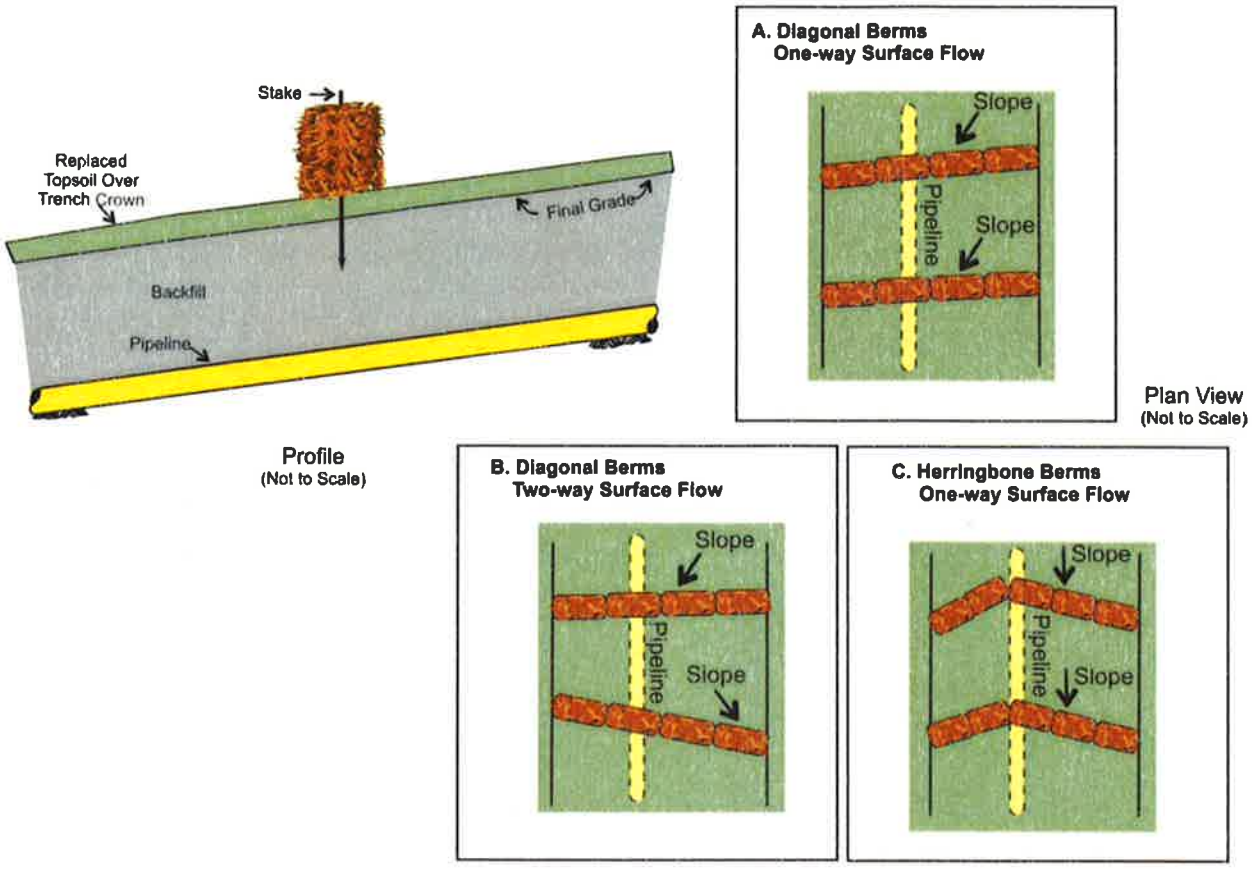
APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

Temporary Diversion Berms



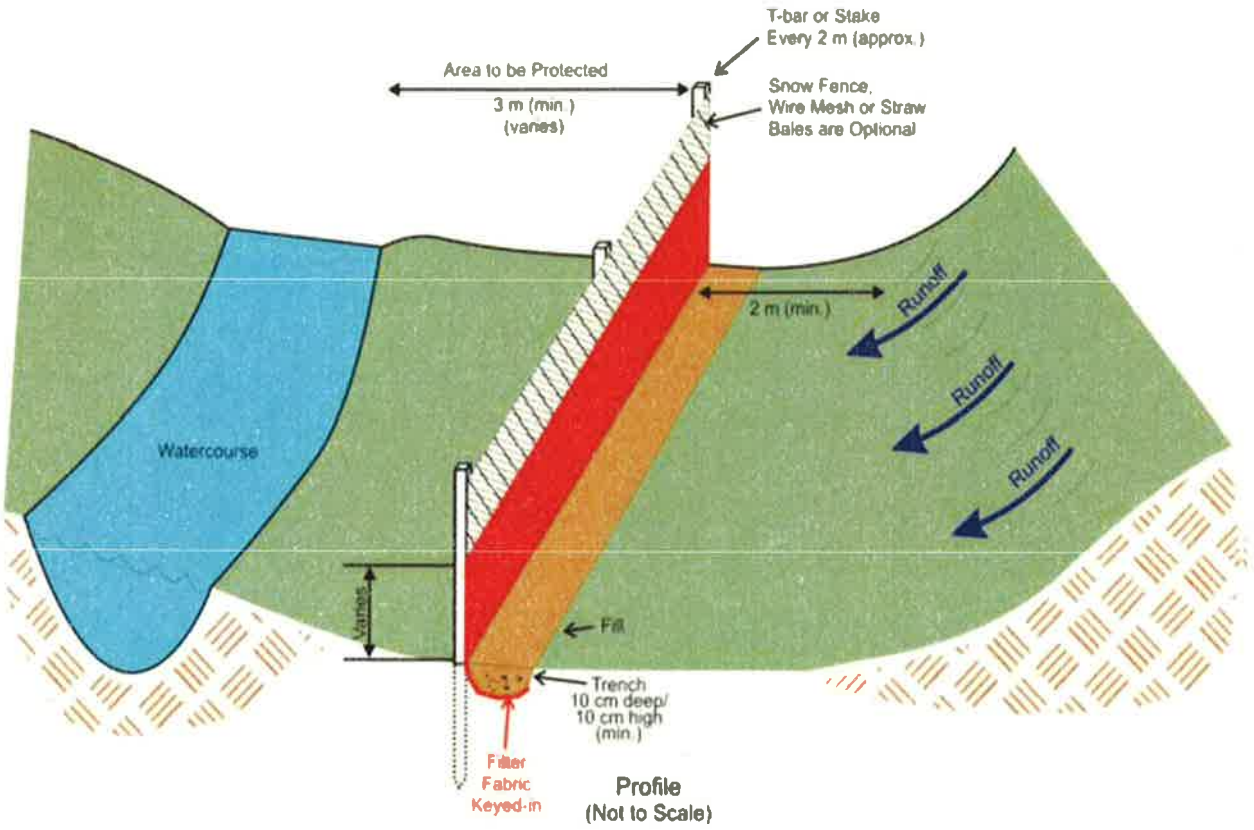
Comments:

