

Health and Safety Procedure

Document Title:	Ground Disturbance – Excavation Procedure
Approver:	
Document Owner:	
COIMS Element:	9 Safe control of work
Document Number:	0003-000005
Issued Date:	June 13, 2022
Review Cycle (years):	3

Version	Description
1.0	Issued for release

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1 Purpose

The purpose of this procedure is to define Cenovus's requirements regarding excavations to support safe execution of excavation and trenching and/or to verify that the working procedures of service providers meet Cenovus's requirements.

This procedure provides detailed overview of the ground disturbance excavation process and the required activities to achieve compliance with local regulatory requirements and/or conformance with the COIMS Framework and/or the corporate ground disturbance standard.

2 Application

This procedure applies to all COIMS Entities accountable and responsible for planning and/or executing ground disturbance damage prevention activities within Cenovus' operations in Western Canada. This includes, but is not limited to: Conventional, Cold/EOR, HOG, Thermal, Downstream, and Marketing (Retail).

3 Intended audience and roles

Table 1: Intended audience and roles

Role	Assignment considerations	Possible positions
Ground Disturbance Supervisor	The primary responsible individual, competent in the execution of Cenovus and Industry ground disturbance expectations.	Site Supervisor Operations Personnel Work Site Leader (WSL) Front Line Supervisor (FLS) Construction Site Representative (CSR) Cenovus Representative
Contractor	Companies and or individuals competent in the execution of the designated responsibilities.	General Contractor Line Locator Contractor Excavation Contractor Hydrovac Contractor Excavation Equipment Owners/Operators Involved Personnel

4 Requirements

4.1 Excavation and trenching defined

Excavations are a cut, cavity, trench, or depression in the earth's surface resulting from rock or soil removal. Excavations can be achieved by hand-digging, hydrovacating, and/or the use of heavy equipment. Regardless of means of removal, all excavations should have safeguards in place that prevent cave-ins and material sloughing into the cavity.

Trenches are a form of excavations where the depth is greater than the width at the bottom. An increased risk of cave-ins is associated with trenches and therefore, require additional safeguards (i.e., trench cages, sloping, shoring etc.).

4.2 Excavation pre-planning requirements

A Ground Disturbance Supervisor, Ground Disturbance Technician or designate is designated by the business function to supervise the excavation operations.

It is the responsibility of the Ground Disturbance Supervisor to ensure the following pre-planning requirements for excavation operations are completed:

- a hazard assessment and safe work permit is completed
- methods of soil stabilization and worker protection (e.g., shields, box, cage, bracing, sheeting) used meet provincial/local regulations
- conduct a safety meeting with all involved workers where the following topics are discussed:
 - a review of potential hazards, safe work procedures, and other standard requirements
 - vehicular and equipment traffic control and barricades
 - emergency response and rescue procedures
- Provincial/state occupational health and safety may need to be notified for excavations deeper than five (5) meters.

4.3 Excavation field execution requirements

It is the responsibility of the Ground Disturbance Supervisor to ensure the following minimum requirements for excavation operations are completed:

- Review of potential hazards, safe work procedures, rescue procedures and other standard requirements.
- Ground shall not be disturbed until buried facilities have been identified and their locations marked.
- Secure structures adjacent to the excavation such as buildings or posts, so that there is no movement due to instability from material removal.
- Scale or trim loose material to prevent material from falling into the excavation.
- Install barricades so that all sides of the excavation prevent workers or equipment from falling or rolling into the excavation. Devices used as barricades shall clearly mark, block, or safeguard against unnecessary or accidental entry into a trench or excavation. The

solution shall be effective, and its purpose clearly understood by all workers. Examples of barricades include but are not limited to:

- aligned concrete blocks
 - erected snow fencing
 - guardrails
 - piles of excavated material
 - hoarding
 - total enclosure
- Ensure a safe means of excavation entry and exit (e.g., ladders, stairs, ramps). A means of safe exit from the excavation shall be no more than 8 meters (25 feet) away from workers.
 - Prevent water from accumulating inside the excavation and remove promptly. Where water has accumulated or used for excavating purposes (e.g., hydrovacating) the stability of the soil shall be assessed and additional controls put in place, if applicable.
 - Provide adequate lighting inside the excavation including the illumination of barricades.
 - Install appropriate ventilation based on atmospheric hazards present and the work conducted in the space.
 - Atmospheric testing shall be completed in accordance with the confined space and hot work standards.
 - When required, ensure trench crossways are at a minimum 50 centimeters in width and are equipped with guardrails and toeboards.

