

# Technical Memorandum



YG Community Services

## Water Well Protection Plan - Part 1 of 2 - Capture Zone Determination & Potential Contaminant Sources Inventory

December 2012



**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee, Associated Engineering (BC) Ltd and Summit Environmental Consultants Inc. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Summit Environmental Consultants Inc. Information in this document is to be considered the intellectual property of Summit Environmental Consultants Inc. in accordance with Canadian copyright law.

This report was prepared by Summit Environmental Consultants Inc. for the account of YG Community Services. The material in it reflects Summit Environmental Consultants Inc.'s best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Summit Environmental Consultants Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

## Table of Contents

<b>Table of Contents</b>	<b>iii</b>
<b>List of After Text Figures</b>	<b>iv</b>
<b>List of After Text Tables</b>	<b>iv</b>
<b>List of After Text Photographs</b>	<b>iv</b>
<b>List of Appendices</b>	<b>v</b>
<b>Introduction</b>	<b>1-1</b>
1.1 Project Background	1-1
1.2 Purpose of Study	1-1
1.3 Report Format	1-1
1.4 Source to Tap Assessment Guide (Province of ColumBIA 2010)	1-2
<b>Drinking Water Source Description</b>	<b>2-1</b>
<b>Methodology and Advisory Committee</b>	<b>3-1</b>
<b>Delineation and Characterization of Water Sources</b>	<b>4-1</b>
4.1 Capture Zones and Delineation of Aquifer Protection Areas	4-1
4.2 Water Source Characterization	4-3
<b>Contaminant Source Inventory</b>	<b>5-1</b>
5.1 Objectives and Methods	5-1
5.2 Historical Aerial Photographs	5-2
5.3 Records Review	5-2
5.4 Maps and Directory, Field Inspection and Windshield Survey Results	5-3
5.5 Relevant Report Review Results	5-3
5.6 Personal Interviews and Phone Surveys	5-4
5.7 Community Meeting	5-4
<b>References</b>	

## List of After Text Figures

Figure 1	Project Location
Figure 2	Capture Zones
Figure 3	Cross-Section
Figure 4	Potential Point Source Contaminants

## List of After Text Tables

Table 3	Summary of Active and Potential Water Supply Wells
Table 4	Potential Contaminant Source Inventory
Table 5	Potential Contaminant Source Hazard Identification

## List of After Text Photographs

Photograph 1	CWW1 Wellhouse (facing NNW; June 6 <sup>th</sup> 2012).
Photograph 2	The inside of CWW1 Wellhouse (June 6 <sup>th</sup> 2012)
Photograph 3	CWW2 Well Head (Facing south; June 6th 2012)
Photograph 4	CWW3 Well Head (Facing SE; June 6th 2012)
Photograph 5	CWW4 Well Head (Facing north; June 6th 2012)

## List of Appendices

**Appendix A - Well Logs**

**Appendix B - Meeting Minutes**

**Appendix C - Potential Contaminant Source Identification Documents**

**Appendix D – Community Meeting Documents**

# 1 Introduction

## 1.1 PROJECT BACKGROUND

The Village of Mayo (VoM) provides high quality drinking water to its population of 446. The source of the VoM's drinking water is a shallow unconfined sand and gravel aquifer hydraulically connected to the Stewart and Mayo rivers. The VoM currently obtains 100% of its water with this one aquifer. Since the VoM has only one active drinking water source, it is important to minimize hazards that can affect drinking water quality. In 2012 the VoM retained Summit Environmental Consultants Inc. (Summit), the environmental sciences division of Associated Engineering (AE), to develop the Source Assessment and Protection Plan for the VoM's drinking water source wells located nearby the water treatment building. This document is a preliminary Technical Memorandum on the Source Assessment and Protection Plan for the VoM aquifer.

## 1.2 PURPOSE OF STUDY

This Technical Memorandum is intended to present preliminary requirements to fulfill conditions of the VoM's approvals to operate the VoM well fields under two conditions: (1) "Permit to Operate a Large Drinking Water System" with Yukon Government Health and Social Services and (2) Water Licence MN10-055 and amendment MN11-045 issued by Yukon Water Board to remove 3,500 cubic metres per day.

This document is the draft Technical Memorandum for review and comment by the VoM and Yukon Environmental Health. Once reviewed, a draft report will be prepared incorporating comments. The draft report will then be available for public comment at a community meeting, and then presented to the VoM Council. A final report will incorporate comments from both the Council and Public meetings.

## 1.3 REPORT FORMAT

The methodology that was used to develop this well head protection plan is based on the Comprehensive Source-To-Tap Assessment Guideline (Province of British Columbia 2010). This document was prepared by the BC provincial government and was recently updated in 2010. The BC guideline is followed because an equivalent document is not yet in place for the Yukon, and it is consistent with CCME's guidelines for drinking water source protection (CCME 2004). This document builds upon the work completed by the BC Ministry of Environment, Well Protection Toolkit (Province of British Columbia 2000). During the initial meeting, we introduced this approach to the VoM to make sure it met project needs.

The report format is organised into sections that follow the structure of the Province of British Columbia's Comprehensive Drinking Water Source to Tap Assessment Guide (2010). There are eight sections called Modules, of which four will be addressed by this project, with a Chapter devoted to each Module following introductory, background information, and general process and advisory committee sections. Maps, tables and appendices follow at the end of the document.



#### **1.4 SOURCE TO TAP ASSESSMENT GUIDE (PROVINCE OF COLUMBIA 2010)**

The health authorities and experts in B.C. use the Province of British Columbia's S2TAG (2010) to help communities reduce their water treatment requirements. This translates to tax payers saving money on water treatment while maintaining a higher quality of drinking water.

The S2TAG (Province of British Columbia 2010) provides a structured and consistent approach to evaluating risks to drinking water and serves as a tool for water systems to develop a more comprehensive understanding of risks to drinking water safety and availability, how to operate effectively, and how to produce the best possible water quality. It follows eight modules:

Module 1: Delineate and characterize drinking water sources

Module 2: Conduct contaminant source inventory

Module 3: Assess water source elements

Module 4: Evaluate water system management, operation and maintenance practices

Module 5: Audit water quality and availability

Module 6: Review financial capacity and governance of water system

Module 7: Characterize risks from source to tap

Module 8: Recommended actions to improve drinking water protection

The scope of work for this project included and addressed Modules 1, 2, 7, and 8. In this Technical Memorandum, we summarise the work completed under Modules 1 and 2.

# 2 Drinking Water Source Description

The VoM has been using groundwater in Mayo in since at least the 1950s for drinking water supply from a cold water well. There are two aquifers that supply water to VOM. “Cold water wells” are supplied by a shallow aquifer, while the warm water wells are supplied by a deep artesian aquifer and temper the source water in the winters. Use of the cold well water well has increased over the years, due to population growth and practice of bleeding in winter.

The drinking water source wells are located adjacent to the water treatment plant off of 6<sup>th</sup> Avenue and Center Street (Figure 1). Since 2012, two cold water wells are used as the source of the VoM's drinking water (CWW1 and CWW3). The wells have been rated to produce up to 32.2 L/sec sustainably. Two drinking water wells have been drilled but not developed (CWW2 and CWW4). The cold water wells are 6-8 m deep and are screened in gravel and silt ion. Well logs for the cold water wells are included in Appendix A (Figure 3).

Two warm water wells produce non-potable water which is used for heat exchange with the cold water wells in the WTP. After the heat is extracted, the water from the warm water wells is discharged to the Mayo River as a waste. The two warm water wells are 250-255 m deep and are screened in sand and gravel material, overlain with layers of sand and silt to 165 m below ground surface.

All the wells (CWW1 through to CWW4) are located in the vicinity of the water treatment building, which is surrounded by residential and recreational areas. The Mayo River is approximately 225 m west of the well field and flows south, to the Stewart River. The Stewart River is located approximately 550 m south of the well field, and flows west towards the Yukon River. Groundwater is presumed to flow south, parallel to the Mayo River in the vicinity of the VoM well field, although there are not enough wells with survey data and depth to water measurements in VoM to confirm this.

In 2010, AECOM reported that the presence and strength of the correlation between river and well water indicates that there is a hydraulic connection between the groundwater and surface water systems. However, the absence of faecal and total coliforms within raw groundwater samples suggests that the connection is weak and that filtration is occurring within the aquifer. Despite this, the well field was characterized as GUDI. A Phase 3 MPA analysis following the US EPA Consensus Method has not been performed and would be required prior to finalizing the GUDI or non-GUDI determination. According to the Yukon Government Assessment Guideline for GUDI determination (YG 2006), “under this method, a “low risk” determination may be used to exempt the water source from the GUDI designation.” Based on Summit's experience with these types of water source, if an MPA sample was collected and interpreted following the US EPA Consensus Method, it is very likely that the source would be designated non-GUDI.



## 3 Methodology and Advisory Committee

This source water assessment and groundwater protection plan has been prepared in a manner that is consistent with the Province of British Columbia's S2TAG (2010), using the general methodology presented as follows:

- i) Collection and review of available data including previous groundwater reports, mapping, flow records, water quality, etc.;
- ii) Conduction of site reconnaissance and review of the existing water system with the licenced operator;
- iii) Coordination of project meetings with the VoM Council, Yukon Environmental Health and the community;
- iv) Public Consultation; and
- v) Completion of the Study.

The sections covering each completed Module (Province of British Columbia 2010) provide additional detail on methodologies.

In partnership with the VoM, the consultant team facilitated the creation of a Technical Advisory Committee (TAC) for the project including representatives from the following organizations:

**Table 1. Technical Advisory Committee (TAC) Contacts and Roles.**

Name	Organization	Role
Kyle Jansson	Infrastructure Development Branch - YG	Project Manager Lead
Laura Prentice	Infrastructure Development Branch - YG	Senior Program Manager
Margrit Wozniak	Village of Mayo	Chief Administrative Officer
Virginia Sarrazin	Associated Engineering	Process Engineer
Siu Fung Ma	Associated Engineering	Civil Engineer
Louis de Lange	Associated Engineering	Electrical Engineer
Simeon Dee	Associated Engineering	Mechanical Engineer
Annette Neylon	Associated Engineering	Structural Engineer
Marta Green	Associated Engineering	Lead Hydrogeologist
Nicole Jacques	Associated Engineering	Environmental Scientist
Lauren Haney	Access Consulting	Permitting Manager

The VoM, Summit, and AE members of the TAC met seven times in 2012. Copies of the meetings are presented in Appendix B. Ms. Tracy Kinsella of YG-Environmental Health advised members of the TAC by phone.



# 4

## Delineation and Characterization of Water Sources

This Section follows Module 1 and includes the delineation of the protection area using capture zone analysis and mapping, characterization of the individual well sources, and a review of available groundwater quality data.

The objective of Module 1 (Province of British Columbia 2010) is to provide the framework for the source protection assessment, including a characterization of the water system, the water sources, the water system setting and governance context, and the assessment of the proposed protection area. Methods applied include:

- Ms. Jacques met with the VoM staff members at project initiation, and completed a site reconnaissance to well fields.
- Reviewed reports in the engineering library.
- Reviewed the well head protection plans developed by others in the Yukon, British Columbia and Ontario to evaluate their approach and identify aspects that may be of value in Mayo.

### 4.1 CAPTURE ZONES AND DELINEATION OF AQUIFER PROTECTION AREAS

Summit completed a capture zone analysis for the Village of Mayo using the Yukon Government's Assessment Guideline for Well Water or Groundwater under the Direct Influence of Surface Water (Yukon Government, 2006) and the B.C. Well Protection Toolkit (MOE, 2000) as a guide. The scope of this analysis is a desktop exercise only. Data was obtained from reports completed for the Village of Mayo by other consultants.

A well capture zone is the area that contributes water to the well under (1) an assumed pumping rate and (2) duration of pumping (time of travel).

The pumping rate was selected using historical and projected 20 year maximum day demand. The capture zone delineation was completed using parameters from three wells currently in use (CWW2, CWW3, and CWW4) plus the estimated flow from an additional well that is expected to be added near CWW3 to meet future community demands. The close proximity of the wells allowed for calculations to be completed as though there was one single well centred on CWW1.

Time of travel capture areas are based on the time it takes groundwater to travel to the well. Areas closer to the well have less opportunity for contaminants to be removed or diluted and therefore require more protection. The time of travel was set at 90 days, one year, five years and 10 years. The 90 day capture zone primarily protects against large microbial contaminants, such as *giardia* and *cryptosporidium*. Microbial contaminants introduced to the groundwater outside of this zone will be removed by the aquifer before the groundwater reaches the municipal supply wells. The one, five, and ten year capture zones

**YG COMMUNITY SERVICES  
WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION &  
POTENTIAL CONTAMINANT SOURCES**

protect against a range of chemical contaminants from substances that are mobile within the groundwater to contaminants that easily bond to soil and tend to persist within groundwater. Summit considers the area within the ten year capture zone to be the aquifer protection area.

Three methods of delineating capture zone were considered as described in the BC Well Protection Toolkit: the Calculated Fixed Radius Method, the Analytical Equation Method and Hydrogeologic Mapping Method. The long, narrow capture zones depicted from the Analytical Equations Method is typical of alluvial aquifers with moderate to high hydraulic conductivity and gradient. A combination of the Calculated Fixed Radius method and Hydrogeological Mapping Method was selected as the most representative method due to the low regional gradient in the Village of Mayo area and the presence of the Mayo and Stewart Rivers. The Mayo and Stewart Rivers were found to have enough volume, relative to the pumping rates, to create a flow boundary to allowing for hydrogeological mapping to be used as the capture zone method for the western extent of the capture zone.

Equation 1 denotes the formula for calculating the capture zone radius for the volume of water pumped from a pumping well through the Calculated Fixed Radius Method.

Equation 1: 
$$r = \sqrt{\frac{10038 \times Q \times t}{n \times b}}$$

For calculating the VOM wells capture zone, the following table presents inputs and results. The results of the calculated fixed radius method for 90-day, 1 year, 5 year, and 10 year times of travel are: 200 m, 500 m, 1.2 km, and 1.7 km respectively. Figure 2 presents the combined calculated fixed radius and hydrogeological mapping method results and the resulting aquifer protection area.

**Table 2. Calculated Fixed Radius variable descriptions, values and results**

Variables	Description	Units	Inputs	Results
Q <sup>1</sup>	Pumping rate	L/s	17.5	-
t	Allowed travel time to the well	Days or years	90 days, 1 year, 5 years, and 10 years	-
n	aquifer porosity	-	0.15	-
b <sup>2</sup>	Aquifer thickness	m	4	-
R <sub>90 day</sub>	Calculated drawdown radius after the specified travel time to the well	Km	-	0.3
R <sub>1 year</sub>		Km	-	0.5
R <sub>5 year</sub>		Km	-	1.2
R <sub>10 year</sub>		Km	-	1.7

Notes:

1. The value of Q was taken to be the 20 year maximum daily demand (MDD)

2. Aquifer thickness estimated from 2009 AECOM GUDI Assessment reported values and time of travel calculations.

The area within the 10 year time of travel is considered to be the Aquifer Protection Area (“APA”).

## **4.2 WATER SOURCE CHARACTERIZATION**

AECOM 2010 summarized the stratigraphy for the Village of Mayo. It is located on a low alluvial plain consisting of fluvial sand and gravel to a depth of 12 m below ground surface. These sediments lie on top of glaciolacustrine silt and clay and till. The bedrock is argillaceous sandstone, comprised of bedded shale, fine to coarse grained quartz-rich sandstone, and quartz-pebble conglomerate (Gordey and Makepeace 1999). Glaciofluvial deposits are present north and west of Mayo.

The majority of identified wells within the Village of Mayo are completed within the shallow unconfined aquifer that is generally considered to be hydraulically connected to the Stewart and Mayo rivers. The deepest well in the village is 225 m deep, completed in bedrock and is used for geothermal heating. Static groundwater levels in shallow Mayo wells range between 3 m and 6 m below ground surface.

Artesian conditions at two deep warm water wells located near source water wells are indicative of the presence of a deep confined aquifer beneath the Village of Mayo. The recharge source for this deep aquifer is unknown. Water from these wells is of poor quality, it is used for tempering the potable groundwater from the source water wells.

The general direction of shallow groundwater flow cannot be confirmed based on the available information. However, due to the influence of surface topography, it is likely that the direction of shallow groundwater flow is southward toward the Stewart River.

The average water demand for the Village of Mayo is approximately 680 m<sup>3</sup>/day. It is supplied mainly by CWW1 and supplemented by water from CWW3. CWW2 and CWW4 are drilled but not currently connected to the system. CWW1 is a shallow “dug” well consisting of a vertical perforated culvert (2.1 m dia) to 7.6 m below ground surface (bgs) and no surface seal (EBA 2010). It is operating at close to maximum capacity during peak winter demand periods.

Table 3 and Figure 3 summarize well construction details for the active and potential source water wells. Photos depicting the well sites during summer 2012 are included at the end of the report (Photographs 1 through 5). The well field is adjacent to residential land use, institutional land use (School and RCMP) and commercial land use (Government Offices, Laundromat, and Trucking Company). CWW1, 3 and 4 are within a fenced in area which is kept locked.



# 5 Contaminant Source Inventory

This section follows Module 2 (Province of British Columbia 2010) and describes the development of a contaminant source inventory for the APA and identification of potential drinking water hazards. It is designed to identify inherent risks to water quality as well as describing land uses, human activities and other potential contaminant sources that could affect source water quality within the assessment areas. It defines the term “contaminant source” as both actual/existing and potential source of contamination.

Information gathered from all the above sources was summarized in a Contaminant Source Inventory Table (Table 4) and in the accompanying Figure 4 as potential contaminant sources.

### 5.1 OBJECTIVES AND METHODS

We used several methods in completing the assessments of potential drinking water hazards including:

1. Existing records review for the Mayo area including:
  - Historical aerial photographs;
  - Zoning maps;
  - Telephone directories identifying historical site occupation information;
  - Air Emissions Permits;
  - Storage Tank Permits;
  - Contaminated Site Inventory;
  - Contaminated Sites on Federal Land;
  - Fuel Storage Tanks;
  - Relocation Permits;
  - Retail Fuel Storage Tanks;
  - Spills;
  - Special Waste Permits;
  - Waste Disposal Sites;
  - Underground utility maps; and
  - Relevant past reports available from the VoM.
2. A community meeting on July 26<sup>th</sup>, 2012 to seek community member’s input on past or present potential sources of contamination.
3. Contaminated Site Registry search.
4. Storage Tank Permit Log.
5. Personal interviews and phone surveys.
6. A windshield survey (two persons visiting the area by vehicle) identifying obvious potential sources covering Mayo.
7. Field inspections of specific areas of interest within the study area.

## YG COMMUNITY SERVICES WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION & POTENTIAL CONTAMINANT SOURCES

The contaminant source inventory information was further analyzed for assessment of hazards according to Modules 2 and 7 (Province of British Columbia 2010) and summarized in a Hazard Identification Table (Table 5) which summarized the following:

- Type of potential contamination sources within the assessment area;
- Nature of contaminants that have been or potentially could be released;
- Measures in place to prevent contaminant releases to the subsurface;
- Potential effects at the source level; and
- Existing preventative measures and associated barriers at the source level.

Figure 4 shows the locations of the identified hazards.

### 5.2 HISTORICAL AERIAL PHOTOGRAPHS

The primary APA saw development prior to 1949 (the first available aerial photograph). At that time the well field was partially cleared of vegetation and there was some building development to the south (Aerial Photograph A12133-79 dated 1949). A small building was constructed on site by 1961, a road was constructed to the west of the well field, and residential development was built up to the east (Aerial Photograph A17059-38 dated 1961). By 1973, two further buildings were constructed on the well field and to its west, general residential and commercial infill occurred to the east and south (Aerial Photograph A23436-102 dated 1961). The current water treatment building was constructed in the 1980s. By 2004 there was a school yard to the north of the well field and some buildings around the site had been upgraded or built (Aerial Photograph G0108058-288 dated 2004).

### 5.3 RECORDS REVIEW

The records review search identified the following within the APA:

1. Special Waste Generator Permits:
  - Ewing Transport Limited, Special Waste Generator permit (41-137)
  - Mayo Taxi & Bus Service, Special Waste Generator permit (41-158)
2. Air Emissions permit (60-010) – operating diesel plants in Dawson, Faro, Mayo, and Whitehorse for Yukon Energy Corporation
3. Relocation Permit (23-436 and 23-448) - km 53 Silver Trail, Heartland Services for Pacesetter Petroleum
4. Summary Map Sanitary Inspection 2012 Results. (YG – CS). November 2012. Village of Mayo.
  - There is a sewage main joint separation or ingrown roots directly adjacent to the well field in 6<sup>th</sup> Avenue. There is a potential that sewage from the main may reach the well heads.
  - The sewage main is underwater or has heavy ponding on several properties adjacent to the well field. This ponding could degrade the sewage lines and assist in transporting sewage contamination to the wells.
5. Spill Reports:

## YG COMMUNITY SERVICES WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION & POTENTIAL CONTAMINANT SOURCES

---

- Heartland Services, km 53 Silver Trail (Block 42, 61678 LTO YT): 2012 gasoline spill reported; remediation on going
- Mayo Recreational Complex (312-6th Avenue): diesel fuel spill reported (2007); absorbents applied, no further action required.
- Fire Hall and Municipal offices: 20 gallon diesel fuel spill reported (2005); absorbents applied, no further action required.
- Yukon Energy Substation #T2: 300 gallons transformer oil spill reported (2000); spill was contained as best as possible, and some soil excavated. Confirmatory sampling showed some contamination remained on site, and the report suggested spreading Oil Gator on the surface of the excavation and backfill. No follow-up confirmatory sampling has been conducted to prove that the remediation was successful.

### 5.4 MAPS AND DIRECTORY, FIELD INSPECTION AND WINDSHIELD SURVEY RESULTS

The area within the APAs is zoned by the VoM as urban residential, commercial, parkland, future development and industrial. The proposed zoning map is included in Appendix C. These zones typically pose low to moderate environmental concerns. Businesses, institutions, and infrastructure currently and historically in the zone include:

- One gas station;
- One food market;
- School (J.V. Clark School);
- VoM Roads;
- Trails;
- Water services and mains;
- Sanitary services and mains;
- Parkland;
- Radio and Cell Phone Tower;
- Laundromat;
- Recycling Center;
- Lift Station; and
- Power line easements.

### 5.5 RELEVANT REPORT REVIEW RESULTS

The following reports were reviewed to identify potential water well contaminant sources:

- AECOM. November 2011. CWW#3 and CWW#4 Well Construction and Hydrogeological Testing. Village of Mayo. Project No. 60222835 & 60222840.
- AECOM. July 2010. 2009 GUDI Assessment. Village of Mayo. Project No. 60118741.
- N.A. Jacobsen. February 2003. Community Water Systems in the Yukon- Mayo. Yukon Government, Environmental Health Services and Health and Social Services.

## YG COMMUNITY SERVICES WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION & POTENTIAL CONTAMINANT SOURCES

- Quest Engineering Group. August 2010. Phase I- Water Supply Assessment and Source Assessment. Yukon Government, Community Services, Infrastructure Development.
- N.A. Jacobsen. March 2004. Mayo Water System– Phase II Report. Yukon Government, Environmental Health Services.
- EBA Engineering Consultants Ltd. November 2010. Completion Report for Village of Mayo Cold Water Well 2. Yukon Government, Community Services, Infrastructure Development.
- Stanley. May 1992. Water System Improvement Project Underground Utilities (updated December)
- Yukon Water Board. December 2011. Licence No. MN10-055 - Type A Water Licence for Municipal Use. Village of Mayo.

Main conclusions from this work are that there are no monitoring wells and the source water wells are monitored for few potential contaminants of concern.

### 5.6 PERSONAL INTERVIEWS AND PHONE SURVEYS

The following people with knowledge of current and historical land use were interviewed or surveyed by phone:

- **Ms. Margrit Wozniak:** Chief Administrative Officer for the Village of Mayo.
- **Mr. William Hummel:** VoM Foreman and Water Systems Operator for VoM.
- **Mr. Edwin Johnson:** Water Systems Operator for VoM.
- **Mr. Glenn Lamoine:** Grounds Coordinator, Property Management Agency, which maintains the school yards adjacent to the well fields.
- **Mr. Patrick Van Bibber:** Long-time resident of VoM, First Nation Elder

The results of the interviews helped to identify or clarify contaminant sources. When relevant, the information found during the interviews is presented under each risk heading in Module 7.