1. Install diversion berm on moderate and steep slopes to collect seepage forced to the surface and to divert surface water off the ROW.
2. Skew temporary berm across the ROW at downhill gradient of 5 to 10%.
3. Construct temporary diversion berm with clean straw bales or filled sandbags. Where native material is highly erodible, protect upslope of berm and base of cross ditch by burying a geotextile liner 16 cm to 20 cm below the surface or armour upslope face of berm with earth-filled sandbags.
4. Leave a break in trench crown immediately upslope of diagonal berm to allow passage of water across the ROW.
5. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to ROW so runoff does not cross ditchline.
6. Determine location and direction of berm based on local topography and drainage patterns. Install berms immediately downslope of trench breakers. If installed, skew berms with downhill gradient of 5 to 10%.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

SILT FENCE



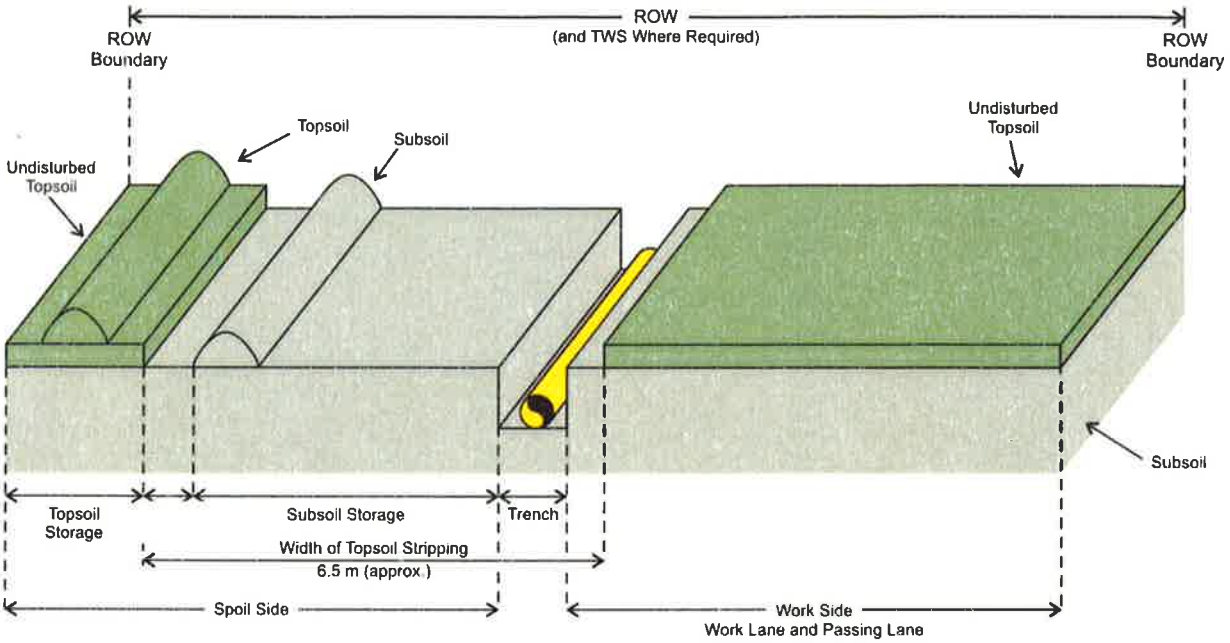
Comments:

1. Silt fences act as temporary sediment barriers at the bottom of cut/fill slopes, swales/ditches with low flow (less than 0.03 m3/s), along watercourse banks, around stockpiles and as mid-slope grade-breaks (using a J-hook pattern). Silt fencing retains eroded soil particles carried in sheet/rill flow, slows runoff velocity to allow particle settling, and prevents soil erosion off construction sites. A silt fence consists of entrenched polypropylene filter fabric, sometimes supported by plastic/wire mesh, supported by steal or wood posts.
2. Site Preparation
- An approx. 0.10 m deep and 0.10 m wide trench is recommended to prevent undercutting.
3. General Construction Guidelines
- Install fences a minimum of 2 m from the toe of the slope, if possible, to provide adequate area for ponding, and sediment removal equipment.
- Silt fencing should remain in place until surrounding disturbed area is permanently stabilized by vegetation.
- Posts should be spaced 2 - 3 m (10 ft) apart. The posts should extend at least 0.61 m into the ground on the downslope side of the fabric.
- Fabric should extend between 0.4 m and 0.6 m above the ground surface.
- Filter fabric should be cut from a continuous roll to avoid joints. Where joints in the fabric are required, splice it together only at a support post.
- Filter fabric should be keyed into the trench and embedded using compacted soil or gravel (minimum 2 cm diameter) to prevent undercutting. Ensure no gaps between ground and fabric.
- Ends of the silt fencing should be curved upslope and extend above the designed impoundment depth to effectively contain runoff.
- Silt fences should not be used on slopes exceeding 2H: 1V (50%).
4. Inspection and Maintenance
- Silt fences should be inspected periodically, especially after precipitation events, for the amount of sediment which has accumulated.
- Repair undercut, split, torn, slumping or weathered fabric.
- It is recommended to remove the sediment when it reaches 1/3 the height of the silt fence or when heavy rain/high water is anticipated.
- During removal, fabric is cut at ground level, the wire and posts are removed.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

TRENCH AND SPOIL CONSTRUCTION TECHNIQUE



Profile
(Not to Scale)

Comments:

1. Strip and Stockpile Topsoil
- Topsoil stripping requires accurate depth control of a grader or equivalent machine to ensure that subsoils and topsoils are adequately separated. Multiple passes are preferred to a single pass. Strip all available topsoil.
- Store topsoil on edge of spoil side of ROW. Storing topsoil on the work side and flattening down to set pipe on is acceptable provided there is no mixing.
- Suspend stripping during periods of high winds or during excessively wet weather when soils are saturated.
- Leave breaks in topsoil pile at obvious drainage courses.

