SKILLEDTRADESBC

PROGRAM OUTLINE

Geotechnical/Environmental Driller

SKILLED TRADES BC

The latest version of this document is available in PDF format on the SkilledTradesBC website
www.skilledtradesbc.ca

To order printed copies of Program Outlines
or learning resources (where available)
for BC trades contact:

Crown Publications, Queen's Printer
Web: www.crownpub.bc.ca
Email: crownpub@gov.bc.ca
Toll Free 1 800 663-6105

GEOTECHNICAL/ENVIRONMENTAL DRILLER

PROGRAM OUTLINE

APPROVED BY INDUSTRY

[JUNE 2014]

Developed by
British Columbia Ground Water Association (BCGWA)
And SkilledTradesBC

SKILLED TRADES BC

TABLE OF CONTENTS

Section 1

INTRODUCTION

Geotechnical/Environmental Driller

Foreword

A Program Outline is an SkilledTradesBC Program Standards communication tool. It reflects the scope of knowledge and skills required to competently perform an occupation anywhere in BC.

All SkilledTradesBC assessment tools are designed to measure achievement of the competencies and learning tasks described by the Program Outline for an occupation.

The Program Outline informs industry, the public, employers and challengers of the occupation's requirements for certification, including:

- The program Credentialing Model
- General Areas of Competence (GACs) and specific competencies required by individuals to perform proficiently in this occupation
- Learning tasks and content that must be mastered in order for an individual to be deemed competent

SAFETY ADVISORY

Be advised that references to the WorkSafeBC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com). Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

Acknowledgements

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the British Columbia Ground Water Association (BCGWA). Members include:

- Mike Wei - Water Protection & Sustainability Branch, BC Ministry of Environment
- Lindsay Macfarlane - Water Protection & Sustainability Branch, BC Ministry of Environment

Industry Subject Matter Experts retained to assist in the development of Program Outline Content:

- Bill Tuytel
- Gordon Gibbons
- Jeff Schaeffers
- Bruce Ingimundson

Facilitators:

- Dan McFaull (North Pacific Training & Performance Inc.)
- Taruna Goel (North Pacific Training & Performance Inc.)
- Diane Evans – SkilledTradesBC

The British Columbia Ground Water Association (BCGWA) and SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the program content of the Geotechnical/Environmental Driller occupation.

How to Use this Document

This Program Outline has been developed for the use of individuals from different audiences. The table below describes how each section can be used by each intended audience.

Section	Employers	Challengers
Program Credentialing Model	Understand the length and structure of the program	Understand challenger pathway to Certificate of Qualification
OAC	Understand the competencies that a challenger is expected to demonstrate in order to achieve certification	Understand the competencies they must demonstrate in order to challenge the program
TOS and Suggested Weighting for exam	Understand the relative weightings of various competencies of the occupation on which assessment is based	Understand the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Identifies detailed program content and competencies	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels

