



4.11 Construction (Operating Pipeline Excavation)

Alberta OH&S Code: *Part 32, Section 441-464*

Purpose

To provide an excavation procedure for Petro-Line personnel and representatives on excavation of client in-service pipelines.

This procedure is only a guideline and must be approved by clients in writing prior to implementation. Client Procedures or Standards must always take precedence and be adhered to.

Precautions

The stated precautions must be adhered to during all work.

1. Do not start or continue work without:
 - a. A competent hoe operator
 - b. A hoe with responsive controls
 - c. A competent guide
2. The operator must be familiar with the machine, experienced in excavation work, skilled in operating a backhoe and readily follows directions. Hoe controls have to be precise; erratic or slow response will make any operator ineffective and represents a risk that cannot be tolerated. In addition, the operator and guide must be familiar with and consistently use standard hand signals as a communication tool whenever the hoe is operated near the pipeline
3. A client representative will be in close proximity of the dig site for line exposure and while heavy equipment is operating within 600 mm of the line
4. The operating pipeline being excavated shall be located by hand or hydrovac to confirm depth and location within the right-of-way
5. If excavating near a foreign line, the line will first be located by the operating company. The line is to be exposed by hand or by hydrovac method if Line Crossing encroaches within the boundaries or the foreign line ROW. Locating the foreign line should be completed on both sides of the excavation in order to identify any changes in elevation or route within the work area
6. Keep vehicles well clear of the immediate dig site unless needed for excavation-related work. In that case, turn wheels away from excavation

Personnel

Supervisors, Employees, Client Personnel

Responsibilities

A. Client Personnel or Ground Disturbance Supervisor

1. Ensure all parties at the work site are familiar with the procedure and all precautions are reviewed during the job planning stage



2. Check for foreign line crossings, including Alberta One Call and Client Land Department. Ensure contact with landowners and foreign line operators who may not be members of Alberta One Call
3. Contact Control Centre if necessary prior to exposing lines they operate or control
4. Completed a Ground Disturbance as per procedure

B. Supervisors

1. Review and document work practices through the job to ensure adherence with this procedure and Provincial regulations (See Pre-Dig Excavation Checklist)
2. Review all the applicable regulations (OH&S, etc.) prior to beginning excavation work
3. Hold an on-site, pre-dig safety meeting to outline the work and precautions. (See Pre-Dig Excavation Checklist)

C. Construction Crew

Note: In winter, leave a snow cover on the line as long as practical to minimize frost penetration and allow easier probing.

1. Locate line with an electronic locator and flag. Never assume these are reliable depth or alignment measurements
2. Check for frost with probes. If no frost is present, probe and locate the line before the hoe begins digging by using grid pattern of less than $\frac{1}{2}$ the pipe diameter to ensure line delineation
3. If frost is present, pull off 30cm layers in area immediately adjacent to the line. Pull the frost layer off from over the line. Probe in a grid pattern after each layer is removed. Do not force probe entry by chipping
4. Locate the side of the pipe with two probes. Leave in approximately 4 meters apart to define pipe alignment
5. Position the hoe so the bucket pulls slightly away from the pipe. In soft terrain, use mats or position the hoe tracks at 90° from the line to safeguard against breakthrough
6. Keep the bucket within the boundary of the probes and at least 600 mm from the line. Excavate to a depth sufficient to accommodate sloughing material from the pipe. Hand expose the line with shovels if sloughing isn't adequate. Use extreme care until the pipe is exposed; never guess at the pipe location
 - Keep the excavation clear of all loose material and ensure the spoil pile is at least 1 meter away. If dig area is positively identified, spoil piles can be placed at the ends of the excavation, rather than the sides
7. Once the line is exposed, mechanical equipment can be used within the 600mm limit for the remainder of the excavation only if directed by the owner of the pipeline being encroached and with client approval. Ensure good hand signals are established between operator and guide per precautions
8. Once the trench reaches a depth of 1.5m, introduce a 45 back-slope to the excavation before permitting entry. Ingress/Egress must also be provided on both sides of the pipe. Using "chicken runs" hoe-prepared steps are recommended over ladders



