SKILLEDTRADESBC

PROGRAM OUTLINE

Well Pump Installer

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WELL PUMP INSTALLER

PROGRAM OUTLINE

APPROVED BY INDUSTRY

[JUNE 2014]

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

SKILLED TRADES BC

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Section 1

INTRODUCTION

Well Pump Installer

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 WorkSafe BC 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:

- Blaine Matuga
- David Mellis
- Ron Nelson
- 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 Well Pump Installer 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

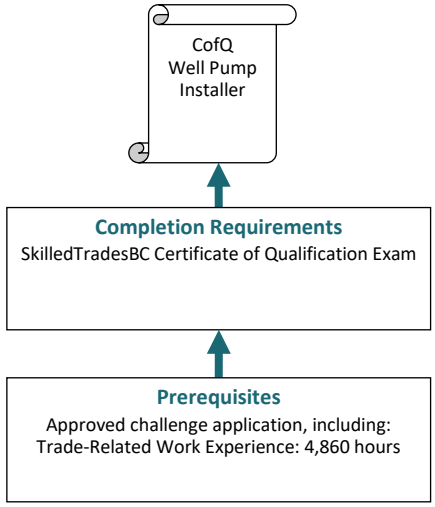
Well Pump Installer

Program Credentialing Model

Challenge Pathway

Well Pump Installer

C of Q = Certificate of Qualification



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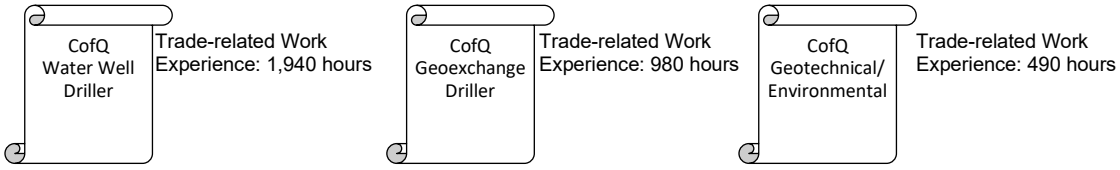

Occupational Analysis Chart

WELL PUMP INSTALLER

Occupation Description: Well pump installers install, test, maintain and repair water well pumps, piping systems and equipment, and perform pumping tests to assess well performance. Well pump installers typically work in an outdoor environment where the worker is exposed to variations in weather conditions and seasonal weather patterns. Work involves contact with water and other liquids. Well pump installers are often employed by well drilling companies, or plumbing companies, and they may be self-employed. Well pump installers can also work for larger construction companies or public works departments. Work can be seasonal, as there is more demand for well drilling in the spring, summer and fall. Well pump installers will work near or with a variety of equipment, instruments, machinery or tools, and must maintain a focus on safety at all times. Equipment can also produce sufficient noise to cause distraction or possible loss of hearing. Well pump installers will need to follow safety regulations as they relate to their work. Workers should be physically fit with the ability to conduct demanding outdoor work, and to lift and carry heavy objects.

Industry Overview and Professional Work Practices **A**	Describe the scope of the trade in BC A1	Describe the BC Certification System. A2	Describe professional work practices. A3	Apply trade math. A4		
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 Wellhead Protection Regulations. B6
	Recognize and comply with the BC Safety Authority Electrical Regulations. B7	State the safety considerations when working in close proximity to a well head. B8				
Well Drilling Methods **C**	Describe the different types of well drilling methods applicable to the trade. C1	Use well drilling methods as applicable to the trade. C2				