### 5.7 COMMUNITY MEETING

A notice announcing a community meeting was posted on local information boards by the VoM. Residents were asked to complete a survey form and were provided with an information sheet (both included in Appendix D). Through this, 11 Mayo residents provided information on the following potential contaminant sources (Table 3):

- Gasoline services stations (historic and current);
- Camp ground;
- Laundromat;
- Sewage lagoon;
- The landfill;
- Mining near Mayo; and
- Storage Tanks (above and/or below ground)

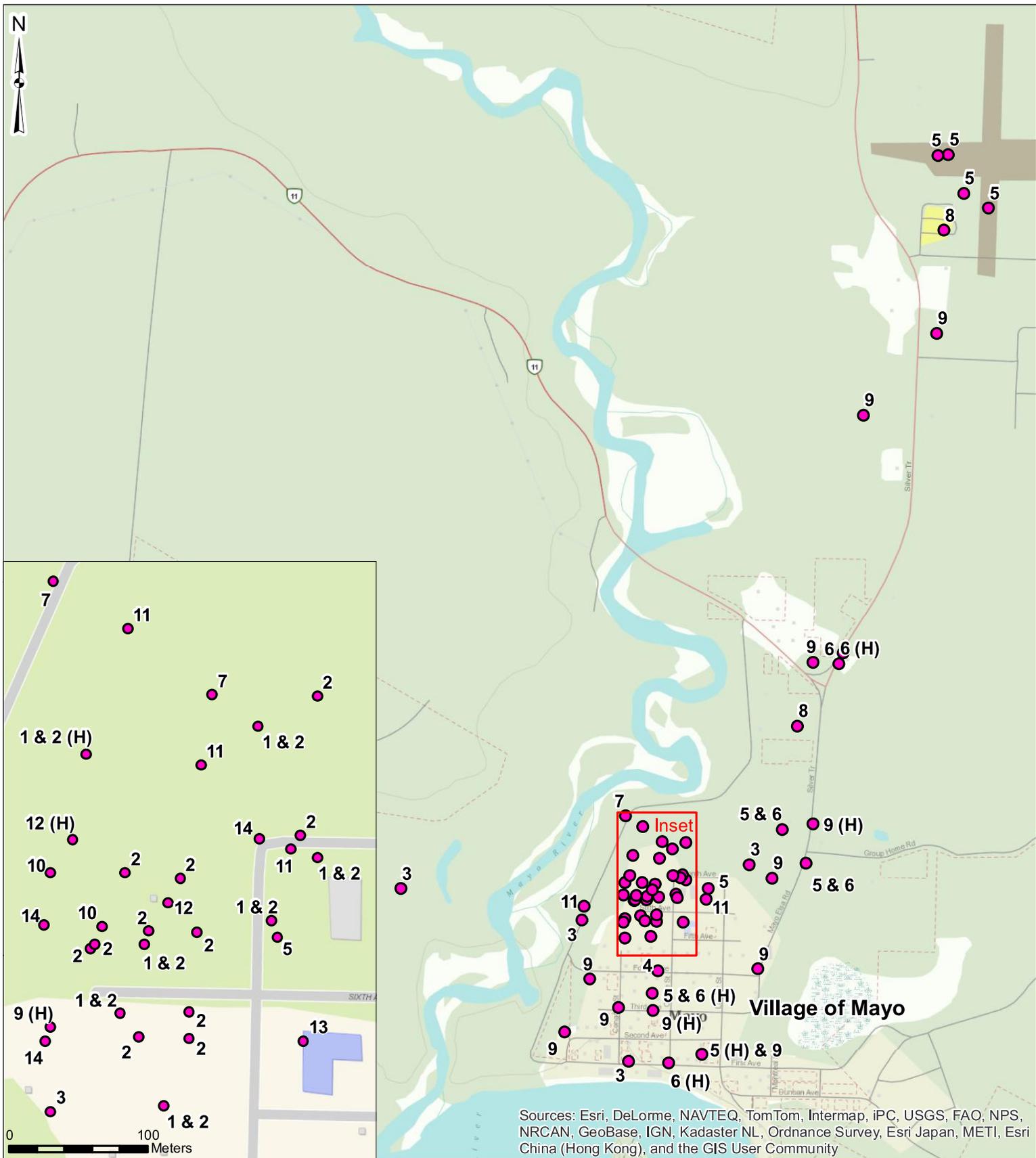
# REPORT

---

## References

- AECOM. 2011. CWW#3 and CWW#4 Well Construction and Hydrogeological Testing. Village of Mayo. Project No. 60222835 & 60222840.
- AECOM. 2010. 2009 GUDI Assessment. Village of Mayo. Project No. 60118741.
- EBA Engineering Consultants Ltd. 2010. Completion Report for Village of Mayo Cold Water Well 2. Yukon Government, Community Services, Infrastructure Development.
- Canadian Council of Ministers of the Environment (CCME). 2004. From source to tap: Guidance on the multi-barrier approach to safe drinking water. Produced jointly by the Federal-Provincial-Territorial Committee on Drinking Water and the CCME Water Quality Task Group.  
<http://www.ccme.ca/sourcetotap/mba.html>
- Province of British Columbia. 2000. Well Protection Toolkit. Victoria: Province of British Columbia. [http://www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/wells/well\\_protection/acrobat.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/acrobat.html).
- Province of British Columbia. 2010. Comprehensive Drinking Water Source-to-Tap Assessment Guideline. Ministry of Healthy Living and Sport.
- N.A. Jacobsen. 2003. Community Water Systems in the Yukon- Mayo. Yukon Government, Environmental Health Services and Health and Social Services.
- N.A. Jacobsen. 2004. Mayo Water System– Phase II Report. Yukon Government, Environmental Health Services.
- Quest Engineering Group. 2010. Phase I- Water Supply Assessment and Source Assessment. Yukon Government, Community Services, Infrastructure Development.
- Stanley. 1992. Water System Improvement Project Underground Utilities (updated December)
- Yukon Government. 2006. Assessment Guideline for Well Water of Groundwater Under the Direct Influence of Surface Water (GUDI), prepared by Environmental Health Services, Health and Social Services, Whitehorse, YT. February 2006.
- Yukon Water Board. 2011. Licence No. MN10-055 - Type A Water Licence for Municipal Use. Village of Mayo.

## **Figures**



Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

● Potential Contaminant Sources:

- 1-Administration Building
- 2-Limited Fuel Storage
- 3-Septic Disposal System
- 4-Laundry Mat
- 5-Documented

- 6-Bulk Fuel Storage
- 7-Groundwater Well
- 8-Cemetery
- 9-Equipment Storage Areas
- 10-Creosote Post (adjacent to wells)
- 11-Leisure Facilities

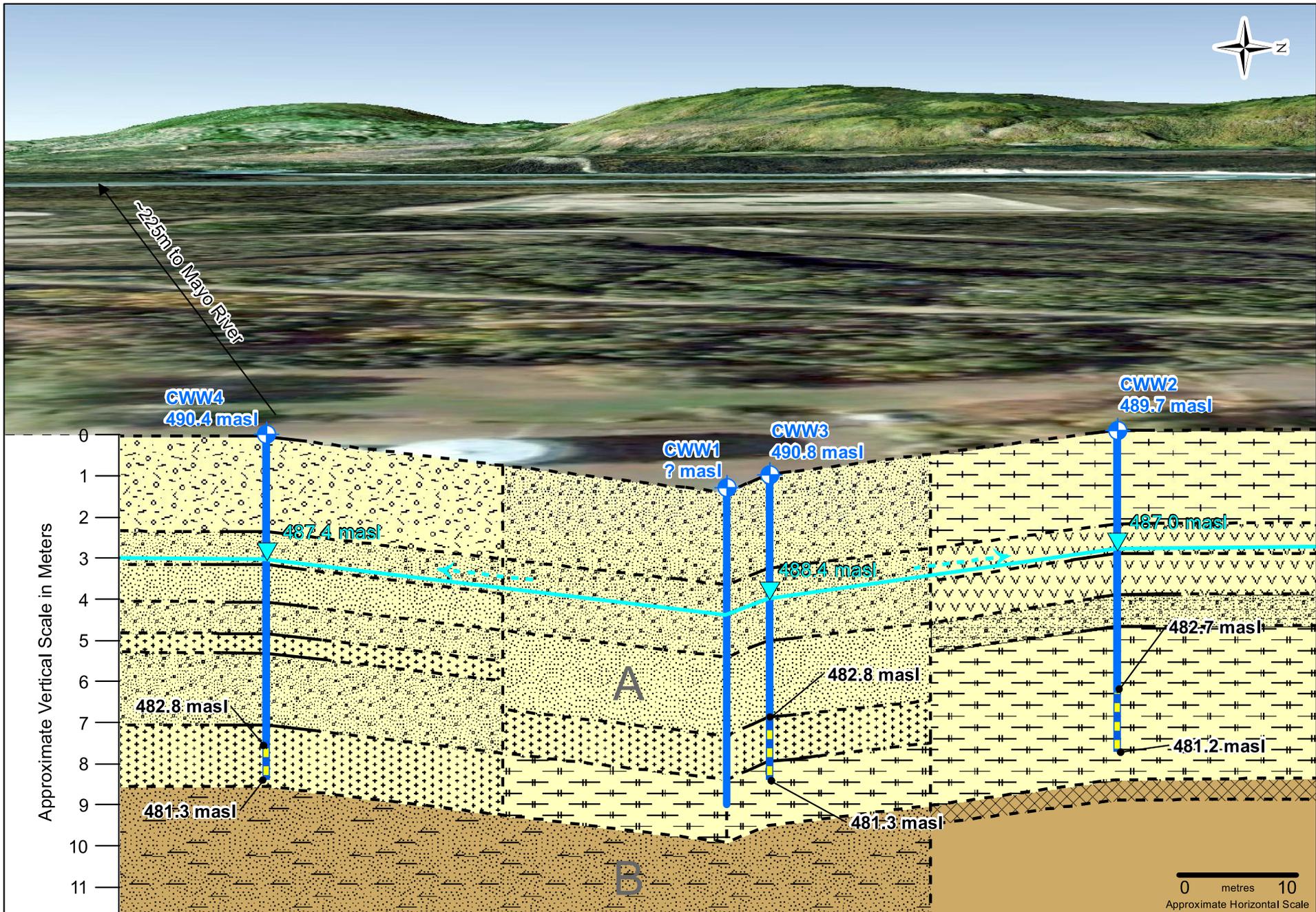
- 12-Ponding Water
  - 13-Nursing Station
  - 14-Fill Material
- (H) signifies a historical source

Figure 4: Potential Point Source Contaminants



0 0.5 Kilometers

Project Number: 2012-2083.011.140  
 Client: Yukon Govt., Community Services  
 Data Source(s): Bing Aerial Maps, 2012  
 Date: September, 2012 Fig 1.mxd



- Clay
- Silt & Sand
- Silt & Gravel
- Silt & Clay & Gravel
- Gravel & Silt
- Sand
- Sand & Gravel
- Sand & Silt
- Gravel
- Gravel & Sand

- UNIT A: Fluvial (Sand & Gravel trace Silt)
- UNIT B: Lacustrine (Silt & trace Clay)

- Well Location
- Static Water Level
- Inferred Groundwater Flow
- Well Casing
- Assumed Strata Boundary
- Known Strata
- Well Screen

Imagery from Google Earth, 2012

PROJECT: 2012.2083  
 DATE: August, 2012  
 DRAWN BY: DA  
 CLIENT: Yukon Govt., Community Services

Figure 3: Cross-Section





Image © 2012 Digital Globe



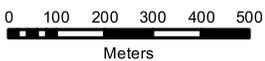
Existing Water Supply Well



Water Quality Site

Capture Zone

**Figure 2: Village of Mayo Wellhead Protection Plan**

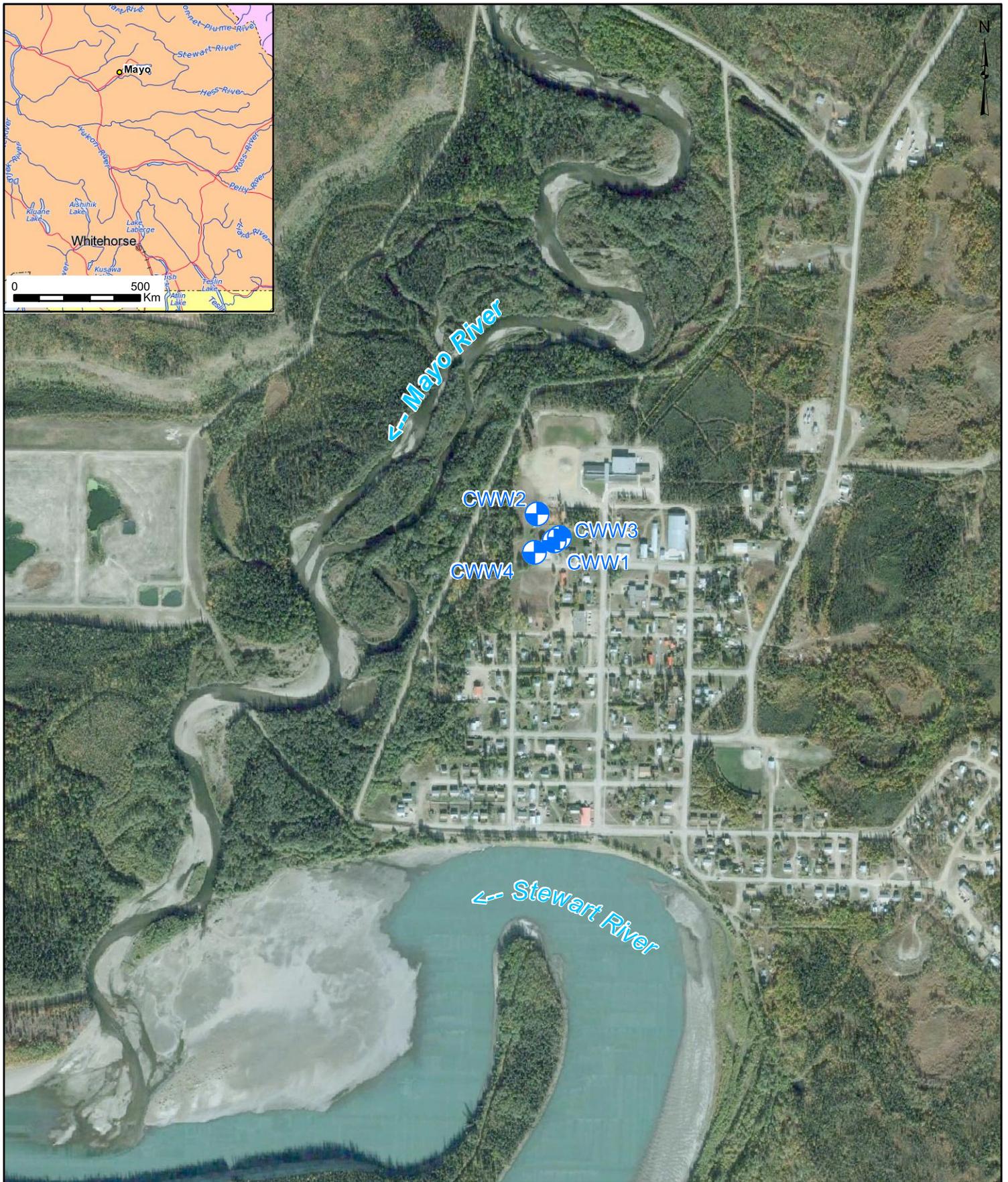


DATE:  
**September, 2012**  
DRAWN BY:  
DA

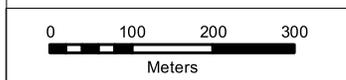
PROJECT:  
2012-2083.011  
(140)

PREPARED FOR:  
**Yukon Govt.,  
Community Services**





**Figure 1: Project Location**



DATE:  
**August, 2012**  
DRAWN BY:  
DA

PROJECT:  
2012-2083.011  
(140)

PREPARED FOR:  
**Yukon Govt.,  
Community Services**



## **Tables**

**Table 3 Summary of Active and Potential Water Supply Wells**

Details	CWW1	CWW2	CWW3	CWW4
Date of Construction	1970s	October 2, 2010	September 8, 2011	September 9, 2011
Drilling Contractor/Method	Excavation	Dual-air Rotary	Air Rotary	Air Rotary
Casing Diameter (m)	2.1	0.25	0.4	0.4
Well Depth (mbgs)	7.6	7.85	8.55	8.2
Stick-up (m)	0.4	0.64	0.97	0.89
Well Screen Diameter	-	0.227 m	0.337 m	0.337 m
Screen Size	-	Variperem telescopic V-wire, 40-Slot and 80-Slot	Variperem continuous wire, 100-Slot	Variperem continuous wire, 100-Slot
Screen Interval (mbgs)	-	6.33 - 7.85	7.03-8.55	6.68-8.2
Static Water Level (mbgs)	-	2.75	2.38	3.03
Total Available Drawdown (m)	-	2.38	3.55	4.28
Sanitary Seal (mbgs)	-	5.5	2.5	2.5
Maximum Sustainable Yield (L/sec)	14	5.1	18.2	6.2
Top of Casing (masl)	-	489.669	490.794	490.379
Ground Level (masl)	-	489.029	489.824	489.489
Top of Screen (masl)	-	482.699	482.794	482.809
Bottom of Screen (masl)	-	481.179	481.274	481.289
Transmissivity (m <sup>2</sup> /day)	394	3456	671	117
Storativity	0.02215 <sup>a</sup>	-	0.007	0.0373
Hydraulic Conductivity K (m/s)	8.82x10 <sup>-4</sup> <sup>a</sup> or 1x10 <sup>-3</sup> <sup>b</sup>	0.008	0.00153	0.000233

a- Mean of CWW3 and CWW4

b- GUDI Result

**Table 4: Potential Contaminant Source Hazard Identification**

Source No.	Source	Owner/ Jurisdiction	Location	Nearest Distance & Direction to Source Well	Potential Contaminants of Concern	Transport Mechanism
<b>Point Sources</b>						
1	Administration Buildings	RCMP, Yukon Government, Village of Mayo, or Private Ownership	Various locations	60 m SE of CWW1	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, heavy metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, Trichlorofluoroethane, xylenes and chlorine	Deposits, leaks and spills to soil and groundwater
2	Fuel Storage (in ASTs, Drums, USTs and short-term storage containers)	RCMP, Yukon Government, Village of Mayo, Various Commercial or Private Ownership	Various locations	25 m E of CWW1	Hydrocarbons and metals	Overfill, leaks, spills and deposits to soil and groundwater
3	Septic Systems	Village of Mayo, Commercial and Private Ownership	Various locations	25 m S of CWW4	Septage, coliform, and non-coliform bacteria, viruses, nitrates, phosphate, heavy metals, tetrachloroethylene, dichlorobenzene, methylene chloride, chloride, sulphate, and PPCPs (pharmaceuticals and personal care products)	Deposits, leaks and spills to soil and groundwater
4	Laundromat	Private Ownership	Center St. and 4th Ave.	250 m SE of CWW4	Solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methyl chloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate).	Deposits, leaks and spills to soil and groundwater
5	Documented Spills	RCMP, Yukon Government, Village of Mayo, Various Commercial or Private Ownership	Various locations	135 m SE of CWW1	Hydrocarbons and metals	Spills to soil and groundwater
6	Bulk Fuel Storage	Yukon Electrical Company Limited and Various Commercial Ownership	Various locations	320 m SE of CWW4	Hydrocarbons and metals	Deposits, leaks and spills to soil and groundwater
7	Direct Pathways for Surface Contamination to Groundwater through Groundwater Wells	Yukon Government, Yukon Electrical Company Limited and Private Ownership	Various locations	125 m S of CWW4	Hydrocarbons, metals, salts, herbicides and pesticides	Deposits, leaks and spills to groundwater
8	Cemetery	Village of Mayo	Mayo Road	650 m NE of CWW2	Formaldehyde, nitrates, nutrients, pesticides and herbicides	Deposits to soil and leaks to groundwater
9	Equipment Storage	Yukon Electrical Company Limited, Yukon Government, Village of Mayo and Various Commercial Ownership	Various locations	60 m S of CWW4	Gasoline, antifreeze, automatic transmission fluid, battery acid, engine and radiator flushes, engine and metal degreasers, hydraulic fluid and motor oils	Deposits, leaks and spills to soil and groundwater
10	Creosote Posts	Village of Mayo	At NW and SE corners of the water treatment building property	25 m SW of CWW2 and 25 m W of CWW3	Creosote, hydrocarbons, heavy metals, methanol, glycol and phenols	Runoff to groundwater
11	Leisure Facilities (Curling Rink, Pool, Sports Fields and Campground)	Village of Mayo	Various locations	30 m E of CWW1	Nitrates, nutrients, chemical residues, left-over product containers, chlorine, septage, gasoline, and household hazardous wastes	Deposits, leaks and spills to soil and groundwater
12	Ponding of Water	Village of Mayo, RCMP	Adjacent to CWW2 and in the yards of the RCMP Residences	5 m E of CWW2	Hydrocarbons, metals, salts, herbicides and pesticides	Runoff to groundwater

**Table 4: Potential Contaminant Source Hazard Identification**

Source No.	Source	Owner/ Jurisdiction	Location	Nearest Distance & Direction to Source Well	Potential Contaminants of Concern	Transport Mechanism
13	Nursing Station	Yukon Government	Center St. and 5th Ave.	190 m SE of CWW1	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, heavy metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, Trichlorofluoroethane, xylenes, chlorine, solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methyl chloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate).	Deposits, leaks and spills to soil and groundwater
14	Fill Material	Various	Adjacent to Water Treatment Building	0 from CWW4	Methane and metals	Deposits to soil and leaks to groundwater
<b>Non-point Source Locations (individual locations not shown on the map)</b>						
N/A	Snow Dump	Village of Mayo	Various locations	50 m SW of CWW4	Sodium chloride, hydrocarbons and ethylene glycol	Deposits leach and spills to soil and groundwater
N/A	Waste from Animals and Pests	N/A	Throughout the APA	20 m E of CWW1	Coliform bacteria and other microbes such as <i>toxoplasmosis</i> in cats	Deposits to soil and groundwater
N/A	Cleaning and maintenance products (disinfection chemicals, metal polishes, refrigerants, rust proofers, degreasers and solvents)	RCMP, Yukon Government, Village of Mayo, or Private Ownership	Throughout the APA	20 m E of CWW1	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, heavy metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, Trichlorofluoroethane and xylenes	Deposits, leaks and spills to soil and groundwater
N/A	Electric Power Easements	Yukon Electrical Company Limited	Throughout the APA	30 m SE of CWW1	Herbicides	Runoff to groundwater
N/A	Roads and Transportation Infrastructure	Village of Mayo	Throughout the APA	20 m SE of CWW1	Automotive wastes, sodium chloride, pesticides, herbicides, solid and liquid spills and runoff	Runoff to groundwater
N/A	Sewer Lines and Mains	Village of Mayo	Throughout the APA	20 m SE of CWW1	Septage, coliform, and non-coliform bacteria, viruses, nitrates, phosphate, heavy metals, tetrachloroethylene, dichlorobenzene, methylene chloride, chloride, sulphate, and PPCPs (pharmaceuticals and personal care products)	Deposits, leaks and spills to soil and groundwater
N/A	Storm Drainage Mains	Village of Mayo	Throughout the APA	20 m SE of CWW1	Hydrocarbons, metals, salts, herbicides and pesticides	Deposit and runoff to groundwater

**Table 5: Hazard Identification**

Source # (Map 4)	Source	Existing Preventative Measures	Identified Barriers		
			Thick Unsaturated Zone <sup>1</sup>	Estimated Long Travel Time to Well <sup>2</sup>	Presence of Organics in Soils <sup>3</sup>
1	Administration Buildings	Regulatory requirements to prevent and respond to spills	no	no	no
2	Fuel Storage (in ASTs, Drums, USTs and short-term storage containers)	Regulatory requirements for fuel storage and to prevent and respond to spills	no	no	no
3	Sewage Systems	Unknown	no	no	no
4	Laundromat	Regulatory requirements to prevent and respond to spills	no	no	no
5	Documented Spills	Unknown	no	no	no
6	Bulk Fuel Storage	Regulatory requirements for fuel storage and to prevent and respond to spills	no	no	no
7	Direct Pathways for Surface Contamination to Groundwater through Groundwater Wells	Unknown	no	no	no
8	Cemetery	Unknown	no	yes	no
9	Equipment Storage	Yukon Energy Cooperation, Yukon Government, Village of Mayo and Various Commercial Ownership	no	no	no
10	Creosote Posts	Yukon electrical	no	no	no
11	Leisure Facilities (Curling Rink, Pool, Sports Fields and Campground)	Regulatory requirements to prevent and respond to spills	no	no	no
12	Ponding of Water	Unknown	no	no	no
13	Nursing Station	Regulatory requirements to prevent and respond to spills	no	no	no
14	Fill Material	Little organic matter in local soil	no	no	no

Notes-

- 1- If a location has evidence of a depth to water greater than 3 m, then it is assumed that an associated barrier is present.
- 2- If a location has evidence of a long distance N/A
- 3- If a location has evidence of organic soils present nearby, then it is assumed that an associated barrier is present.