Section 2

PROGRAM OVERVIEW

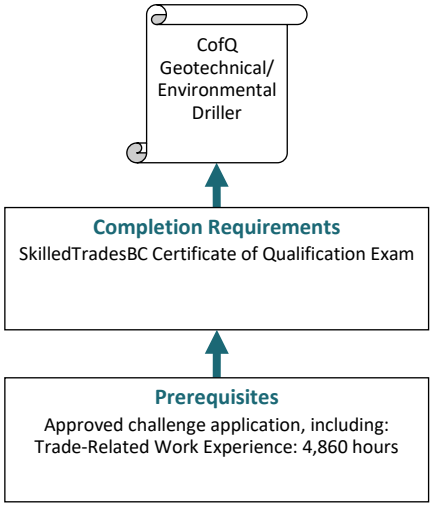
Geotechnical/Environmental Driller

Program Credentialing Model

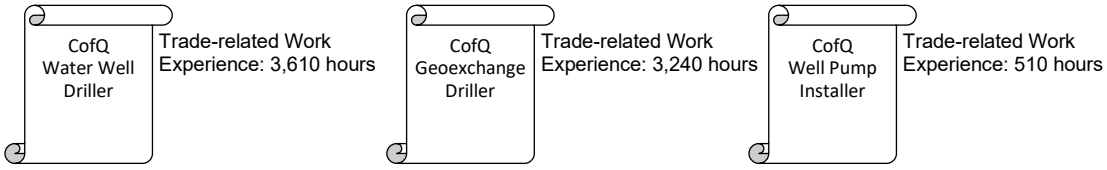
Challenge Pathway

Geotechnical/Environmental Driller

C of Q = Certificate of Qualification



CREDIT FOR PRIOR LEARNING



Occupational Analysis Chart

GEOTECHNICAL/ENVIRONMENTAL DRILLER

Occupation Description: A "Geotechnical and Environmental Driller" (Geo/Enviro Driller) is a person who operates various types of mobile soil and rock drilling equipment for the purpose of gathering site characterization information and data. A Geo/Enviro Driller typically works together on site with an engineer or technologist to achieve a greater understanding of the stratigraphy or hydrogeological conditions present by collecting soil or water samples, performing various types of probe or in-situ tests, or by setting various types of installations for either geotechnical or environmental monitoring. A Geo/Enviro Driller must have both training and experience with various drilling, sampling and testing techniques in order to conduct a safe and efficient site investigation program, and to ensure the maintenance of drilling and support equipment. All drillers must also have a competent understanding of provincial hole closure regulations to ensure safety to both the environment and public.

Industry Overview and Professional Work Practices **A**	Describe the scope of the trade in BC. A1	Describe the BC Certification System. A2	Apply trade math. A3		
Workplace Safety **B**	Describe common safety hazards associated with the trade. B1	Use safety equipment and procedures when dealing with hazards. B2	Use the WHMIS System to practice safe care and control of hazardous products. B3	Recognize and describe hazards to the environment associated with the trade. B4	Recognize and comply with WorkSafeBC Regulations. B5
	Recognize and comply with the BC Groundwater Protection Regulations. B6	Work safely on the drilling and ground water monitoring sites. B7	State the safety considerations when dealing with hazardous vapours. B8		
Drilling Methods **C**	Describe the different types of drillings methods applicable to the trade. C1	Use drilling methods as applicable to the trade. C2			

Geology **D**	Use proper terminology to describe geological formations as it applies to the trade. D1				
Ground Water **E**	Describe the Hydrologic Cycle (Water Cycle). E1	Use proper terminology to describe various water-bearing zones. E2	Use proper terminology to describe ground water formations. E3	Describe different sources of water. E4	
Artesian Water Flow **F**	Describe the characteristics of artesian water flow. F1	Describe the measures to contain/close artesian water flow. F2	Recognize and prepare for the likelihood of encountering artesian water flow. F3	Identify the potential hazards associated with artesian water flow. F4	
Pump Types and Applications **G**	Identify different types of pumps used for drilling and their components and application. G1	Use different types of pumps for drilling, based on their capabilities and limitations. G2			
Hydraulic Systems **H**	Explain the principles of operation of different types of hydraulic systems applicable to the trade. H1	Describe the functions of the basic components of hydraulic systems. H2	Identify component and system failures of hydraulic systems and their causes. H3	Explain the importance of maintenance schedules and required system servicing. H4	
Monitoring Well/Borehole Reclamation **I**	Identify the equipment required for closing a monitoring well and/or borehole. I1	Close a monitoring well and/or borehole in accordance with the regulations. I2			

Sampling and Testing **J**	Identify different types of samples and tests and their purpose. J1	Use specific devices to conduct sampling and testing. J2
Soil and Ground Water Monitoring **K**	Describe the purpose and operating principles of various devices that are installed in monitoring wells. K1	Install various types of monitoring devices. K2

Identify ground water contamination sources. K3	Describe containment movement. K4	Construct ground water monitoring wells. K5