Geology D	Identify various rock types and the processes that form them. D1	Describe various soil types found in BC D2	Use proper terminology to describe geological formations as it applies to the trade. D3		
Ground Water E	Describe the Hydrologic Cycle (Water Cycle). E1	Use proper terminology to describe various subsurface zones. E2	Use proper terminology to describe ground water formations. E3	Describe different sources of water. E4	Define appropriate terms and abbreviations used to report on lithology. E5
Aquifer Potential F	Explain ground water flow as it pertains to various formations. F1	Recognize hydraulic properties of bedrock and overburden (soil) aquifers. F2	Describe the different types of aquifer tests and the equipment necessary. F3	Perform various aquifer tests, record the readings and interpret the results. F4	Use technologies for data acquisition. F5	Describe the use of monitoring wells for data collection. F6
Ground Water Quality G	Interpret detailed chemistry reports. G1	Use proper techniques for acquiring water samples. G2	Use proper methods of disinfection. G3	Identify ground water treatment that may be required for common concerns. G4		
Pumping System H	Describe different types of shallow and deep well pumps. H1	Describe equipment requirements for different pump types. H2	Determine the appropriate electrical wire size for pump installation. H3	Describe the types and sizes of pressure tanks. H4	Select pump type according to application and sizing. H5	Determine the Total Dynamic Head for a well pumping system. H6
	Design and install a water pumping system for a well site. H7					

Pumping System Electricals **I**	Recognize electrical circuits. I1	Use lockout/tag out procedures. I 2	Use a voltmeter, ampmeter, ohmmeter and megohmmeter. I 3	Use methods for wiring motor controls. I 4	Use procedures for protecting and burying underground cables. I 5	Install a waterproof splice on a submersible pump motor lead in accordance with the electrical code. I 6
	Identify the requirements for an electrical disconnect on a pump system. I 7	Complete a control box installation. I 8	Complete a system ground for a pump installation. I 9	Perform electrical tests as required on pumping systems. I 10	Describe power supply alternatives for electric motor pumps. I 11	
Pumping System Troubleshooting and Repair **J**	Perform pump system tests to identify problems. J1	Repair pump systems. J2				
Water Well Systems **K**	Describe the characteristics of well aquifer. K1	Describe various water well components. K2	Describe various in-well pump components. K3	Describe pump control systems and components. K4	Use various methods and equipment for well head completion. K5	

Suggested Weighting for Exam

WELL PUMP INSTALLER

		Weighting %
Line A	**Industry Overview and Professional Work Practices**	**6%**
A1	Describe the scope of the trade in BC	
A2	Describe the BC Certification System.	
A3	Describe professional work practices.	
A4	Apply trade math.	
Line B	**Workplace Safety**	**11%**
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 Wellhead Protection Regulations.	
B7	Recognize and comply with the BC Safety Authority Electrical Regulations.	
B8	State the safety considerations when working in close proximity to a well head.	
Line C	**Well Drilling Methods**	**4%**
C1	Describe the different types of well drilling methods applicable to the trade.	
C2	Use well drilling methods as applicable to the trade.	
Line D	**Geology**	**3%**
D1	Identify various rock types and the processes that form them.	
D2	Describe various soil types found in BC	
D3	Use proper terminology to describe geological formations as it applies to the trade.	
Line E	**Ground Water**	**5%**
E1	Describe the Hydrologic Cycle (Water Cycle).	
E2	Use proper terminology to describe various subsurface zones.	
E3	Use proper terminology to describe ground water formations.	
E4	Describe different sources of water.	
E5	Define appropriate terms and abbreviations used to report on lithology.	
Line F	**Aquifer Potential**	**5%**
F1	Explain ground water flow as it pertains to various formations.	
F2	Recognize hydraulic properties of bedrock and overburden (soil) aquifers.	
F3	Describe the different types of aquifer tests and the equipment necessary.	
F4	Perform various aquifer tests, record the readings and interpret the results.	
F5	Use technologies for data acquisition.	
F6	Describe the use of monitoring wells for data collection.	
Line G	**Ground Water Quality**	**5%**
G1	Interpret detailed chemistry reports.	