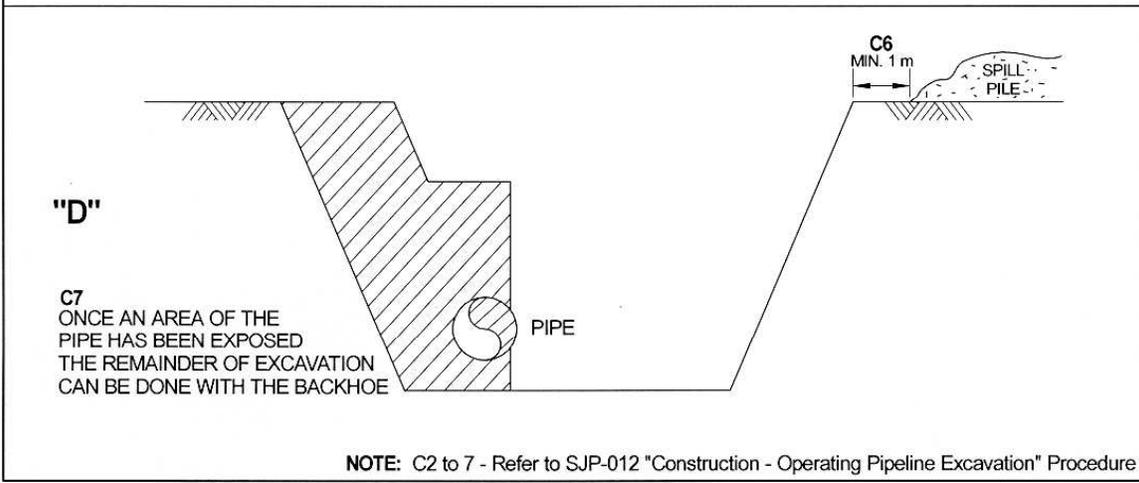
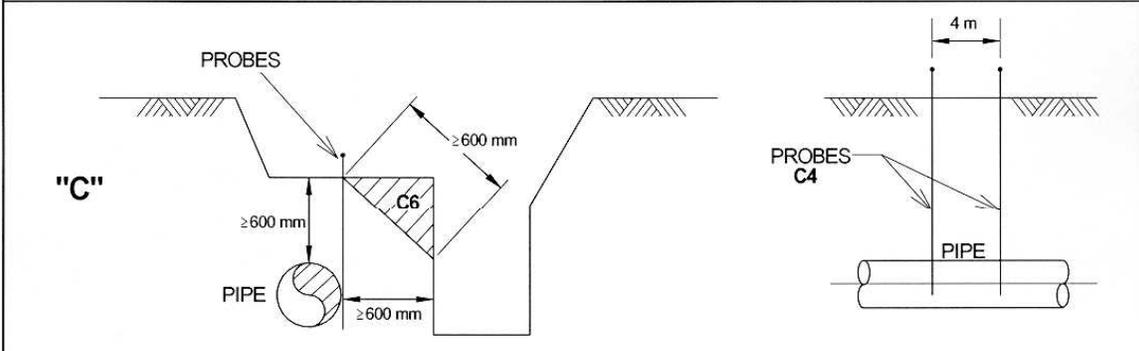
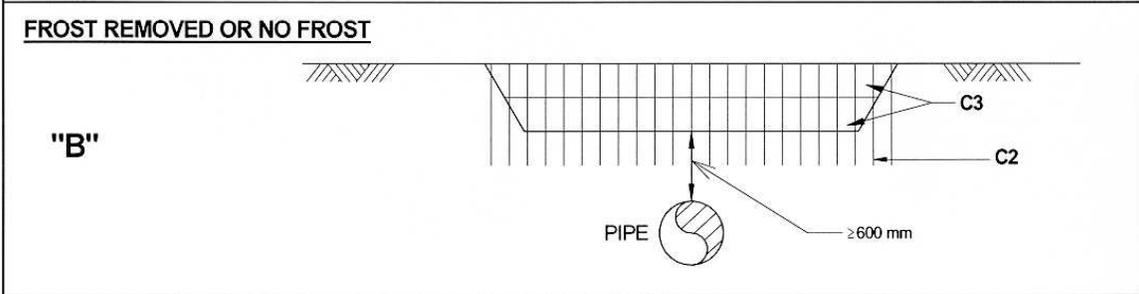
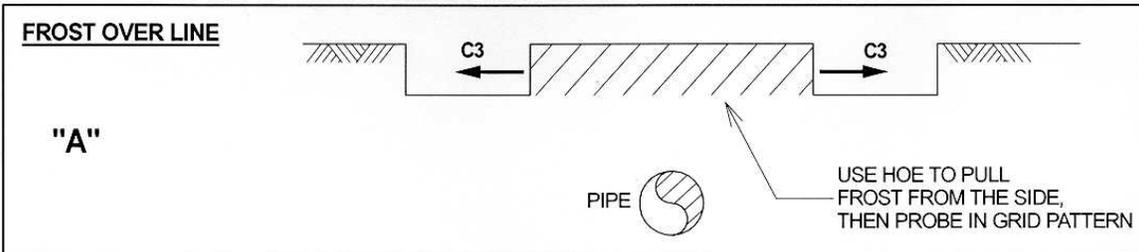
9. Minimize the length of line exposed without support. Maximum unsupported distances are as follows:
- 16" - 24" Diameter 8m (Max. Unsupported)
 - 10" - 12" Diameter 7m (Max. Unsupported)
 - 8" Diameter 6m (Max. Unsupported)
 - 4" - 6" Diameter 5m (Max. Unsupported)
10. A barricade, ribbon or plastic fence must be erected to prevent open access if the trench is left open with no one at the excavation site