2. Excavate Trench and Stockpile
- Maintain separation between topsoil and subsoil.

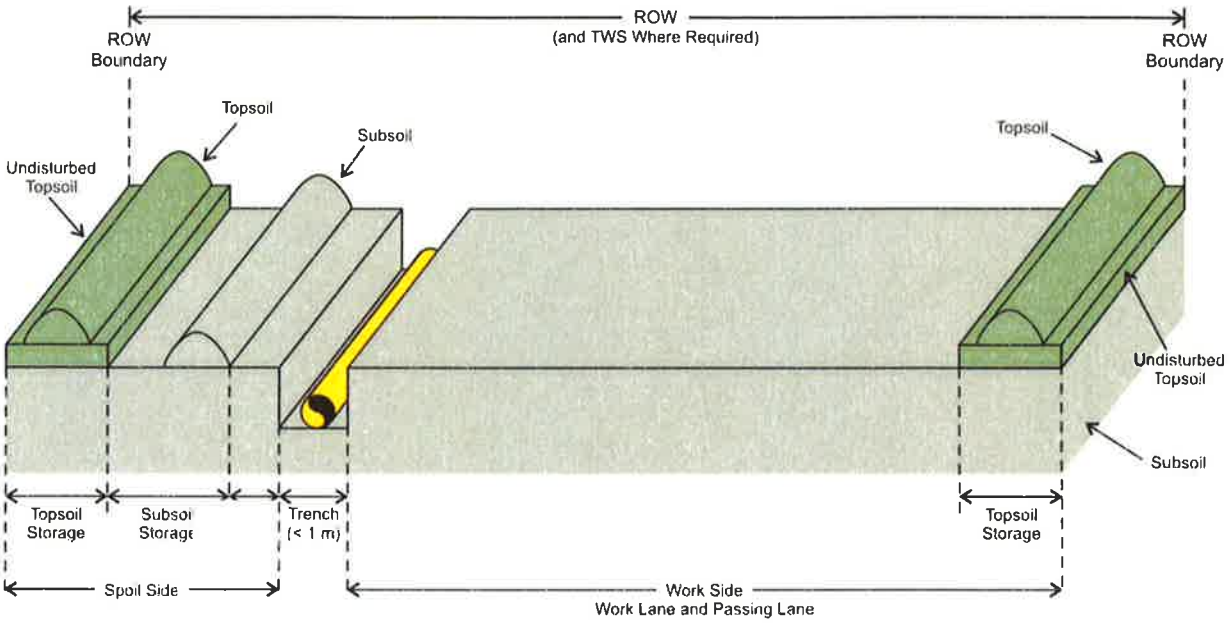
3. Backfill Trench
- Backfill and compact trench. Crown trench to allow for settlement of fill. Leave breaks in crown at obvious drainages.
- Avoid mixing subsoil with topsoil.

4. Replace Topsoil and Clean-up
- Consider breaking up subsoil if very lumpy prior to topsoil replacement.
- Pick rocks and debris equivalent to the surrounding subsoil prior to topsoil replacement.
- Evenly replace topsoil with grader or equivalent machine.
- Suspend replacement activities during periods of high winds if soil drifting begins to occur or during excessively wet weather when soils are saturated.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

FULL ROW CONTRUCTION TECHNIQUE



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Comments:

1. Strip and Stockpile Topsoil
- Strip topsoil from over the proposed trench, subsoil storage and work areas.
- Store salvaged topsoil on both sides of the ROW adjacent to the stripped area.
- Topsoil stripping requires accurate depth control of a grader of equivalent machine to ensure that subsoils and topsoils are adequately separated. Multiple passes are preferred to a single pass. Strip all available topsoil.
- Suspend stripping during periods of high winds or during excessively wet weather when soils are saturated.
- Leave breaks in topsoil pile at obvious drainage courses, farmer access and wildlife corridors.

2. Excavate Trench and Stockpile
- Maintain separation between topsoil and subsoil.

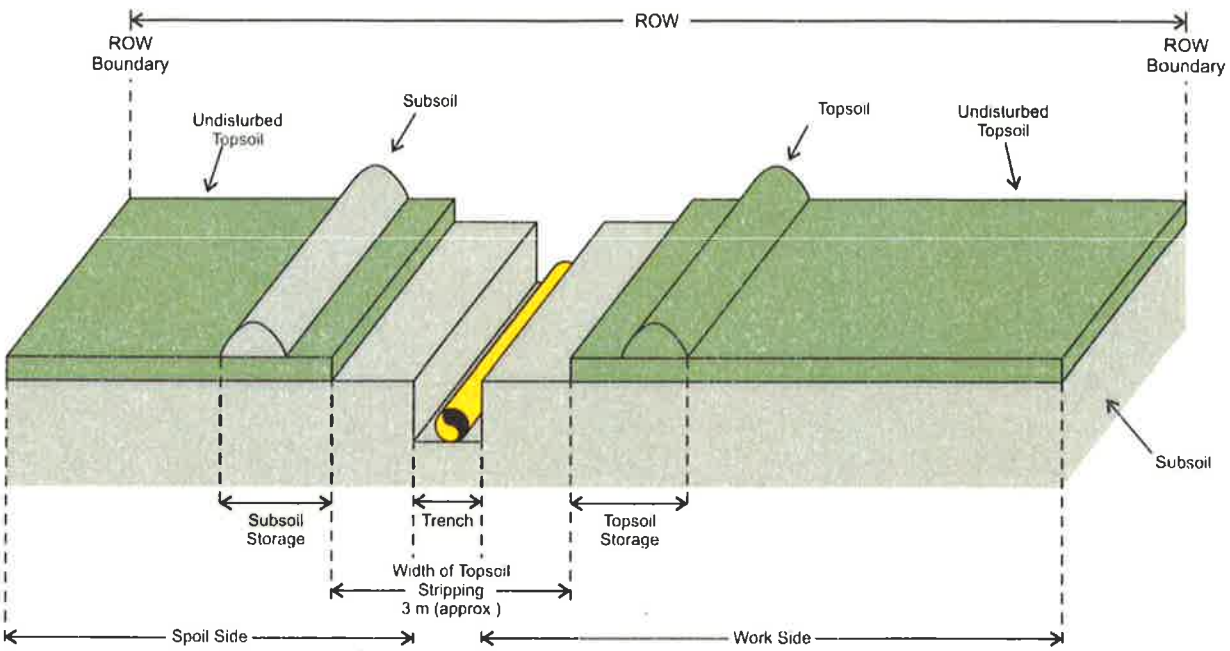
3. Backfill Trench
- Backfill and compact trench. Crown trench to allow for settlement of fill. Leave breaks in crown at obvious drainages.
- Avoid mixing subsoil with topsoil.

4. Replace topsoil and Clean-up
- Consider breaking up subsoil if very lumpy prior to topsoil replacement.
- Pick rocks and debris equivalent to the surrounding subsoil prior to topsoil replacement.
- Evenly replace topsoil with grader or equivalent machine.
- Suspend replacement activities during periods of high winds if soil drifting begins to occur or during excessively wet weather when soils are saturated.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

MIMINUM STRIPPING TECHNIQUE



Profile
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Comments:.

1. Strip and Stockpile Topsoil
- Remove topsoil from a 3 m (approx.) wide strip centered over the trench line. Stripped area should be sufficiently wide to accommodate the track of the ditcher or backhoe.
- Increase topsoil stripping width at locations where trench sloughing may occur, stockpile topsoil a greater distance from the trench at these sites.
- Stockpile topsoil on work side or subsoil side.
- Topsoil stripping requires accurate depth control of a grader or equivalent machine to ensure that subsoils and topsoils are adequately separated. Multiple passes are preferred to a single pass. Strip topsoil to color change.
- Suspend stripping during periods of high winds if soil drifting begins to occur or during excessively wet weather.
- Leave breaks in topsoil pile at obvious drainage courses.