## **Photographs**

**YG COMMUNITY SERVICES  
WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION &  
POTENTIAL CONTAMINANT SOURCES**

---



**Photograph 1: CWW1 Wellhouse (facing NNW; June 6<sup>th</sup> 2012).**



**Photograph 2: The inside of CWW1 Wellhouse (June 6<sup>th</sup> 2012)**

**YG COMMUNITY SERVICES  
WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION &  
POTENTIAL CONTAMINANT SOURCES INVENTORY**

---



**Photograph 3: CWW2 Well Head (Facing south; June 6<sup>th</sup> 2012)**



**Photograph 4: CWW3 Well Head (Facing SE; June 6<sup>th</sup> 2012)**

**YG COMMUNITY SERVICES  
WATER WELL PROTECTION PLAN - PART 1 OF 2 - CAPTURE ZONE DETERMINATION &  
POTENTIAL CONTAMINANT SOURCES**

---

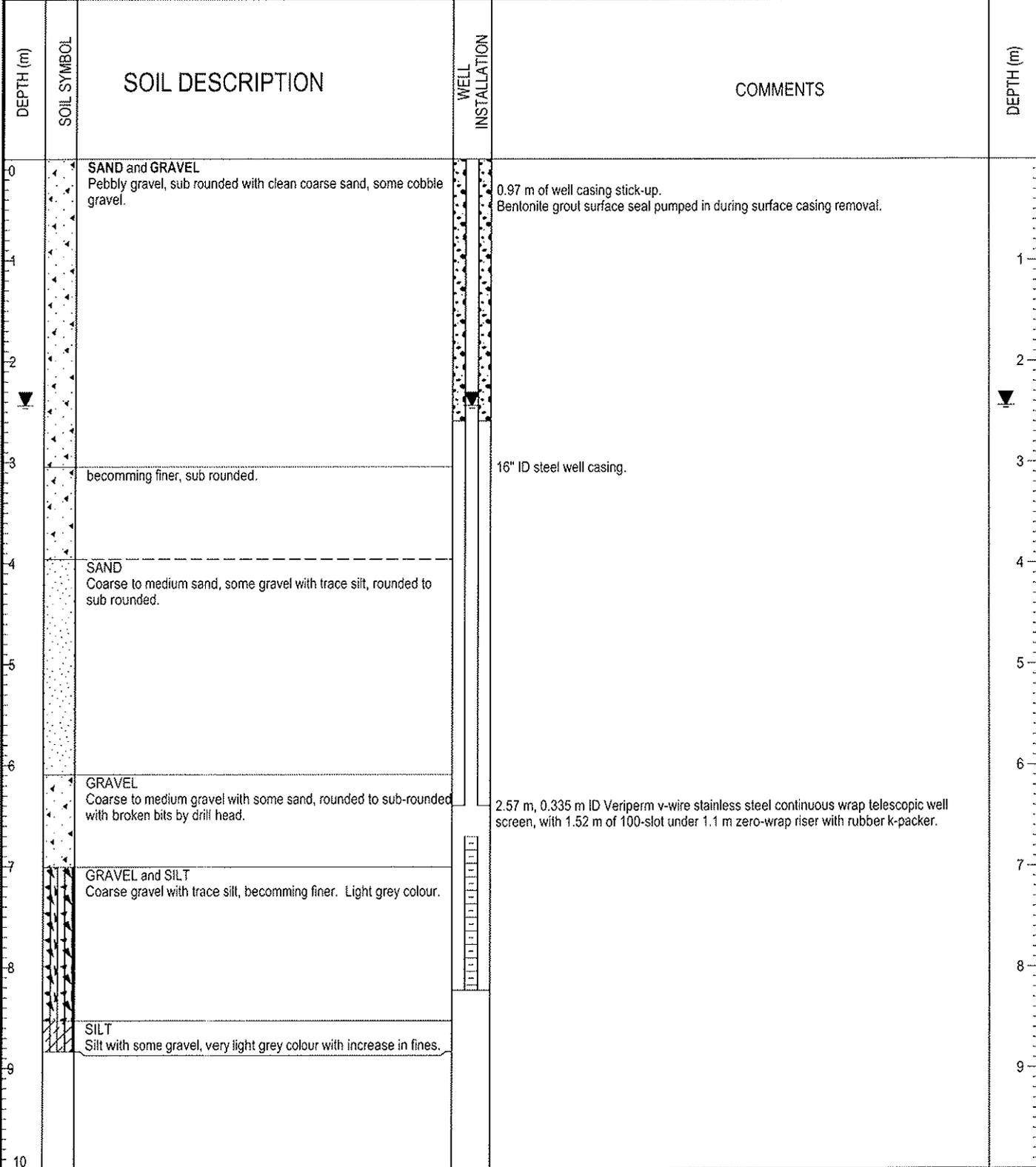


**Photograph 5: CWW4 Well Head (Facing north; June 6<sup>th</sup> 2012)**

## **Appendix A - Well Logs**



PROJECT: Mayo CWW#3 and CWW#4	CLIENT: Village of Mayo	TESTHOLE NO: CWW3				
LOCATION: Mayo, Yukon		PROJECT NO.: 60222835				
CONTRACTOR: Ensign Coring and Drilling	METHOD: Air Rotary	ELEVATION (m):				
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input checked="" type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND



ENVIRONMENTAL (VAPOUR ONLY): MAYO DRILLING.GPJ UMA.GDT 11/7/11

AECOM

LOGGED BY: Caleb Light	COMPLETION DEPTH: 8.84 m
REVIEWED BY: Jonathan Kerr	COMPLETION DATE: 7/9/11
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Mayo CWW#3 and CWW#4	CLIENT: Village of Mayo	TESTHOLE NO: CWW4
LOCATION: Mayo, Yukon		PROJECT NO.: 60222835
CONTRACTOR: Ensign Coring and Drilling	METHOD: Air Rotary	ELEVATION (m):
SAMPLE TYPE <input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE		
BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input checked="" type="checkbox"/> CUTTINGS <input type="checkbox"/> SAND		

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	WELL INSTALLATION	COMMENTS	DEPTH (m)
0		GRAVEL and SAND Gravelly sand, some cobbles overlain by gravel fill placed previously. Light brown colour.		0.97 m of well casing stick-up. Bentonite grout surface seal pumped in during surface casing removal.	
3		SAND and GRAVEL Sandy gravel angular to sub rounded, pieces broken by drill head. Light brown colour. Very Dry.			
3		SAND Coarse to medium sand becoming fine, rounded to sub rounded, trace gravel.	16" ID steel well casing.		3
4		SAND and GRAVEL Course sand with some gravel and trace silt, angular to sub-rounded, light brown, very dry.			4
5		GRAVEL Clean pebble gravel followed by wet gravel.			5
6		SAND and GRAVEL Coarse sandy gravel, wet, rounded to sub rounded. Light brown in colour.			6
7		SAND and GRAVEL Sandy gravel with some silt, increasing fines return with water.		2.57 m, 0.335 m ID Veriper m v-wire stainless steel continuous wrap telescopic well screen, with 1.52 m of 100-slot under 1.1 m zero-wrap riser with rubber k-packer.	7
8		GRAVEL Coarse gravelly sand, some cobbles, large pieces, rounded to sub-rounded. Fines suspended in water return.			8
9		SAND and SILT Silt till with some sand, moist, light grey colour.		Some infill during well-screen installation with fine material, requiring additional blowout.	9

ENVIRONMENTAL (VAPOUR ONLY): MAYO DRILLING.GPJ UMA.GDT 11/7/11

AECOM

LOGGED BY: Caleb Light	COMPLETION DEPTH: 9.14 m
REVIEWED BY: Jonathan Kerr	COMPLETION DATE: 9/9/11
PROJECT ENGINEER:	Page 1 of 1

## Appendix B - Meeting Minutes

<b>Date:</b>	June 7, 2012	<b>File:</b>	2012.2083
<b>Time:</b>	9:00	<b>Page:</b>	1 of 5
<b>Project:</b>	Village of Mayo Engineering Services for Water Supply, Protection and Treatment Upgrades		
<b>Subject:</b>	Kick off meeting		
<b>Client:</b>	Yukon Government - Community Services		
<b>Location:</b>	Village of Mayo office		
<b>Present:</b>	Margrit Wozniak (Village of Mayo) William C. Hummel (Village of Mayo) Edwin G. Johnson (Village of Mayo) Laura Prentice (Yukon Government) Nicole Jacques (Associated Engineering) Virginia Sarrazin (Associated Engineering)		
<b>Distribution:</b>	Those Present		

## RECORD OF MEETING

Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

**Action By:**

**Discussion:**

**Introduction & Generalities**

- Virginia S. A site visit and collect of information was performed by Nicole Jacques and Virginia Sarrazin on June 6<sup>th</sup> and 7<sup>th</sup>. The following documents have been collected and will be returned once copies have been made:
- Design Brief Water System Improvements, Stanley, 1987
  - Pumphouse As-Built Drawings, Stanley, 1988
  - Mechanical O&M manuals, Stanley, 1988
  - Electrical O&M manuals, Dynamic Systems, 2001
  - Building Structure Drawings, Nason Construction, 1988.
- Laura P. Rick Savage who worked extensively on the system will be contacted to collect more background information if available.
- Laura P. A survey of the pumphouse site and wells will be coordinated.
- Laura P. Any geotechnical information available will be sent by YG to AE.
- AE The intent is still to perform the well ties in in the summer of 2012. The tendering documents should also include all what is required for the well head protection plan, including extension of the property fencing to the property boundary, repair of fencing where needed, increasing the fence height where needed, proper closing gates, shelter for the well heads, monitoring wells.

Subject: Kick off meeting  
June 7, 2012  
Page 2 of 5

**Action By:**

**Discussion:**

**Collection of Information During Meeting**

AE The current operators at the plant are William C. Hummel, Edwin G. Johnson and Dale Hutton (in process of being certified). A past operator is John Ewing working now for YEC.

CWW1 is constantly in operation this likely reduces the risk of lines freezing.

The old well was decommissioned when CWW1 was put on line has been filled with sand from a local sand pit.

WW1 and WW2 are artesian and constantly draw water from the aquifer. In summer the heat exchanger is bypassed and the warm water is sent to the Mayo river. In winter, the well pumps are operated and the warm water goes through the heat exchanger before being sent to the Mayo river.

VoM confirmed that the culvert installed in the ditch along 7<sup>th</sup> avenue close to CWW2 has been blocked with gravel for approximately 8 years. No overflowing of the ditch has been observed since then. This has diverted the stormwater from 7<sup>th</sup> avenue to Centre street and 6<sup>th</sup> Avenue. Prior to this, water pooled adjacent to CWW2.

Staff present during the kick off meeting were not aware of spills or contaminated sites in the vicinity of the wells.

Fuel has been stored on site and on adjacent sites. It has mostly been heating fuel (diesel) but there may have been chemicals used by YG Forestry stored on an adjacent (to the south) property.

Limited soil staining in the area of two wells (CWW3 and CWW2) is from the drilling rig used to drill the wells.

The sump and drains in the Treatment Building feed directly into the Village's sewer infrastructure.

Gravel was used around CWW4 to raise the ground level so that it was even with the rest of the property.

The area within the well field has not been known to flood.

Subject: Kick off meeting  
June 7, 2012  
Page 3 of 5

**Action By:**

**Discussion:**

AE

There are two septic systems in the Village. One directly south of the well field and one to the northeast of the well field. Additionally, there are outhouses in the campground west of the property.

A double walled AST was purchased and will be installed on the SE corner of the water treatment plant to feed the day tank inside the building.

The pumphouse houses two booster pumps which were installed for heat exchange for the RCMP building. They have never been operated and can be removed if the space is needed. There is also two heat pumps and air conduit that were installed for a heat exchange project and which are not used. They could also be removed if the space is needed.

All the other space currently available in the plant can be used if needed.

No pesticides or herbicides are used on site.

There are currently no monitoring wells on or adjacent to the wellfield. If one or more is to be installed, it should be installed to be frost resistant. Design specification should be included in the Tendering Documents

Some ground movement is observed at the location of the concrete pad on the outside of the building on the side of the chlorination room.

**Wells Tie In Follow-up Action Items**

Virginia S. Utility maps will be requested to YECL and Nwtel.

VoM No information is available on the depth of the underground pipe connecting CWW1 to the pumphouse. Digging will be performed to find out.

Virginia S. CWW3 has not proven to produce the flow rate expected from the design report from AECOM (18.2 L/s). Two flow tests have been performed to confirm this fact. The results of these tests will be collected and discussed with AECOM.

Virginia S. Once the final flow rate is determined for CWW3, a tie in configuration will be designed for CWW2, 3 and 4 to the water treatment plant. This should take into account that provision for sampling from each well must be in place, and that a solution for redundancy of the source must be provided.

Subject: Kick off meeting  
June 7, 2012  
Page 4 of 5

**Action By:**

**Discussion:**

Once a design is accepted by YG and VoM, a construction schedule will be produced so that local contractors can be informed ahead of time. Also, a list of material should be provided as early as possible to avoid manufacturing and shipping delays.

Virginia S. Yukon Energy will be contacted in order to collect the historical data on the water levels in the Mayo river to potentially identify any connection with the water level in CWW3.

Virginia S. Coordination will be done with Lauren Haney from ACCESS who is taking care of the permitting application for wells CWW3 and CWW4.

**Wellhead Protection Plan – Follow-up Action Items**

Margrit W. The updated zoning maps from 2012 will be sent to AE as soon as available.

Laura P. The sewage pipes are being scoped by YG through CCTV inspection performed by Bob White. The report and DVD video on the pipes close to the site will be provided to AE when available.

Margrit W. An Emergency Response Plan for the wells will be prepared as none is in place. Only a Community EMO is available and will be sent to AE.

AE A public consultation will be held in the village. Potential options for the format of the meeting were discussed. The meeting should include food and the survey should be facilitated in order to retain interest. An example of the survey form was given to VoM for consultation and input.

Nicole J. Additional interview will be performed of key people in the Village who have an extended knowledge of the history of spills and modification of the local infrastructure. The RCMP personnel and archives, the fire crew, elders, past and current operators will be consulted.

VoM The concrete containment located outside of the building at the fuel tank fill point is full of water and algae. It must be emptied and cleaned on a regular basis.

Laura P. Protection Plan requirements have been discussed with YG- Health and Social Services. They will be forwarded to AE to be included in the Protection Plan.

Margarit W. Zoning maps from 2007 are currently being amended, the new ones will be sent to AE as soon as they are available.

Laura P. YG will provide AE with the contact information for the property manager of the RCMP yard. AE

Subject: Kick off meeting  
June 7, 2012  
Page 5 of 5

**Action By:**

Nicole J.

**Discussion:**

will contact this person for additional information

**Treatment Upgrade – Follow-up Action Items**

The operators are comfortable using the gas chlorination system. New equipment has been ordered to replace the main parts of the Severn Trent system, since only minor parts replacement has been performed so far. VoM gave a list of the purchased equipment to AE.

Virginia S.

AE mentioned that if gas chlorination is conserved in the future, a scrubber must be installed to collect a potential leak from the ventilation system. AE will provide more information on the space and O&M requirements of this equipment.

Virginia S.

VoM asked for an O&M cost comparison of the different options proposed by AECOM for the upgrade of the disinfection system in their report "VoM WTP Conceptual Design and Hydrogeological Work Scoping Study", March 2011. VoM precised that one challenge is the lack of a full time operator. Consideration for the level of operator's training should also been taken into account in the final assessment of the different options.

**\*\* END OF DOCUMENT \*\***

<b>Date:</b>	June 29, 2012	<b>File:</b>	2012.2083
<b>Time:</b>	10:30	<b>Page:</b>	1 of 2
<b>Project:</b>	Village of Mayo Engineering Services for Water Supply, Protection and Treatment Upgrades		
<b>Subject:</b>	Discussion on Technical Memorandum #1 on Well Development and Tie in		
<b>Client:</b>	Yukon Government - Community Services		
<b>Location:</b>	Conference Call		
<b>Present:</b>	Margrit Wozniak (Village of Mayo) William C. Hummel (Village of Mayo) Edwin G. Johnson (Village of Mayo) Dale Hutton (Village of Mayo) Laura Prentice (Yukon Government) Kyle Jansson (Yukon Government) Nicole Jacques (Associated Engineering) Virginia Sarrazin (Associated Engineering)		
<b>Distribution:</b>	Those Present		

## RECORD OF MEETING

Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

#### Well Operation

Village of Mayo (VoM) agreed on Option 1 presented in the Technical Memorandum suggesting drilling a new well in order to provide full redundancy to the water supply. The Public Works staff does not have capacity to deal with boil water advisories whenever CWW#1 is in operation.

Therefore, the operation will alternate between CWW#3 alone, and combined CWW#2, CWW#4 and the new well. The alternate operation will be automated with potential for manual operation.

An air rotary rig from Midnight Sun Drilling (now Ensign Energy Services co.) will be in Mayo at the end of July to drill monitoring well at the solid waste facility. YG will look at coordinating the drilling of the new water supply well and monitoring wells (at the WTP site) at the same time. YG will communicate with AE in terms of requirement for a well drilling RFP which is not included in the original AE scope of work.

VoM mentioned that the size of the casing should be big enough to provide as much water as possible. AE will find out what maximum size of casing can be installed.

Subject: Kick off meeting

~~June 7, 2012~~ June 29, 2012

Page 2 of 2

**Action By:**

**Discussion:**

**Well Tie in**

Each well pipe will enter the water treatment building separately to facilitate the operation and centralize the sampling points. VoM sent a sketch of the underground electrical wire detected on site by Yukon Energy.

Virginia S.  
VoM

The possibility of reusing the well pipe from CWW#1 will be studied. VoM team will dig out the pipe next week and will take picture to get a sense of the external state of the pipe, as well as its depth. YG will contact Aquatech to determine if a camera inspection of the pipe can be done.

**Wellhead Protection Plan**

Each well head will be protected by a lockable enclosure high enough to be easily located in winter under the snow pack. The enclosure must be insulated.

YG

A fence is planned to enclose Lots 1-8, Block 37, which are currently partially enclosed.

Virginia S.

The oil tank to be installed outside the building will be located at less than 60 m than the wells which does not respect Section 9 of the Public Health and Safety Act (OIC 2001/139). YG with Lauren Haney of Access Consulting Group will discuss what protection measures should be put in place for the AST. They will confirm these measures with Environmental Health.

AE will provide information with the protection measures accepted by Environmental Health for the AST at the Old Crow water treatment plant.

\*\* END OF DOCUMENT \*\*

<b>Date:</b>	July 5, 2012	<b>File:</b>	2012.2083
<b>Time:</b>	2:00 pm	<b>Page:</b>	1 of 2
<b>Project:</b>	Village of Mayo Engineering Services for Water Supply, Protection and Treatment Upgrades		
<b>Subject:</b>	Discussion on Permitting and Well Development		
<b>Client:</b>	Yukon Government - Community Services		
<b>Location:</b>	YG-CS Boardroom		
<b>Present:</b>	Margrit Wozniak (Village of Mayo) (phone) Laura Prentice (Yukon Government) Kyle Jansson (Yukon Government) Lauren Haney (Access Consulting Group) Virginia Sarrazin (Associated Engineering)		
<b>Distribution:</b>	Those Present		

## RECORD OF MEETING

Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

#### Permitting and Licensing

Lauren confirms that the Water Board can review the application before receiving the Decision Document. Lauren also reminds that the Water Board only meet once a month.

Lauren confirms that the work on the wells can start before the YESAA application is submitted because they are located on Title Land.

The water license includes CWW#2 and an emergency amendment was produced by the Water Board for the temporary CWW#3 connection. This amendment was conditional to the fact that Village of Mayo would perform a permanent installation later on.

Laura  
AE      The new well will be identified as CWW#1A. YG-CS will give a contract to AE to prepare the drilling specifications for the new well. Laura will provide the specifications used for the other wells.

AE      Before being able to send the YESAA application:  
 - AE needs to confirm the number of monitoring wells for the YESAA application.  
 Lauren      - Lauren needs to provide more details on the new well CWW#1. Laurent will send the list  
 AE      of information she needs for AE to complete.

Laura      Laura will contact the Building Inspections Department if a permit application is required for changes to be done in the water treatment plant (electrical, mechanical work).

Subject: Kick off meeting  
June 7, 2012  
Page 2 of 2

**Action By:**

**Discussion:**

- AE AE will setup a meeting with YG-EHS in order to discuss the following items:
- Proposal for safe installation of oil tank within 60 m of the wells
  - Concern with oil tank located on the RCMP compound within 60 m of the wells
  - Concern with the sewer pipes located within 60 m of the wells
  - Tie in of new wells before treatment is in place
  - Sealing around the casing not deep enough for CWW#3 and 4
  - Schedule for application for a permit to modify to a large public drinking water system
  - Location of monitoring wells.

The tentative date is July 18<sup>th</sup>.

**Discussion on well development**

Margrit says that the Council is concerned by the number of monitoring wells to be added on the pumphouse lot. They are concerned that it might create additional access to the shallow aquifer.

CWW#1 will not be decommissioned before next year to ensure that there is always a source of water available in case of problems after the commissioning of the other wells.

- AE AE will find strategies to connect the new wells while keeping CWW#1 connected and knowing that additional treatment will be added in the plant in the near future.

Laura Laura will contact Bob White for potential camera inspection of the pipe from CWW#1.

- AE AE will propose a simple design for a wellhead protection box with insulation and heating with a light bulb.

Margrit will check which is better between the 18<sup>th</sup> and 19<sup>th</sup> of July to organize the Community Survey. Laura confirmed that coupons or meals will be provided and the cost will be covered by YG.

AE says that the Operation and Maintenance cost assessment for the different solutions for chlorination is out of the initial scope. AE will provide a draft of the rough cost comparison to determine if a change order is required to incorporate more details in the analysis.

**\*\* END OF DOCUMENT \*\***

<b>Date:</b>	July 18, 2012	<b>File:</b>	2012.2083
<b>Time:</b>	2 pm	<b>Page:</b>	1 of 2
<b>Project:</b>	Village of Mayo Engineering Services for Water Supply, Protection and Treatment Upgrades		
<b>Subject:</b>	Meeting YG-EHS		
<b>Client:</b>	Yukon Government - Community Services		
<b>Location:</b>	Conference Call		
<b>Present:</b>	Laura Prentice (Yukon Government) Kyle Jansson (Yukon Government) Laura Haney (Access) Virginia Sarrazin (Associated Engineering)		
<b>Distribution:</b>	Those Present		

## RECORD OF MEETING

Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

#### 1. Potential Upgrade of CWW#1

Virginia AE suggests the upgrade of the existing CWW#1 well compare to drilling a new well. AE will submit some more information on what work would be performed for the upgrade, as well as on some relative experience in BC.

Laura emphasizes that drillers can be on site or 2 days and that if a decision can be taken shortly, the project would benefit from avoiding additional mob/demob costs for drilling.

YG-EHS YG-EHS will decide once all the information is received.

#### 2. Safe installation of plant oil tank

YG-EHS AE proposes a safe design for the installation of the oil tank outside of the water treatment plant. A sketch has been provided to YG-EHS. YG-EHS will review the design and make recommendations if needed, based on previous discussions with Village of Mayo.

Laura Laura will contact Margrit about previous discussions the Village had in the past about the oil tank installation.

Subject: Kick off meeting  
June 7, 2012  
Page 2 of 3

**Action By:**

**Discussion:**

**3. Oil tanks on RCMP property**

YG-EHS The RCMP property located next to the water treatment plant one has several above ground oil tanks installed outside and located within 60 m of the drinking water wells. AE is looking for some input from YG-EHS on how this situation can be addressed.

**4. Sewer pipes**

YG-EHS Sewer pipes are installed along 6<sup>th</sup> avenue which is within 60 m of the drinking water wells. AE is looking for some input on potential protective actions.

**5. Monitoring wells**

The number and location of monitoring wells will be determined later this summer and drilling will happen next year. YG-EHS should take this information into account when making recommendations on protective actions for the drinking water wells.

Lauren Lauren will see if an amendment will be required to the water license once the monitoring plan is ready.

**6. Tie in of new wells**

AE points out that the wells will be tied in to the plant before the new treatment is in place. The new treatment will include UV disinfection and chlorination (with an upgraded disinfection system).

The sequence of work for the tie will be as following:

- (1) Permanent development of CWW#3 and connection to the water system,
- (2) Upgrade of CWW#1 or drilling and development of CWW#1A,
- (3) Alternate operation of CWW#1 (or 1A) and CWW#3.

Virginia AE will send the information on the temporary CWW#3 tie in to YG-EHS and YG-CS.

**7. CWW#3 and 4 sealing**

YG-EHS The sealing for CWW#3 and 4 is 3 m deep when the Guidelines for Water Well Construction recommends 5 m. The rationale is provided in the completion report prepared by AECOM. YG-EHS should review this information and make recommendations is necessary.

Subject: Kick off meeting  
June 7, 2012  
Page 3 of 3

**Action By:**

**Discussion:**

**8. Backup power supply**

YG-EHS YG-CS discussed the upgrades with Ron Bramadat, building inspector. A backup power source is required for the water treatment plant. AE recommends the installation of an outside plug in for a portable generator in order to avoid an additional potential source of contamination close to the wells. AE is looking for potential input from YG-EHS on the installation of a backup power source.

**9. Schedule for permit**

YG-EHS YG-EHS will inform AE on the schedule to follow for the application to modify a large public drinking water system knowing that the well tie in is not a major modification and that the treatment upgrades will be performed subsequently.

Virginia AE will start the application process according to this schedule.

**10. Other**

Lauren gave a copy of the EBA's Technical Memorandum on Village of Mayo Water Supply Source Assessment (August 17, 2010) to AE.

\*\* END OF DOCUMENT \*\*

<b>Date:</b>	July 24, 2012	<b>File:</b>	2012.2083
<b>Time:</b>	2 pm	<b>Page:</b>	1 of 2
<b>Project:</b>	Village of Mayo Engineering Services for Water Supply, Protection and Treatment Upgrades		
<b>Subject:</b>	Meeting YG-EHS		
<b>Client:</b>	Yukon Government - Community Services		
<b>Location:</b>	YG-EHS office - 2 Hospital Road		
<b>Present:</b>	Tracey Kinsella (YG-EHS) Pat Brooks (YG-EHS) Laura Prentice (Yukon Government) Kyle Jansson (Yukon Government) Laura Haney (Access) Virginia Sarrazin (Associated Engineering)		
<b>Distribution:</b>	Those Present		

## RECORD OF MEETING

Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

#### 1. Potential Upgrade of CWW#1

Given that:

- Design information on CWW#1 culvert is not available
- No detailed plan is available for the upgrade of CWW#1
- Such culvert can release Cd/Zn over time
- There is no screen installed

YG-EHS recommends drilling a new well close to CWW#1 and decommission CWW#1 once the new well is operational.

#### 2. Safe installation of plant oil tank

AE AE will refine the design of the oil tank set up and submit a contingency plan for a spill event.

YG-EHS Based on AE design, the local conditions and the contingency plan, YG-EHS will prepare a recommendation on this issue.