4.4 Excavation and trench entry/egress

Before a worker enters or begins working in an excavation greater than 1.2 meters in depth, all necessary precautions are taken to protect those individuals from cave-ins, excavation wall collapse and sliding and/or rolling materials.

Workers shall not enter in excavations where water has collected or is collecting unless the necessary controls are in place. Controls may include, but not limited to:

- temporary protective structures
- cut-back/benching
- dewatering techniques
- excavation pre-entry checklist

Access/Egress

A safe means of access and egress shall be provided for those individuals entering and excavation.

The access and egress point shall be no more than eight (8) meters away from any worker. Temporary protective structure components should never be used a means of access or egress from the excavation.

When ladders are utilized, they shall:

- meet the appropriate Canadian Standards Association (CSA) Standard
- shall only be painted with transparent materials (wooden ladders)
- extend one (1) meter above ladder access point / ground level
- be secured for stability at both top and bottom

4.5 Soil classification

Soil classification is vital to ensure soil is stable for safe work. Correct classification helps determine the best method to control soil instability and the method of protection. Find detailed descriptions of the soil types and their characteristics: Appendix A: Alberta and British Columbia Soil Types.

The Functional Leader and/or Ground Disturbance Supervisor shall identify and designate a competent person in the classification of the soil type at the excavation site. The soil classification may be provided in a geotechnical report or study.

There may be more than one soil type in one excavation area. Ensure that the method of protection selected addresses the least stable type.

4.5.1 Methods of protection and soil stabilization

The hazard assessment, the location of the excavation, and its soil type will determine the method for stabilizing the soil and protect workers and equipment in and in proximity of the excavation.

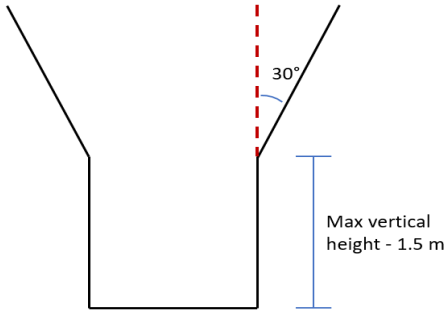
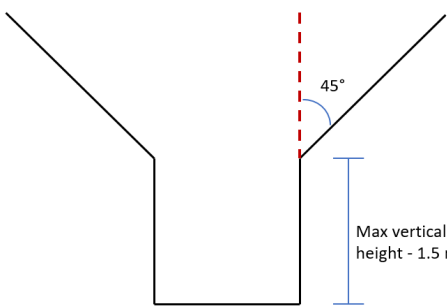

Temporary protective structures shall be designed and/or certified as safe by a Professional Engineer and installed, used, maintained, and dismantled in accordance with that design

Table 2: Methods of protection and soil stabilization

Methods	Description
sloping (a.k.a. cut back)	The removal of material from the banks of an excavation at an angle to stabilize the ground. Requirements for sloping in sections 4.5.2 and 4.5.3.
benching	The removal of material from the banks of an excavation to stabilize the ground. This can be a single or multi-bench system. Requirements for benching in sections 4.5.2 and 4.5.3.
trench box	Trench boxes are primarily designed to prevent cave-ins and to protect the workers. Often used in combination with sloping and benching as these methods are used to stabilize the ground.
shoring (a.k.a. shielding)	The mechanical means of preventing an excavation wall from moving or shifting by supporting the trench face. Where sloping is not a feasible means of protection due to the depth of the excavation or the proximity of structures, shoring can be utilized. Requirements for shoring is in section 4.5.4 Shoring systems.
artificial stabilization techniques	Examples include freezing or grouting (injecting a chemical or cement in soil voids). These artificial methods shall be designed by a Professional Engineer and installation shall follow all specifications. Natural freezing is subjected to fluctuation and it is NOT a method of protection. Additional methods shall be implemented.