Suggested Weighting for Exam

GEOTECHNICAL/ENVIRONMENTAL DRILLER

		Weighting %
Line A	**Industry Overview and Professional Work Practices**	**5%**
A1	Describe the scope of the trade in BC.	
A2	Describe the BC Certification System.	
A3	Apply trade math.	
Line B	**Workplace Safety**	**10%**
B1	Describe common safety hazards associated with the trade.	
B2	Use safety equipment and procedures when dealing with hazards.	
B3	Use the WHMIS System to practice safe care and control of hazardous products.	
B4	Recognize and describe hazards to the environment associated with the trade.	
B5	Recognize and comply with WorkSafeBC Regulations.	
B6	Recognize and comply with the BC Groundwater Protection Regulations.	
B7	Work safely on the drilling and ground water monitoring sites.	
B8	State the safety considerations dealing with hazardous vapours.	
Line C	**Drilling Methods**	**15%**
C1	Describe the different types of drillings methods applicable to the trade.	
C2	Use drilling methods as applicable to the trade.	
Line D	**Geology**	**10%**
D1	Use proper terminology to describe geological formations as it applies to the trade.	
Line E	**Ground Water**	**6%**
E1	Describe the Hydrologic Cycle (Water Cycle).	
E2	Use proper terminology to describe various water-bearing zones.	
E3	Use proper terminology to describe ground water formations.	
E4	Describe different sources of water.	
Line F	**Artesian Water Flow**	**5%**
F1	Describe the characteristics of artesian water flow.	
F2	Describe the measures to contain/close artesian water flow.	
F3	Recognize and prepare for the likelihood of encountering artesian water flow.	
F4	Identify the potential hazards associated with artesian water flow.	

		Weighting %
Line G	**Pump Types and Applications**	**7%**
G1	Identify different types of pumps used for drilling and their components and application.	
G2	Use different types of pumps for drilling based on their capabilities and limitations.	
Line H	**Hydraulic Systems**	**8%**
H1	Explain the principles of operation of different types of hydraulic systems applicable to the trade.	
H2	Describe the functions of the basic components of hydraulic systems.	
H3	Identify component and system failures of hydraulic systems and their causes.	
H4	Explain the importance of maintenance schedules and required system servicing.	
Line I	**Monitoring Well/Borehole Reclamation**	**8%**
I1	Identify the equipment required for closing a monitoring well and/or borehole.	
I2	Close a monitoring well and/or borehole in accordance with the regulations	
Line J	**Sampling and Testing**	**15%**
J1	Identify different types of samples and tests and their purpose.	
J2	Use specific devices to conduct sampling and testing.	
Line K	**Soil and Ground Water Monitoring**	**11%**
K1	Describe the purpose and operating principles of various devices that are installed in monitoring wells.	
K2	Install various types of monitoring devices.	
K3	Identify ground water contamination sources.	
K4	Describe containment movement.	
K5	Construct ground water monitoring wells.	
	Total Percentage for Geotechnical/Environmental Driller	**100%**

Section 3

PROGRAM CONTENT

Geotechnical/Environmental Driller

Line (GAC): A INDUSTRY OVERVIEW AND PROFESSIONAL WORK PRACTICES

Competency: A1 Describe the scope of the trade in BC

Objectives

To be competent in this area, the individual must be able to:

- Describe the scope of the trade as it applies to BC.
- Identify industry associations and whom they represent.

LEARNING TASKS	CONTENT
1. Describe the scope of the trade	• Role and responsibilities of a Geotechnical/Environmental Driller
2. Identify industry associations	• British Columbia Ground Water Association (BCGWA)

Line (GAC): A INDUSTRY OVERVIEW AND PROFESSIONAL WORK PRACTICES

Competency: A2 Describe the BC Certification System.

Objectives

To be competent in this area, the individual must be able to state the certification process for the trade in BC.

LEARNING TASKS	CONTENT
1. Describe the requirements for certification	• Skills and qualities • Specific job knowledge • Work experience
2. Describe the challenge pathway and certification	• Certification process • British Columbia Ground Water Association (BCGWA)
3. Describe registration process with the Government	• Registration process • Role of BC Government

SKILLED TRADES BC

Line (GAC): **A** **INDUSTRY OVERVIEW AND PROFESSIONAL WORK PRACTICES**

Competency: **A3** **Apply trade math.**

Objectives

To be competent in this area, the individual must be able to perform measurements and conversions using metric and imperial units.

LEARNING TASKS

1. Perform measurements and conversions

CONTENT

- Metric and Imperial measurements
- Convert between units of measurement

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B1 Describe common safety hazards associated with the trade.

Objectives

To be competent in this area, the individual must be able to describe the types of personal hazards associated with the trade.

LEARNING TASKS	CONTENT
1. Describe common personal safety hazards	• Tools and systems hazards including hydraulic systems • Rotating machinery • Compressed air • Water pressure • Exhaust gases • Lifting and hoisting equipment – fall, crane and overhead hazards

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B2 Use safety equipment and procedures when dealing with hazards.