Subject: Kick off meeting  
June 7, 2012  
Page 2 of 3

**Action By:**

**Discussion:**

**3. Oil tanks on RCMP property**

Virginia

YG-EHS has no authority over oil tanks installed on private property. A municipal bylaw would be the only way to control the installation of oil tank close to the wells. Virginia will discuss the issue with the Council during the meeting scheduled for July 26<sup>th</sup> in Mayo.

**4. Sewer pipes**

Laura  
AE

The sewer pipes are planned to be CCTV inspected. Laura will make sure that this section of pipe will be inspected this summer. AE will submit a contingency plan for a sewage spill.

YG-EHS

Based on the results of the CCTV inspection, the local conditions and the contingency plan, YG-EHS will prepare a recommendation on this issue.

**5. Monitoring wells**

YG-EHS does not have any regulations or guidelines in place for the location and installation of monitoring wells.

AE is working on a monitoring plan which will specify the number of monitoring wells, their location, the type of parameters to be monitored, and the frequency of monitoring. This monitoring plan is based on the determination of the capture zones, the data collection on contaminant sources and the public survey scheduled in Mayo for July 26<sup>th</sup>.

AE

AE will submit the draft monitoring plan to YG-EHS for review.

**6. Tie in of new wells**

The new wells will be connected to the water system before the treatment upgrade. YG-EHS recommends the following monitoring plan to be applied on each well:

- Turbidity monitoring (raw water), for a minimum of twice a day,
- Bacterio testing (raw and treated water), twice a week.

This monitoring plan would apply for a limited period of time determined by YG-EHS.

Subject: Kick off meeting  
June 7, 2012  
Page 3 of 3

**Action By:**

**Discussion:**

**7. CWW#3 and 4 sealing**

Because of the specific conditions, YG-EHS agrees to the variation from the Canadian Groundwater Association Guidelines for Water Well Construction.

**8. Backup power supply**

AE  
YG-EHS

AE will include this item in the contingency plan to be submitted to YG-EHS who will prepare a recommendation on this issue.

**9. Schedule for permit**

Laura  
Virginia

Laura will prepare application for a permit to modify the Mayo Large Public Drinking Water System. Virginia will review the application. Three applications will be prepared, one for each phase of the upgrade project:

- Phase 1: Drilling of new well CWW#1A,
- Phase 2: Wells tie in,
- Phase 3: Treatment upgrade.

**10. Treatment Upgrade**

YG-EHS

The current regulation asks for filtration for GUDI sources, however some exception may apply. Once more data are available from the new wells, YG-EHS will prepare a recommendation on this issue.

**\*\* END OF DOCUMENT \*\***



<b>Date:</b>	July 26, 2012	<b>File:</b>	2012-2083.100.140
<b>Time:</b>	7:00 - 8:20 pm	<b>Page:</b>	1 of 6
<b>Project:</b>	Mayo Wellhead Protection Plan- Update and SWOT		
<b>Subject:</b>	Drinking Water Source Protection Planning		
<b>Client:</b>	YG Community Services		
<b>Location:</b>	Village of Mayo Office		
<b>Present:</b>	Kyle Jansson (YG), Scott Bolton (Mayor), Kris Pavlovich (Councillor), Trevor Ellis (Councillor), Barb Barchen (Treasurer), Margrit Wozniak (CAO), Virginia Sarrazin (AE), Gwenda Sulem (AE)		
<b>Distribution:</b>	Those Present, Nicole Jaques (AE), Laura Prentice (AE).		

## RECORD OF MEETING

These minutes are considered to be complete and correct. Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

#### Project Team with Roles/Titles

- Virginia Sarrazin – AE Project Manager
- Nicole Jacques – AE Contaminants Lead
- Gwenda Sulem – AE Junior Engineer
- Kyle Jansson – YG Community Services
- Laura Prentice – YG Community Services

#### Reason for/Goals of this Meeting

- Update VoM on status of wellhead protection plan.
- Learn more about the system from VoM's point of view.
- Determine what kinds of protection measures VoM would be interested in applying.

#### Discussion on Drinking Water Source Protection Plan Methods

- Protection Plan will be based on BC Ministry of Health Comprehensive Source To Tap Assessment Guideline.
- **Project Familiarization**  
AE has familiarized themselves with the background information for the Mayo wells.
- **Identification of Potential Contaminant Sources**  
AE have and will complete the following steps to identify potential contaminant sources:
  1. Public Consultation (held at noon today).
  2. Existing records review:
    - Historical aerial photographs
    - Zoning maps
    - Fire insurance
    - Underground utility maps
    - Relevant past reports available from the Village of Mayo
  3. Contaminated Site Registry Query.



Subject: Drinking Water Source Protection Planning

July 26, 2012

Page 2 of 6

**Action By:**

**Discussion:**

4. Strength, Weaknesses, Opportunities, Threats (SWOT) analyses (to be conducted at this meeting).
  5. Personal interviews and phone surveys.
  6. "Windshield" survey (conducted on July 26, 2012)
  7. Field Inspections.
- We understand that a GUDI assessment (groundwater under the direct influence of surface water) has been completed on the well field and that the wells are classified as GUDI. This means that there is a risk of large pathogens. For this reason, water will be treated by chlorination, and UV disinfection.
  - Hazards will be mapped on top of the mapped capture zones (90 day, 1 year, and 10 year) and groundwater flow directions. This will give a good indication of the area of interest.
  - **Risk Assessment of Contaminant Sources**  
AE will evaluate the risk (likelihood) that the contaminant sources will affect Mayo's Drinking water. To do this we give each contaminant source a number between 1 and 5. One means it is not very or unlikely to occur and five means it is very likely to occur. AE will then assign a value to what the consequence would be if the risk occurs. The risk (likelihood) and the consequence information is then combined into a risk level which is either (low, moderate, high or very high).
  - **Risk Management**  
A SWOT will be required to determine the risk management actions. Information on your concerns and priorities for the water source protection will be gathered through answering a series of questions.
  - **Emergency Contingency Plan**  
AE will prepare an emergency contingency plan based on the completion of the previous steps. We understand the Village of Mayo has general emergency plans but no specific information for the wells.  
Steps to develop the emergency contingency well protection plan:
    1. Form a community planning team.
    2. Define the well protection area.
    3. Identify potential contaminants.
    4. Develop and implement management strategies.
    5. Develop contingency plans.
    6. Monitor results and evaluate the plan.
  - **Final Report**  
A draft report will be prepared for review and comment by the Village administration in February 2013. Second draft report will be prepared incorporating comments. The second draft will then be presented to the Village Council and Public. A final report will be made to incorporate comments from both the Council and Public meetings. The report will be fully referenced and written in a style that will be readily understood by Village staff, Council, and informed members of the public.
  - **Public/Council Presentation**  
A formal presentation to the Village Council will be made once the final report outlining the Well



Subject: Drinking Water Source Protection Planning  
July 26, 2012  
Page 3 of 6

**Action By:**

**Discussion:**

Head and Well Field Protection Plans is complete. The presentation will provide an overview of the plans including key features and innovations, decision support and next steps.

The presentation will include maps, graphs and other visual imagery to support Council in any deliberations that may occur. The presentation will also include a brief summary of the public consultation process.

A public presentation will be made following the presentation to Village Council. The presentation will focus on the risk assessment and emergency contingency plans with an emphasis on the importance of public support in an emergency. Reference will be made to the public consultation held at the outset of the project. The presentation will include maps, graphs and other visual imagery to describe the process leading up to the preparation of the Well Head and Well Field Protection Plans.

Mayo WWPP Contaminant Survey Findings To-date

1. Capture Zone Areas
2. Identified Concerns

AE  
VoM

AE to update map with concerns noted from public survey and windshield survey.  
Village of Mayo Council to confirm map of contaminants/concerns once received.

VoM SWOT Analyses of Current Wellhead Protection

- What is working well in the current drinking water system?
  - The size of the current well is sufficient.
  - The taste/quality of the water from the current well is "good".
  - Good water and good system for over 30 years.
  - Mayo is a small town that if there is something wrong with the water, council/mayor would hear of it immediately. The only complaint VoM has gotten regarding the drinking water is about having too much chlorine in the water. The chlorine concentration in the village's drinking water was increased 5 to 10 years ago.
- What does not work well or does not consistently work well with the current drinking water system?
  - Bleeders in the water system. Bleeders in the main water system are lowering drinking water supply.
  - Some residents leave the tap running when leaving their house for a long period of time (ie. vacation) to avoid freezing of pipes.
  - YG changing the regulations constantly, and not giving the rationale.
  - VoM is also not told where to find the regulatory changes.
  - Accumulation of reports required by regulators. Operators may miss a key test because they are too busy with all the new regulations and reports required.
  - Environmental Health will require additional test sample in the beginning for the new well. Currently, VoM submits a BacT sample every two weeks. The samples are shipped with Kluane shipping, which are only available on Mondays or Wednesdays.
  - Last winter there was a potential water shortage. Council says this was due to the 400



Subject: Drinking Water Source Protection Planning

July 26, 2012

Page 4 of 6

**Action By:**

**Discussion:**

man camp for the Mayo B project. The amount of water supplied to the band has also increased.

- The water distribution system is old. VoM is experiencing an increase amount of water main breaks and freeze ups. The aging water main is being replaced, one section at a time. The infrastructure in town is okay, but the infrastructure to the band is about 20 years old.
- The water system needs to be looped to avoid bleeding and decrease water consumption.
- What are all the ways we could improve the drinking water system?
  - Having a well head protection plan.
  - Educating the public on Mayo's water source. There have not been any major problems and the public does not seem interested in this topic.
  - Even during the water boil advisory, many residents did not boil the water prior to drinking. The school purchased bottled water for the children.
  - VoM said to make sure the well is drilled shallow. If the well is dug too deep, the water may have high minerals and arsenic.
- What might prevent us from implementing all the ways we could to improve the drinking water system?
  - Yukon Energy (YEC) controlling the water level. Contaminants/sediments are carried over to the well area during high water. YEC had previously tried to drill 2 additional wells. These two wells did not produce good drinking water.
  - Notes on the current potential contaminants map:
    - Recreation centre had a spill in the past (day tank overfilled), however the spill was contained and drained into the sanitary system.
    - Health Centre had a propane tank in the past.
    - The oil tank heating the building for the pool is unprotected from vehicles backing into it.
    - Front street is known to have contamination. The area was used for a flight plane depot (on the Stewart River dyke), and for the Whitepass.
    - School has a reinjection well for geothermal heating.
- VoM is invited to add to the SWOT notes above if more ideas arise.

Protection Measures VoM May or May Not be Interested In:

1. Monitoring wells (due to the large capture zone, shallow sources water, etc. contaminants could pass by monitoring wells before sampling results).
2. Monitoring well sampling frequency. Once the potential contaminants are identified, monitoring frequency can be determined.
3. Data loggers are an option to reduce (not eliminate) sampling. Data loggers can be remote, allowing data to be sent to the data collected directly. One data logger will be required for each parameter required.



Subject: Drinking Water Source Protection Planning

July 26, 2012

Page 5 of 6

**Action By:**

**Discussion:**

4. Sampling source water for contaminants. In some instances, the confirmation of certain levels a contaminant may be too late.
5. Limiting activities near well area through bylaws (development, fertilizer use, pesticide use, vehicle maintenance, storage tank protection measures, etc.).  
AE suggested VoM to create a by-law to ban the installation of oil tanks within 60m of the drinking water well. Currently, the oil tank of the RCMP office is on the lot adjacent to the well. Because this property is not YG land, YG Environmental Health does not have jurisdiction.
  - VoM notes that they would require the estimated cost for the different options of protection measures to be able to make an informed decision.
  - Council also notes that all the oil tanks are currently above ground. Leaks would be seen and action taken quickly.
  - Sampling of the water may be done by VoM themselves, however testing for hydrocarbons would have to be conducted in Vancouver. VoM would need to know how often sampling would be required as transportation to Whitehorse is limited to twice a week (by Kluane Freight System).
  - VoM inquired if YG would be able to assist with sampling and testing.

**Next steps for the Wellhead Protection Plan:**

VoM

1. Community meeting data summary.
2. Interviews with knowledgeable people (elders, RCMP, etc.). VoM to give AE contact list.
3. Determine risk. Summarize the Contaminant Sources combined with Capture Zones in Memo (Aug. 2012). Review with Council for which parameter and contaminant they feel should be prioritized.
4. Wellhead Protection Plan (Feb. 2013)
  - a. Recommendations on how to reduce contaminant risks
  - b. Monitoring Plan (including well locations and well frequency)
  - c. Emergency Response Plan (Feb. 2013)

**Discussions with YG Environmental Health**

- AE and YG Community Services have been in contact with Pat Brooks and Tracey Kinsella of YG Environmental Health to discuss the Mayo Water Source and Treatment Plant
- YG Environmental Health does not agree with upgrading CWW1. YG Environmental Health feels the current well is a risk because there is no screen at the bottom. Particles would surround the screen, creating a natural filter.
- The proposed oil tank for the water treatment facility was also discussed. Currently, YG requires oil tanks to be placed at least 60 m away from a drinking water well. AE proposed designing an oil tank with the 5 levels of safety (second containment, spill box, fill alarm, protective casing over piping, within a berm, and sheltered) for installation within the 60m. YG has allowed this for a couple other water treatment facilities in the Yukon. Final decision is pending.
- The sewer pipe along 6<sup>th</sup> Avenue is 57 m away from the well. YG requires 60 m. A CCTV inspection of the sanitary pipe is being arranged to help assess the condition of the pipe.



Subject: Drinking Water Source Protection Planning

July 26, 2012

Page 6 of 6

**Action By:**

**Discussion:**

- Environmental Health has no jurisdiction over monitoring wells.
- There will be an increase of samples required (turbidity, BacT) in the initial stages of the new well. This is because the wells will be tied in before treatment.
- CWW3 and CWW4 have seals that are less than 5 m deep. Environmental Health okay with this because of AECOM's justifications.
- Back-up power supply should be provisioned. AE suggested an plug-in for a portable generator.
- Permits for tie-ins and new treatment will be required.
- AE currently working on a cost estimate for mobilization/demobilization of drilling a new cold water well.

Meeting adjourned 8:20 pm.

Prepared by:

Gwenda Sulem, EIT



<b>Date:</b>	August 3, 2012	<b>File:</b>	2012-2083
<b>Time:</b>	9:30 - 10:30 am	<b>Page:</b>	1 of 3
<b>Project:</b>	Mayo Water Treatment Plant Upgrades		
<b>Subject:</b>	Proposal for Consulting Services for CWW1a installation, pump test and MPA		
<b>Client:</b>	YG - Community Services		
<b>Location:</b>	AE Whitehorse Office		
<b>Present:</b>	Nicole Jacques (AE), Virginia Sarrazin (AE) and Laura Prentice (YG-CS)		
<b>Distribution:</b>	Those Present, Kyle Jansson (YG)		

## RECORD OF MEETING

These minutes are considered to be complete and correct. Please advise the writer within one week of any errors or omissions, otherwise these minutes will be considered to be an accurate record of the discussions.

### Action By:

### Discussion:

Background: Summit submitted a proposal to YG-CS on August 3<sup>rd</sup>, 2012 for the hydrogeological investigation of a new well CWW1A. Three options were included:

- Option 1: Supervision of drilling, particle size analysis, screen design and reporting,
- Option 2: Supervision of pumping test, end of test sampling,
- Option 3: GUDI study for CWW1A.

Laura Believes the MPA would be beneficial but we need to have a sense of EHS's interest. Laura will approach EHS.

Nicole

Nicole Will provide Laura with a one page document describing the method to be used and a reference to the US EPA documents discussing the method either by the end of the day today or on Monday.

Virginia Asked if AECOM shut down CWW1 while drilling CWW3.

Laura Answered that she did not know if AECOM shut down CWW1 while drilling CWW3, but perhaps we can find that out in their report. She asked if we need to do MPA method on all wells we are tying in or if we can do "representative" MPAs on a couple of the wells.

Virginia Replied that the use of "representative wells" would need to be approved by EHS.

Laura

Laura Will discuss the use of the MPA method on "representative wells" rather than all the wells with EHS.

Nicole Suggested that the Proposal Option 3 (MPA GUDI Assessment) be held until after the wells that are going to be used are tied in.



Subject: Consulting Services for Proposal for CWW1a installation, pump test and MPA  
August 3, 2012  
Page 2 of 3

**Action By:**

**Discussion:**

Laura The MDD of 17.5 L/s listed in the RFP may not be accurate by the way flow is monitored (by Totalizer), and it is counting on no added efficiencies in the system (replacement and/or removal of bleeders).

Virginia Not knowing the actual flow rates makes designing the plant and choosing wells to tie in less accurate.

Laura If we don't drill CWW1A this summer, what will the impacts on the AE project be?

Virginia It would allow us to get actual rates of use and therefore design the system to be more efficient.

Laura If we need more information on the usage to design the treatment then we should hold off on the design until we get that information. EHS said that we can keep CWW1 online until the fall of 2013. After that, it will need to be disconnected. We will need to tie in CWW3 to meet needs for this year. Laura will include this plan in the memo to EHS. Will we need a pump test company to get the MPA samples from the wells that are not tied in at the time of sampling?

Nicole

Nicole Will find out if we need a pump test company to get those samples.

Laura Virginia will need to consider spacing for the CWW3 tie in this year and maybe the CWW2+CWW4 or CWW1a tie ins next year.

The VoM infrastructure assessment tender will be completed for YG-CS next week. That will be useful for our future scope.

If EHS approves of the proposed MPA method, we will do a change order to cover that work.

Laura Understands that this review has taken some time and effort on AE's part.

Nicole Some of the time we spent was proposal preparation and the other time was providing information on which to base our options. Would you be amenable to sharing the cost?

Laura A cost sharing would be fair.

Nicole Would 50/50 split work for you.



Associated  
Engineering

GLOBAL PERSPECTIVE.  
LOCAL FOCUS.

## Record of Meeting

Subject: Consulting Services for Proposal for CWW1a installation, pump test and MPA

August 3, 2012

Page 3 of 3

**Action By:**

**Discussion:**

Laura Yes, could you please make note of the cost we are incurring for that. Use a title like:  
**Options Assessment for Supply Analyses.**

Prepared by:

Nicole Jacques, M.Sc., EP

## Appendix C - Potential Contaminant Source Identification Documents

Nicole Jacques

---

From: Margrit Wozniak <caomayo@northwestel.net>  
Sent: 30-Aug-12 12:12 PM  
To: Nicole Jacques  
Subject: RE: Quick questions

Hello Nicole,

The Village of Mayo uses calcium sand when the roads get slippery.

We have several locations where we stockpile snow in the winter. If possible we let the snow melt, only in severe winters we would haul the snow out of town with trucks prior to the melt.

Our snow stockpile locations are:

- 1) In the field at the west end of Sixth Avenue (no sand is added at this location)
- 2) The school pushes their snow from their parking lot to the west end of Seventh Avenue (no salt is added at this location)
- 3) At the westerly end of Fifth Avenue, Third Avenue and Second Avenue
- 4) Along First Avenue on the Stewart River Dike side
- 5) On lot 3 Block 3 along First Avenue
- 6) behind the ball park
- 7) at the easterly end of 7th Avenue around the arena
- 8) behind the Staff house (easterly end of alley between 5th and 4th Avenues)
- 9) across from the Mayo Pool in a vacant YHC lot
- 10) in the empty lot on Block 17 Lot 9 and 10 (Dick Ewing's lot)
- 11) in the empty lot on Block 7 Lots 6-9, vacant YHC lot
- 12) on the Mayo Motors lot on Block 6 Lots 1-6 (now that this property is being developed we will not be able to stockpile snow there in the future)
- 13) on the Variety Store Lot behind the Binet House Museum on Block 8 Lots 16-18 and across from the Binet House on Block 9 Lots 16 and 17
- 14) in vacant lots in the easterly end of First Avenue and Duncan Avenue
- 15) in the vacant lot by the Village of Mayo Senior Centre

Sincerely,  
Margrit

Margrit Wozniak  
Chief Administrative Officer  
Village of Mayo  
Box 160  
Mayo, Yukon  
Y0B 1M0  
Tel: 867-996-4300  
Fax: 867-996-2907

---

From: Nicole Jacques [<mailto:nrj@summit-environmental.com>]  
Sent: Wednesday, August 29, 2012 5:00 PM

To: Margrit Wozniak ([caomayo@northwestel.net](mailto:caomayo@northwestel.net))

Subject: Quick questions

1. Where is the snow from the roads dumped in the winter?
2. Does the Village use salt to reduce ice?

Thanks,

Nicole Jacques, M.Sc., EP  
Environmental Scientist

301- 4109 4th Avenue  
Whitehorse, YT, Canada, Y1A 1H6

Tel: 867 456-2711 Ext 225

Fax: 604 291-6163



ONE OF CANADA'S  
50 BEST-MANAGED COMPANIES



Web: [www.summit-environmental.com](http://www.summit-environmental.com)

---

This email is intended for the named recipient(s) only, and may contain information that is privileged and/or confidential. Any distribution, use, or copying of this email or the information contained by persons other than the intended recipient(s) is unauthorized. If you received this email in error, please advise the sender immediately by return email and delete this email.

Nicole Jacques

---

From: Bethany.Peters@gov.yk.ca  
Sent: 15-Jun-12 3:43 PM  
To: Nicole Jacques  
Cc: shannon.jensen@gov.yk.ca  
Subject: RE: Mayo Permit Query

Hi Nicole,

Thank you for your information request. I have conducted a query of the Environmental Programs Branch permits database for all permits issued to an address or a site location in Mayo. Please note that the database does not list storage tank permits; you will need to contact the Fire Marshal's Office to get information on storage tank permits in Mayo.

Following is a list of active permits issued to individuals or companies in Mayo, Yukon:

- Ewing Transport Limited, Special Waste Generator permit (41-137)
- Mayo Taxi & Bus Service, Special Waste Generator permit (41-158)
- Wilf's Contracting, Special Waste Generator permit (41-136)
- Village of Mayo, Solid Waste Disposal Facility permit (80-006)
- Al's Enviro Cleanup Inc, Land Treatment Facility permit (24-019)
- Yukon Energy Corporation, Air Emissions permit (60-010) – operating diesel plants in Dawson, Faro, Mayo, and Whitehorse
- Peter Kiewit Infrastructure, Special Waste Disposal permit (43-059) – Mayo Hydro Project
- Pacesetter Petroleum, Relocation Permit (23-436 and 23-448) – Km 53 Silver Trail, Heartland Services
- Alkan Air Ltd., Relocation Permit (23-447) – Mayo Airport
- Transportation Maintenance Branch, Special Waste Facility permit (42-004) – various highway maintenance camps, including Mayo
- Aviation Branch, Special Waste Generator permit (41-183) – various community aerodromes, including Mao

Should you have any immediate questions on the above permits, please contact Shannon Jensen at 667-8787, as I will be out of the office for the duration of next week.

Best,

**Bethany Peters**

*Environmental Protection Analyst*

Environment Yukon (V-8)

P: 867.667.8848 F: 867.393.6205

e: [bethany.peters@gov.yk.ca](mailto:bethany.peters@gov.yk.ca)

<http://environmentyukon.gov.yk.ca/contaminatedsites>

-----Original Message-----

From: Jacquie.VanMarck  
Sent: Friday, June 15, 2012 8:41 AM  
To: Shannon.Jensen; Bethany.Peters  
Subject: FW: Mayo Permit Query

Jacquie Van Marck  
Administrative Assistant  
Environmental Programs Branch  
Yukon Government

(PH) 867-667-5683  
(FAX) 867-393-6213

---

From: Nicole Jacques [<mailto:nrj@summit-environmental.com>]  
Sent: Thursday, June 14, 2012 5:13 PM  
To: envprot  
Subject: Mayo Permit Query

I am completing a contaminant inventory for the Village of Mayo. This will be used in planning for the protection of Mayo's drinking water source. My Study area is the downtown "core" plus some undeveloped areas (see attached figure). Could you please provide me with information on any of the following permits issued within that study area:

- Air Emissions Permits
- Storage Tank Permits
- Ozone Depleting Substances & Halocarbons Permit

Thank you,

Nicole Jacques, M.Sc., EP  
Environmental Scientist  
301- 4109 4th Avenue  
Whitehorse, YT, Canada, Y1A 1H6

Tel: 867 456-2711 Ext 225  
Fax: 604 291-6163



ONE OF CANADA'S  
50 BEST-MANAGED COMPANIES



Web: [www.summit-environmental.com](http://www.summit-environmental.com)

This email is intended for the named recipient(s) only, and may contain information that is privileged and/or confidential. Any distribution, use, or copying of this email or the information it contains by persons other than the intended recipient(s) is unauthorized. If you receive this email in error, please advise the sender immediately by return email and delete this email.

Nicole Jacques

---

From: Bethany.Peters@gov.yk.ca  
Sent: 14-Jun-12 12:46 PM  
To: Nicole Jacques  
Subject: RE: Spills in Mayo?

Hi Nicole,

The Environmental Programs Branch does not have any file listings on the property at 206-6<sup>th</sup> Avenue in Mayo, otherwise known as Lots 1-8 Block 37. Please note that this does not mean that the property is not contaminated, only that we have no information.