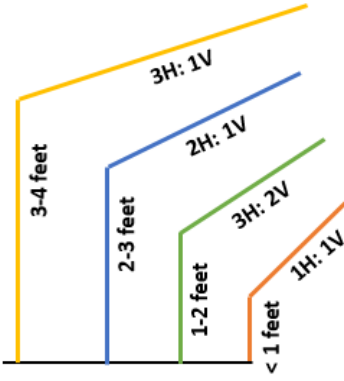
4.5.2 Alberta sloping and benching requirements

Table 3: Alberta sloping and benching requirements

Soil type	Sloping	Benching
Hard/ Compact Soil		<p>Max height for vertical rise is 1.2 m</p> <p>Slope (ratio) = rise 1, run 0.75</p> <p>Max depth of bench from base of excavation is 6.0 m</p>
Likely Crack/ Crumble		<p>Max height for vertical rise is 1.0 m</p> <p>Slope (ratio) = rise 1, run 1</p> <p>Max depth of bench from base of excavation is 6.0 m</p>
Soft, Sandy, or Loose		<p>Not suitable</p>

4.5.3 British Columbia sloping and benching requirements

Table 4: British Columbia sloping and benching requirements

Soil type	Sloping	Benching
A: hard/ compact soil	 <p>H: horizontal run, V: vertical rise</p>	<p>maximum height for vertical rise is 1.2 m</p> <p>runs minimum horizontal length is 1.2 m</p> <p>maximum depth of bench from base of excavation is 6.0 m</p>
B: likely crack/ crumble	<p>Horizontal run of 3 units to a vertical raise of 1 unit (H3:V1). Steeper slopes require written instruction from a professional engineer.</p>	<p>written instruction from professional engineer</p>

4.5.4 Shoring systems

When shoring is deemed the appropriate safeguards against cave-ins and sloughing, the following shall be followed:

- When using lumber and timber for shoring, ensure material meets provincial regulations.
- Shoring components are to be installed from the top of the trench working downwards to the base of the trench.
- Removal of shoring components will be in reverse order of installation unless ground conditions have deteriorated. Shoring will then be removed without workers entering the space (e.g., cranes).
- Shoring systems shall be installed in firm contact with the excavation face and voids shall be backfilled or blocked, unless noted by the manufacturer.
- Ensure prefabricated shoring including bracing is constructed and installed in accordance with engineering designs and specifications and installation follows the appropriate provincial’s legislation.

