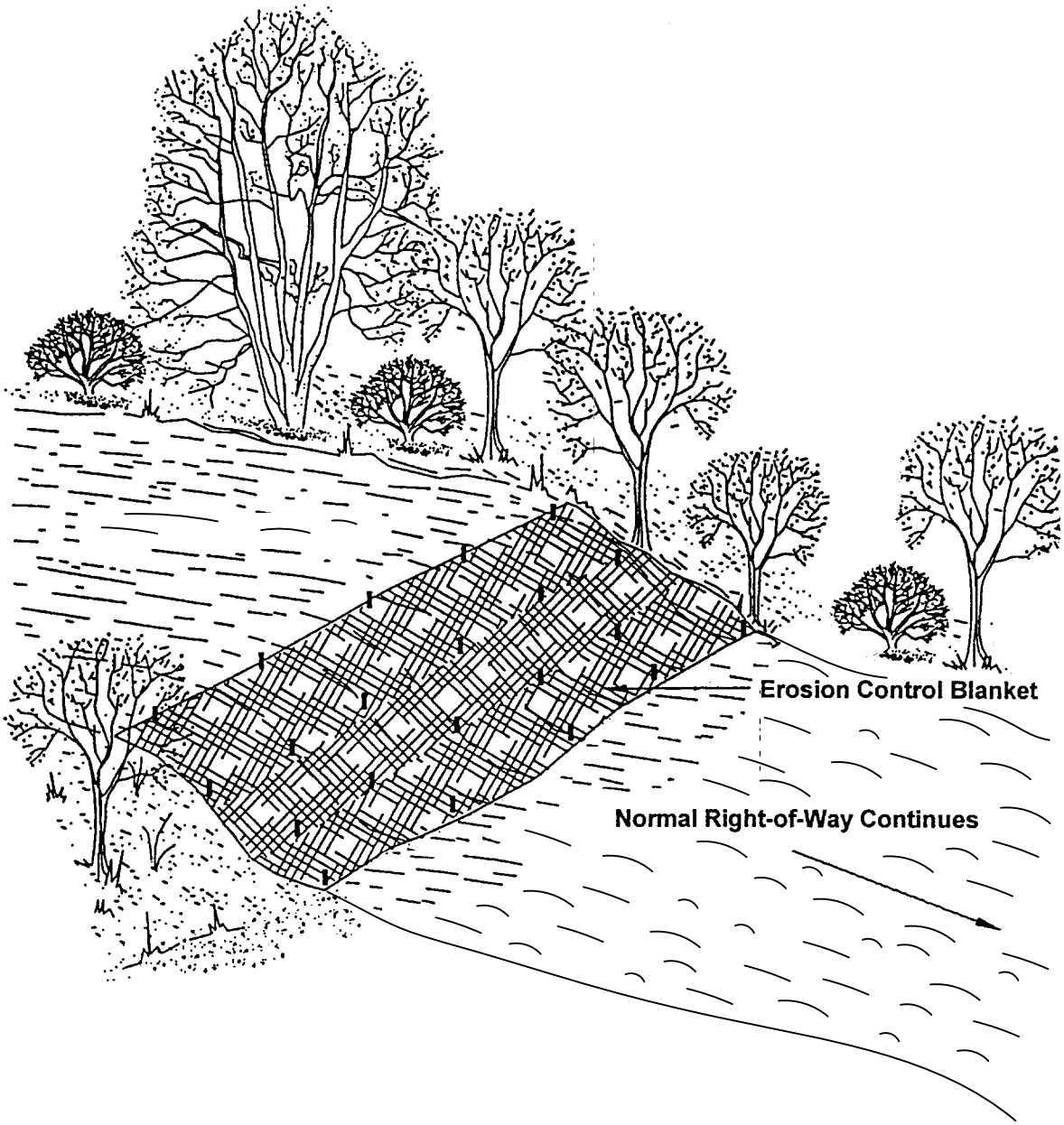

NOTES

1. INSTALL EROSION CONTROL BLANKET AS PER MANUFACTURER'S SPECIFICATIONS.
2. ADDITIONAL INFORMATION INCLUDED ON OTHER DRAWINGS.

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Figure 7.2
Environmental Mitigation Plan
Erosion Control Blanket - Steep Slopes (≥30%)

DATE:	11/15/2000
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL
K:\335\2006-135\060\7.2.VSD	

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NOTE: PLACE JUTE BLANKET A MINIMUM OF ONE (1) FOOT UNDER RIP RAP. EXTEND JUTE BLANKET FROM MEAN HIGH WATER LEVEL TO SEVERAL FEET BEHIND HIGH BANK.