We do have information on the following sites which may be of interest to you:

- (former) Highway maintenance camp (Parcel F Lot 12 Group 1004): diesel contaminated soil detected when a UST was removed from the maintenance camp. Unknown volume of soil was removed from site to NE end of Mayo airport; no confirmatory sampling conducted at excavation site.
- Mayo Airport (Lot 1068 Quad 105M/12): contaminated soil discovered during removal of 2 USTs on site; estimated 100-150m<sup>3</sup> soil required remediation (1995). (Soil was to be treated on site.) No final report in file indicating soil remediated, or details on the known groundwater contamination.
- Non-Directional beacon site near Mayo airport: 2m<sup>3</sup> near-surface hydrocarbon contaminated soil found in vicinity of AST adjacent to NDB building; soil analytical above applicable standards, but it is unclear where the samples were taken from or if any soil was relocated to the land treatment facility (Arctic Backhoe Services), as per authorization (issued 2001).
- Heartland Services, km 53 Silver Trail (Block 42, 61678 LTO YT): 2012 gasoline spill reported; remediation on going
- Mayo Recreational Complex (312-6<sup>th</sup> Avenue): diesel fuel spill reported (2007); absorbents applied, no further action required.
- Fire Hall and Municipal offices: 20 gallon diesel fuel spill reported (2005); absorbents applied, no further action required.
- Yukon Energy Substation #T2: 300 gallons transformer oil spill reported (2000); spill was contained as best as possible, and some soil excavated. Confirmatory sampling showed some contamination remained on site, and the report suggested spreading Oil Gator on the surface of the excavation and backfill. No follow-up confirmatory sampling has been conducted to prove that the remediation was successful.

Please contact me at 667-8848 if you have any further questions, would like to view any of our files or need other information in the future.

Cheers,

**Bethany Peters**

*Environmental Protection Analyst*

Environment Yukon (V-8)

P: 867.667.8848 F: 867.393.6205

e: [bethany.peters@gov.yk.ca](mailto:bethany.peters@gov.yk.ca)

<http://environmentyukon.gov.yk.ca/contaminatedsites>

-----Original Message-----

From: Nicole Jacques [<mailto:nrj@summit-environmental.com>]

Sent: Friday, June 08, 2012 10:31 AM

To: Bethany.Peters

Subject: Spills in Mayo?

Hi Bethany,

I am looking for any spills and/or contaminated that are recorded within a 1 km range of a site. My site is 206-6<sup>th</sup> Avenue or Lots 1-8, Block 37, Plan 24315.

Thank you,  
Nicole Jacques M.Sc., EP  
Environmental Scientist  
301- 4109 4th Avenue  
Whitehorse, YT, Canada, Y1A 1H6

Tel: 867 456-2711 Ext 225  
Fax: 604 291-6163



ONE OF CANADA'S  
50 BEST-MANAGED COMPANIES



Web: [www.summit-environmental.com](http://www.summit-environmental.com)

This email is intended for the named recipient(s) only, and may contain information that is privileged and/or confidential. Any distribution, use, or copying of this email or the information it contains by persons other than the intended recipient(s) is unauthorized. If you receive this email in error, please advise the sender immediately by return email and delete this email.

# Appendix "A"

Black Lettering = Current designation/zone

Red Lettering = Proposed designation /zone

Green Line = New designation/zone boundary or new boundary line

## LEGEND

- P PARKLAND
- OS OPEN SPACE
- UR URBAN RESIDENTIAL
- C COMMERCIAL
- I INDUSTRIAL
- CU COMMUNITY USE
- FD FUTURE DEVELOPMENT
- NACHO NYAK DUN FIRST NATION LANDS

# VILLAGE OF MAYO

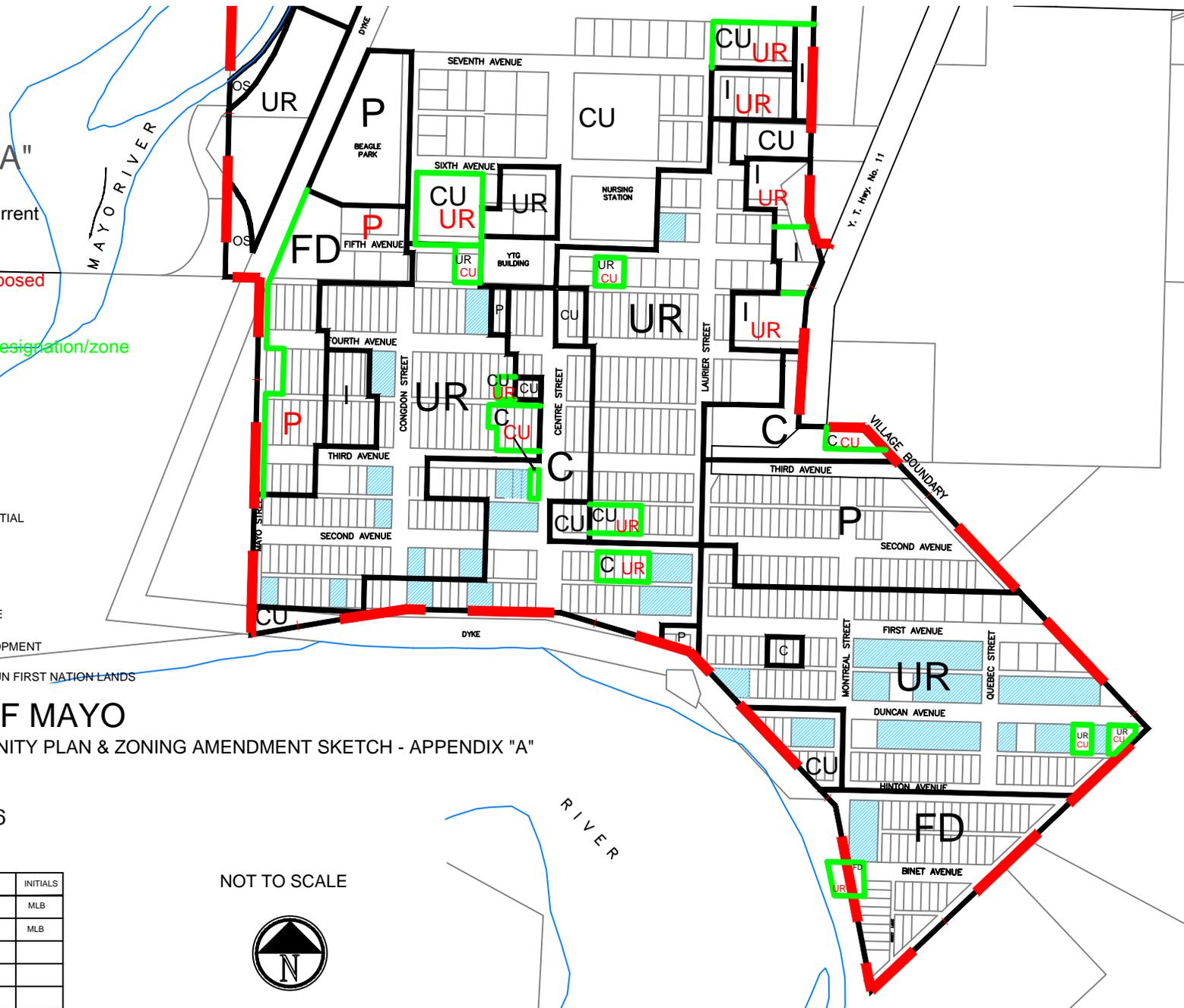
OFFICIAL COMMUNITY PLAN & ZONING AMENDMENT SKETCH - APPENDIX "A"

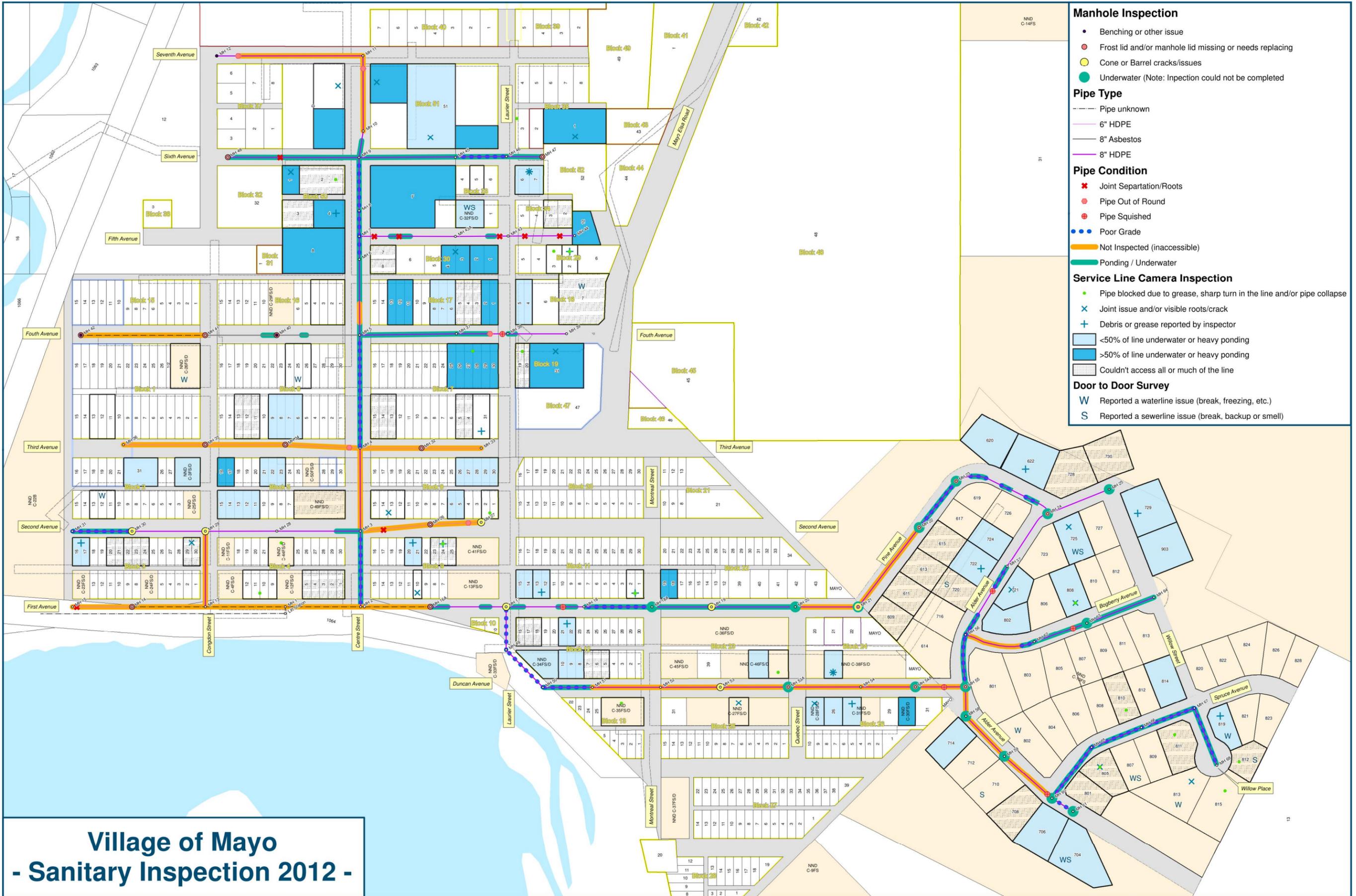
FEBRUARY 2006

## REVISIONS

DATE	DESCRIPTION	INITIALS
14 October 05	Revision 1	MLB
20 February 06	Lot 20-26 Block 47	MLB

NOT TO SCALE





**Manhole Inspection**

- Benching or other issue
- Frost lid and/or manhole lid missing or needs replacing
- Cone or Barrel cracks/issues
- Underwater (Note: Inspection could not be completed)

**Pipe Type**

- Pipe unknown
- 6" HDPE
- 8" Asbestos
- 8" HDPE

**Pipe Condition**

- ✗ Joint Separation/Roots
- Pipe Out of Round
- Pipe Squished
- Poor Grade
- Not Inspected (inaccessible)
- Ponding / Underwater

**Service Line Camera Inspection**

- Pipe blocked due to grease, sharp turn in the line and/or pipe collapse
- ✗ Joint issue and/or visible roots/crack
- ✚ Debris or grease reported by inspector
- <50% of line underwater or heavy ponding
- >50% of line underwater or heavy ponding
- Couldn't access all or much of the line

**Door to Door Survey**

- W Reported a waterline issue (break, freezing, etc.)
- S Reported a sewerline issue (break, backup or smell)

**Village of Mayo  
- Sanitary Inspection 2012 -**

## **Appendix D – Community Meeting Documents**



### Potential Contaminant Sources (current and historical)

- Airports, abandoned airfields
- Animal feedlots and burial areas
- Areas infested with pests (mosquitoes, ants, etc.)
- Asphalt plants
- Auto repair shops
- Barber and beauty shops
- Bowling alleys
- Campgrounds
- Car washes
- Cemeteries
- Communications equipment
- Crop areas, irrigation sites and drainage
- Decaying organic matter
- Laundry or Dry cleaners
- Excavation sites
- Fire Stations, fire-training facilities and retardant recharge facilities.
- Firing ranges
- Funeral services and crematories
- Furniture repair and finishing shops
- Garden nurseries, florists
- Gasoline services stations
- Geological radioactivity
- Heating oil companies
- Highways, road maintenance depots, and de-icing operations.
- Industrial pipelines
- Junk cars and debris in yards
- Land areas applied with wastewater
- Machine and metal working shops
- Manure storage, treatment (composting), spreading and/or disposal
- Material stockpiles (coal, ores, etc.)
- Medical institutions (hospitals, dentists, clinics, Veterinary.)
- Mining operations (surface and underground), underground storage mines
- Motor oils and waste oils
- Municipal sewers, sewage treatment plants and storm water drains
- Natural hydrogeological events and formations
- Office buildings
- Pesticides and Fertilizers storage areas and containers
- Pharmacies
- Plastic materials and synthetics producers
- Pool and hot tub disinfection and maintenance chemicals
- Print, photography processing shops
- Public utilities (phone, electric power, gas)
- Radioactive waste disposal materials
- Railroad tracks and yards
- Recycling/reduction facilities
- Resource Wells (exploration for gas, oil, coal, monitoring, geothermal and heat recovery)
- Sawmills and planers
- Scrap, tire, and junk yards
- Septic systems, cesspools, and sewer lines
- Storage Tanks (above and/or below ground)
- Storage, treatment, disposal ponds, lagoons, and other surface impoundments
- Transport and transfer stations (trucking terminals and rail yards)
- Unsealed abandoned mines used as waste pits
- Waste Incinerators
- Waste landfills (current and historical)
- Water supply wells (for monitoring, drinking water and livestock)
- Welders
- Wood preserving facilities



## Village of Mayo Drinking Water Source Protection Plan

Yukon Government, Community Services has contracted Associated Engineering on behalf of the Village of Mayo to develop a protection plan for your drinking water source. Your help in this matter will be incorporated into the plan. The Village of Mayo gets all drinking water from the groundwater wells in the Village of Mayo Pumphouse compound located between Avenues 6 and 7, on the westerly edge of the municipality.

This is an opportunity for you to provide valuable local knowledge. Please contact Village of Mayo, Associated Engineering staff or Yukon Government- Community Services, should you need assistance with the survey or have questions related to the Village of Mayo Wellhead Protection Planning Project. Maps and a list of potential contaminant sources are displayed.

For each of the questions, please locate potential concerns on the map, provide the address, or describe the location in relation to other known landmarks in or around Mayo. Place the completed questionnaire in the box, return it to Margrit at the Village office, email it to Associated Engineering ([nrj@summit-environmental.com](mailto:nrj@summit-environmental.com)), or fax it to: (604) 291-6163, Attention Nicole Jacques before July 31<sup>st</sup>, 2012.

### Questions-

1. What contamination, spills, leaks or dumping do you know of in/around Mayo?  
Describe the type of contamination and give the locations.
  
2. What sewage dumps, garbage dumps or in-fill do you know of in/around Mayo?  
Describe them and give the locations.

3. What businesses and industries do you think could pose a threat to drinking water?  
Locate them on the map and describe their threats.

4. What do you think is the biggest threat to your drinking water?

5. Would you like to be involved in emergency responses if/when required to protect your drinking water?

Yes      No

Other Comments?

Please provide the following contact information. AE follows strict privacy guidelines so your information will not be shared or made public.

Name: \_\_\_\_\_

Phone Number: \_\_\_\_\_ or email: \_\_\_\_\_

Thank you for your participation. Safe drinking water now and for future generations!

## REPORT

### YG Community Services

### Water Well Protection Plan - Part 2 of 2 Characterization & Mitigation of Potential Risks



October 2013



**CONFIDENTIALITY AND © COPYRIGHT**

This document is for the sole use of the addressee and Summit Environmental Consultants Inc. The document contains proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of Summit Environmental Consultants Inc. Information in this document is to be considered the intellectual property of Summit Environmental Consultants Inc. in accordance with Canadian copyright law.

This report was prepared by Summit Environmental Consultants Inc. for the account of YG Community Services. The material in it reflects Summit Environmental Consultants Inc.'s best judgement, in the light of the information available to it, at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Summit Environmental Consultants Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

## Executive Summary

The Village of Mayo (VoM) provides high quality drinking water to its population, supplied by a shallow, unconfined sand and gravel aquifer that is hydraulically connected to the Stewart and Mayo Rivers. In 2012, the VoM retained Summit Environmental Consultants Inc. (Summit), the environmental sciences division of Associated Engineering (AE), to develop its Water Well Protection Plan.

In December 2012, Summit submitted Part 1 of 2 of the Water Well Protection Plan (Summit 2012), which focused on delineating the capture zones and inventorying potential contaminants. This report, which is Part 2 of the Water Well Protection Plan, is focused on the characterization and mitigation of potential risks to the drinking water supply, and is designed to be read in conjunction with Part 1.

The objective of this report is to determine the main contaminant risks to the VoM water supply wells, and to develop specific actions that promote the protection of this groundwater resource. Contaminant risks were classified based on their likelihood of occurrence and their associated magnitude of consequence using methods outlined in Module #7: of B.C. Ministry of Healthy Living and Sport (2010). Recommended actions to improve drinking water protection were developed using the process outlined in Module #8 of B.C. Ministry of Healthy Living and Sport (2010).

Recommended actions to promote groundwater protection were developed based on the risk determination. These recommendations include:

- The development of a risk management plan with specific recommendations addressing water monitoring, fuel storage, wellhead protection, community education, underground infrastructure, and herbicide and pesticide usage.
- A raw water monitoring program that details the frequency of sampling events, and the parameters to be sampled for. The frequency of sampling events is generally based on the severity of risk that their contaminant source was assigned.
- The organizational framework and additional emergency actions to be included in the VoM Emergency Response Plan in the event of an emergency involving contamination of the drinking water aquifer.

## Table of Contents

<b>SECTION</b>	<b>PAGE NO.</b>
<b>Executive Summary</b>	<b>i</b>
<b>Table of Contents</b>	<b>ii</b>
<b>List of Tables</b>	<b>iii</b>
<b>1 Risk Characterization</b>	<b>1-1</b>
1.1 Risk Characterization Methods	1-1
1.2 Contaminant Risk Characterization Results	1-2
<b>2 Recommended Actions to Promote Groundwater Protection</b>	<b>2-1</b>
2.1 Risk Management Plan	2-1
2.2 Risk Monitoring Program	2-3
2.3 Emergency Response Planning	2-4
<b>Closure</b>	
<b>References</b>	
<b>Appendix A - Tables</b>	
<b>Appendix B - Figures</b>	
<b>Appendix C - Village of Mayo Emergency Response Plan</b>	
<b>Appendix D - Village of Mayo Emergency Measures Plan</b>	

## List of Tables

		PAGE NO.
Table 1-1	Likelihood of Risk Occurrence	1-1
Table 1-2	Magnitude of Risk Consequence	1-1
Table 1-3	Risk to Drinking Water	1-2

## 1 Risk Characterization

### 1.1 RISK CHARACTERIZATION METHODS

This section presents the results of Module #7: Characterize Risks from Source to Tap (B.C. Ministry of Healthy Living and Sport 2010). According to this document, risk is “the combination of the likelihood that a hazard will occur, that it will cause harm, and the extent and degree of that harm.”

Risk can be quantitatively evaluated by multiplying the likelihood of a hazard occurring by the magnitude of that hazard (B.C. Ministry of Healthy Living and Sport 2010). To determine potential risks, Summit used the criteria outlined in Tables 1-1 and 1-2 to rate each identified potential contaminant (Table 4 - Summit 2012) in terms of their:

1. Likelihood of occurrence (the probability the event occurs in the next 10 years, and that if it occurs, the likelihood that the contaminant will migrate to the aquifer); and
2. Magnitude of consequence (the consequence of the event occurring).

**Table 1-1  
Likelihood of Risk Occurrence**

Level	Description	Probability of Occurrence in Next 10 Years
A	Almost certain - expected to occur in most circumstances	>90%
B	Likely - will probably occur in most circumstances	71-90%
C	Possible - will probably occur at some time	31-70%
D	Unlikely - could occur at some time	10-30%
E	Rare - will only occur in exceptional circumstances	<10%

**Table 1-2  
Magnitude of Risk Consequence**

Level	Description
1	<b>Insignificant</b> - no illness, little disruption to normal operation, little or no increase in normal operating costs.
2	<b>Minor</b> - small population, mild illness, some manageable operation disruption, small increase in operating costs.
3	<b>Moderate</b> - minor impact for large population, mild to moderate illness probable, significant moderation to normal operations but manageable, operating costs increased, increased monitoring.
4	<b>Major</b> - impact to small population, severe illness probable, systems significantly compromised and abnormal operation if at all, high level monitoring required.
5	<b>Catastrophic</b> - Major impact for large population, severe illness probable, complete failure of system.

The product of the likelihood of occurrence and magnitude of consequence was then used to determine the risk to drinking water, as shown in Table 1-3.

**Table 1-3  
Risk to Drinking Water**

Likelihood	Magnitude				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5(Catastrophic)
A (Almost Certain)	Moderate	High	Very High	Very High	Very High
B (Likely)	Moderate	High	High	Very High	Very High
C (Possible)	Low	Moderate	High	Very High	Very High
D (Unlikely)	Low	Low	Moderate	High	Very High
E (Rare)	Low	Low	Moderate	High	High

**1.2 CONTAMINANT RISK CHARACTERIZATION RESULTS**

Each potential contaminant source identified in the Water Well Protection Plan - Part 1 of 2 - Capture Zone Determination & Potential Contaminant Sources Inventory (Summit 2012) was assessed to understand what risk it poses to the VoM’s drinking water aquifer in terms of human health. The Contaminant Risk Summary Table (Appendix A - Table 1) summarizes the identified risks for each potential contaminant source. Appendix B – Figure 1 shows the location of the potential contaminants, as well as the result of the risk assessment described above. Previous water quality data used in the risk characterization has been summarized by AE (2013).

From this process, Summit identified one very high, three high, seven moderate, and ten low risk contaminant sources (Appendix A - Table 2). The following sections discuss the contaminant sources deemed to be of very high, high, and moderate risk for the VoM’s drinking water wells.

**1.2.1 Sewer Lines and Mains – Very High Risk**

The available water quality data indicated inconsistent presence of Total Coliform and *E. coli*. viruses in the raw groundwater, but not in the treated groundwater. The risk to the VoM’s drinking water aquifer from sewer lines and mains is rated “very high” based on a likelihood of “possible” and a magnitude of consequence being “major” (Appendix A - Table 1). A “possible” probability was assigned because sewer mains and services are present in the area within the 10 -Year Capture Zone and leaks and breaks in these areas will probably occur at some time. A “major” magnitude of consequence was assigned because sewage could introduce a number of potential contaminants to the source water and their impact is likely to cause severe illness.

Contaminants of concern associated with sewer lines and mains include:

- Nutrients (i.e. nitrates and phosphates);
- Bacteria;
- Viruses;
- Various trace and heavy metals;

- Chloride;
- Sulphate;
- Calcium; and
- Residual pharmaceuticals and personal care products.

The highest hazard from sewer main breaks or leaks is from viruses and fecal coliforms, especially *E. coli*. The VoM will disinfect all groundwater with Ultra Violet (UV) disinfection and chlorine injection prior to distribution. Chlorine disinfection provides very effective treatment to almost all viruses assuming contact times are met. Moreover, free chlorine residual will be continuously monitored at the treatment plant, providing real-time detection of potential cross contamination to the wells. The design of the chlorination system is based on the local conditions of pH, temperature, retention time and hydraulic efficiency. This design will provide enough protection against pathogens coming from a potential cross connection at the source. In addition, minimum free chlorine residual will be maintained at all times in the distribution system for further additional inactivation. Finally, in case the chlorine analyzer detects free chlorine residual lower than 0.4 mg/L, the system will be shut down and a boil-water advisory initiated.

The second highest risk from sewer main breaks or leaks is from protozoan contamination (*Giardia*, *Cryptosporidium*). These pathogens are not monitored on a regular basis, but their presence in the water can be correlated to abnormal high concentrations of fecal coliforms, including *E. coli*. To control this risk, bi-weekly sampling of the wells for fecal coliforms will be performed. In addition, the UV disinfection system installed will be able to inactivate 3 log of *Giardia* and *Cryptosporidium*. If the UV dose goes lower than 40 mJ/cm<sup>2</sup>, the system will be shut down and a boil water advisory will be initiated.

### 1.2.2 Fuel Storage – High Risk

Contaminants of concern associated with fuel storage that can negatively impact human health include:

- Hydrocarbons; and
- Metals.

There is currently no analysis that is conducted in the well water for hydrocarbon contaminants of concern (AE 2013). The risk from fuel storage (spills, leaks, overfills and deposits) is rated “high” based on a likelihood of “possible” and a magnitude of consequence being “moderate” (Appendix A - Table 1). The actual level of risk from a spill, leak, overfill, or deposit depends on the spill volume and its relative proximity to a wellhead (for the purposes of this risk characterization, we have considered the loss of fuel to be >100 L and within the 90 - Day Capture Zone or >1000 L and within 10 - Year Capture Zone). A “possible” probability was assigned as there is currently fuel storage located in both the 90-Day and 10-Year capture zones, and spills, leaks, overfills, or deposits at these locations will probably occur at some time. A “moderate” magnitude of consequence was assigned because hydrocarbons in drinking water can result in mild to moderate illnesses.