TRENCH CAGE

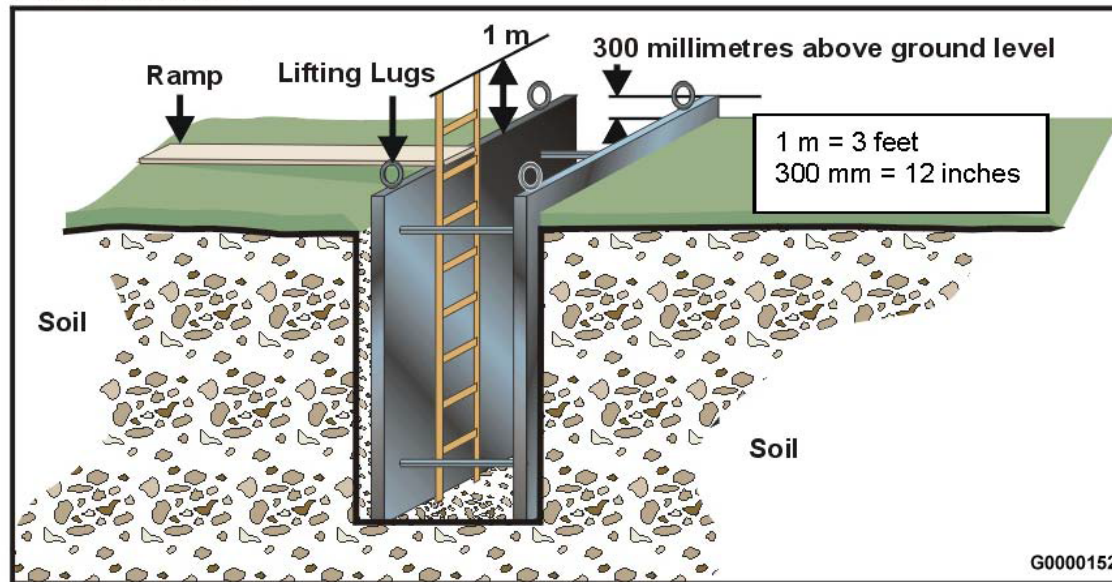


Figure 1: Example of trench cage

4.6 Heavy equipment

Heavy equipment and loads (excluding spoil piles) shall be no closer than the distance equal to the depth of the excavation unless deemed safe by a hazard assessment.

When heavy equipment operates near an excavation edge and within a distance equal to the depth of the excavation, additional safeguards are necessary to compensate for the vibration and weight of the machinery. The following points should be considered:

- keep the equipment and machinery level on solid footing to prevent sliding or tipping into the trench or excavation
- change the slope angle, the work process, or both, to strengthen the trench wall. Cutting away or benching will provide adequate strength
- place support mats along the opening for the machinery to work from
- have rollover protection on the unit and the operator shall wear a seat belt
- when backhoes/ track hoes are being used, workers in the excavation shall not be within the full reach of the equipment when operational
- the open side(s) of an access route into an excavation or bridge way used by mobile equipment shall have a curb

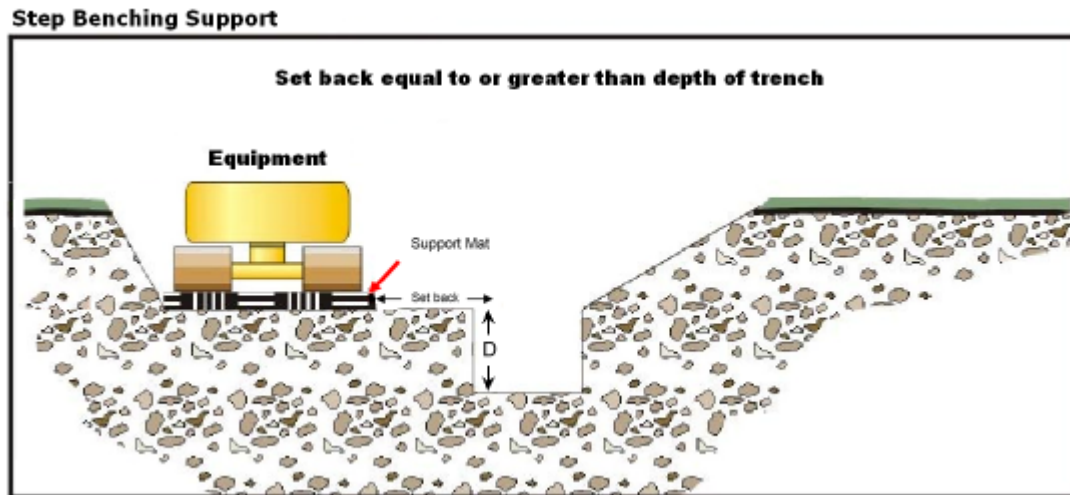


Figure 2: Heavy equipment setback

4.7 Spoil piles

The hazard assessment associated with the excavation shall take into consideration the following regarding spoil piles:

- the soil type and amount of soil to be removed to determine the required space needed to store the material
- ensure the spoil pile remains at least one (1) metre from the edge of the excavation in Alberta and 60 centimetres from the edge in British Columbia
- ensure the slope of the spoil pile adjacent to the excavation does not exceed 45° from the vertical
- additional safeguards may be required when piles are more than 60 cm (2 feet) in height