Objectives

To be competent in this area, the individual must be able to identify and use safety equipment and procedures when dealing with hazards.

LEARNING TASKS	CONTENT

1. Identify and use safety equipment	• PPE
	  ○ Personal apparel
	  ○ Hand protection
	  ○ Leg and foot protection
	  ○ Headgear
	  ○ Eye protection
	  ○ Ear protection
	  ○ Lung protection
	• Use, inspect, maintain and store PPE

2. Identify and use safety procedures	• Use safety procedures guided by regulations that specifically govern the:
	  ○ Drilling and construction of boreholes
	  ○ Installation of monitoring devices

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B3 Use the WHMIS System to practice safe care and control of hazardous products.

Objectives

To be competent in this area, the individual must be able to:

- Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS).
- Explain the contents of Material Safety Data Sheets (MSDS).
- Use the WHMIS System.

LEARNING TASKS	CONTENT
1. State the purpose of WHMIS	• Appropriate labelling to ensure protection of workers • Recognition of rights
2. Describe the key elements of WHMIS	• Material Safety Data Sheets (MSDS). • Labelling of containers for hazardous materials
3. Describe the information disclosed in MSDS	• Hazardous ingredients • Preparation information • Product information • Physical data • Fire or explosion • Reactivity data • Toxicology properties • Preventive measures • First-aid measures
4. Identify symbols found on WHMIS labels and describe their meaning	• Compressed gases • Flammable and combustible materials • Oxidizing materials • Poisonous and infectious materials • Corrosive materials • Dangerously reactive materials
5 Use the WHMIS system	• Usage, storage and disposal of hazardous materials such as Portland cement, Bentonite powder, Caustic soda, products containing Silica dust etc.

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B4 Recognize and describe hazards to the environment associated with the trade.

Objectives

To be competent in this area, the individual must be able to recognize and describe hazards to the environment associated with the trade.

LEARNING TASKS

1. Describe the hazards to the environment

CONTENT

- Contamination of ground water
- Discharge of drill fluids (Bentonitic products and polymers associated with drilling geotechnical and environmental boreholes)
- Hydraulic oil leaks
- Hydrocarbon spills (gas, diesel, hydraulic oil)
- Silica exposure from DTH drilling or installation of monitor well supplies
- Environmental impacts when working by water ways or sensitive areas

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B5 Recognize and comply with WorkSafeBC Regulations.

Objectives

To be competent in this area, the individual must be able to recognize and comply with WorkSafeBC Regulations.

LEARNING TASKS

1. Interpret and comply with WorkSafeBC regulations as applicable to the trade

CONTENT

- Regulations
- Standards
- Guidelines
- For example:
  - Limits of approach to overhead or underground electrical power lines.
  - Safety around rotating equipment.
  - Winch operation
  - Rigging and hoisting.
  - Moving and setting up equipment in soft/ slippery soil conditions etc.

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B6 Recognize and comply with the BC Groundwater Protection Regulations.

Objectives

To be competent in this area, the individual must be able to recognize and comply with the BC Groundwater Protection Regulations.

LEARNING TASKS

1. Interpret and comply with BC Groundwater Protection Regulations

CONTENT

- Regulations
- Standards
- Guidelines

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B7 Work safely on the drilling and ground water monitoring sites.

Objectives

To be competent in this area, the individual must be able to work safely on the drilling and ground water monitoring sites.

LEARNING TASKS	CONTENT
1. Work safely on the drilling and ground water monitoring sites	• Identify safety hazards related to the work site such as uneven terrain, traffic, energized overhead and underground lines etc. • Follow safety procedures and regulations on the worksite • Identify the importance of safety tailgate meetings

SKILLED TRADES BC

Line (GAC): B WORKPLACE SAFETY

Competency: B8 State the safety considerations when dealing with hazardous vapours.

Objectives

To be competent in this area, the individual must be able to state the safety considerations when dealing with hazardous vapours.

LEARNING TASKS

1. State the safety considerations when dealing with hazardous vapours

CONTENT

- Hazardous vapours such as:
  - Methane
  - Hydrogen Sulphide
  - Natural gas
  - Carbon Monoxide
- Specific safety training
  - Use of a gas detection monitor/4-way gas monitors (personal)
  - SCBA (Self Contained Breathing Apparatus)
  - Engines with positive air shut off devices
  - Steps to take when gas is detected, for example:
  - Shut down equipment engine
  - Move upward or to a designated muster point

SKILLED TRADES BC

Line (GAC): C DRILLING METHODS

Competency: C1 Describe the different types of drillings methods applicable to the trade.