### 1.2.3 Ponding of Water (Including Mayo River Winter Flooding Events) – High Risk

Potential contaminants include:

- Hydrocarbons;
- Metals;
- Salts;
- Herbicides; and
- Pesticides.

The available water quality data shows very minimal effect from human activity; therefore, it does not appear that the wells have been compromised by previous water ponding. However, the risk from ponding water is rated “high” based on a combination of a “likely” probability and a “moderate” magnitude of consequence (Appendix A – Table 1). A “likely” probability was assigned because surficial water ponding will probably occur in most circumstances during winter flooding of the Mayo River floodplain, spring run-off and heavy summer rains. A “moderate” magnitude of consequence was assigned because of the accumulation of contaminants in ponds next to the wellheads. These contaminants would likely cause a minor impact to a large population and mild to moderate illness.

### 1.2.4 Ditches – High Risk

Contaminants of concern associated with storm drainage mains include:

- Hydrocarbons;
- Metals;
- Salts;
- Herbicides; and
- Pesticides.

The available water quality data shows very minimal effect from human activity; therefore, it does not appear that the drinking water has been compromised by storm drainage mains. Despite this, the risk from potential ditches is “moderate” based on a combination of “likely” probability and “minor” magnitude of consequence (Appendix A – Table 1). A “likely” probability was assigned because storm drains are located within the 90-Day Capture Zone and storm drainage mains may create a pathway for contamination to reach source water through breaks, leaks, or deposits that will probably occur in most circumstances. A “major” magnitude of consequence was assigned because the potential contaminants that would be introduced to the aquifer would likely resulting in severe illness to a small population.

### 1.2.5 Septic Systems – Moderate Risk

Contaminants of concern associated with septic fields include:

- Nutrients (i.e. nitrates and phosphates);
- Bacteria;
- Viruses;
- Metals;
- Chloride;
- Sulphate;
- Calcium; and

- Residual pharmaceuticals and personal care products.

The available water quality data shows very minimal effect from human activity; therefore, it does not appear that the drinking water has been compromised by septic systems. However, the risk from septic systems is considered to be “moderate” based on an “unlikely” probability of occurrence and a “moderate” magnitude of consequence (Appendix A – Table 1). An “unlikely” probability was assigned because leakage from septic systems into groundwater could occur at some time. A “moderate” magnitude of consequence was assigned because sewage could introduce a number of potential contaminants to the source water and their impact is likely to cause mild to moderate illness.

### 1.2.6 Documented Spills – Moderate Risk

Contaminants of concern associated with documented spills include:

- Hydrocarbons; and
- Metals.

There is currently no analysis done on the well water for hydrocarbon contaminants of concern. For this reason, it is unknown if the drinking water could be contaminated with hydrocarbons from documented spills.

Yukon Environment provided information about previous spills that have been documented in the VoM, and they are as follows:

- Heartland Services, km 53 Silver Trail (Block 42, 61678 LTO YT): 2012 gasoline spill reported; remediation on-going.
- Mayo Recreational Complex (312-6th Avenue): diesel fuel spill reported (2007); absorbents applied, no further action required.
- Fire Hall and Municipal offices: 20 gallon diesel fuel spill reported (2005); absorbents applied, no further action required.
- Yukon Energy Substation #T2: 300 gallons transformer oil spill reported (2000); spill was contained as best as possible, and some soil excavated. Confirmatory sampling showed some contamination remained on site, and the report suggested spreading Oil Gator on the surface of the excavation and backfill. No follow-up confirmatory sampling has been conducted to prove that the remediation was successful.

There is a likely potential that additional, unreported historic spills exist within the VoM that present a risk to the drinking water aquifer.

The risk from these documented spills to the drinking water is considered “moderate” based on an “unlikely” probability of occurrence and a “moderate” magnitude of consequence (Appendix A – Table 1). An “unlikely” probability was assigned because any of the documented contaminated sites could impact the aquifer at some time. A “moderate” magnitude of consequence was assigned because of the mild to moderate illness that would likely result.

### 1.2.7 Cemetery – Moderate Risk

Contaminants of concern associated with the cemetery include:

- Formaldehyde;
- Nitrates;
- Nutrients;
- Pesticides; and
- Herbicides.

There is currently no analysis done on the well water for the contaminants of concern associated with the cemetery. For this reason, it is unknown if the drinking water could be contaminated from it. The risk to VoM's drinking water aquifer from the cemetery is rated "moderate" based on a likelihood of "possible" and a magnitude of consequence of "minor" (Appendix A – Table 1). A "possible" likelihood was assigned because contamination from the cemetery into the aquifer will probably occur at some time. A "minor" magnitude of consequence was assigned because contamination from the cemetery would likely result in a mild illness to a small population of people.

### 1.2.8 Creosote Posts – Moderate Risk

Contaminants of concern associated with creosote posts include:

- Creosote;
- Hydrocarbons;
- Metals;
- Methanol;
- Glycol; and
- Phenols.

There is currently no analysis done on the well water for the contaminants of concern associated with the creosote posts. For this reason, it is unknown if the drinking water could be contaminated with the contaminants of concern associated with creosote posts.

The risk to VoM's drinking water aquifer from creosote posts is rated "moderate" based on a likelihood of "possible" and a magnitude of consequence being "minor" (Appendix A – Table 1). A "possible" likelihood was assigned because contamination from creosote posts will probably occur at some time. A "minor" magnitude of consequence was assigned because the contamination from the creosote posts would likely result in a mild illness to a small number of people.

### 1.2.9 Snow Dump – Moderate Risk

Contaminants of concern associated with the snow dump include:

- Sodium and chloride;
- Hydrocarbons; and
- Ethylene glycol.

There is currently no analysis done on the well water for the contaminants of concern associated with the snow dump. For this reason, it is unknown if the drinking water could be contaminated with the contaminants of concern associated with the snow dump.

The risk to VoM's drinking water aquifer from the snow dump is rated "moderate" based on a likelihood of "possible" and a magnitude of consequence being "minor" (Appendix A – Table 1). A "possible" likelihood was assigned because contamination from the snow dump will probably occur at some time. A "minor" magnitude of consequence was assigned because contamination resulting from the snow dump would likely result in a mild illness to a small number of people.

### 1.2.10 Roads and Transportation Infrastructure – Moderate Risk

Contaminants of concern associated with roads and transportation infrastructure include:

- Automotive wastes;
- Sodium Chloride;
- Pesticides;
- Herbicides;
- Solid and liquid spills; and
- Runoff.

There is currently no analysis done on the well water for the contaminants of concern associated with the roads and transportation infrastructure. For this reason, it is unknown if the drinking water could be contaminated with the contaminants of concern associated with roads and transportation infrastructure.

The risk from roads and transportation infrastructure is "moderate" based on a combination of "possible" probability and "minor" magnitude of consequence (Appendix A – Table 1). A "possible" likelihood was assigned because contamination from roads and transportation infrastructure will probably occur at some time. A "minor" magnitude of consequence was assigned because contamination resulting from the roads and transportation infrastructure would likely result in a mild illness to a small number of people.

## 2 Recommended Actions to Promote Groundwater Protection

This Section presents recommendations for protecting the VoM's drinking water aquifer that have been developed in accordance with Module #8 of B.C. Ministry of Healthy Living and Sport (2010) is to develop risk management actions. These recommendations include actions to reduce the likelihood and consequence of each identified hazard, and are specific, measurable, achievable, realistic, and time bound form (SMART) in accordance with B.C. Ministry of Healthy Living and Sport (2010).

Summit has divided the actions into three parts:

1. Risk management plan: describes actions to reduce risk in day to day maintenance and operation.
2. Risk monitoring program: describes methods to look out for the risks so that corrective measures can be taken to reduce their consequence.
3. Emergency response planning: describes actions to reduce risks arising during emergency situations.

### 2.1 RISK MANAGEMENT PLAN

The risk management plan is a compilation of actions described in Appendix A – Table 2. Each action is designed on SMART principles as outlined in both the B.C. Ministry of Health and Sport (2010) Module #8 and the B.C. Well Protection Toolkit: Step Four (B.C. Ministry of Environment 2006). Reduction of risk can be accomplished with the activities described in the following sections, for each of the very high, high, and moderate risks.

#### 2.1.1 Raw Water Monitoring

Currently, the VoM is collecting two raw water samples each year for the identification of contaminants of concern. Summit recommends monthly raw water monitoring. A water monitoring program for the supply wells that is designed to test the raw water for the identification of contaminants of concern is outlined in Section 2.2.1 as a part of the Risk Monitoring Program.

#### 2.1.2 Fuel Contamination

To protect the aquifer from fuel contamination, Summit recommends that the YG takes preventative measures with fuel storage in the capture zones. The first priority is to upgrade fuel storage facilities following these three steps:

1. The first step is to remove and replace all underground storage tanks (USTs) within the 10-Year Capture Zone with covered and contained aboveground storage tanks (ASTs)10 - Year. USTs cannot be monitored for leaks until it is too late to protect the aquifer and because of the coarse nature of the aquifer, once contamination has occurred it will eventually migrate to the wellhead with very little improvement of water quality. Therefore, removal of all USTs within the 10-Year Capture Zone is the

highest priority for protection of the drinking water aquifer. This should be done within the next 1-3 years.

2. The second step is to install secondary containment on all ASTs with a volume greater than 1,000 L within the 10-Year Capture Zone. This should be done in the next 3-5 years.
3. Once all of the USTs have been removed and secondary containment has been installed on the large ASTs, upgrade the existing ASTs so they have secondary containment. The ASTs in the centre of the capture zones should be upgraded first, working outwards over time until they have all been upgraded. Five or more AST upgrades should be done per year, if feasible. These upgrades should be done within the next 5-10 - Years.

Summit recommends that the VoM approach residents, governments and businesses (including fuelling companies) living or working within the 10-year capture zone and encourage them to track their monthly consumption rates. If an irregularity is found, then the VoM should be notified immediately.

During the period of removing USTs and improving ASTs, the drinking water aquifer remains at risk to contamination. We recommend that fuel tanks located in the 90-Day Capture Zone be labelled to warn fuel truck operators to take extra precautions when filling fuel tanks, as overflows and spillage pose a risk to the drinking water supply.

Summit recommends that a contingency plan be developed in the event that contaminants are identified in quarterly monitoring. If groundwater supply is used as the back-up source under the contingency plan, a well drilled in the northeast corner of the VoM would be the safest choice because it would be up-gradient from most fuel-related contaminants. However, once pumping begins, this location would also be at risk of contamination due to changes in the groundwater flow direction induced typically by the dewatering cone of depression. This location could only provide a short term contingency until a long term solution that is not vulnerable to contamination can be established. The timeline to conduct investigative drilling and establish necessary infrastructure for a ready connection can take six months to a year under expedited conditions.

### 2.1.3 Underground Infrastructure

To protect against well contamination from sewer line and main leaks, Summit recommends that the YG replace the sanitary lines within the 90-Day Capture Zone with a double walled system in the next 1-3 years. We also recommend removing all of the septic systems in the 10-Year Capture Zone within the next 3-5 years. Additionally, the YG should perform regular maintenance that includes identifying and repairing any leaking storm mains in the capture zones on an ongoing basis.

### 2.1.4 Wellhead Area Protection

The area directly around the wells is considered high risk because the wells provide direct pathways for surface contamination to reach the groundwater. The fence surrounding the site should be extended higher with properly closing, locking gates, and each wellhead should be protected by a lockable, insulated, and heated enclosure within the next 1-3 years. Additionally, the area around the wellheads (on the site and directly adjacent to the site) should be checked regularly for animal wastes and standing water. If animal

## 2 - Recommended Actions to Promote Groundwater Protection

wastes are found they should be removed from the site. Summit understands that the YG- Infrastructure Development Branch is investigating long-term solutions to the Mayo River winter flooding concerns as a separate project. There have been three winters where high water and flooding has occurred and this remains a concern for potential damages and contaminants into the drinking water system. If winter flooding or other ponded water is noted on site or on adjacent properties, then actions should be taken to remove the standing water (potentially by pumping or diverging).

### 2.1.5 Pesticide and Herbicide Usage

The VoM does not currently use pesticides and herbicides, however there may be some residents that do use these chemicals on their properties. Pesticide usage within the VoM should be restricted because it poses a threat to the drinking water aquifer. This restriction should be maintained on an ongoing basis. Summit also recommends that the YG meet with Yukon Energy in the next 1-3 years to confirm that Yukon Energy will continue to avoid the use of herbicides on their easements.

### 2.1.6 Community Education

An important aspect of the risk management plan is to educate community members about different environmental risks to the aquifer. Topics of particular concern include chemical spills and how they are to be reported, the importance of using clean 'fill material,' chemicals entering storm drains, and pesticide usage. Educated residents are more likely to report spills and take preventative measures to protect their drinking water source. This should be done on an ongoing basis.

## 2.2 RISK MONITORING PROGRAM

The risk monitoring program has been created using the results from the risk assessment. The risk monitoring program includes the location and frequency of sampling events along with the analytical parameters associated with the contaminants of concern. This section presents recommendations for a sampling program focused on the water supply wells, as well as an alternative option that focuses on sampling monitoring wells.

### 2.2.1 Supply Well Sampling Program

Summit recommends that raw water samples from the supply wells are analyzed for the contaminants of concern in addition to the routine sampling that is already performed in order to limit long term exposure to any contamination. Due to the proximity of fuel storage and sewer lines and mains to the drinking water aquifer, the installation of monitoring wells is not an efficient method to monitor the aquifer, and is not recommended. This is because a potential contaminant would take a short period of time to reach the drinking water wells, requiring an unrealistically high frequency of sampling events to successfully detect the contaminant before it reaches the wells. Preventative risk management actions concerning potential contaminants from fuel storage and sewer lines that don't involve monitoring wells are available (Appendix A – Table 2).

Sampling raw water from the drinking water wells is currently being carried out for limited parameters. Summit recommends that the frequency of this sampling increase to once per month and that the analyses be carried out to detect contaminants of concern associated with the potential sources of contamination identified (Appendix A – Table 2). Our recommended frequency of sampling parameters associated with particular contaminants of concern has been determined based on the source's risk of occurrence (Table 1-3). In general, a higher frequency of sampling events has been assigned to detect contaminants of concern from sources with a higher risk of occurrence.

Raw water chemistry data should be analyzed to determine whether there are any increasing, or otherwise unusual trends. Currently, the VoM samples raw water data twice per year for some of these contaminants of concern. The proposed frequency of raw water monitoring should be conducted as follows:

- **Twice per month:** Bacteriological contaminants of concern (No change is required from the current monitoring program for these parameters)
- **Once per month:** Nutrients (including alkalinity, anions and cations), hydrocarbons, metals (by ICP-MS), pesticides and herbicides
- **Once during spring thaw and once during late summer:** Field parameters, glycols, and phenols
- **Twice per year:** Residual pharmaceuticals and personal care products
- **Once per year:** Formaldehyde, creosote, Laundromat chemicals

A more detailed description of monitoring parameters, risk occurrence, and sample frequency is available in Appendix A – Table 3.

### 2.2.2 Monitoring Well Sampling Program

An alternative method of risk monitoring involves the installation and sampling of monitoring wells that are located nearby the water supply wells. As is stated in Section 2.2.1, due to the high frequency of sampling events required for monitoring wells to be efficient, regular sampling and laboratory analysis is not recommended. Alternatively, field parameters such as dissolved oxygen and electrical conductivity could be continually monitored and analyzed with the use of a data-logger. Significant irregularities in the readings of these parameters could be triggered by a contaminant plume that is moving towards the supply wells. Although initially more costly to install, the benefit of this method is that the real-time nature of data collected and analyzed by a data-logger may allow for the detection of a contaminant before it reaches the water supply wells. With a real-time sampling program such as this in place, the sampling frequency for contaminants of concern as shown in Section 2.2.1 could be reduced, saving the costs of sample analyses in the long term.

## 2.3 EMERGENCY RESPONSE PLANNING

### 2.3.1 Emergency Planning Methods

Emergency plans that are specific to emergency situations involving the VoM's drinking water are presented in this section. These emergency plans have been completed after our risk characterization (Section 1), as a part of our recommended action plans to promote groundwater protection. In an effort to

## 2 - Recommended Actions to Promote Groundwater Protection

promote the adoption and familiarization of these emergency plans and to avoid redundancy, Summit has recommended additions to the VoM Emergency Response Plan (Appendix C), and to the Emergency Measures Plan (Appendix D).

The steps taken to develop these recommended additions included:

- The formation of a community planning team through the Technical Advisory Committee, detailed in Section 3 of Summit (2012).
- The definition of the well protection area through the calculation of the 10-Year Capture Zone, detailed in Section 4 of Summit (2012).
- The identification of potential contaminants that would affect the drinking water from the local aquifer, summarized in Appendix A - Table 1.
- The development of risk management strategies, detailed in Section 1-1.
- The development of specific contingency plans in case of emergency situations that are detailed in Section 2.3.2.1.

The emergency response plan should be re-evaluated annually based on the results of the ongoing monitoring of water quality results, detailed in Section 2.2. .

### 2.3.2 Emergency Plan Recommendations

#### 2.3.2.1 Additions to the VoM Emergency Response Plan

The VoM Emergency Response Plan (Appendix C) details specific emergencies and their associated response actions. These emergencies range from natural disasters such as fires, floods, and earthquakes, to aquifer contamination through spills or vandalism, and operational emergencies such as broken water mains. Summit recommends the addition of a figure that shows the location of potential contaminants (such as Appendix B – Figure 1), and the addition of the following emergency situations to the VoM Emergency Response Plan:

##### 1) Type of Emergency: Broken Sewer Lines or Mains

- Take necessary steps to stop or divert sewer flows away from the break following VoM procedures;
- Advise Environmental Health Services (1-800-661-0408);
- Notify all affected users of interruption to service and arrange for an alternate source of drinking water;
- Contact a qualified environmental professional to determine the most effective methods for monitoring, protecting, or decontaminating the water supply; and
- Repair the break in accordance with VoM procedures.

##### 2) Type of Emergency: Fuel or Chemical Spill within the Capture Zone or into the Storm Drainage Mains

- Report the Spill to Yukon Environment Spill Hotline (867-667-7244);
- Secure an alternate water supply. Water could be supplied from Whitehorse, Dawson City, Keno City, or the First Nation of Na-Cho Nyak Dun.

- Contact a qualified environmental professional to determine the most effective methods for monitoring, protecting, or decontaminating the water supply, and remediate the affected area in accordance with the Contaminated Sites Regulation (OIC 2002/171); and
  - Create a clear spill response plan, accompanied by adequate funding, in the event of a spill within the 10-Year Capture Zone. Early detection and immediate response and remediation are crucial in the event of a spill. Generally speaking, if a spill is cleaned up soon after it occurs, it will cost less to remediate and there will likely be less human exposure to harmful chemicals.
- 3) Type of Emergency: Raw Water Analysis Above Allowable Limits**
- Notify Environmental Health Services (1-800-661-0408);
  - Secure an alternate water supply;
  - Notify all users by telephone, door-to-door communication, or notices if required;
  - Contact a qualified environmental professional to determine the most effective method for returning the water supply to allowable limits; and
  - Determine the source of contamination and take steps to eliminate the contamination. Consult Appendix A – Tables 1 and 2.

Summit also recommends the following additions to existing sections in the VoM Emergency Response Plan:

- 1) Type of Emergency: Contamination of Source (Page 5 of the Emergency Response Plan):**
- A qualified environmental professional should be contacted to determine the cause and extent of contamination. Depending on the source and extent of contamination, different methods for decontaminating the water supply should be considered. These methods may range from a boil water advisory to securing an alternate water supply.
- 2) Type of Emergency: Bacteriological Contamination of Well Water or Distribution System (Page 13 of the Emergency Response Plan):**
- Determine the cause of contamination and take measures to eliminate it. If necessary, contact a qualified environmental professional to ensure this is done adequately.

### 2.3.2.2 Use of the Village of Mayo Emergency Measures Plan

The VoM Emergency Measures Plan (Appendix D) is a comprehensive document that outlines the necessary steps and organizational responsibilities when responding to an emergency in the VoM. This document includes communication procedures, emergency response procedures, recommended training, finance information, and important personnel and their roles and responsibilities. In the event of an emergency involving contamination of drinking water, the procedures in the Emergency Measures Plan should be followed.

# REPORT

## Closure

This report was prepared for the VoM to develop Part 2 of their Water Well Protection Plan. The report includes sections that characterize the risks to the drinking water aquifer and provides recommended actions for the promotion of groundwater protection. It is designed to be read in conjunction with Part 1 of the Water Well Protection Plan (Summit 2012).

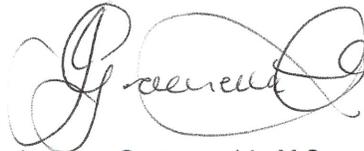
The services provided by Summit Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,  
Summit Environmental Consultants Inc.



Nicole Jacques, M.Sc., E.P.  
Environmental Scientist

Reviewed by,



Jacques Groenewald, M.Sc.  
Senior Hydrogeologist

## References

Associated Engineering (AE). 2013. Report – Village of Mayo Water Treatment Plant Upgrades. Prepared for YG – Community Services.

British Columbia (B.C.) Ministry for Healthy Living and Sport. 2010. Comprehensive Source-To-Tap Assessment Guideline, Version 1.0.

British Columbia (B.C.) Ministry of Environment. 2006. Well Protection Toolkit.

Summit Environmental Consultants Inc. (Summit). 2012. Water Well Protection Plan - Part 1 of 2 - Capture Zone Determination & Potential Contaminant Sources Inventory, Village of Mayo. Prepared for YG Community Services and the Village of Mayo.

# REPORT

## Appendix A - Tables

**Table 1: Contaminant Risk Summary, Water Well Protection Plan, Mayo**

Source No.	Source	Transport Mechanism	Potential Contaminants of Concern	Likelihood of Occurrence (Table 1-1)	Magnitude of Occurrence (Table 1-2)	Risk of Occurrence (Table 1-3)
N/A	Sewer Lines and Mains	Deposits, leaks and spills to soil and groundwater	Total fecal coliform, total coliform, E. Coli, giardia, cryptosporidium, chloride, total dissolved solids, nitrate, nitrite, phosphorus, sulphate, calcium, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides, and pesticides, residual pharmaceuticals, and personal care products	C	4	Very High
2	Fuel Storage (in ASTs, Drums, USTs and short-term storage containers)	Overfill, leaks, spills and deposits to soil and groundwater	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	C	3	High
12	Ponding of Water	Runoff to groundwater	Chloride, total dissolved solids, electrical conductivity, nitrate, nitrite, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides, and pesticides	B	2	High
N/A	Ditches	Deposit and runoff to groundwater	Chloride, total dissolved solids, calcium, metals, volatile hydrocarbons and extractable petroleum hydrocarbons, herbicides, and pesticides	B	2	High
3	Septic Systems	Deposits, leaks and spills to soil and groundwater	Total fecal coliform, total coliform, E. Coli, giardia, cryptosporidium, chloride, total dissolved solids, nitrate, nitrite, phosphorus, sulphate, calcium, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides, pesticides, residual pharmaceuticals, and personal care products	D	3	Moderate
5	Documented Spills	Spills to soil and groundwater	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	D	3	Moderate
6	Bulk Fuel Storage	Deposits, leaks and spills to soil and groundwater	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	D	3	Moderate
8	Cemetery	Deposits to soil and leaks to groundwater	Formaldehyde, nitrate, nitrite, phosphorus, sulphate, pesticides, and herbicides	C	2	Moderate
10	Creosote Posts	Runoff to groundwater	Creosote, extractable petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals, methanol, glycol, and phenols	C	2	Moderate
N/A	Snow Dump	Deposits leach and spills to soil and groundwater	Chloride, total dissolved solids, electrical conductivity, extractable petroleum hydrocarbons, volatile hydrocarbons, and ethylene glycol	C	2	Moderate
N/A	Roads and Transportation Infrastructure	Runoff to groundwater	Extractable petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals, methanol, glycol, and phenols	C	2	Moderate
1	Village of Mayo Office and Administration/Government Buildings	Deposits, leaks and spills to soil and groundwater	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, trichlorofluoroethane, xylenes and chlorine	E	2	Low
4	Laundromat	Deposits, leaks and spills to soil and groundwater	Perchloroethylene, petroleum solvents, freon, trichloroethane, methyl chloroform, ammonia, peroxides, hydrochloric acid, rust removers and amyl acetate.	E	2	Low
7	Direct Pathways for Surface Contamination to Groundwater through Groundwater Wells	Deposits, leaks and spills to groundwater	Hydrocarbons, metals, salts, herbicides and pesticides	E	2	Low
9	Equipment Storage	Deposits, leaks and spills to soil and groundwater	Gasoline, antifreeze, automatic transmission fluid, battery acid, engine and radiator flushes, engine and metal degreasers, hydraulic fluid and motor oils	B	2	Low
11	Leisure Facilities (Curling Rink, Pool, Sports Fields and Campground)	Deposits, leaks and spills to soil and groundwater	Nitrates, nutrients, chemical residues, left-over product containers, chlorine, septage, gasoline, and household hazardous wastes	E	2	Low
13	Nursing Station	Deposits, leaks and spills to soil and groundwater	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, Trichlorofluoroethane, xylenes, chlorine, solvents (perchloroethylene, petroleum solvents, Freon); spotting chemicals (trichloroethane, methyl chloroform, ammonia, peroxides, hydrochloric acid, rust removers, amyl acetate).	E	2	Low
14	Fill Material	Deposits to soil and leaks to groundwater	Methane and metals	D	2	Low
N/A	Waste from Animals and Pests	Deposits to soil and groundwater	Pesticides	D	2	Low
N/A	Cleaning and maintenance products (disinfection chemicals, metal polishes, refrigerants, rust proofers, degreasers and solvents)	Deposits, leaks and spills to soil and groundwater	Acetone, alcohols, benzene, bromine, calcium hypochlorite, chlorine, chlornexade, copper-based algaecides, cresols, chlorinated phenols, cyanuric acid, glycol esters, metals, hexachlorophene, hydrocarbons, iodine, isopropanol, muriatic acid, peroxides, petroleum distillates, phenols, algaecides, ammonia, sodium carbonate, sodium cyanide, sodium hydroxide, sodium hypochlorite, sulphonates, trichloroethane, trichloroethylene, Trichlorofluoroethane and xylenes	E	2	Low
N/A	Electric Power Easements	Runoff to groundwater	Pesticides and herbicides	D	2	Low