		Weighting %
G2	Use proper techniques for acquiring water samples.	
G3	Use proper methods of disinfection.	
G4	Identify ground water treatment that may be required for common concerns.	
Line H	**Pumping System**	**17%**
H1	Describe different types of shallow and deep well pumps.	
H2	Describe equipment requirements for different pump types.	
H3	Determine the appropriate electrical wire size for pump installation.	
H4	Describe the types and sizes of pressure tanks.	
H5	Select pump type according to application and sizing.	
H6	Determine the Total Dynamic Head for a well pumping system.	
H7	Design and install a water pumping system at a well site.	
Line I	**Pumping System Electricals**	**17%**
I1	Recognize electrical circuits.	
I2	Use lockout/tag out procedures.	
I3	Use a voltmeter, ampmeter, ohmmeter and megohmmeter.	
I4	Use methods for wiring motor controls.	
I5	Use procedures for protecting and burying underground cables.	
I6	Install a waterproof splice on a submersible pump motor lead in accordance with the electrical code.	
I7	Identify the requirements for an electrical disconnect on a pump system.	
I8	Complete a control box installation.	
I9	Complete a system ground for a pump installation.	
I10	Perform electrical tests as required on pumping systems.	
I11	Describe power supply alternatives for electric motor pumps.	
Line J	**Pumping System Troubleshooting and Repair**	**16%**
J1	Perform pump system tests to identify problems.	
J2	Repair pump systems.	
Line K	**Water Well Systems**	**11%**
K1	Describe the characteristics of well aquifer.	
K2	Describe various water well components.	
K3	Describe various in-well pump components.	
K4	Describe pump control systems and components.	
K5	Use various methods and equipment for well head completion.	
	Total Percentage for Well Pump Installer	**100%**

Section 3

PROGRAM CONTENT

Well Pump Installer

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 well pump installer
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 • Role of British Columbia Ground Water Association (BCGWA)
3. Describe registration process with the Government	• Registration process • Role of BC Government

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

Competency: **A3** **Describe professional work practices**

Objectives

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

- Recognize the need for record keeping.
- State the need for various records and reports and to whom they are distributed.

LEARNING TASKS	CONTENT
1. Recognize the need for record keeping	• Well pump installation information • Drill log • Business information
2. State the need for various records and reports for water well construction and pump installation and to whom they are distributed	• For the customer • For any regulatory bodies (such as drill logs and water analysis) • For the driller or company file

SKILLED TRADES BC

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

Competency: **A4** **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

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 work assigned to a well pump installer.

LEARNING TASKS	CONTENT
1. Describe common personal safety hazards	• Electrical tools and systems hazards • Lifting and hoisting equipment – fall, crane and overhead hazards • Confined space hazards • Hazards related to compressed gases • Trench and excavation hazards etc.

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 associated with being a well pump installer.

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 water wells and well pump installation. • Use safety procedures for working in confined spaces.

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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	• Use, storage and disposal of hazardous materials

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	CONTENT
1. Describe the hazards to the environment	• Contamination of ground water • Oil leaks and spills • Inappropriate waste disposal • Improper well drilling and construction procedures • Infrastructure degradation

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	CONTENT
1. Interpret and comply with WorkSafeBC regulations as applicable to the trade	• Regulations • Standards • Guidelines

Line (GAC): B WORKPLACE SAFETY

Competency: B6 Recognize and comply with the BC Wellhead Protection Regulations

Objectives

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

LEARNING TASKS	CONTENT
1. Interpret and comply with BC Wellhead Protection Regulations	• Regulations • Standards • Guidelines

Line (GAC): B WORKPLACE SAFETY

Competency: B7 Recognize and comply with the BC Safety Authority Electrical Regulations

Objectives

To be competent in this area, the individual must be able to recognize and comply with the BC Safety Authority Electrical Regulations.

LEARNING TASKS

1. Interpret and comply with BC Safety Authority Electrical Regulations

CONTENT

- Regulations
- Standards
- Guidelines

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Line (GAC): B WORKPLACE SAFETY

Competency: B8 State the safety considerations when working in close proximity to a well head

Objectives

To be competent in this area, the individual must be able to state the safety considerations when working in close proximity to a well head.