Related Practices

Excavation procedures may vary depending on the company for whom the work is being completed. Refer to "Construction - Excavation & Trenching" for general excavation and trenching guidelines.



PIPELINE EXCAVATION PROCEDURES
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NOTE: C2 to 7 - Refer to SJP-012 "Construction - Operating Pipeline Excavation" Procedure

JULY 24, 2002



4.12 Winter Construction Excavation Supplement

Alberta OH&S Code: *Part 32, Sections 441-464*

Purpose

To provide a supplement to the excavation procedure for Petro-Line personnel and representatives on excavation of client in-service pipelines during winter conditions.

This procedure is only a guideline and must be approved by clients in writing prior to implementation. Client Procedures or Standards must always take precedence and be adhered to.

Precautions

The stated precautions must be adhered to during all work:

1. All Procedures for Excavations will be followed, this supplement is to address specific issues related to winter excavation programs
2. Temporary access work may be required to allow crews to enter to the site through potentially difficult terrain. Knowledge of the ground conditions is essential to ensure proper equipment is used to develop access trails. In areas where topography is unknown, utilize small wide pad equipment to prepare access trails. Monitor frost penetration in area to guide limits of snow plowing
3. Leave snow cover on pipeline to control the degree of frost penetration over the pipeline, only plow open areas of access for travel & parking
4. The operating pipeline being excavated shall be located by hydrovac on either end of the dig site to confirm depth and location within the right-of-way
5. If excavating near a foreign line, the line will first be located by the operating company. The line is to be exposed by hand or by hydrovac method if Line Crossing encroaches within the boundaries or the foreign line ROW. Locating the foreign line should be completed on both sides of the excavation in order to identify any changes in elevation or route within the work area. Ensure all agreements are in place prior to crossing any foreign lines to access the site
6. Keep vehicles well clear of the immediate dig site unless needed for excavation-related work. In that case, turn wheels away from excavation

Personnel

Supervisors, Employees, Client Personnel

Responsibilities

A. Client Personnel or Ground Disturbance Supervisor

1. Ensure all parties at the work site are familiar with the procedure and all precautions are reviewed during the job planning stage
2. Check for foreign line crossings, including Alberta One Call and Client Land Department. Ensure contact with landowners and foreign line operators who may not be members of Alberta One Call
3. Completed a Ground Disturbance as per procedure