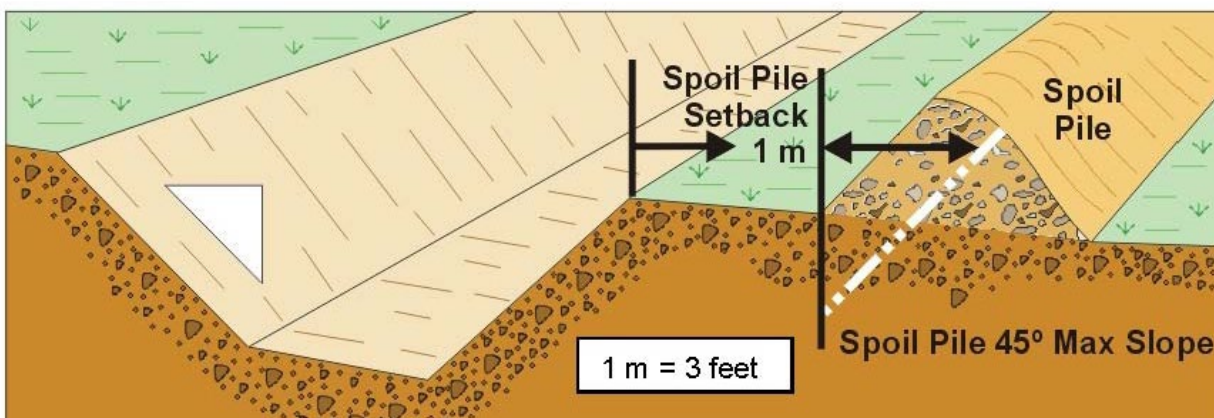


Figure 3: Spoil piles

*This figure demonstrated Alberta legislation. BC legislation requires the spoil piles to be at least 60 centimetres (2 feet) away from the edge of the excavation.

4.8 Restricted or confined space

An excavation that exceeds 1.5 m shall be considered at a minimum a restricted space (Alberta). The Issuing Authority with assistance from the Ground Disturbance Supervisor will determine if the space will be a confined space (Alberta and British Columbia). Atmospheric testing shall be completed according to the confined space and hot work standards.



An excavation shallower than 1.5 m has the potential to be considered a confined space based on the hazards present in the space. See Confined Space Entry Standard for more details.

4.9 Managing work conditions or scope changes

The Ground Disturbance Supervisor shall continuously monitor the worksite for any working conditions or scope changes.

Any changes in working conditions or work scope will result in the immediate suspension of the safe work permit. Upon suspension, all work associated with that permit shall stop. The related hazard assessment shall be revised to evaluate the changes for new hazards, and the appropriate hazard controls shall be implemented.

4.10 Backfilling guidelines

All backfilling notifications shall comply with ground disturbance standard and ground disturbance procedure. Backfill material should be free from garbage, construction waste, contaminated soil, and large rocks. Backfill compaction, if allowed, will be in accordance with the backfill procedure and the contract's specifications to prevent undesired displacement of backfilled material and facility.

5 Training

All Cenovus and contract staff who are involved in any ground disturbance activities are required to possess and be readily available to provide proof of valid training certification from a course provider that is endorsed by the Utility Safety Partners (formerly the Alberta Common Ground Alliance {ABCGA}). All other training certificates for ground disturbance are not recognized on a Cenovus worksite.

Table 5: Training requirements

Role or description of role	Requirement
Workers involved in any type of ground disturbance activity, excluding supervision. Workers with this level of training shall always be working under the direct supervision and guidance of a supervisor who has a valid ground disturbance supervisory (Level 2) certificate.	Ground Disturbance 101 (Level 1)
Anyone who is involved in the supervision of a ground disturbance activity.	Ground Disturbance 201 (Level 2)

6 Related information

6.1 Glossary of terms

Table 6: Terms and abbreviations

Term or abbreviation	Details
buried facility	<p>All below ground infrastructure, including but not limited to:</p> <ul style="list-style-type: none"> • pipelines (regardless of status) • cables • conduit • well bores (slant well path) • abandoned well casing • tanks • piles • foundations • utilities • irrigation <p>Does not include waste and/or scrap material.</p>
competent	A person who is adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision.
confined space	An enclosed or partially enclosed space that is or may become hazardous to the worker entering the space because of atmospheric hazards, a condition or changing circumstances within the space, or the potential or inherent characteristics of an activity that can produce adverse or harmful consequences within the space.