Objectives

To be competent in this area, the individual must be able to describe the different types of drillings methods applicable to the trade.

LEARNING TASKS	CONTENT

1. Describe Auger drilling method	• Terminology
	• Types
	  ○ Solid stem
	  ○ Hollow stem

2. Describe Mud Rotary drilling method	• Terminology

3. Describe Air Rotary drilling method	• Terminology
	• Types
	  ○ ODEX
	  ○ DTH Hammer (Down the Hole Hammer)

4. Describe Coring	• Terminology ○ Diamond drilling
5. Describe Sonic drilling method	• Terminology

6. Describe Direct Push drilling method	• Terminology
	• Types
	  ○ CPT
	  ○ Geoprobe systems
	  ○ Soil and water sampling

7. Other drilling methods	• Terminology ○ Becker Hammer

SKILLED TRADES BC

Line (GAC): C DRILLING METHODS

Competency: C2 Use drilling methods as applicable to the trade.

Objectives

To be competent in this area, the individual must be able to use drilling methods as applicable to the trade.

LEARNING TASKS	CONTENT

1. Use Auger drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

2. Use Mud Rotary drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

3. Use Air Rotary drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

4. Use Coring	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	  ○ Procedures

5. Use Sonic drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

6. Use Direct Push drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards

LEARNING TASKS	CONTENT

7. Use other drilling methods (Becker Hammer)	• Principles of operation
	• Procedures
	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

SKILLED TRADES BC

Line (GAC): D GEOLOGY

Competency: D1 Use proper terminology to describe geological formations as it applies to the trade.

Objectives

To be competent in this area, the individual must be able to use proper terminology to describe geological formations as it applies to the trade.

LEARNING TASKS	CONTENT
1. Describe geological formations as it applies to the trade	• Bed rock types (igneous, metamorphic, sedimentary) • Overburden (Soil) types (clay, silt, sand, gravel, glacial till, organic soil)

SKILLED TRADES BC

Line (GAC): E GROUND WATER

Competency: E1 Describe the Hydrologic Cycle (Water Cycle).

Objectives

To be competent in this area, the individual must be able to describe the Hydrologic Cycle (Water Cycle).

LEARNING TASKS

1. Describe the Hydrologic Cycle (Water Cycle)

CONTENT

- Terminology
  - Importance of precipitation
  - Infiltration
  - Transpiration
  - Evaporation

SKILLED TRADES BC

Line (GAC): E GROUND WATER

Competency: E2 Use proper terminology to describe various water-bearing zones.

Objectives

To be competent in this area, the individual must be able to describe various water-bearing zones.

LEARNING TASKS

1. Describe various water-bearing zones

CONTENT

- Zone of saturation
- Occurrence and movement of ground water
- Water Table
- Phreatic Surface

SKILLED TRADES BC

Line (GAC): E GROUND WATER

Competency: E3 Use proper terminology to describe ground water formations.

Objectives

To be competent in this area, the individual must be able to describe ground water formations.

LEARNING TASKS

1. Describe ground water formations

CONTENT

- Aquifer
  - Confined (Artesian aquifer)
  - Unconfined
- Aquitard
- Porosity
- Permeability

SKILLED TRADES BC

Line (GAC): E GROUND WATER

Competency: E4 Describe different sources of water.

Objectives

To be competent in this area, the individual must be able to describe different sources of water.

LEARNING TASKS

1. Describe different sources of water

CONTENT

- Surface water
- Effects of surface water on the water table
- Ground water
- GUDI (Ground Water Under the Direct Influence of Surface Water)

SKILLED TRADES BC

Line (GAC): F ARTESIAN WATER FLOW

Competency: F1 Describe the characteristics of artesian water flow.

Objectives

To be competent in this area, the individual must be able to describe the characteristics of artesian water flow.

LEARNING TASKS

1. Describe the characteristics of artesian water flow

CONTENT

- Occurrence
- Pressures
- Flows
  - High head low flow
  - Low head high flow

Line (GAC): F ARTESIAN WATER FLOW

Competency: F2 Describe the measures to contain/close artesian water flow.