LEARNING TASKS

1. State the safety considerations when working in close proximity to a well head

CONTENT

- Eye and ear protection when modifying the well head
- No open flames or ignition sources near well head
- Use of intrinsically safe components
- No steel hammer on well head and production lines

Line (GAC): C WELL DRILLING METHODS

Competency: C1 Describe the different types of well drilling methods applicable to the trade

Objectives

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

LEARNING TASKS

1. Describe Air Rotary drilling method
2. Describe Dual Rotary drilling method
3. Describe Cable tool drilling method
4. Other drilling methods

CONTENT

- Terminology
- Terminology
- Terminology
- Hand dug, Sonic, HDD etc.
  - Terminology

SKILLED TRADES BC

Line (GAC): C WELL DRILLING METHODS

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

Objectives

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

LEARNING TASKS	CONTENT

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

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

3. Describe Cable tool drilling method	• Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

4. Other drilling method	• Hand dug, sonic, HDD etc.
	  ○ Components
	  ○ Drill bits
	  ○ Drilling fluids
	  ○ Rotation Guards
	• Principles of operation
	• Procedures

Line (GAC): D GEOLOGY

Competency: D1 Identify various rock types and the processes that form them

Objectives

To be competent in this area, the individual must be able to identify various rock types and the processes that form them.

LEARNING TASKS	CONTENT
1. Identify various rock types	• Igneous • Metamorphic • Sedimentary
2. Identify the processes that form various rock types	• Erosion • Volcanic • Ice • Heat • Pressure

Line (GAC): D GEOLOGY

Competency: D2 Describe various soil types found in BC

Objectives

To be competent in this area, the individual must be able to describe various soil types found in BC.

LEARNING TASKS	CONTENT
1. Identify various soil types and their characteristics	• Surficial • Fluvial • Glacial • Sedimentary • Loams • Saturated and unsaturated

SKILLED TRADES BC

Line (GAC): D GEOLOGY

Competency: D3 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	• Terminology • Description

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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
- The effect of weather and water movement on the water cycle

SKILLED TRADES BC

Line (GAC): E GROUND WATER

Competency: E2 Use proper terminology to describe various subsurface zones

Objectives

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

LEARNING TASKS

1. Describe various subsurface zones

CONTENT

- Zone of soil moisture
- Zone of aeration
- Zone of saturation
- Effects of gravity and capillary motion
- Occurrence and movement of ground water

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 as it pertains to water storage.

LEARNING TASKS	CONTENT
1. Describe groundwater formations	• Aquifer (saturated zone) • Aquitard (confining beds) • Porosity etc.

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)

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Line (GAC): E GROUND WATER

Competency: E5 Define appropriate terms and abbreviations used to report on lithology

Objectives

To be competent in this area, the individual must be able to define appropriate terms and abbreviations used to report on lithology.

LEARNING TASKS	CONTENT
1. Define terms and abbreviations commonly-used in lithology reporting	• Terms • Abbreviations

Line (GAC): F AQUIFER POTENTIAL

Competency: F1 Explain ground water flow as it pertains to various formations

Objectives

To be competent in this area, the individual must be able to explain ground water flow as it pertains to various formations.

LEARNING TASKS

1. Explain ground water flow as it pertains to various formations

CONTENT

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

Line (GAC): F AQUIFER POTENTIAL

Competency: F2 Recognize hydraulic properties of bedrock and overburden (soil) aquifers

Objectives

To be competent in this area, the individual must be able to recognize hydraulic properties of bedrock and overburden (soil) aquifers.

LEARNING TASKS

1. Describe hydraulic properties of bedrock and overburden (soil) aquifers

CONTENT

- Porosity
- Permeability
- Hydraulic properties
- Types of aquifers (confined and unconfined)
- Transmissivity
- Storativity
- Hydraulic gradient

Line (GAC): F AQUIFER POTENTIAL

Competency: F3 Describe the different types of aquifer tests and the equipment necessary

Objectives

To be competent in this area, the individual must be able to describe the different types of aquifer tests and the equipment necessary.