**Table 2: Contaminant Risk Summary, Water Well Protection Plan, Mayo**

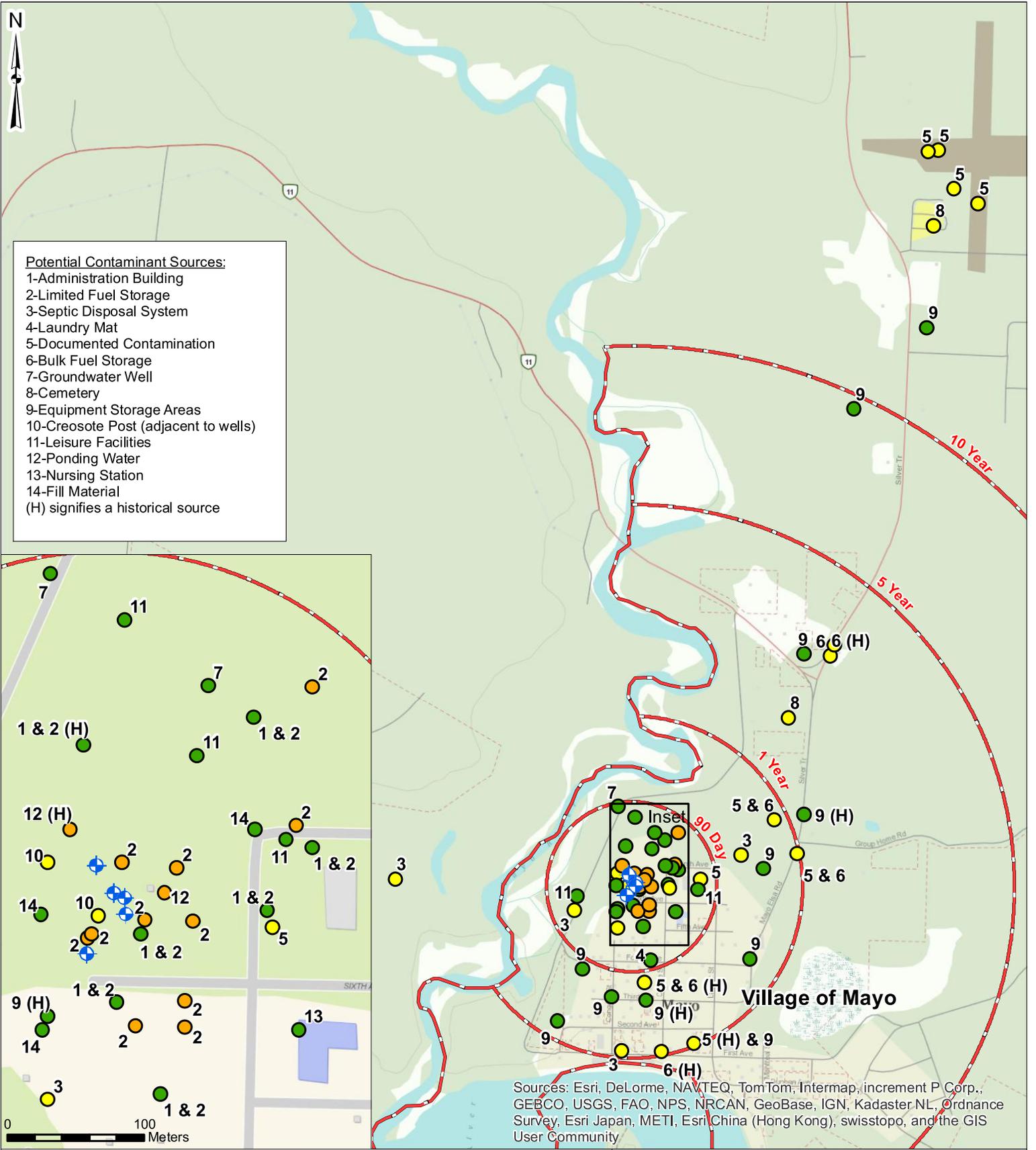
Source No.	Source	Transport Mechanism	Risk of Occurrence (Table 1-3)	Risk Management Action	Timeline
N/A	Sewer Lines and Mains	Deposits, leaks and spills to soil and groundwater	Very High	Monitor raw water for contaminants of concern.	Ongoing
				Replace the sanitary lines within the 90 day Capture Zone with a double walled system.	Within 1-3 years
2	Fuel Storage (in ASTs, Drums, USTs and short-term storage containers)	Overfill, leaks, spills and deposits to soil and groundwater	High	Monitor raw water for contaminants of concern.	Ongoing
				Remove and replace all USTs with covered and contained ASTs within the 10 year Capture Zone.	Within 1-3 years
				Install secondary containment on all large ASTs (greater than 1,000 L) within the 10 year Capture Zone.	Within 3-5 years
				Start from the centre of the Capture Zones and work outwards, to upgrade all ASTs over time.	Within 5-10 years
			Have the Village of Mayo inform residents, governments and business owners of the importance to monitor their fuel consumption. Encourage those within the 10 year Capture Zone to contact the Village of Mayo immediately if they notice any anomalies to their consumption rates or if they find a leak or spill.	Within 1-3 years	
12	Ponding of Water	Runoff to groundwater	High	Monitor raw water for contaminants of concern.	Ongoing
				Pump water ponded around the well heads into a truck to be removed from site or divert water from pond areas.	Ongoing (when ponded water is present)
N/A	Ditches	Deposit and runoff to groundwater	High	Monitor raw water for contaminants of concern.	Ongoing
				Educate community on the potential risk to drinking water from chemicals deposited into ditches	Ongoing
				Maintain and repair leaking, or potentially leaking storm drains in the Capture Zones.	Ongoing
3	Septic Systems	Deposits, leaks and spills to soil and	Moderate	Monitor raw water for contaminants of concern.	Ongoing
				Remove and replace all septic systems within the 10 year Capture Zone.	Within 3-5 years
5	Documented Spills	Spills to soil and groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
				Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
				Remediate contaminated material within the Capture Zones to below the Contaminated Sites Regulation Drinking Water Standards.	Within 3-5 years
6	Bulk Fuel Storage	Deposits, leaks and spills to soil and groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
				Remove and replace all USTs with covered and contained ASTs within the 10 year Capture Zone.	Within 1-3 years
				Install secondary containment on all large ASTs (greater than 1,000 L) within the 10 year Capture Zone.	Within 3-5 years
				Start from the centre of the Capture Zones and work outwards, to upgrade all ASTs over time.	Within 5-10 years
8	Cemetery	Deposits to soil and leaks to groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
10	Creosote Posts	Runoff to groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
N/A	Snow Dump	Deposits leach and spills to soil and groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
N/A	Roads and Transportation Infrastructure	Runoff to groundwater	Moderate	Monitor raw water for contaminants of concern.	Ongoing
1	Village of Mayo Office and Administration/ Government Buildings	Deposits, leaks and spills to soil and groundwater	Low	Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
4	Laundromat	Deposits, leaks and spills to soil and groundwater	Low	Monitor raw water for contaminants of concern.	Ongoing
				Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
7	Direct Pathways for Surface Contamination to	Deposits, leaks and spills to groundwater	Low	Enclose area directly adjacent to wells to prevent public access.	Within 1-3 years
				Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
9	Equipment Storage	Deposits, leaks and spills to soil and groundwater	Low	Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
11	Leisure Facilities (Curling Rink, Pool, Sports Fields and Campground)	Deposits, leaks and spills to soil and groundwater	Low	Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
13	Nursing Station	Deposits, leaks and spills to soil and groundwater	Low	Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
14	Fill Material	Deposits to soil and leaks to groundwater	Low	Educate community that fill material should be sourced from clean material, which lacks organic material.	Ongoing
N/A	Waste from Animals and Pests	Deposits to soil and groundwater	Low	Do not allow for the use of pesticides on land managed by the Village of Mayo.	Ongoing
				Monitor raw water for pesticides.	Ongoing
				Educate community that pesticides should not be used within the Capture Zones.	Ongoing
				Maintain the area around the well heads by removing wastes from animals and pests.	Ongoing
N/A	Cleaning and maintenance products (disinfection chemicals, metal polishes, refrigerants, rust proofers, degreasers and solvents)	Deposits, leaks and spills to soil and groundwater	Low	Educate community on the potential risk to drinking water from chemical spills, and that they should be reported.	Ongoing
N/A	Electric Power Easements	Runoff to groundwater	Low	Monitor raw water for contaminants of concern.	Ongoing
				Meet with Yukon Electrical to confirm that they are to keep avoiding the use of herbicides on their easements.	Within 1-3 years

**Table 3: Contaminant Risk Summary, Water Well Protection Plan, Mayo**

Source No.	Source	Transport Mechanism	Risk of Occurrence (Table 1-3)	Monitoring Parameters	Frequency
N/A	Sewer Lines and Mains	Deposits, leaks and spills to soil and groundwater	Very High	Total Fecal Coliform, Total Coliform, E. Coli, Giardia and Cryptosporidium	2/Month
				Chloride, total dissolved solids, nitrate, nitrite, phosphorus, sulphate, calcium, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides and pesticides.	1/Month
				Residual pharmaceuticals, and personal care products.	2/Year
2	Fuel Storage (in ASTs, Drums, USTs and short-term storage containers)	Overfill, leaks, spills and deposits to soil and groundwater	High	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	1/Month
12	Ponding of Water	Runoff to groundwater	High	Chloride, total dissolved solids, electrical conductivity, nitrate, nitrite, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides and pesticides.	1/Month
N/A	Ditches	Deposit and runoff to groundwater	High	Chloride, total dissolved solids, calcium, metals, volatile hydrocarbons and extractable petroleum hydrocarbons, herbicides and pesticides.	1/Month
3	Septic Systems	Deposits, leaks and spills to soil and groundwater	Moderate	Total Fecal Coliform, Total Coliform, E. Coli, Giardia and Cryptosporidium	2/Month
				Chloride, total dissolved solids, nitrate, nitrite, phosphorus, calcium, metals, volatile hydrocarbons, extractable petroleum hydrocarbons, herbicides and pesticides.	1/Month
				Residual pharmaceuticals, and personal care products.	2/Year
5	Documented Spills	Spills to soil and groundwater	Moderate	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	1/Month
6	Bulk Fuel Storage	Deposits, leaks and spills to soil and groundwater	Moderate	Metals, volatile hydrocarbons, and extractable petroleum hydrocarbons	1/Month
8	Cemetery	Deposits to soil and leaks to groundwater	Moderate	Formaldehyde, nitrate, nitrite, phosphorus, sulphate, pesticides and herbicides	1/Year
10	Creosote Posts	Runoff to groundwater	Moderate	Creosote, extractable petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals, methanol, glycol and phenols	1/Year
N/A	Snow Dump	Deposits leach and spills to soil and groundwater	Moderate	Chloride, total dissolved solids, electrical conductivity, extractable petroleum hydrocarbons, volatile hydrocarbons and ethylene glycol	1/Spring Melt 1/Summer
N/A	Roads and Transportation Infrastructure	Runoff to groundwater	Moderate	Extractable petroleum hydrocarbons, polycyclic aromatic hydrocarbons, metals, methanol, glycol and phenols	1/Spring Melt 1/Summer
4	Laundromat	Deposits, leaks and spills to soil and groundwater	Low	Perchloroethylene, petroleum solvents, freon, trichloroethane, methyl chloroform, ammonia, peroxides, hydrochloric acid, rust removers and amyl acetate.	1/Year
N/A	Waste from Animals and Pests	Deposits to soil and groundwater	Low	Pesticides	1/Year
N/A	Electric Power Easements	Runoff to groundwater	Low	Herbicides and pesticides.	1/Year

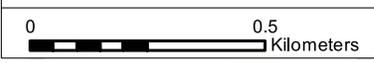
# REPORT

## Appendix B - Figures



**Figure 1: Drinking Water Capture Zones and Point Source Contaminant Risks**

Prepared For:



Project Number: 2012-8023.400.410  
 Data Source(s): Bing Aerial Maps, 2012  
 Date: August, 2013 Fig 1.mxd

# REPORT

## Appendix C - Village of Mayo Emergency Response Plan

## Type of Emergency: Broken Water Main

### ACTIONS :

Reduce pressure by switching to Jockey pump at the Pumphouse (Maintain enough pressure to prevent back flow).

Isolate leak with Main line valves ( Do not shut off completely as positive pressure in Main is required to keep dirt or ground water from possibly entering Water Main.)

Advise Environmental Health Services.

Call Excavator contractor.

Village of Mayo staff to notify all affected users of interruption of service.

Arrange for alternate source of drinking water if necessary ie: bottled water

Repair leak using Village of Mayo Standard Operating Procedures for repairing broken water main lines. ( SOPs located at the Mayo Water Pumphouse and VOM foremens office.)

## **TYPE OF EMERGENCY: CONTAMINATION OF SOURCE ( Oil spills, Vandalism of well house and water well)**

### **ACTIONS:**

**Shut down all pumps and isolate source.**

**Notify Environmental Health Services**

**Notify all users with Village of Mayo Personnel and Mayo Volunteer Fire Department members. V.O.M. staff and M.V.F.D. to go door to door and contact users that were not reached by phone and post Notices if required.**

**Contact Government Agencies( see below for advice and assistance)**

**Contact local Media for Public service announcement.**

**CONTACTS: Environmental Health Services, Emergency measures organization, Y.T.G. Disaster Assistance, Y.T.G. Spills Emergency Line, R.C.M.P. Others as necessary depending on severity.**

## **TYPE OF EMERGENCY : FLOOD CONDITIONS**

### **ACTIONS:**

**Notify all users of the potential for water contamination, Loss of pumps, Power ect.**

**Users should be advised to store drinking water in advance and to boil any suspect water for five minutes or disinfect with bleach when flood conditions exist.**

**Call Environmental Health Services and E.M.O.**

**Call local media for Public Service Announcement.**

**Pre-arrange Alternate source from Bulk Water Haulers and bottled water suppliers.**

## **TYPE OF EMERGENCY: CHLORINATOR FAILURE**

### **ACTIONS:**

**Notify Environmental Health Services.**

**Notify all Users to boil water for five minutes or take other disinfection procedures in accordance with recommendations from Environmental Health Services.**

**Users to be notified by V.O.M. staff and M.V.F.D.**

**V.O.M. Operators to repair ASAP using maintenance kits and spare equipment components stored at the Mayo Water Pumphouse.**

**If necessary call chlorine equipment Supplier and manufacturer.**

## **TYPE OF EMERGENCY: COMPLETE PUMP FAILURE AT THE PUMPHOUSE**

### **ACTIONS:**

**Notify Environmental Health Services.**

**Users to be notified of interruption of service by the V.O.M. staff and M.V.F.D.**

**V.O.M. staff to repair ASAP , if assistance is needed call Pump Supplier.**

**If problem is electrical call Electrical Contractor.**

**Arrange for Alternate Source if needed.**

## EMERGENCY TYPE: BACKFLOW OR BACK SIPHONAGE

### ACTIONS:

Notify Environmental Health Services.

Notify all users to boil water for five minutes or take other disinfection procedures in accordance with recommendations from Environmental Health Services.

Correct problem A.S.A.P

Users to be notified by the V.O.M. staff and the M.V.F.D.

Purge and disinfect lines as directed, after corrections have been made.

## **EMERGENCY TYPE: CHLORINE GAS LEAK**

### **ACTIONS:**

**Village Operators and M.V.F.D. to respond to the leak as per Chlorine Emergency Procedures posted in the Mayo Water Pumphouse, M.V.F.D. Hall and the V.O.M. Foremens office.**

**If Chlorinator fails after leak is repaired respond with CHLORINATOR FAILURE RESPONSE PLAN.**

## EMERGENCY TYPE: EARTH QUAKE

### ACTIONS:

Shut off and isolate leaking water mains as required

Notify Environmental Health Services

Notify users of Interruption of service with V.O.M. staff and M.V.F.D.

Arrange for alternate water source

Call Municipal Engineer to assess damage to system

Call the following Government agencies for advice and assistance : Emergency Measures Organization, Environmental Health Services

**TYPE OF EMERGENCY: BACTERIOLOGICAL CONTAMINATION OF WELL WATER OR DISTRIBUTION SYSTEM( Coliforms / E.coli etc.)**

**ACTIONS:**

**Notify Environmental Health Services**

**Notify Users with the V.O.M. staff and the M.V.F.D. Not to use water for domestic purposes and post Boil Water Advisory as directed by Environmental Health Services.**

**If contamination site is known isolate from the rest of system A.S.A.P.**

**Flush and disinfect system as directed by Environmental Health Services**

**Arrange for alternate water source**

**Call other Government Agencies for advice and assistance as necessary, depending on severity**

## **TYPE OF EMERGENCY: POWER OUTAGE**

### **ACTIONS:**

**Go to Pumphouse to ensure stand by diesel fire pump is running and pumping water from reservoir to distribution system and fire pump generator is powering pumphouse lights.**

**Call Yukon Energy for information on approximate duration of power outage if known**

**If Power outage is extended call for mobile generator from Yukon Energy to run cold well pumps, which will keep water reservoir full.**

**ALEXCO also has a large generator capable of powering cold well pumps.**

**Advise Environmental Health**

**Monitor reservoir level and pump operation for duration of outage.**

## **TYPE OF EMERGENCY: FIGHTING LARGE FIRE WITH EXTENDED USE OF WATER SYSTEM**

### **ACTIONS:**

**Monitor Water Reservoir and take readings to ensure reservoir does not run dry**

**Monitor cold well water level and reset low water cut out on cold well pumps if required**

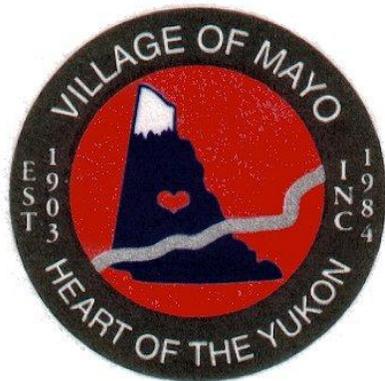
**Advise Environmental Health Services**

**Notify users to conserve water use and possible interruption of service**

**Arrange for alternate water source if necessary**

# REPORT

## Appendix D - Village of Mayo Emergency Measures Plan



## EMERGENCY MEASURES PLAN

### VILLAGE OF MAYO

#### **Executive Summary**

The Plan begins with an explanation of the relationship of the various governments with responsibilities for emergency response in Mayo. It lays out the Mayo Emergency Measures Organization and describes the emergency mobilization of the people involved. Most significantly, the Plan describes in detail the individual responsibilities of the Mayo Emergency Control Group (ECG). Annexes to the Plan provide background information on the additional responsibilities of the Mayor and Council, the Emergency Measures Commission, population, buildings, geography, hazards, legislation, training and finance, resources and supporting agency plans.

Approved March 2002

**DISTRIBUTION LIST**

Mayor  
Chair of the Emergency Measures Commission/Member of Council  
Chief Administrative Officer  
Village Foreman  
Fire Chief  
YTG Social Services Mayo  
Nurse-in-Charge Mayo Nursing Station  
Supervisor, Yukon Ambulance Service Mayo  
YTG Highways Foreman Mayo  
Airport Manager Mayo  
RCMP Detachment Mayo  
DIAND Fire Services Mayo  
YTG Renewable Resources Mayo  
Principal JV Clark School  
Canadian Ranger Patrol Mayo  
SAR Society Mayo  
Yukon Energy Corporation Mayo  
Northwestel Mayo  
Chief, Na-Cho Nyak Dun First Nation  
Deputy Chief, Na-Cho Nyak Dun First Nation  
Operations Director, Na-Cho Nyak Dun First Nation  
Director YTG EMO  
DM YTG Department of the Environment  
DM YTG Department of Community Services  
DM YTG Department of Infrastructure  
DM YTG Department of Health and Social Services  
DM YTG Department of Education

**AMENDMENT RECORD**

<b>Amendment #</b>	<b>Date</b>	<b>Pages</b>	<b>Amended by</b>
Original	March 2002		As issued
Amdt # 1			

**TABLE OF CONTENTS**

<b>Preface and Aim</b>	Page 1	
<b>Functional Intergovernmental Organization</b>	Page 2	
<b>Mayo Emergency Measures Organization</b>	Page 3	
<b>Emergency Mobilization</b>		
• Emergency Alerting System	Page 4	
• Assembly	Page 5	
• Communications	Page 5	
• Equipment	Page 5	
• The Emergency Operations Centre	Page 5	
• Checklist for members of the ECG working in the EOC	Page 6	
<b>Individual and Particular Responsibilities</b>		
• Mayor and Council	Page 7	
• Emergency Control Group		
○ Chair and Engineering Coordinator (and Public Information Coordinator until augmentation is found possibly from Yukon EMO) (CAO Mayo)	Page 8	
○ EOC Coordinator and Diarist (and Communications Coordinator until a volunteer is found from Cdn Rangers) (Mayo Clerk/Treasurer)& Diarist (Secretary)	Page 9	
○ Fire Chief	Page 10	
○ RCMP	Page 11	
○ Emergency Health Services Coordinator	Page 12	
○ Emergency Social Services Coordinator	Page 13	
<b>Annexes</b>		
Annex A	<b>General Responsibilities</b>	
	▪ The Emergency Measures Commission	Page 14
	▪ The Emergency Control Group	Page 14
	▪ Assisting departments and organizations	Page 15
Annex B	<b>General Information</b>	Page 16
	• Population	
	• Buildings	
	• Geography	
Annex C	<b>Hazards</b>	Page 17
Annex D	<b>Legislation</b>	Page 19
Annex E	<b>Training and Finance</b>	Page 20
Annex F	<b>Resource List</b>	Page 21
Annex G	<b>Map</b> (Not attached to draft)	Page 22
Annex H	<b>Supporting Plans</b> (To be developed)	Page 23
	• Outline for supporting plans	Page 23
Annex Z	<b>Essential (Fan Out) Phone Numbers</b>	Page 24

## **PREFACE**

The Yukon *Government-wide Emergency Plan* defines emergencies as abnormal situations requiring prompt and exceptional action, beyond normal procedures, to limit damage to life, property or the environment.

The Yukon *Civil Emergency Measures Act* defines peacetime disasters as any real or apprehended disaster resulting from fire, explosion, flood, earthquake, landslide, weather, epidemic, shipping accident, mine accident, transportation accident, electrical power failure, nuclear accident and any other disaster not attributable to enemy attack.

While it may not be possible to forecast precisely when or in what form disaster may strike or emergencies occur, it is prudent to establish organizations and operating procedures designed to mitigate their effects. Priorities of action are the preservation of life, property, the environment and economic well-being of the community.

## **AIM**

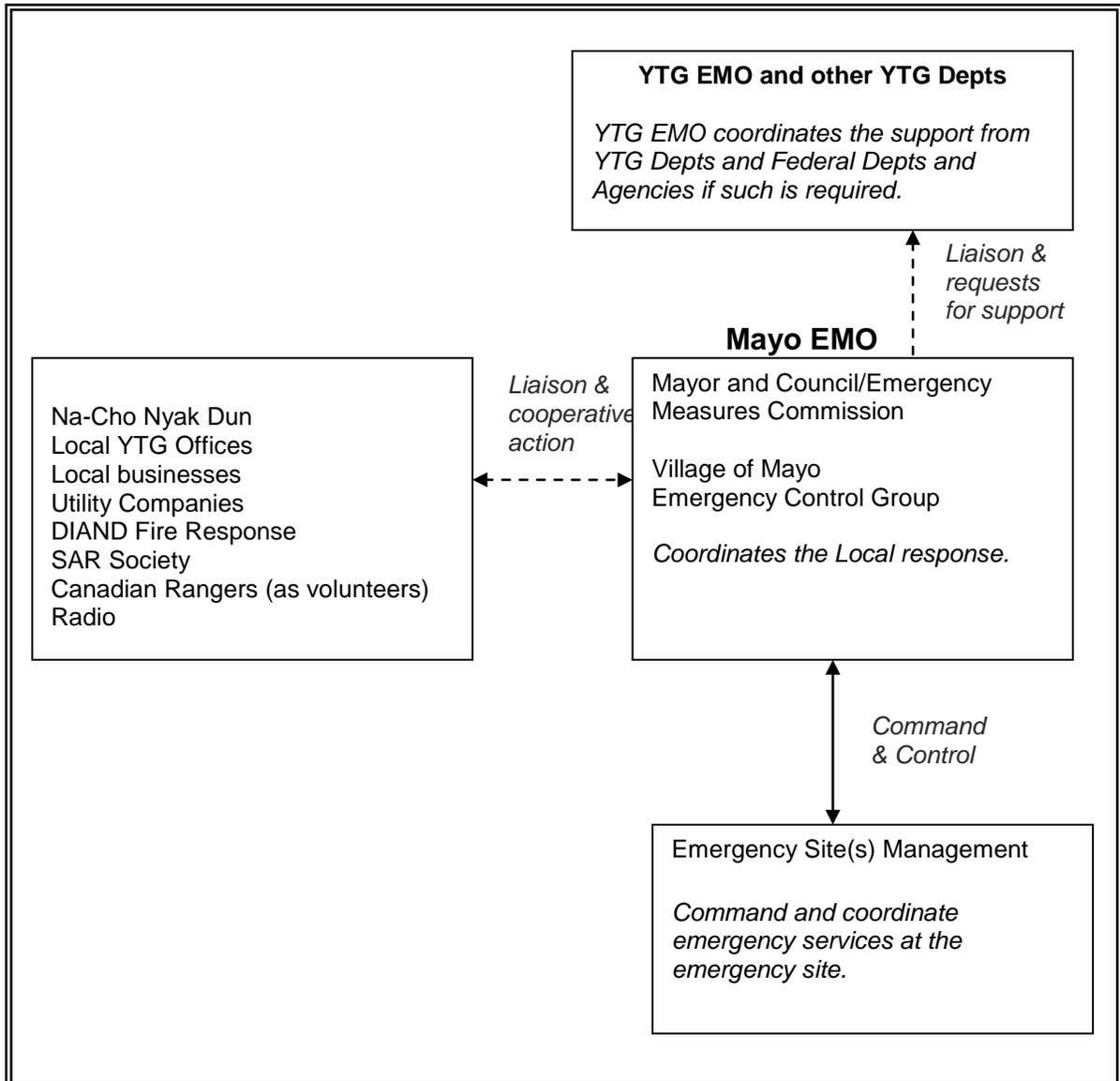
The aim of this emergency measures plan is to:

- Provide for a prompt and coordinated response to emergencies and disasters affecting the Village of Mayo;
- Minimize the effects of an emergency or disaster on Mayo and its residents; and
- Assist in the restoration of essential services.