Objectives

To be competent in this area, the individual must be able to describe the measures to contain/close artesian water flow.

LEARNING TASKS

1. Describe the measures to contain/close artesian water flow

CONTENT

- Identify if flow control is practical or required
- Flow is contained when:
  - It is conveyed through the production casing
  - It does not pose a risk to property, environmental damage or public safety
  - It can be indefinitely stopped without leakage
- Flow control using
  - Flowing well pitless unit
  - Drawdown seals
  - Flow discharge piping at well head
  - Elevated flow tank
  - Borehole sealant
  - Heavy mud or bentonite chips
  - Pressure grouting
- Measure or calculate artesian pressures, and then calculate the necessary Barite mix to balance the pressure.

SKILLED TRADES BC

Line (GAC): F ARTESIAN WATER FLOW

Competency: F3 Recognize and prepare for the likelihood of encountering artesian water flow.

Objectives

To be competent in this area, the individual must be able to recognize and prepare for the likelihood of encountering artesian water flow.

LEARNING TASKS

1. Recognize and prepare for the likelihood of encountering artesian water flow

CONTENT

- Perform a database review
  - BC Water Atlas online GIS System
- Do a site assessment
- Use appropriate protocols
- Use appropriate sealing methods and pressurization for artesian

SKILLED TRADES BC

Line (GAC): F ARTESIAN WATER FLOW

Competency: F4 Identify the potential hazards associated with artesian water flow.

Objectives

To be competent in this area, the individual must be able to identify the potential hazards associated with artesian water flow.

LEARNING TASKS

1. Identify the potential hazards associated with artesian water flow

CONTENT

- Environmental risks
  - Contamination of surface water
  - Impact on the habitat of aquatic species
- Aquifer depletion
- Subsurface voids
- Flooding of the well site
- Property damage

SKILLED TRADES BC

Line (GAC): G PUMP TYPES AND APPLICATIONS

Competency: G1 Identify different types of pumps used for drilling and their components and application.

Objectives

To be competent in this area, the individual must be able to identify different types of pumps used for drilling and their components and application.

LEARNING TASKS

1. Identify different types of pumps used for drilling and their components and application

CONTENT

- Piston
  - Components
  - Application
- Progressive cavity
  - Components
  - Application
- Centrifugal
  - Components
  - Application
- Diaphragm
  - Components
  - Application
- Peristaltic
  - Components
  - Application

SKILLED TRADES BC

Line (GAC): G PUMP TYPES AND APPLICATIONS

Competency: G2 Use different types of pumps for drilling based on their capabilities and limitations.

Objectives

To be competent in this area, the individual must be able to use different types of pumps for drilling based on their capabilities and limitations.

LEARNING TASKS

1. Identify different types of pumps used for drilling and their capabilities and limitations

CONTENT

- Piston
  - Capabilities
  - Limitations
  - Procedures
- Progressive cavity
  - Capabilities
  - Limitations
  - Procedures
- Centrifugal
  - Capabilities
  - Limitations
  - Procedures
- Diaphragm
  - Capabilities
  - Limitations
  - Procedures
- Peristaltic
  - Capabilities
  - Limitations
  - Procedures

SKILLED TRADES BC

Line (GAC): H HYDRAULIC SYSTEMS

Competency: H1 Explain the principles of operation of different types of hydraulic systems applicable to the trade.

Objectives

To be competent in this area, the individual must be able to explain the principles of operation of different types of hydraulic systems applicable to the trade.

LEARNING TASKS

1. Explain the principles of operation of different types of hydraulic systems applicable to the trade
.

CONTENT

- Hydraulic
  - Schematic/layout
  - Principles of operation
- Electric over hydraulic
  - Schematic/layout
  - Principles of operation
- Different PSI pressures
  - Principles of operation

SKILLED TRADES BC

Line (GAC): H HYDRAULIC SYSTEMS

Competency: H2 Describe the functions of the basic components of hydraulic systems.

Objectives

To be competent in this area, the individual must be able to describe the functions of the basic components of hydraulic systems.