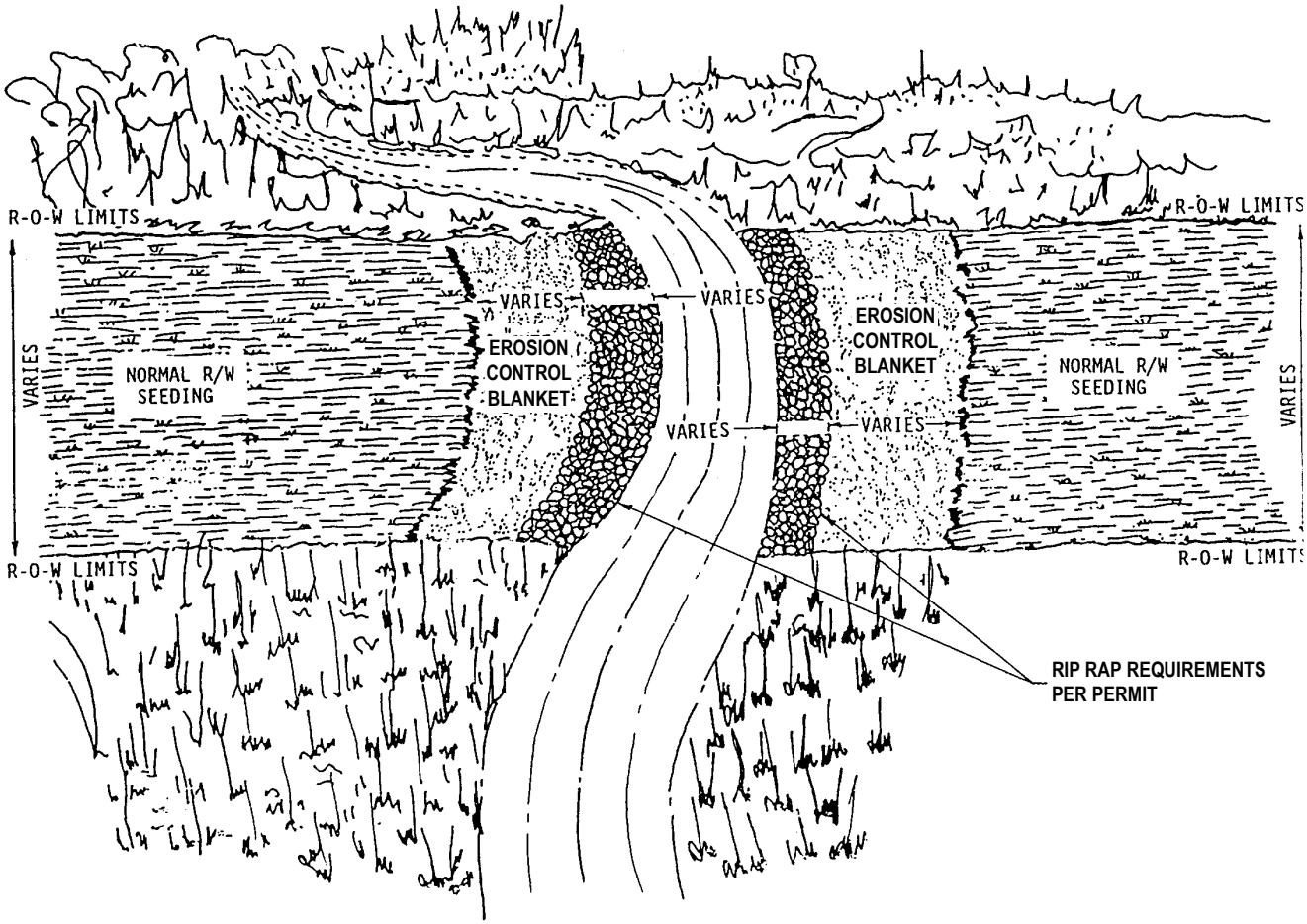

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Figure 7.3

Environmental Mitigation Plan

Typical Final Stream Bank Stabilization
Rip Rap & Erosion Control

DATE:	7/19/2000
REVISED:	12/21/05
SCALE:	NTS
DRAWN BY:	KMKENDALL

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K:\335\2006-135\060\7.3.VSD