B. Supervisors

1. Review and document work practices through the job to ensure adherence with this procedure and Provincial regulations (See Per-Dig Excavation Checklist)
2. Review all the applicable regulations (OH&S, etc.) prior to beginning the access and/or excavation work
3. Hold an on-site safety meeting to outline the work and precautions

C. Construction Crew

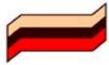
1. Review dig site maps and plotted location of digs sites to determine the most favourable route for access
2. Review topography of area and marshal appropriate equipment to prepare access
3. Begin plowing access, monitoring frost penetration, Do Not Expose the right of way over the operating pipeline
4. Leave a snow cover on the line as long as practical to minimize frost penetration and allow easier probing
5. At the dig site locate line with an electronic locator and flag. Never assume these are reliable depth or alignment measurements. As defined in the Precautions (4) the operating line will be exposed using Hyrdovac at each end of the excavation to validate the depth and alignment of the pipeline to be excavated
6. Check for frost with probes. If no frost is present continue with the Excavation Procedure
7. If frost is present, using the excavator and digging bucket with Tiger Teeth Scratch the frozen earth in 30cm layers in the areas parallel to the line (approximately 1 m on either side of the center line of pipeline). Once the frozen earth is broken up, remove the earth with the excavator bucket. Continue Scratching and then Excavating on either side of the pipeline until below the frost level (Diagram "A"). Once excavated below the Frost level, Use the Excavator perpendicular to the pipeline, carefully pulling the frost layer up and off the line by placing the bucket on one side trench and sliding the material into the opposite side trench (C3). It may be necessary to Hydrovac a slot(s) perpendicular to the pipeline to allow controlled pulling of manageable sizes of frozen material by the excavator. Probe in a grid pattern after each layer is removed. Do not force probe entry by chipping
8. For regions where topsoil conservation is critical, it may be necessary to employ frost pulverizing equipment. The pulverizing equipment shall chip frost in Controlled depths of no greater than 30cm layers. Where employing Frost Pulverizing equipment the following steps should be taken:
 - Confirm the equipment is suited for the **Controlled** removal of Frost
 - Equipment must be able to maintain desired depths of chipping
 - Equipment to be inspected for damage or wear
 - A Competent Experienced Operator shall be employed
9. Frozen material removed from the dig area shall be stock piled in accordance with the Excavation Procedure
10. Excavation will continue utilizing the Excavation Procedures



11. Once the site is ready for **backfill** additional considerations are needed for winter construction:
 - a. Where possible minimize the time the excavation is open and spoil pile has the opportunity to freeze
 - b. During backfill break apart the spoil pile to use selected unfrozen material to fill around the pipe
 - c. Gently compact the material around the pipe, do not compact frozen earth on the pipeline. Continue to backfill with fine backfill material as much as possible
 - d. Once the excavation is filled with fine material to a minimum of 30cm over the pipe, carefully place frozen material in trench to complete the backfill
 - e. Topsoil placement and final clean up will be done during the spring/summer season

Related Practices

Excavation procedures may vary depending on the company for whom the work is being completed. Refer to “Construction - Excavation & Trenching” for general excavation and trenching guidelines.



4.13 Construction (Excavating & Trenching)

Alberta OH&S Code: *Part 32, Sections 441-464*

Purpose

To protect workers from hazards associated with general excavating operations where the excavation walls are vertical or nearly so, including trench excavations.