LEARNING TASKS

1. Describe the functions of basic components of hydraulic systems

CONTENT

- Schematic diagrams and symbols for hydraulic components
- Types of hydraulic fittings (JIC, Metric DIN, BSPP)
- Hydraulic hoses
  - Types
  - Pressure rating
- Hydraulic hose clamps
  - Types
  - Uses
- Hydraulic oil
  - Types
  - Designation
  - Uses
- Pumps
  - Suction
  - Discharge
- Motors
  - Vane
  - Piston
- Cylinders
  - Removing safely
  - Checking for damage to shaft seals
  - Keeping shaft clean
- Valves
  - Mechanical valves
  - Electric over hydraulic valves
  - Application of needle valves, flow control valves, ball valves, check valves (pressure controlled)
- Plumbing/fixtures/hoses
- Reservoirs
  - Breather operation
  - Filter screen
  - Check level in reservoir
- Filters

LEARNING TASKS	CONTENT
	○ Importance of filtration ○ Micron rating ○ Types ○ Low and High pressure • Heat exchangers • Clutches and brakes(hydraulic) • Electric controls ○ Identify and use ○ Solenoids (on/off, or variable resistance) ○ Need for and use of Kill Switch on the rotary components of the drill rig • Fuels ○ Types ○ Grades • Accumulator

SKILLED TRADES BC

Line (GAC): H HYDRAULIC SYSTEMS

Competency: H3 Identify component and system failures of hydraulic systems and their causes.

Objectives

To be competent in this area, the individual must be able to identify component and system failures of hydraulic systems and their causes.

LEARNING TASKS

1. Identify component and system failures of hydraulic systems and their causes

CONTENT

- Typical component failures
- Common causes of these failures
- For example:
  - Over heating
  - Cooling fan not working
  - Blown hoses/hose failures
  - Hoses flexing too tightly
  - Chaffed hoses
  - Loose levers
  - Leaking cylinders
  - Blown oil filters
  - Quick connects leaking
  - Hydraulic oil contamination
  - Failures of electric components
  - Engine not starting etc.

SKILLED TRADES BC

Line (GAC): H HYDRAULIC SYSTEMS

Competency: H4 Explain the importance of maintenance schedules and required system servicing.

Objectives

To be competent in this area, the individual must be able to explain the importance of maintenance schedules and required system servicing.

LEARNING TASKS	CONTENT
1. Explain the importance of maintenance schedules and required system servicing	• Need for maintenance • Required system servicing – such as changing filters and fluids • Exhaust smoke type and implications • Daily inspection of cooling systems, coolant quality, fan belt condition, alternator and battery condition etc. • Daily/weekly hose wear checks and cleaning • Annual inspection by pulling the pumps to check splines etc. and oil change

SKILLED TRADES BC

Line (GAC): I MONITORING WELL/BOREHOLE RECLAMATION

Competency: I1 Identify the equipment required for closing a monitoring well and/or a borehole.

Objectives

To be competent in this area, the individual must be able to identify the equipment required for closing a monitoring well and/or a borehole.

LEARNING TASKS

1. Identify the equipment required for closing a monitoring well and/or a borehole

CONTENT

- Grouting equipment such as grout pumps to pump grout into borehole
- Drill rig
- Well cover puller
- Measuring tape to determine depth and volumes

Line (GAC): I MONITORING WELL/BOREHOLE RECLAMATION

Competency: I2 Close a monitoring well and/or borehole in accordance with the regulations.

Objectives

To be competent in this area, the individual must be able to close a monitoring well and/or borehole in accordance with the regulations.

LEARNING TASKS

1. Identify the regulations for closing a monitoring well and/or borehole
2. Use specific methods to close a monitoring well and/or borehole in accordance with the regulations

CONTENT

- Current BC Water Act "Controlling Artesian Flow" Section 77
- Drill out well and grout in
- Fill pipe with grout or Bentonite and cut off below grade (if proper seals were put in place during installation the well)

SKILLED TRADES BC

Line (GAC): J SAMPLING AND TESTING

Competency: J1 Identify different types of samples and tests and their purpose.

Objectives

To be competent in this area, the individual must be able to identify different types of samples and tests and their purpose.