2. Excavate Trench and Stockpile
- Place and store subsoil on subsoil side of the ROW.

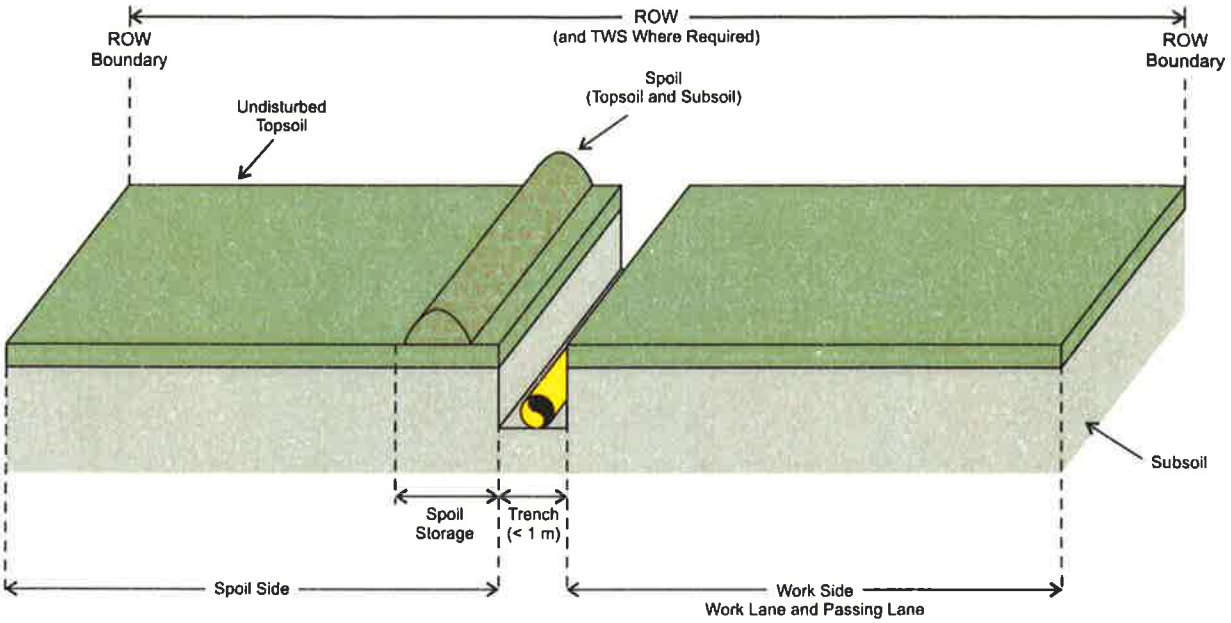
3. Backfill Trench
- Backfill and compact trench. Crown trench as required to allow for settlement of fill.
- Avoid mixing subsoil with topsoil. Also avoid scalping sod layer.
- Pick stones and debris equivalent to the surrounding subsoil.

4. Replace Topsoil and Clean-up
- Evenly replace topsoil. Avoid scalping sod layer.
- Suspend replacement activities during periods of high winds if soil drifting begins to occur or during excessively wet weather.
- Pick stones equivalent to the surrounding topsoil.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

NO STRIPPING TECHNIQUE



Profile
(Not to Scale)

Comments:

1. Excavate Trench and Stockpile
- Excavate trench with a narrow wheel ditcher or backhoe (0.6 m).
- Lower in pipe immediately following trenching to minimize sloughing of trench walls.

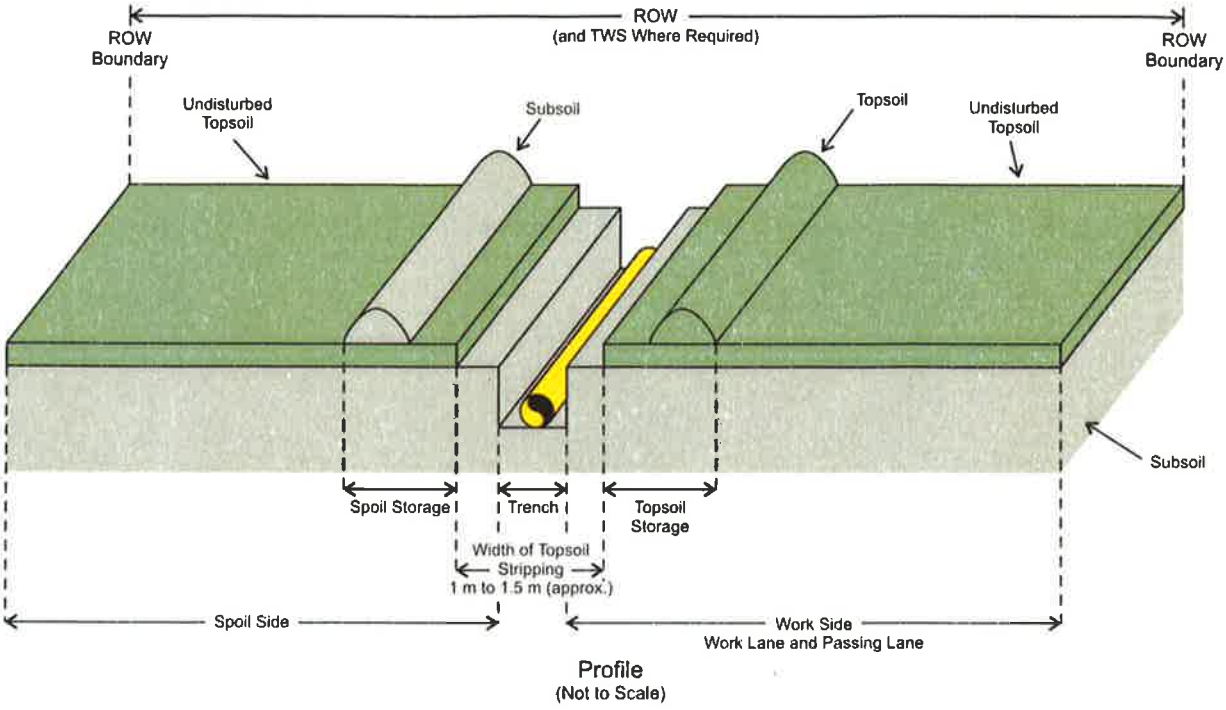
2. Backfill Trench
- Backfill trench taking care to replace all spoil and minimize scalping of sod.
- Adequate compaction is to be obtained using a packing wheel, grader wheel or equivalent.