LEARNING TASKS	CONTENT
1. Describe the different types of aquifer tests	• Test conditions such as water levels, water temperature, ground water quality, weather conditions, pump discharge etc. • Proper use of tests
2. Describe the equipment required for the tests	• Electric or steel tapes • Pressure transducers and data logger • Barometers • Temperature gauge • Pump discharge measurement devices • Flow meter etc.

Line (GAC): F AQUIFER POTENTIAL

Competency: F4 Perform various aquifer tests, record the readings and interpret the results

Objectives

To be competent in this area, the individual must be able to perform the various aquifer tests, record the readings and interpret the results.

LEARNING TASKS	CONTENT
1. Perform the various aquifer tests, record the readings and interpret the results	• Prepare for the test • Record data • Evaluate test results

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Line (GAC): F AQUIFER POTENTIAL

Competency: F5 Use technologies for data acquisition

Objectives

To be competent in this area, the individual must be able to use technologies for data acquisition.

LEARNING TASKS	CONTENT
1. Use technologies for data acquisition	• Data loggers • Static indicators • Flow meters • Orifice tubes etc.

Line (GAC): F AQUIFER POTENTIAL

Competency: F6 Describe the use of monitoring wells for data collection

Objectives

To be competent in this area, the individual must be able to describe the use of monitoring wells for data collection.

LEARNING TASKS

1. Describe the use of monitoring wells for data collection

CONTENT

- Who can construct monitoring wells
- Examples of monitoring wells
  - Bore holes drilled to asses ground water quality
  - Holes drilled to monitor water table elevations

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Line (GAC): G GROUND WATER QUALITY

Competency: G1 Interpret detailed chemistry reports

Objectives

To be competent in this area, the individual must be able to interpret detailed chemistry reports.

LEARNING TASKS

1. Interpret detailed chemistry reports

CONTENT

- Important mineral constituents in ground water
- Typical parameters for chemical analysis
- Common substances naturally found in ground water in BC that can cause problems in operating wells
- Quality characteristics
  - Measure of total dissolved solids (TDS) as an indicator of the mineralized character of the water
  - Water quality standards

Line (GAC): G GROUND WATER QUALITY

Competency: G2 Use proper techniques for acquiring water samples

Objectives

To be competent in this area, the individual must be able to use proper techniques for acquiring water samples.

LEARNING TASKS	CONTENT
1. Use proper techniques for acquiring water samples	• Select sample site • Conduct visual inspection of site • Acquire the correct number of samples • Label samples clearly • Use appropriate sampling containers • Use appropriate sampling procedures • Preserve and store sample • Prevent sample contamination

Line (GAC): G GROUND WATER QUALITY

Competency: G3 Use proper methods of disinfection

Objectives

To be competent in this area, the individual must be able to use proper methods of disinfection.

LEARNING TASKS

1. Use proper methods of disinfection

CONTENT

- Well cleaning
- Disinfection using chlorine
  - Simple chlorination
  - Shock chlorination
  - Bulk displacement chlorination
- Chlorination of tools and materials

Line (GAC): G GROUND WATER QUALITY

Competency: G4 Identify ground water treatment that may be required for common concerns

Objectives

To be competent in this area, the individual must be able to identify ground water treatment that may be required for common concerns.

LEARNING TASKS

1. Identify ground water treatment that may be required for common concerns

CONTENT

- Common concerns such as:
  - Bacteria
  - Chemicals such as Arsenic, Boron, Uranium etc.
- Suitable treatments for common concerns using:
  - Water softener
  - Reverse osmosis
  - Ultraviolet

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Line (GAC): H PUMPING SYSTEM

Competency: H1 Describe different types of shallow and deep well pumps

Objectives

To be competent in this area, the individual must be able to describe different types of shallow and deep well pumps.