excavation	Cut, cavity, trench or depression in the earth's surface resulting from rock or soil removal.
ground disturbance activity	<p>Any work, operation, or activity on or under the existing surface resulting in a disturbance or displacement of material. An activity is not considered a disturbance or displacement if it is the result of the following:</p> <ul style="list-style-type: none"> • routine, minor site maintenance • cultivation to a depth of less than 45 cm with agricultural equipment below the grounds surface over a pipeline, or • minor surface work not more than 30 cm below the grounds surface, where it does not permanently remove cover over a buried facility <p>Minor surface work activities can include grass seeding, minor spill clean-up and marker post anchor installation.</p>
restricted space	An enclosed or partially enclosed space, not intended for continuous human occupancy, that has a restricted, limited, or impeded means of entry or exit because of its construction.
spoil pile	Material excavated from an excavation or trench.
temporary protective structure	A structure or device designed to provide protection in an excavation or trench from cave-ins, collapses, or sliding or rolling materials and includes, but is not limited to shoring, bracing, piles, planking, cages, boxes, trench shields, engineer approved.
temporary protective structures - trench shield	<p>A Professionally engineered device to protect workers from against a collapse of the excavation. The trench shield can withstand a collapse without buckling.</p> <p>A trench shield should not be confused with a shore. While they may serve the same function, trench shoring is a different physical application that holds up the walls of a trench to prevent collapse.</p>
temporary protective structures - trench shoring	A professionally engineered device to prevent against of collapse by maintaining positive pressure on the sides of the excavation, protecting workers the excavation and surrounding structures and foundations.
trench	A long, narrow dug out area of ground that is deeper than its width at the bottom. All trenches are excavations.
work area	The physical geographic location the ground disturbance activity is being undertaken.

6.2 References

Table 7: Internal governing references

Document name	Description
COIMS Framework	Element 9 Safe Control of Work
Ground Disturbance Standard	Corporate Ground Disturbance Standard
Ground Disturbance Procedure	Corporate Ground Disturbance Procedure

Table 8: External governing references

Document name	Description
Alberta Energy Regulator (AER)	Alberta Pipeline Act
Alberta OHS Act, Regulation, and Code	Part 32 Excavating and Tunneling
Canadian Energy Regulator (CER)	Pipeline Damage Prevention Regulations
WorkSafe BC	Part 20 Construction, Excavation, and Demolition

Table 9: Other references

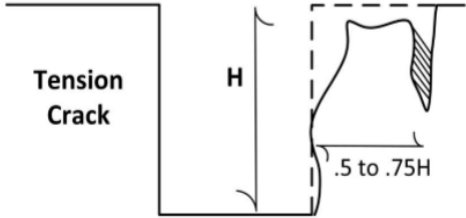
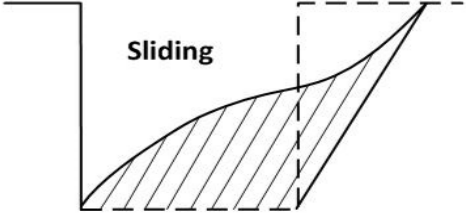
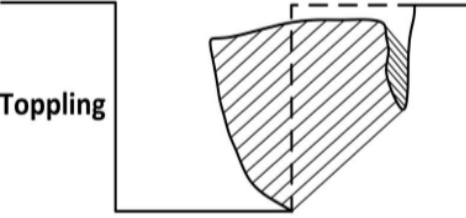
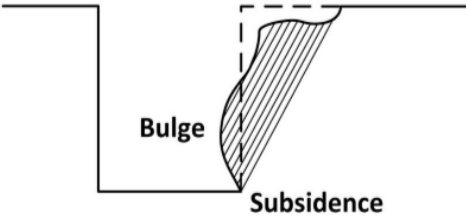
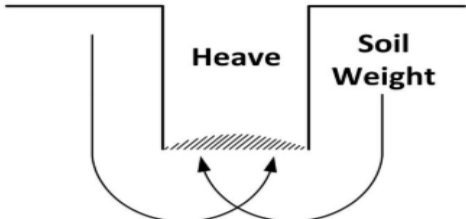
Document or tool name	Description
Utility Safety Partners	Utility Safety Partners
Canadian Common Ground Alliance	Underground Infrastructure Damage Prevention
Energy Safety Canada	Ground Disturbance and Damage Prevention: A Program Development Guide