Hazards

The principle hazard of excavation work is death by suffocation or crushing from falling soil. Workers are also subject to the following hazards:

1. Falls when climbing into or out of the excavation
2. Toxic, irritating or flammable gases
3. Muddy or slippery conditions, which increase danger of slips and falls
4. Increased chance of being struck by objects because the workplace is congested
5. Exposure to broken utility lines (electricity, water, steam, natural gas, or other product)
6. Health hazards from the presence of silica dust, methane or other toxic or flammable gas; oxygen deficiency; or poisonous or irritating substances
7. Being struck by moving equipment
8. Back injuries from incorrect lifting of a hand probe

Public hazards include:

1. Falling hazards due to unguarded or unlighted excavations and inadequate barricades, fences and warning signs
2. Damage to nearby structures, streets or highways, public walks, utility installations or any other adjacent property because of soil changes

Personal Protective Equipment

Excavation workers must wear or have available the following personal protective equipment (PPE):

1. Standard Petro-Line work wear and personal protective equipment
2. In deep excavations, safety lines and belts may be required
3. Respiratory and resuscitation equipment, if necessary
4. Fire retardant clothing if working around existing operating pipelines

Training

Employees are to be carefully selected for excavation work. Both new and longer term employees should be made aware of all hazards of the job.

When locating buried structures, only properly trained personnel may use electronic line locating equipment. This is especially critical in congested areas where a line may or may not exist.



Guidelines - “General Excavation”

1. Before starting any excavations:
 - a. Refer to and follow the Code of Practice “Ground Disturbances” for performing any ground disturbances
 - b. Ensure a safe work permit is issued if required
 - c. Survey for and mark existing utility lines (power, sewage, gas). Contact all public utility companies, municipal departments and private owners for information on underground facilities. (See Locating and Marking Buried Structures, later in this procedure)

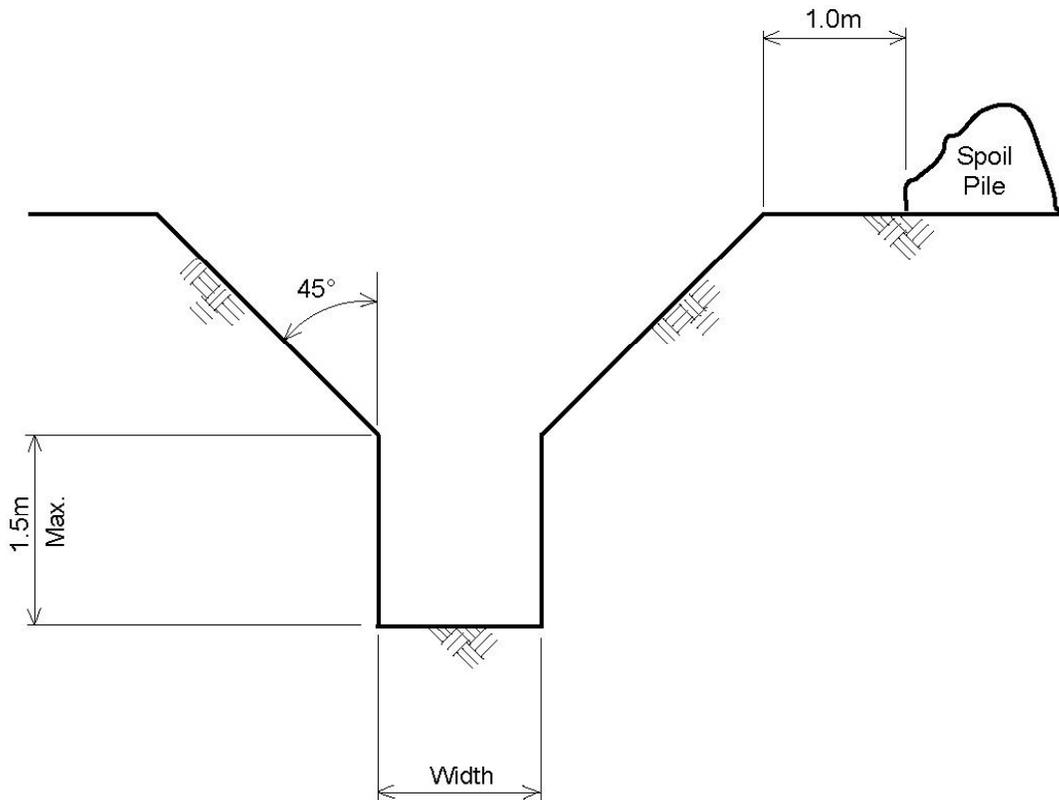
NOTE: All buried lines or structures must be hand exposed or hydrovac exposed.