LEARNING TASKS

1. Describe different types of shallow and deep well pumps

CONTENT

- Shallow well pumps:
  - Hand pump
  - Centrifugal pump
  - Air lift pump
  - Jet pump
- Deep well pumps
  - Submersible pump
  - Line shaft turbine
  - Reciprocating pump with a lifting well
  - Deep well jet pump

SKILLED TRADES BC

Line (GAC): H PUMPING SYSTEM

Competency: H2 Describe equipment requirements for different pump types

Objectives

To be competent in this area, the individual must be able to describe equipment requirements for different pump types.

LEARNING TASKS

1. Describe equipment requirements for different pump types

CONTENT

- Shallow well pumps:
  - Hand pump
  - Centrifugal pump
  - Air lift pump
  - Jet pump
- Deep well pumps
  - Submersible pump
  - Line shaft turbine
  - Reciprocating pump with a lifting well
  - Deep well jet pump
- Licensing requirements for different pumps

Line (GAC): H PUMPING SYSTEM

Competency: H3 Determine the appropriate electrical wire size for pump installation

Objectives

To be competent in this area, the individual must be able to determine the appropriate electrical wire size for pump installation.

LEARNING TASKS

1. Determine the appropriate electrical wire size for pump installation

CONTENT

- For electric wire sizing, consider factors including:
  - Voltage
  - Distance
  - Power source
  - Phase

SKILLED TRADES BC

Line (GAC): H PUMPING SYSTEM

Competency: H4 Describe the types and sizes of pressure tanks

Objectives

To be competent in this area, the individual must be able to describe the types and sizes of pressure tanks.

LEARNING TASKS	CONTENT
1. Describe the types and sizes of pressure tanks	• Air-over-water pressure tank • Diaphragm pressure tank • Bladder pressure tank

SKILLED TRADES BC

Line (GAC): H PUMPING SYSTEM

Competency: H5 Select pump type according to application and sizing

Objectives

To be competent in this area, the individual must be able to select pump type according to application and sizing.

LEARNING TASKS

1. Select pump type according to application and sizing

CONTENT

- Consider factors including:
  - Pump capacity
  - Pumping maximum temperature
  - Specific gravity
  - System demand (water usage and location)
  - Well capacity
  - Casing diameter
  - Static water level
  - Depth of well

Line (GAC): H PUMPING SYSTEM

Competency: H6 Determine the Total Dynamic Head (TDH) for a well pumping system

Objectives

To be competent in this area, the individual must be able to determine the Total Dynamic Head (TDH) for a well pumping system.

LEARNING TASKS

1. Determine the Total Dynamic Head for a well pumping system

CONTENT

- Consider factors including:
  - Friction loss (pipe size/length/diameter)
  - Altitude
  - Elevation change
  - Operating pressure
  - Distance
  - Pipe materials
  - Velocity head
  - Flow rate

SKILLED TRADES BC

Line (GAC): H PUMPING SYSTEM

Competency: H7 Design and install a water pumping system for a well site

Objectives

To be competent in this area, the individual must be able to design and install a water pumping system for a well site.

LEARNING TASKS

1. Design and install a water pumping system for a well site

CONTENT

- Consider factors such as:
  - Type of well pump
  - Licensing and equipment requirements
  - Electrical wire sizing
  - Pressure tank sizing
  - Pump type sizing
  - Total Dynamic Head
  - Well location
  - Well depth
  - Construction materials

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I1 Recognize electrical circuits

Objectives

To be competent in this area, the individual must be able to recognize electrical circuits.

LEARNING TASKS	CONTENT
1. Identify common drawings for electric circuits	• Wiring diagram • Schematic diagram

2. Describe the basic operation of electric circuits	• Circuit terminology
	  ○ Resistance, voltage and current
	  ○ Phase
	• Circuit components
	• Current flow

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I2 Use lockout/tag out procedures

Objectives

To be competent in this area, the individual must be able to explain lockout requirements and use lockout procedures for various situations.