3. Clean-up
- Feather excess spoil material over ROW to eliminate trench crown.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

MINIMUM STRIPPING TECHNIQUE



Comments:

1. Strip and Stockpile Topsoil
- Strip trench width as per drawing. Standard stripping width is 1 m to 1.5 m. Use grader with step blade, modified wheel ditcher or backhoe.
- Increase topsoil stripping width at locations where trench sloughing may occur. Stockpile topsoil a greater distance from the trench at these sites.
- Topsoil stripping requires accurate depth control of a grader or equivalent machine to ensure that subsoils and topsoils are adequately separated. Strip topsoil to color change (as per Alignment Sheets).
- Suspend stripping during periods of high winds if soil drifting begins, or during wet weather.
- Leave breaks in topsoil pile at obvious drainage courses.

2. Excavate Trench and Stockpile
- Excavate trench with a narrow wheel ditcher, narrow bucket or chain trencher. Use V bucket if trench sloughing is occurring.
- Store subsoil on top of topsoil on subsoil side of ROW.
- Minimize wide bucket hoe ditching.

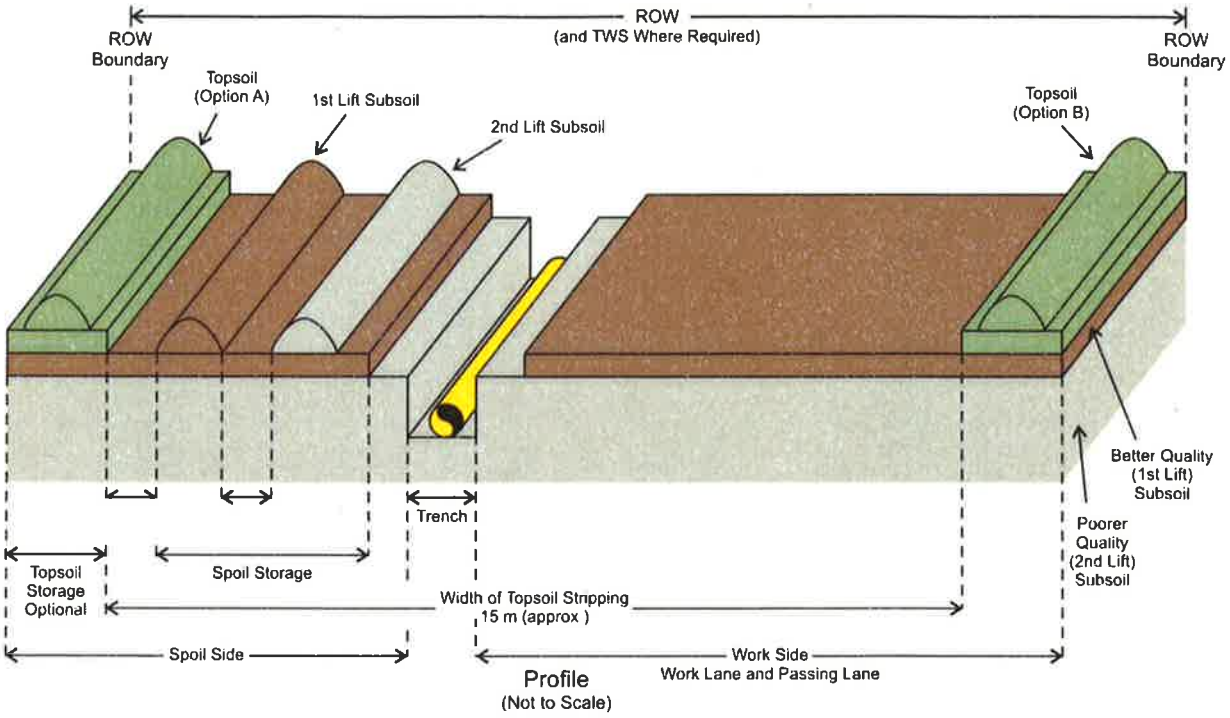
3. Backfill Trench
- Backfill trench taking care to remove subsoil only.
- Adequate compaction is to be obtained using a packing wheel, grader wheel or equivalent.

4. Replace Topsoil and Clean-up
- Replace and feather out topsoil using grader. Take care to avoid scalping sod layer.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

THREE LIFT CONSTRUCTION TECHNIQUE



Comments:

1. Strip and Stockpile Topsoil

Strip and stockpile topsoil and subsoil first lift as shown above. Depending on soil conditions, the workside may or may not be stripped.

- Change offset stakes where three-lift soils handling is to be conducted at locations indicated on the Alignment Sheets.

2. Excavate Trench and Stockpile

- Excavate first lift of subsoil as indicated and stockpile as shown above. Note: a bulldozer may be required to move this subsoil (first lift) to allow room for windrowing and subsequent backfilling of the second subsoil lift.
- Excavate remainder of subsoil (second lift) and stockpile as shown above.
- Maintain at least separation between all stockpiles.

3. Backfill Trench

- Return second lift of trench subsoil to the trench and compact. Scalp upper subsoil base under second lift of trench subsoil during backfilling to ensure all second lift subsoil is returned to the trench.
- Return first lift of trench subsoil to the trench and compact.

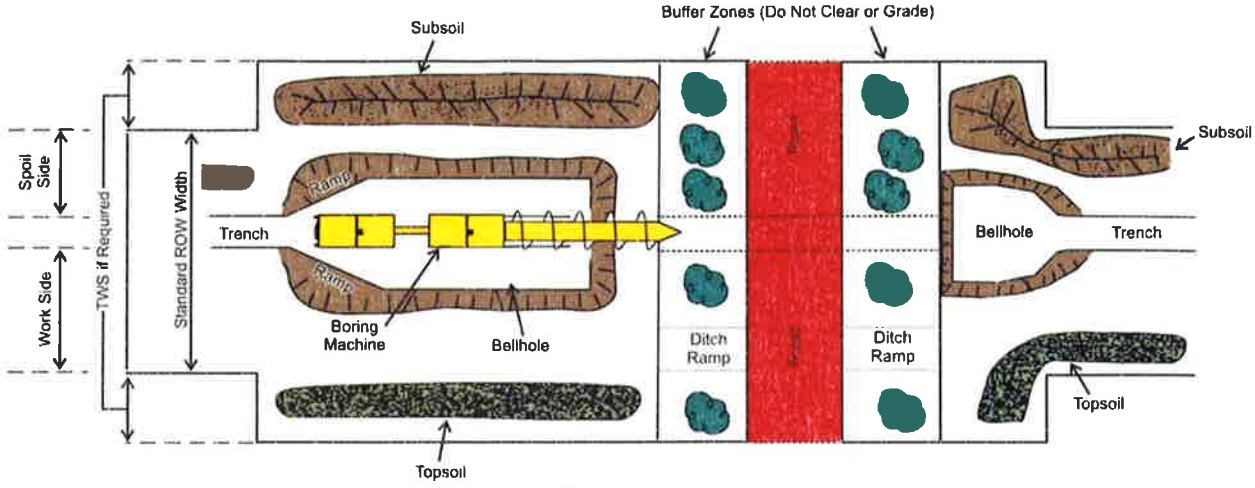
4. Replace Topsoil and Clean-up

- Evenly replace topsoil with grader or equivalent machine. Avoid scalping sod layer.
- Suspend replacement activities during periods of high winds if soil drifting begins to occur or during extremely wet weather.
- Cultivate disturbed part of the ROW. Seed disturbed areas as appropriate.
- Pick stones equivalent to the surrounding topsoil.

