



## Yukon Water & Wastewater Operator Program

# Basic Hydrogeology

## Course Outline

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**INSTRUCTOR:** Stephan Klump  
**DATE:** December 18, 2017 (Monday)  
**TIME:** 8:30 am – 4:00 pm

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### **Course Description**

This 1 day course is designed to increase the participants' knowledge in basic hydrogeology principles which include aquifer types and properties, groundwater flow direction, groundwater as a potable water source, sources and migration of contaminants, water chemistry, groundwater remediation, and groundwater under the direct influence of surface water (GUDI).

### **Course Pre-requisites**

There are no specific pre-requisites for this course. However, Grade 12 (or equivalent) math skills are an asset. Math upgrades are available –contact us.

### **Continuing Education Units (CEUs)**

This course is accepted with EOCP as core for WD - SWS - for 0.60 CEUs.

### **Course Duration**

- 1 day
- 8:30 am to 4:00 pm
- 1 hour lunch break
- morning and afternoon break (15 minutes each)

### **Course Topics and Learning Outcomes**

Introduction

Basic Principles of Hydrogeology

- The Hydrologic Cycle
- Recharge and Discharge
- Aquifers and Aquitards
- Heterogeneous and Homogeneous
- Pore Space
- Saturated and Unsaturated Zone



- Monitoring Wells and Piezometers
- Hydraulic Head

#### Groundwater Flow

- Darcy's Law
- Groundwater Flow Velocity & Direction
- Hydraulic Conductivity
- Hydraulic Gradient
- Triangulation

#### Groundwater Flow Modeling

- Model Output Example
- Contaminant Transport Modeling
- Usefulness of Modeling

#### Groundwater Contamination

- Potential Sources of Contamination
- Migration of Contamination
  - Advection
  - Dispersion
  - Diffusion
  - Density Effects
- Groundwater Remediation

#### Wellhead Protection Plans

- Purpose of Wellhead Protection Plan

#### Groundwater Under the Direct Influence of Surface Water (GUDI)

- Understanding GUDI
- Dangers of Surface Water
- GUDI Assessment Guideline
- Potential Vulnerable Wells

#### Groundwater Chemistry

- Major Ions in Groundwater
- Total Metals for Drinking Water
- Drinking Water Quality
- Naturally Occurring Groundwater Contamination



### **Delivery Method/Format**

<b>Instructional Method</b>	<b>Percentage of Class Time</b>
Hands-on/Q & A	25
Examples/Case Study	15
Presentation/Lecture	60

### **Material/Handouts (supplied)**

- Student Binder: Yukon College, 2017. Basic Hydrogeology; an elective – Technical Development– course. Whitehorse, Yukon.
- EOCP Course Completion and Evaluation Form.
  - every student needs to complete and return this form for any CEU allocation
- Calculators are provided but students are welcome to use their own.
  - please return

### **Course Requirements**

Attendance and participation in class are required. CEUs will be allocated based on attendance and course completion; Yukon College records will show a pass or fail result. If the participant doesn't attend the class, Yukon College records will show a “no show” result and no CEUs will be allocated.

### **Evaluation**

There will be a quantifiable evaluation at the end of this course with a passing mark of 70%. If anyone fails this evaluation, arrangements can be made for a re-assessment. Please note that this evaluation is for self-assessment purpose only.

### **Class Outline**

- 8:30 am to 9:00 am: Introduction
- 9:00 am to 10:00 am: Basic Principles of Hydrogeology
- 10:00 am to 10:15 am: *Health Break*
- 10:15 am to 10:50 am: Basic Principles of Hydrogeology (cont.....)
- 10:50 am to 12:00 am: Groundwater Flow Equations
- 12:00 pm to 1:00 pm: *Lunch*
- 1:00 pm to 1:30 pm: Groundwater Flow Equations (cont.....)
- 1:30 pm to 1:45 pm: Groundwater Flow Modeling
- 1:45 pm to 2:00 pm: Groundwater Contamination
- 2:00 pm to 2:15 pm: Migration of Contaminants
- 2:15 pm to 2:30 pm: *Health Break*
- 2:15 pm to 2:30 pm: Migration of Contaminants (cont.....)
- 2:30 pm to 3:00 pm: Groundwater Remediation
- 3:00 pm to 3:15 pm: Wellhead Protection Plans
- 3:15 pm to 3:30 pm: Groundwater Under the Direct Influence of Surface Water (GUDI)
- 3:30 pm to 4:00 pm: Groundwater Chemistry