2. In order to protect utility lines when excavating, ensure a utility representative is present. Arrange for disconnections or protecting service on both above and below ground service lines if required
3. Ensure that all oil and gas flow lines are identified and marked, and all company and OH&S regulations are followed
4. Regularly test and maintain excavation equipment such as cranes, shovels, draglines and trucks
5. Use the recommended system of shoring and bracing and maintain it at designed strength
6. Correction or reinforcement is required if one or more braces have moved or buckled, or if any sheeting or walls bulge or bend. Check closely after washouts or heavy rains. If the stability of adjoining walls or buildings is endangered, the shoring, bracing or underpinning should be inspected daily or as conditions warrant
7. Keep excavated material, equipment, trucks and other loads back from the edge of an excavation a distance equal to one-half the depth of the excavation. This helps to prevent soil stress
8. To control shock and vibration:
 - a. Use light hammers for pile driving
 - b. Eliminate unnecessary movement of heavy equipment
9. Frequently inspect excavation for evidence of impending failures
10. Install handrails, barricades, toe boards, fences and warning signs to minimize the hazards
11. In areas accessible to the public, consider using guard service, traffic controls and the assistance of local law enforcement authorities
12. Install ladders, stairways or ramps for entry and exit in every excavation 1.3m (4 ft.) or more in depth. The number and spacing of these installations should allow every worker in the excavation to be no more than 7.6m (25 ft.) from one of them. If ladders are used, their tips should extend 0.9 meters (3 ft.) above the ground level
13. Provide adequate illumination for every area of the job. For night work, install appropriate warning signs where special hazards exist
14. Take every precaution to minimize congestion of the work place and the dangers resulting from the movement of workers and equipment



Trench Excavation

A trench is a narrow excavation where the depth is greater than the width, and the width is not greater than 4.5m (15 ft.). For trench excavation, all safety precautions for general excavation apply, as well as those listed below.



* Always check provincial regulations to confirm the safe trenching requirements

FIGURE 1. Typical Sloped Trench

Shoring - Conventional

1. Properly shore the walls of the trench to prevent soil failures
2. A trench box or sliding trench shield may be used where line installation closely follows the trencher and where trench walls may cave in after line installation

Using Machines

1. Take special precautions where soil is removed by machine:
 - a. Keep the machine level to prevent undercutting the trench walls



- b. Keep shoring as close as practical to the machine. If the set-up is improperly arranged, the hoist or bucket may strike the bracing and damage it. In mechanically excavated trenches, all connections should be bolted
2. When internal combustion engines are used in or near trenches, prevent exhaust gases from entering the trenches

Gaseous Areas

1. Where trenches cross old gas mains, sewers or soil saturated with offensive organic material, artificial ventilation may be necessary
2. Where explosive, flammable or toxic gas is suspected, qualified personnel must test for the need for ventilation
3. To provide ventilation, use portable blowers equipped with canvas tubes for carrying air to the necessary points
4. Where flammable gases are suspected, do not use equipment that produces sparks or has open flames

Storing Excavated Material

Where personnel are required to enter or work in an excavation, store the excavated material at least 1m (3 ft.) from the edge of the excavation. The amount of soil to be removed, as well as the nature of the soil structure, will determine how far back from the edge of the trench the soil must be piled. When super-imposed loads or equipment are within the limiting plane of rupture, increase shoring to withstand the additional pressures.

Supporting Utility Lines

If sewer lines and drains, usually of bell-flange tile construction, are to remain undisturbed, they must be supported along all the exposed area. Support of conduits, power cables or metal pipes depends on the actual lengths exposed.