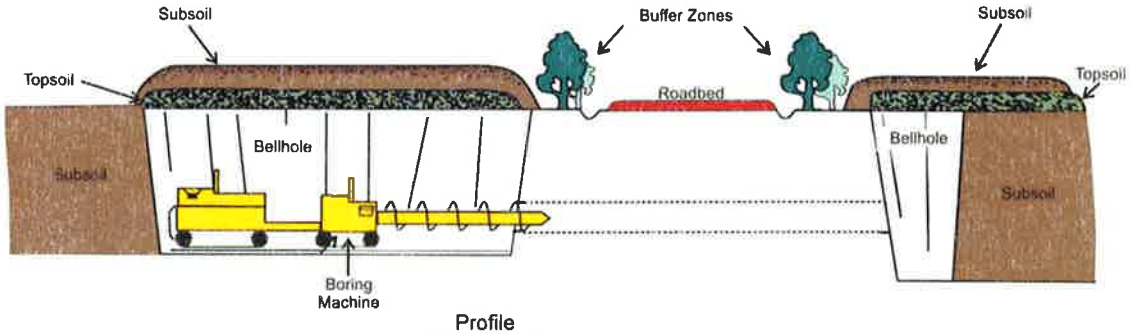
Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

ROAD CROSSING WITH BORING TECHNIQUE



Plan View
(Not to Scale)



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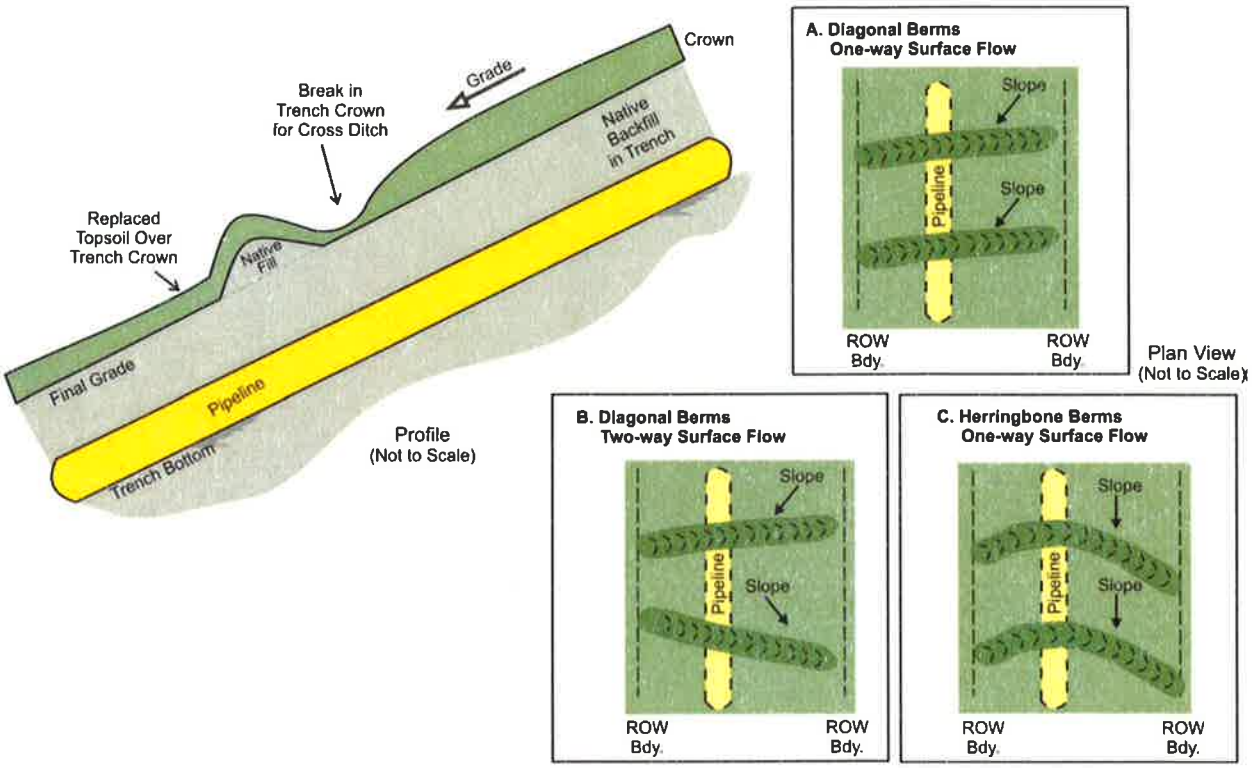
Comments:

1. Acquire and mark additional temporary workspace.
2. Salvage topsoil from bellhole and store separately from subsoil storage. Salvage topsoil from an area larger than the bellhole to allow feathering out of subsoil over stripped area. During frozen conditions, only strip area to be excavated.
3. Install ditch ramps using subsoil.
4. Excavate bellhole. If possible store subsoil on opposite side of ROW from topsoil or adjacent to topsoil maintaining adequate separation to avoid admixing topsoil and subsoil.
5. Backfill and compact. Leave a crown to allow for subsidence.
6. Remove ditch ramps.
7. Replace topsoil.
8. Reseed as appropriate.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

CROSS DITCHES AND DIVERSION BERMS



Comments:

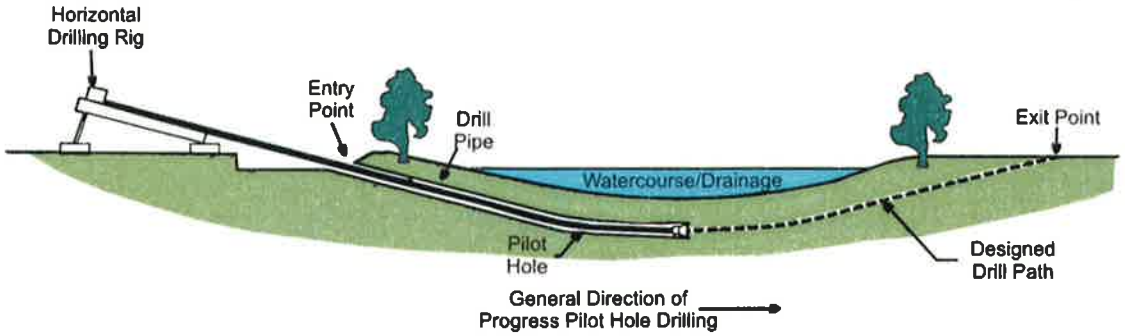
1. Consider installing diversion berm and cross ditch on moderate and steep slopes to divert surface water off-ROW.
2. Skew berm across the ROW at downhill gradient of 5 to 10%.
3. Construct diversion berm of compacted native subsoils where extensive disturbance of the sod layer has occurred. Diversion berms should be constructed of timbers, imported logs or sandbags if disturbance of the sod layer is limited.
4. Typical diversion berm height and widths are approx. 0.75 m [summer] and/or 1 m [winter].
5. Use diagonal berms where direction of slope and surface water movement is oblique to pipeline ROW.
6. Use herringbone berm and cross ditch where direction of slope and surface water movement is parallel to ROW so runoff does not cross ditch line.
7. Determine location and direction of berm based on local topography and drainage patterns.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