LEARNING TASKS

1. Use lockout/tag out procedures

CONTENT

- Safety isolation requirements
- WorkSafeBC regulations
- Electrical lockout procedures such as:
  - Use of locks
  - Use of tags
  - Documentation
- De-energize and isolate equipment

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I3 Use a voltmeter, ampmeter, ohmmeter and megohmmeter

Objectives

To be competent in this area, the individual must be able to use a voltmeter, ampmeter, ohmmeter and megohmmeter.

LEARNING TASKS	CONTENT

1. Use a voltmeter, ampmeter, ohmmeter and megohmmeter	• Safety
	• Circuit placement
	  ○ Lead to lead
	  ○ Lead to ground test
	• Function
	• Ranges and specifications
	• Polarity
	• Reading scales
	• Zero adjustment
	• Stray magnetic fields

2. Maintain analog/digital meters	• Inspection • Storage • Part replacement

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I4 Use methods for wiring motor controls

Objectives

To be competent in this area, the individual must be able to use methods for wiring motor controls.

LEARNING TASKS	CONTENT
1. Use methods for wiring motor controls	• Follow the regulations and Canadian Electrical Code requirements • Differentiate between single-phase and 3-phase circuits and methods of wiring

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I5 Use procedures for protecting and burying underground cables

Objectives

To be competent in this area, the individual must be able to use procedures for protecting and burying underground cables.

LEARNING TASKS	CONTENT
1. Use procedures for protecting and burying underground cables	• Seek information from BC One Call or a Locates company • Carefully inspect the site • Conduct a pre-survey of the site • Use cable locating devices • Use safe digging practices • Prevent possible vehicular or pedestrian traffic damage using cones and barricades • Use trenching as required for the site • Follow federal/provincial regulations

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I6 Install a waterproof splice on a submersible pump motor lead in accordance with the electrical code

Objectives

To be competent in this area, the individual must be able to install a waterproof splice on a submersible pump motor lead in accordance with the electrical code.

LEARNING TASKS

1. Install a waterproof splice on a submersible pump motor lead in accordance with the electrical code

CONTENT

- Need for a waterproof slice
- Use specific instructions as supplied with the drop cable or in the pump motor manual
- Use appropriate materials and methods such as:
  - Waterproof tapes
  - Resin castings
  - Heat shrink tubes etc.
- Perform a test after making the splice to ensure it is waterproof
- Measure the total resistance of the complete drop cable and motor circuit to ensure a good splice

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I7 Identify the requirements for an electrical disconnect on a pump system

Objectives

To be competent in this area, the individual must be able to identify the requirements for an electrical disconnect on a pump system.

LEARNING TASKS

1. Identify the requirements for an electrical disconnect on a pump system

CONTENT

- Use of disconnect switches
  - Proper sizing
  - Fuse requirements

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I8 Complete a control box installation

Objectives

To be competent in this area, the individual must be able to complete a control box installation.

LEARNING TASKS

1. Complete a control box installation

CONTENT

- Meet regulations and electrical code requirements
- Consider area of installation
- Cabling and connector requirements
- Use of auxiliary (noise reduction) capacitors

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I9 Complete a system ground for a pump installation

Objectives

To be competent in this area, the individual must be able to complete a system ground for a pump installation.

LEARNING TASKS	CONTENT
1. Complete a system ground for a pump installation	• Systems, circuits and equipment for grounding • Location of grounding connections • Type and sizes of grounding conductors • Methods of grounding • Compliance with appropriate regulations

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I10 Perform electrical tests as required on pumping systems

Objectives

To be competent in this area, the individual must be able to perform electrical tests as required on pumping systems.