Dismantling Shoring

1. Where excavation is carried on near buildings or roads, leave the sheeting in place after cutting it off flush or below ground level and then fill in the trench. This practice prevents the possibility of soil settling and cracking building foundations
2. Dismantle systematically from the bottom upward by:
 - a. Pulling out braces from above with lifting jacks that will take up the strain of wedged timber cross braces, making removal easy
 - b. Very slowly releasing the strain on the jacks, taking into account the condition of the side walls
 - c. Back-filling carefully immediately following the removal of shoring
3. Carefully inspect for defects any steel sheeting or other types of shoring that are to be reused. Discard shoring that has even a minor defect

Locating and Marking Buried Structures

Electronic pipe detectors/locators or other equipment are a useful aid to identify pipeline routes, but should NEVER be used in place of proper hand or hydrovac locating and probing. When using this equipment, delectability of buried pipe is dependant upon:



- a. Size of pipe
- b. Depth of pipe
- c. Polarization: length of time pipe has been buried
- d. Whether pipe is coated or bare: bare metal is more difficult to locate
- e. Interference of other buried structures in the immediate vicinity
- f. Interference of overhead power lines
- g. Presence of ice and water, which can cause erratic depth locations

Using Pipe Locators

See the instruction manual or consult a trained expert.

Hand or Hydrovac Excavation

Use hand or hydrovac excavation to locate buried structures:

- a. When their location is not known and cannot be determined with a pipe locator
- b. When survey plans indicate a buried structure, yet it cannot be located
- c. In conjunction with a excavator

Marking Structures

1. Define the location of a structure with a flagged lath. Indicate on the lath the type and depth of the buried structure
2. Use colored flagging on stakes as follows, make all aware of the what the colors represent:
 - Boundaries of old and new ROW = Orange
 - Existing pipeline = Yellow
 - New ditch line = blue
3. If the structure has straight alignment, space the lath at a maximum of 30m (100 ft.) intervals
4. If the structure has meandering alignment, space the lath with spacing as to clearly define the location
5. To define a buried structure crossing, set a crossed lath over the point where the crossing exists
6. Ensure that identifying stakes are up-to-date or have not been destroyed, especially if construction requirements have changed

Pipeline and Cable Crossings

1. Ensure the entire width of the right-of-way to be crossed is surveyed and checked by trained personnel with a line locator for known or unknown lines
2. Ensure foreign pipeline crossing(s) are identified and:
 - a. The appropriate personnel of that company are sufficiently notified
 - b. A letter of agreement is in place with Public Lands and the company involved



3. Ensure the crossing agreement received from the owner outlines all excavation details, and the Owners agree on crossing locations
4. As a minimum, notify pipeline owners 48 hours in advance of excavating lines. Recheck the complete right-of-way for location of line(s) before beginning any work
5. All workers must be informed of excavation procedure in case an incident occurs
6. Before beginning work ensure that:
 - a. All lines to be exposed are clearly marked with fluorescent tape
 - b. All lines have been located and their depths determined.

Hand or Hydrovac Excavating

1. All pipelines and cables must be exposed by hand:
 - a. Before any excavation equipment comes within 5 m (16 ft.) of the pipeline or cable
 - b. To 60 cm (2 ft.) on either side of the line or cable for pipeline R.O.W. crossings, or 150 cm (5 ft.) for plant pipeline crossings to a depth of the new ditch. The distances above can only be changed if written permission has been provided by the pipeline Owner
 - c. Whenever the location of the buried lines or cable is in doubt
2. Excavation procedures may vary depending on the company that the work is being completed for. Refer to procedure on "Operating Pipeline Excavation" for an option of excavating operating pipelines. Remember that this procedure must be approved in writing by the Owner prior to any work commencing using the "Operating Pipeline Excavation" Procedure
3. Ensure the new line is a minimum of 30 cm (1 ft.) below the existing pipeline or cable. For additional requirements on foreign line crossings, refer to the crossing agreement with the pipeline owner
4. If possible, dig perpendicular to the buried pipeline

Acts, Regulations and Standards

For more information on trenching and excavating, refer to applicable provincial Occupational Health & Safety regulations.