LEARNING TASKS

1. Identify different types of samples and tests and their purpose

CONTENT

- Grab sample
- Standard Penetration Tests (SPT)/ Large Penetration Tests (LPT)
- Dynamic cone penetration (DCPT)
- Vane Shear Testing (VST)
- Shelby tube sample
- Pressure meter test
- Packer test
- Bedrock coring (Diamond)
- Overburden coring (Diamond or Sonic)
- Ground water sampling and testing

Line (GAC): J SAMPLING AND TESTING

Competency: J2 Use specific devices to conduct sampling and testing.

Objectives

To be competent in this area, the individual must be able to use specific devices to conduct sampling and testing.

LEARNING TASKS

1. Use specific devices to conduct sampling and testing

CONTENT

- Shelby tube
  - Push in or piston
- Split spoon
  - Driven
- Vanes
  - Push in and turned to measure torque
- CPT
  - Push in
- Packer test
  - Water filtration
- DCPT
  - Driven

SKILLED TRADES BC

Line (GAC): K SOIL AND GROUND WATER MONITORING

Competency: K1 Describe the purpose and operating principles of various devices that are installed in monitoring wells.

Objectives

To be competent in this area, the individual must be able to describe the purpose and operating principles of various devices that are installed in monitoring wells.

LEARNING TASKS

1. Describe the purpose and operating principles of various devices that are installed in monitoring wells

CONTENT

- Piezometer (measures water level)
  - Stand pipe piezometer
  - Vibrating Wire/Electronic Transducer
  - Pneumatic piezometer
- Settlement Gauges (measures vertical movement of settlement)
  - Magnetic
  - Borros anchor
  - Deep settlement plates
  - Extensometer
- Inclinometer (measures horizontal movement)
- Operating principles of all various devices

SKILLED TRADES BC

Line (GAC): K SOIL AND GROUND WATER MONITORING

Competency: K2 Install various types of monitoring devices.

Objectives

To be competent in this area, the individual must be able to install various types of monitoring devices.

LEARNING TASKS

1. Install various types of monitoring devices

CONTENT

- Installation methods for various devices
- Piezometer (measures water level)
  - Stand pipe piezometer
  - Vibrating Wire/Electronic Transducer
  - Pneumatic piezometer
- Settlement Gauges (measures vertical movement of settlement)
  - Magnetic
  - Borros anchor
  - Deep settlement plates
  - Extensometer
- Inclinometer (measures horizontal movement)

SKILLED TRADES BC

Line (GAC): K SOIL AND GROUND WATER MONITORING

Competency: K3 Identify ground water contamination sources

Objectives

To be competent in this area, the individual must be able to identify ground water contamination sources.

LEARNING TASKS

1. Identify ground water contamination sources

CONTENT

- Substances found naturally in rocks or soils such as Iron, Manganese, Arsenic, Chlorides etc.
- Release or spills from storage tanks above or below ground containing oil, chemicals or other liquids
- Mixing of aquifers due to improper hole closures when drilling
- Onsite wastewater disposal systems
- Septic systems
- Surface impoundments
- Improper disposal of hazardous waste
- Landfills
- Chemicals and Road Salts
- Pesticides and fertilizer use
- Atmospheric contaminants
- Old lumber mills (creosote)
- Fuel stations (gas/diesel)
- Wood preservative operations
- Dry cleaning operations etc.

Line (GAC): K SOIL AND GROUND WATER MONITORING DEVICES

Competency: K4 Describe containment movement.

Objectives

To be competent in this area, the individual must be able to describe containment movement.

LEARNING TASKS

1. Describe containment movement

CONTENT

- Need for containment movement
  - Prevent or reduce the migration of contaminants
- Knowledge about methods for containment

SKILLED TRADES BC

Line (GAC): K SOIL AND GROUND WATER MONITORING

Competency: K5 Construct ground water monitoring wells.

Objectives

To be competent in this area, the individual must be able to construct ground water monitoring wells.

LEARNING TASKS

1. Construct a ground water monitoring well

CONTENT

- Construct a ground water monitoring well based on the following considerations:
  - Well design
  - Drilling method
  - Materials used
  - Joints
  - Size of boreholes
  - Borehole construction and sealing
  - Monitoring well protection
  - Monitoring well development
  - Monitoring well completion

Reference Materials

For reference material and resources please contact BC Ground Water Association.

Telephone:	604-530-8934	Fax:	604-530-8934
Toll Free (within BC):	1-855-530-8934	Email:	secretary@bcgwa.org
Website:	www.bcgwa.org		