LEARNING TASKS

1. Perform electrical tests as required on pumping systems

CONTENT

- Electrical tests for insulation resistance, continuity, voltage, current imbalance etc.
- Specific tests such as:
  - Ground test
  - Phase balance test
  - Megohmmeter test
  - Lead to lead test

SKILLED TRADES BC

Line (GAC): I PUMPING SYSTEM ELECTRICALS

Competency: I11 Describe power supply alternatives for electric motor pumps

Objectives

To be competent in this area, the individual must be able to describe power supply alternatives for electric motor pumps.

LEARNING TASKS	CONTENT
1. Describe power supply alternatives for electric motor pumps	• Single phase and three-phase power supply system in relation to electric motors • Motor voltage requirements

SKILLED TRADES BC

Line (GAC): J PUMPING SYSTEM TROUBLESHOOTING AND REPAIR

Competency: J1 Perform pump system tests to identify problems

Objectives

To be competent in this area, the individual must be able to perform pump system tests to identify problems.

LEARNING TASKS	CONTENT
1. Describe common problems associated with pump systems	• Typical problems, causes and solutions
2. Perform pump system tests to identify problems	• Well flow tests • Instrumentation required for testing including flow meters, electrical meters and pressure instruments • Specific testing procedures • Interpret test results to identify problems

Line (GAC): J PUMPING SYSTEM TROUBLESHOOTING AND REPAIR

Competency: J2 Repair pump systems

Objectives

To be competent in this area, the individual must be able to repair pump systems.

LEARNING TASKS	CONTENT
1. Diagnose pump system problems	• Use appropriate protocols to diagnose pump system problems • Use a troubleshooting decision tree
2. Repair pump systems	• Isolate the cause and repair the pump system

SKILLED TRADES BC

Line (GAC): K WATER WELL SYSTEMS

Competency: K1 Describe the characteristics of an aquifer

Objectives

To be competent in this area, the individual must be able to describe the characteristics of an aquifer.

LEARNING TASKS

1. Describe the characteristics of an aquifer

CONTENT

- Well yield
- Static level
- Pumping water level
- Artesian flow
- Water quality
- Overburden aquifers (confined and unconfined)
- Water bearing bedrock fractures

Line (GAC): K WATER WELL SYSTEMS

Competency: K2 Describe various water well components

Objectives

To be competent in this area, the individual must be able to describe various water well components.

LEARNING TASKS

1. Describe various water well components

CONTENT

- K-Packer
- Screen
- Liner
- Tail pipe
- Casing
- Drive shoe
- Sand/gravel point

SKILLED TRADES BC

Line (GAC): K WATER WELL SYSTEMS

Competency: K3 Describe various in-well pump components

Objectives

To be competent in this area, the individual must be able to describe various in-well pump components.

LEARNING TASKS

1. Describe various in-well pump components

CONTENT

- Pump
- Pipe
- Electrical wire
- Sounding tube
- Safety line
- Pitless adaptor
- Torque arrestor
- Splices
- Pump shroud

SKILLED TRADES BC

Line (GAC): K WATER WELL SYSTEMS

Competency: K4 Describe pump control systems and components

Objectives

To be competent in this area, the individual must be able to describe pump control systems and components.

LEARNING TASKS	CONTENT
1. Describe pump control systems and components	• Pressure tank • Pressure switches • Control boxes • Control panel • Variable Frequency Drive (VFD) • Disconnects • Motor protection devices • Motor control devices • Pressure relief

SKILLED TRADES BC

Line (GAC): K WATER WELL SYSTEMS

Competency: K5 Use various methods and equipment for well head completion

Objectives

To be competent in this area, the individual must be able to use various methods and equipment for well head completion.

LEARNING TASKS

1. Use various methods and equipment for well head completion

CONTENT

- Protection from vehicular damage
- Surface seals (Install and repair)
- Well cap/covers/seal (Install and repair)
- Surface set backs
- Electrical junction box
- Well tag/identification plates
- Stick up
- Pitless adaptor
- Venting

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		