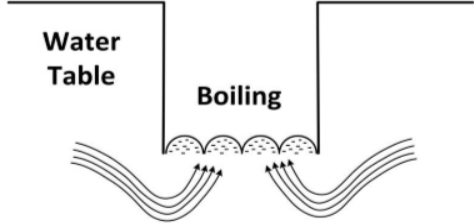
Appendix A: Alberta and British Columbia soil types

Soil characteristics	Soil type		
	Hard and compact soil	Likely to crack and crumble soil	Soft, sandy or loose soil
Consistency	Hard, very dense in compactive condition	Stiff, compact in compactive condition	Firm to very soft, loose to very loose in compactive condition
Ability to penetrate	Only with difficulty by a small, sharp object	With moderate difficulty with a small, sharp object	With ease
Appearance	Dry	Damp after it is excavated, has low to medium natural moisture content	Appears solid but flows or becomes unstable when disturbed. Can be dry, running easily into a well-defined conical pile, or wet
Ability to excavate with hand tools	Extremely difficult	Moderately difficult	With ease
Water seepage	Shows no signs of water seepage	Shows signs of localized water seepage	
Other	Does not include previously excavated soil	Shows signs of surface cracking	<ul style="list-style-type: none"> ▪ Is granular soil below the water table, unless the soil has been dewatered ▪ Exerts substantial hydraulic pressure when a support system is used

Note: These soil type definitions are copied from Alberta's *Occupational Health and Safety Code 2009 Explanation Guide*, Part 32, Section 442.

Appendix B: Common causes of excavation failure

Common forms of excavation failures	Description
 <p>The diagram shows a cross-section of an excavation of height H. A vertical crack is shown on the right wall. A dashed line indicates the failure surface, which is a vertical line extending from the top of the crack down to the bottom of the excavation. The horizontal distance from the edge of the excavation to the crack is labeled as $.5 \text{ to } .75H$.</p>	<p>Release of solid material from the excavation wall due to the tension.</p>
 <p>The diagram shows a cross-section of an excavation. A shaded area represents a mass of soil that has moved downwards and outwards from the excavation wall, following a curved failure surface.</p>	<p>Sliding - The downward and outward movement of a defined mass. Sloughing – the release of material from the surface, usually due to drying and cracking, or freezing and thawing.</p>
 <p>The diagram shows a cross-section of an excavation. A shaded area represents a mass of soil that has sheared along a vertical failure surface and is toppling into the excavation.</p>	<p>The trench's vertical face shears along the tension crack line and topples into the excavation</p>
 <p>The diagram shows a cross-section of an excavation. A shaded area on the right wall is labeled 'Bulge'. Below the excavation, a shaded area is labeled 'Subsidence'.</p>	<p>An unsupported excavation can create an unbalanced stress in the soil and can cause subsidence at the surface and bulging of the vertical face of the excavation.</p>
 <p>The diagram shows a cross-section of an excavation. A shaded area at the bottom of the excavation is labeled 'Heave'. An arrow labeled 'Soil Weight' points downwards from the top of the excavation, indicating the downward pressure causing the heave.</p>	<p>Bottom heaving or squeezing is caused by the downward pressure created by the weight adjoining soil. This pressure can cause a bulge in the bottom of the excavation. Can occur even when shoring or shielding is in place.</p>

 <p>The diagram illustrates the phenomenon of boiling in an excavation. It shows a cross-section of a cut with a high water table. Arrows indicate water flowing upwards from the water table into the bottom of the cut, labeled 'Boiling'.</p>	<p>Boiling is evidenced by an upward water flow into the bottom of the cut. A high-water table can cause this, and it can occur even when shoring and shielding is in place.</p>
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