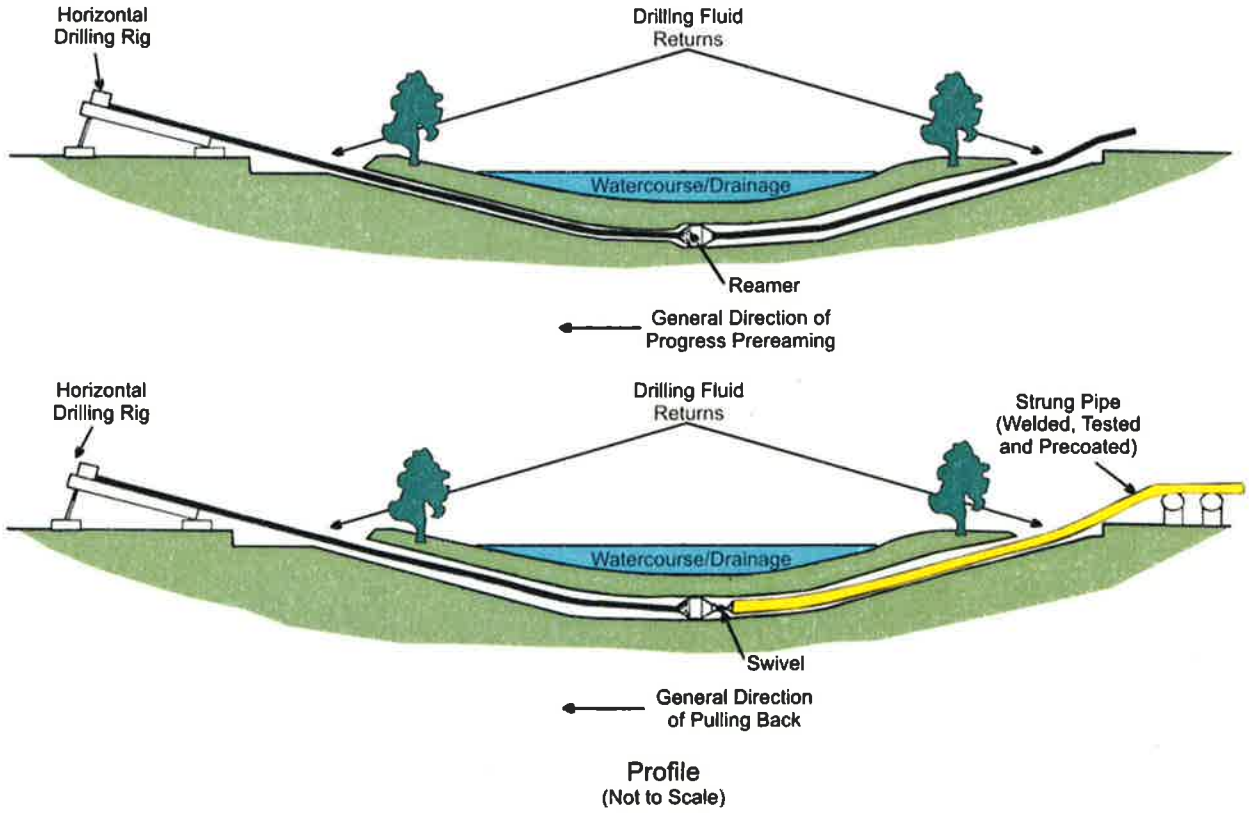
APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

Trenchless Crossing – Directional Drill

Stage 1: Pilot Hole Directional Drilling



Stage 2: Reaming and Pulling Back



Profile
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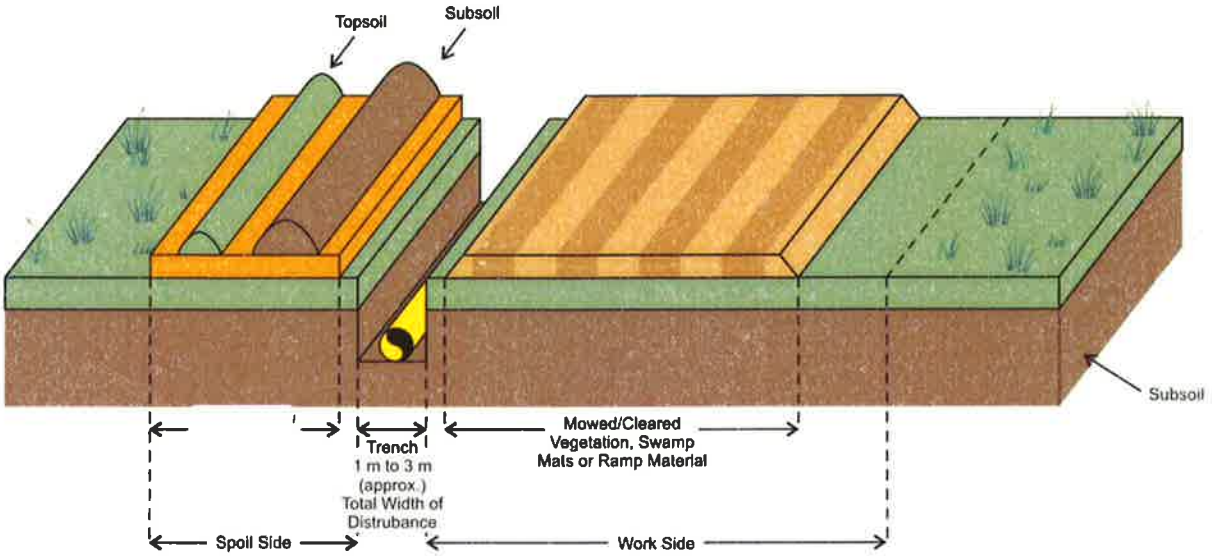
Comments:

1. Set up drilling equipment a minimum of 10 m from the edge of the watercourse/drainage; do not clear or grade within 10 m zone, except along the work side, if temporary vehicle crossing is utilized.
2. Monitor for an inadvertent mud release into or adjacent to the watercourse/drainage.
3. Ensure that only bentonite based drilling mud is used.
4. Install suitable drilling mud tanks or sumps to prevent contaminationof watercourse/drainage.
5. Install berms downslope from the drill entry and anticipated exit points to contain any release of drilling mud.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

WETLAND CROSSING TECHNIQUE



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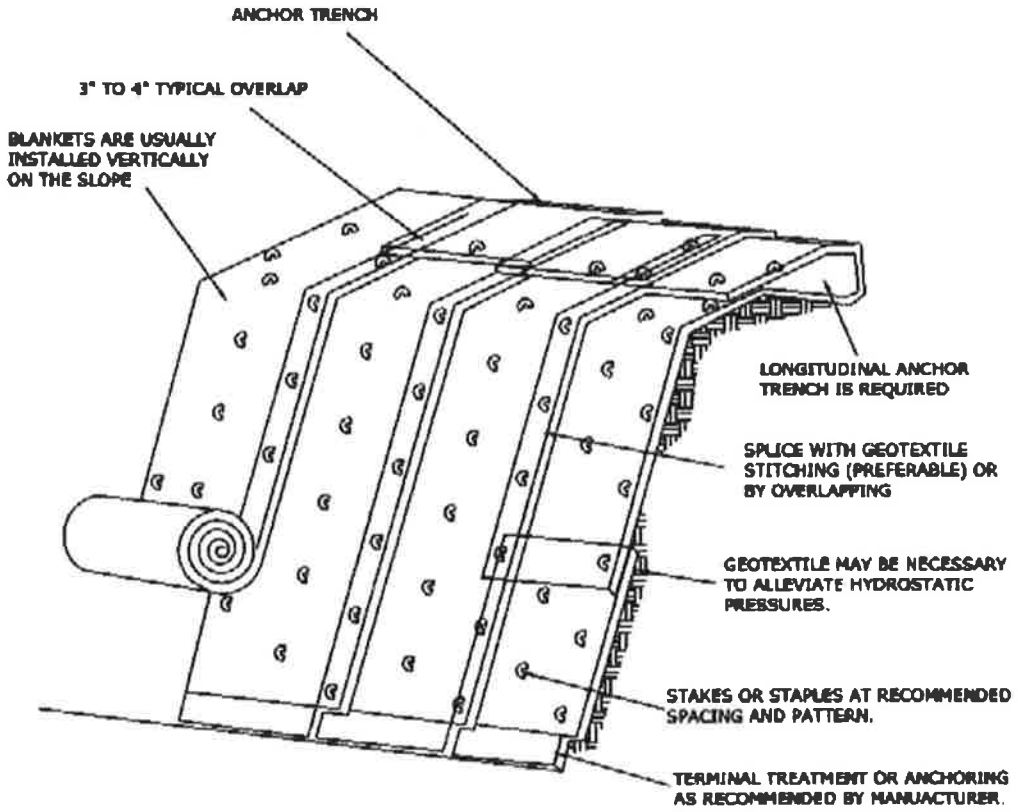
Comments:

1. Use wide pad, low-ground pressure equipment or utilize mats. Avoid rutting and admixing of wetland with appropriate ramping options such as swamp mats or geotextile and spoil ramps. Place topsoil and subsoil directly beside trench as shown in drawing. Do not use swamp mats or geotextile to store topsoil or subsoil on.
2. Restrict top soil removal only to that area necessary for pipeline construction.
3. Build dams and pump trench water onto stable and well-vegetated areas if encountered. Monitor discharge areas to ensure adequate filtration.
4. Backfill and clean-up wetland and remove matting or ramp. Restore to pre-construction profile.

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

APPENDIX VI
TYPICAL CONSTRUCTION AND EROSION CONTROL TECHNIQUES

EROSION CONTROL BLANKETS



Comments:

1. Erosion control blankets are made of biodegradable materials such as jute matting, excelsior wood fibre, coconut fibre, straw or interwoven paper strips, and a netting made of a biodegradable polypropylene or extruded plastic. Erosion control blankets prevent soil detachment from raindrops and runoff, similar to mulching, but are much more stable and longer lasting than normal mulches. Erosion control blankets decrease runoff velocity, promote water infiltration, prevent surface crusting/compaction, and protect seed. Erosion control blankets should be installed on slopes, or in ditches/swales where the soil is erodible but will support vegetation.

2. Site Preparation

- Manufacturers should be consulted in selecting the product for the intended purpose. Always follow the manufacturer's recommendations for orientation, overlapping, entrenching, and securing blankets and mats.
- Use adequate amounts of anchoring staples to avoid water flow under blankets.
- Temporary erosion control blankets are typically used to stabilize concentrated flow areas where velocities are less than 1.5 m/s and slopes 2.5H:1V or steeper with a height of 3 m or greater. Permanent erosion control matting is typically used when velocities are between 1.5 m/s and 3 m/s.
- Temporary erosion control blankets are used to stabilize ditches and swales with profile grades of lesser than 6% under low or moderate flow conditions.

3. General Construction Guidelines

- Prior to seeding, install all necessary water control structures such as water bars, broad based dips and turn outs.
- Prepare the seedbed by roughening the soil surface by hand, remove rocks or any other material that will prevent contact of the blanket with the soil surface. If topsoil is available add to the area, seed prior to installation of matting.
- Blankets should be installed vertically from top to bottom of slopes.
- A trench 30 cm deep x 20 cm wide should be excavated approx.1 m back from the crest of the slope along the length of the slope to be protected.
- Insert the leading edge of the erosion control blanket into the trench then backfill and compact.
- Roll the blanket down slope slowly while inserting staples as per the manufacturers specifications or as required. To maintain sufficient contact with the soil, blankets should be kept loose and stretching should be avoided to ensure sufficient contact with soil.
- Staples or stakes should be spaced a maximum of 0.5 m apart on slopes steeper than 2H:1V and a maximum of 1 m on slopes shallower than 2H:1V.
- Overlap vertical joints at least 7.6 cm (3 in. to 4 in.) or per manufacturer's specifications. Staple through overlapped area a maximum of every 90 cm

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.

- Trim blankets as needed to optimize coverage.
- Erosion control blankets should be laid and stapled down on smooth, prepared surfaces, and maintain continuous contact with the disturbed soil surface.
This is especially important when using rigid materials. Failure to maintain contact will result in undercutting of the blanket causing mounding anderosion.
- Construction of a diversion berm at the top of the slope to collect and divert runoff will reduce the risk of undercutting and failure due to high runoff.

FOR ALL WATERCOURSE CROSSINGS PLEASE REFER TO CAPP GUIDELINE "PIPELINE ASSOCIATED WATERCOURSE CROSSINGS, LATEST EDITION"

Note: These are to be used as typical construction and erosion control techniques. Local conditions may result in modifications of these typicals with the objective of reducing environmental impacts.