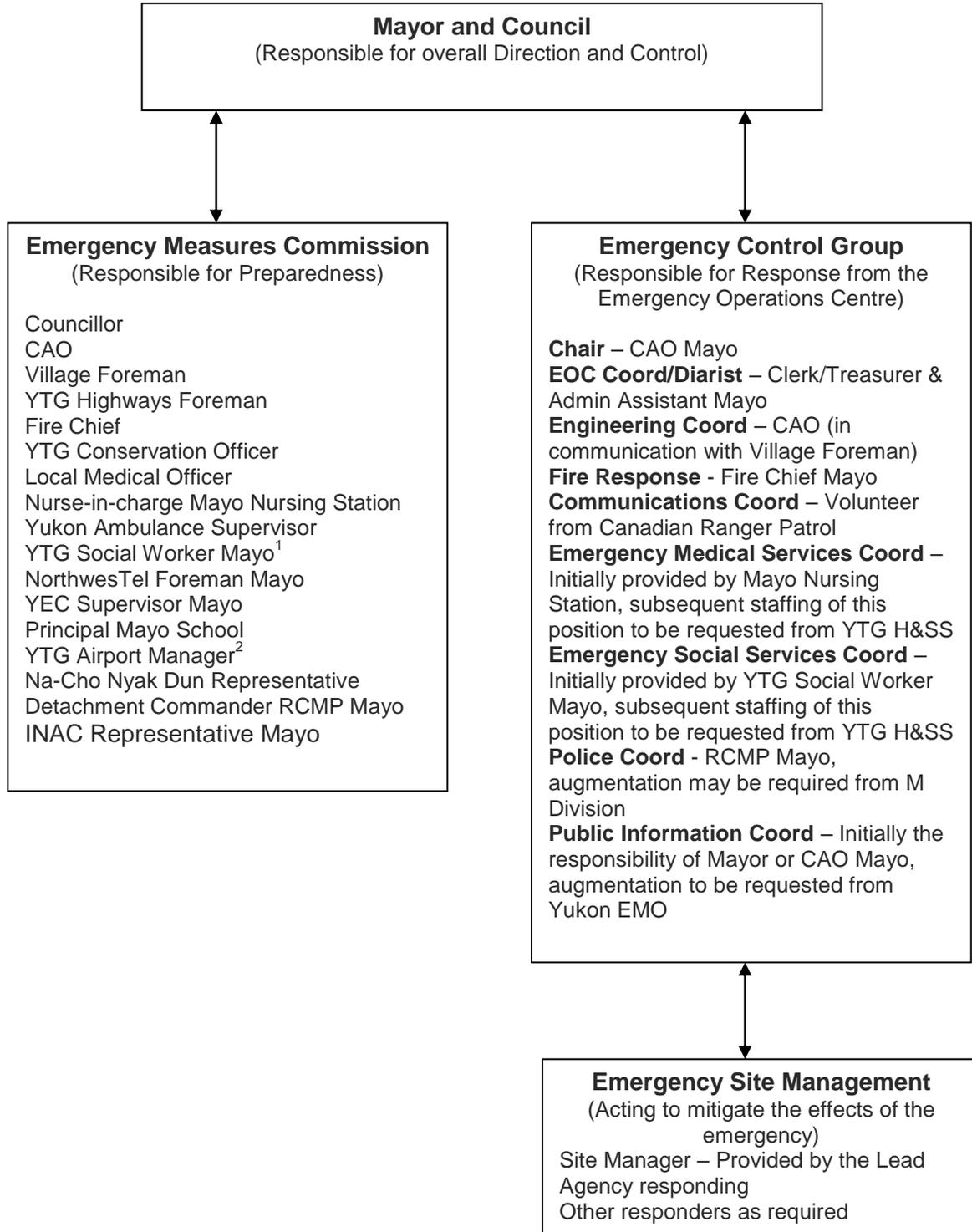
This emergency plan does not apply to day-to-day situations that can be handled by appropriate responding agencies on their own.

## FUNCTIONAL INTERGOVERNMENTAL ORGANIZATION

This plan has been developed to complement the plans of other levels of government involved in emergency responses in Mayo. This plan does not detail the responsibilities or operating procedures for territorial or federal departments and agencies in response to emergencies in Mayo. This plan proposes a system that will allow the elected officials and residents of Mayo to contribute to the prevention and mitigation of disasters and to assist in recovery operations. The Plan allows for situations in which the Village of Mayo will be the lead agency or for situations in which the Village will be a supporting agency for other responders.



**VILLAGE OF MAYO**  
**EMERGENCY MEASURES ORGANIZATION**



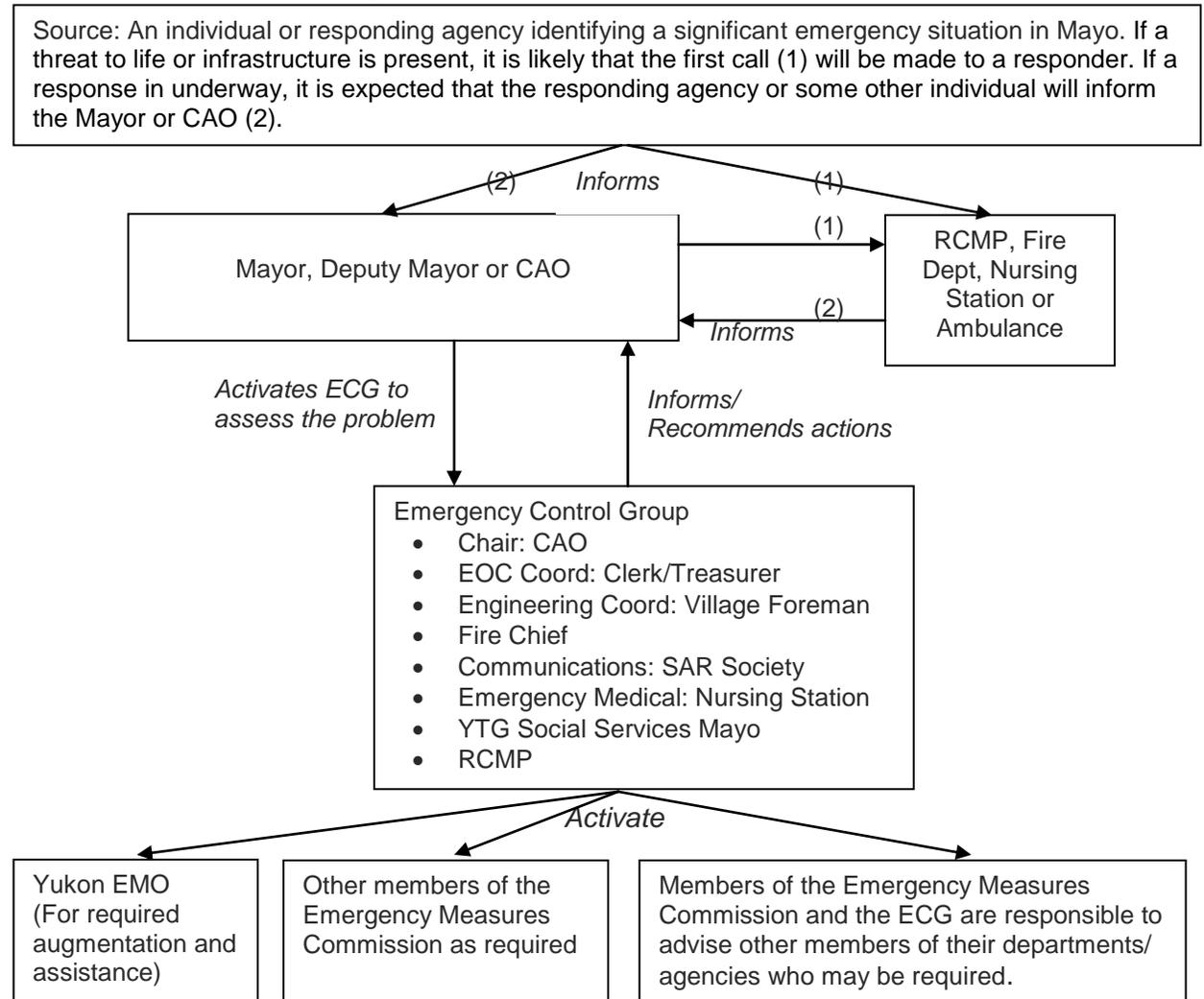
## EMERGENCY MOBILIZATION

### **Emergency Alerting System (Essential Phone Numbers are at Annex Z)**

The Mayor, Deputy Mayor or CAO of Mayo must be made aware of emergency situations which could overwhelm the normal capabilities of response agencies. Awareness of such a possibility could originate with a member of the public, a responder, the Mayor or a Councillor, a member of the Emergency Measures Commission or from a source outside Mayo such as Yukon EMO.

When a member of the Emergency Measures Commission or a member of the Emergency Control Group learn of a real or potential emergency or disaster that threatens Mayo, that person will ensure the Mayor, Deputy Mayor or CAO is informed of the situation. The Mayor, Deputy Mayor or CAO may authorize the staffing of the EOC by the ECG, fully or in part. On receipt of a warning, any member of the Emergency Measures Commission or the Emergency Control group (ECG) may activate the Emergency Organization Alerting System in whole or in part by contacting the other members.

A situation that requires the staffing of the EOC may require a response from a number of agencies in addition to those of the normal medical, police and fire responders. The Chair of the ECG will establish communications with other members of the Emergency Measures Commission as required.



## Assembly

The Emergency Control Group will first assemble in the primary Emergency Operations Centre (EOC) that will be located in the Village of Mayo Council Chambers. The primary phone number will be 996-2317. A possible layout for the EOC is shown below.

## Communications

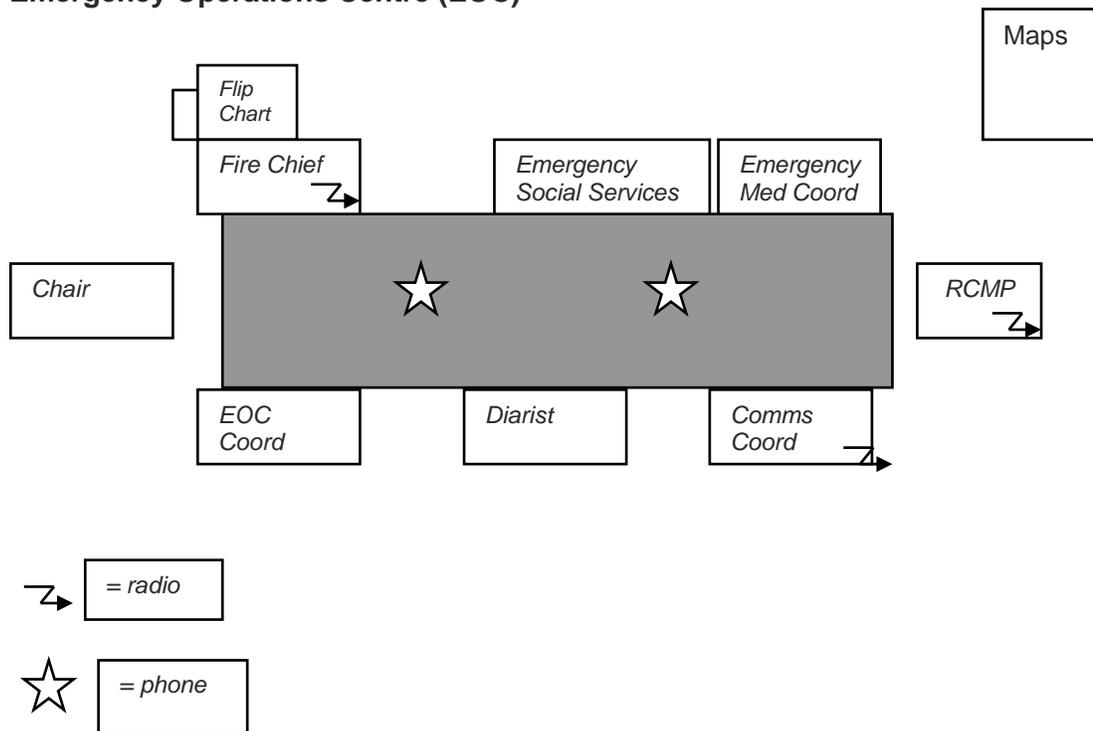
Two telephones that can be extended into the Council Chambers for the ECG. If the phone system fails, communications within Mayo can be achieved by runner. All agencies except the Nursing Station and DIAND have the capability to communicate on the common EMO radio channel. The RCMP will be able to communicate with M Division by radio and satellite phone. Flooding may result in the loss of standard telephone services. MDMRS radio and radio-telephone services should not be affected by flood situations. There are a number of satellite phones in the village including one with the RCMP.

If it is necessary to employ voice radios in the EOC, these sets should be equipped with earphone and throat mike sets to minimize the noise.

## Equipment

Most other equipment requirements such as flip charts and stationary can be found in the Village offices in the building. **No emergency power is currently available and the building is located in the flood plain.** The Mayo Airport Terminal building and the Village of Mayo Shop have been considered as appropriate alternate EOC sites if required.

## The Emergency Operations Centre (EOC)



**A checklist for members of the ECG working in the Emergency Operations Centre**

- You should have table space and a chair identified on the EOC diagram. Find a phone that you can use. This plan calls for a volunteer to be found from the Mayo SAR Society to coordinate communications to and from the EOC.
- Start a record of actions and information. Write a brief description of the current situation and include the time that you are starting.
- Read first the specific departmental plan at annex H that relates to your appointment on the Emergency Control Group.
- Make phone contact with critical members of your organization and explain the situation. Get people in position to respond with equipment and other resources as required.
- Make phone contact with important colleagues in Whitehorse first and then with YTG Departments as appropriate.
- Review the responsibilities stated in this plan for yourself and the other members of the ECG.
- Be prepared to brief the Chair and other members of the ECG on your department's plan for this type of emergency.
- Collect information on the current emergency from other members of the ECG and contacts outside the EOC.
- Relate this information to your plan and consider what else can be done to respond to the situation.
- Try to fulfill the requests you will receive from the Chair and other members of the ECG, find alternate solutions or refer the problem to the Chair of the ECG.

## **RESPONSIBILITIES OF THE MAYOR AND COUNCIL IN AN EMERGENCY**

The Mayor and Council will:

- Provide direction and support to the Emergency Control Group;
- Decide matters of political significance or policy approval;
- Approve the expenditure of funds, above levels of expenditures already delegated to members of the ECG, for the preservation of life, health, property and environment;
- Approve actions requested by the ECG that have not been previously delegated in the Plan;
- Provide any necessary liaison with elected officials in other governments; and
- Keep a record of information received and actions taken.

## **RESPONSIBILITIES OF INDIVIDUAL MEMBERS OF THE EMERGENCY MEASURES PLANNING TEAM (ECG) IN THE EMERGENCY OPERATIONS CENTRE**

**The Chief Administrative Officer** (Chair of the Emergency Control Group) will:

- Chair the Emergency Control Group;
- Coordinate an assessment of the problem;
- Brief the Mayor and Council;
- Advise the Mayor and Council of any necessary actions that should be taken which are not covered in the emergency plan;
- Maintain contact with Yukon EMO as required;
- Determine if local resources are adequate and advise the Mayor and Council;
- Coordinate the local emergency response;
- Provide and/or coordinate the provision of equipment and personnel as required to emergency site managers (annex F is a short list of available resources);
- Coordinate private contractors and engineering resources if required. Note: Avoid duplicate requests through close liaison with YTG EMO if they are involved;
- Until an augmentee is sent from YTG, coordinate media requirements e.g. periodic briefings, briefing areas, information processing in conjunction with representatives of other governments and agencies and liaise with other Public Information Officers at Yukon EMO and YTG Departments;
- Assisted by the Village Clerk/Treasurer:
  - Keep the residents of Mayo informed of significant developments during the emergency, and
  - Establish and operate a public inquiry centre;
- In conjunction with the Village Foreman, coordinate engineering and public works efforts, liaise with the utility companies and work to restore essential services;
- Until an Emergency Health Services Representative arrives from Whitehorse, coordinate the provision of alternate supplies of water when required and liaise with Environmental Health Services on matters concerning water quality. (Note AMT Properties Elsa may be able to provide treated water.);
- Make a full report to Mayor and Council after the emergency; and
- Keep a record of information received and actions taken.

**The Village Clerk/Treasurer** (The EOC Coordinator) will

- Set up the EOC;
- Find volunteers to help at the EOC;
- Arrange EOC security;
- Coordinate the purchase of supply requirements in consultation with Yukon EMO;
- Maintain records of all expenses;
- Until a volunteer is found to coordinate communications:
  - Establish communications requirements and a communications plan,
  - Liaise with NorthwesTel,
  - Liaise with Yukon EMO communications section,
  - Provide radios, phones, operators and runners as required,
  - Provide backup communications,
  - Coordinate radio frequencies;
- Assist the Chair in keeping the public informed; and
- With the help of the Village Secretary, maintain the master activity board/log for the EOC

**The Fire Chief will:**

- Coordinate fire fighting operations;
- Liaise with DIAND fire services;
- Liaise with Keno Volunteer Fire Department and AMT Elsa Properties (Note: It is unlikely that the only fire fighting equipment in Keno will be available to respond to Mayo but it may be useful to coordinate a regional response to particular situations.); and
- Contact dangerous goods support agencies if necessary.

**The RCMP will:**

- Provide security and prevent criminal offences from occurring in evacuated areas;
- Coordinate evacuations;
- Provide traffic control to facilitate the movement of emergency vehicles;
- Provide emergency site security;
- Coordinate perimeter control of emergency site(s);
- Control crowds;
- Coordinate Search and Rescue;
- Provide assistance to the Coroner;
- Provide investigative services when required; and
- Keep a record of information received and actions taken.

**The Emergency Health Services Coordinator** (Provided initially by the Nursing Station until an augmentee can be provided by the Department of Health and Social Services) will:

- Provide available assets and resources as required for an effective emergency health service response;
- Coordinate the ambulance response;
- Care for the sick and injured and management of mass casualty incidents;
- Provide information, advice and direction on emergency sanitation procedures including but not limited to water quality, sewage and solid waste disposal, food quality, institutional hygiene, field sanitation and communicable disease control; and
- Keep a record of information received and actions taken.

**The Emergency Social Services Coordinator** (Provided initially by the Mayo office of YTG Social Services until an augmentee can be provided by the Department of Health and Social Services) will:

- Coordinate the social services response, including but not limited to:
  - Registration and Inquiry,
  - Emergency feeding,
  - Clothing,
  - Personal Services,
  - Lodging,
  - The establishment of a Reception Centre if required;
- Coordinate the response of Mayo volunteers directly involved with social services;
- Liaise with the Principal of JV Clark School concerning the possible use of school buildings; and
- Keep a record of information received and actions taken.

## GENERAL RESPONSIBILITIES

### **The Emergency Measures Commission**

The Emergency Measures Commission shall be responsible for:

- The exercise of the overall responsibility for the planning and coordinating of measures to be taken in the event of an emergency in Mayo;
- The submission of a report of activities to Council at least once a year;
- The submission of an emergency plan and any amendments thereto to Council for approval;
- The familiarization of new mayors or councillors with the emergency plan;
- The recommendation of appropriate emergency preparedness training for elected officials, employees and residents of Mayo; and
- Planning and conducting an exercise, on an annual basis if possible, subject to Council consideration of available funding through review of the budget.

### **The Emergency Control Group (ECG)**

The Emergency Control Group (ECG) shall be responsible for:

- Directing and coordination of all Village resources, other emergency response agencies and volunteer organizations involved in the response to an emergency beyond the scope of the normal response agencies;
- Providing administrative and logistic support to emergency responders;
- Assisting the Emergency Site Manager(s) by marshalling and providing resources to control the emergency or disaster site;
- Recommend the declaration of a local emergency, in accordance with *the Civil Emergency Measures Act*, to the Mayor and Council, if necessary.
- Submitting regular reports to the Mayor and Council to keep them fully informed of progress; and
- Coordinating all emergency response activities with YTG EMO.

## **Assisting Departments and Organizations**

Assisting Departments and Organizations shall:

- Prepare their own emergency plans and submit these plans to the Emergency control group (ECG) from time to time as required by the Committee;
- Train employees and volunteers in methods and procedures to carry out its emergency plan; and
- Maintain detailed records of the resources of each department or organization.

## GENERAL INFORMATION

### **Population**

Approximately 500 people reside in Mayo. Another 20-40 people live in the area around Mayo and on the Silver Trail. Depending on industry trends, a number of outfitters, tourists and miners will be present in the area.

### **Buildings**

Housing in Mayo is of wood frame construction built over the course of the 20<sup>th</sup> Century. Some of the buildings have no independent heating capability but are dependant on electricity to provide heat or to activate the oil and propane fired heaters. Many of the buildings are constructed on permafrost. For a list of the major buildings in Mayo see annex F.

### **Geography**

Mayo is located on low ground at the confluence of the Stewart and Mayo rivers. Mayo is surrounded by boreal forest and trees grow in the larger spaces between houses. One all-weather road connects Mayo with the North Klondike highway, 53 kilometres away.

A number of factors define the geographical area served by Mayo responders and therefore are relevant to this plan. The municipal boundaries for the village are shown on the map attached as annex G. Much of the Na-Cho Nyak Dun community borders the village and is served by the same emergency responders. A mutual aid agreement is in effect between the Village of Mayo and the Na-Cho Nyak Dun First Nation. The Village of Mayo has requested a boundary expansion which, if approved, would add a number of homes and property to the village.

The Yukon Ambulance Service based in Mayo is responsible to respond from Keno to Stewart Crossing and for some kilometres north and south on the North Klondike highway from Stewart Crossing. The Mayo Nursing Station is the main medical facility in the area. The RCMP detachment has a similar response area. The Mayo Volunteer Fire Department serves the First Nation of Na-Cho Nyak Dun as well as responding to emergencies close to Mayo as required. No mutual aid agreements have been made with other volunteer fire departments. The Mayo airport also serves the communities of Keno, Elsa, Pelly Crossing and Stewart Crossing.

### **Weather**

Mayo has experienced the lowest and highest temperatures recorded in the Yukon. Extended periods of  $-40^{\circ}$  C are possible in winter with temperatures reaching  $+30^{\circ}$  C in the summer. The amount of precipitation is small.

## **HAZARDS**

A number of hazards have the potential to create an emergency situation that could require the implementation of this plan. Some of those hazards are: forest fire, flood, dam breach, earth quake, power failure, water contamination, tour bus accident, aircraft crash, pandemic, mine accident and hazardous material spill. Those deemed to be most hazardous due to their likelihood and potential for destruction are discussed below.

### **Forest Fire**

Predictability of forest fires in the summer months is very high and a number of residential buildings have been lost to forest fires in Yukon in the past. Power lines are vulnerable to wild fire. Some activities have been conducted under the "Fire Smart" program to mitigate the wild fire hazard. A new firebreak to the east and the Stewart and Mayo rivers provide the Village with reasonable protection. Forest fires may also cause the evacuation of other Yukon communities and Mayo, with its nursing station and new school, has significant capability to assist with evacuees.

### **Flooding of the Stewart River**

Flooding of the Stewart River has often extended to the town site in the past. A dike has been constructed and strengthened over the years to prevent a reoccurrence. Flooding of the town site would probably result in the failure of the local telephone switch, which is in the village, and widespread cuts to power as a precautionary measure. Water contamination is possible. An evacuation of a significant number of residents would probably be required. The impact on fuel storage sites in the village could be environmentally serious.

### **Earthquake/Dam Breach/Loss of Power**

An earthquake has the potential to cause significant damage to roads, bridges, buildings, power lines, the dike and the hydroelectric dam. Secondary effects of a dam breach could include the loss of the Mayo river bridge, flooding of the town site from the Mayo River, and the loss of electrical power (both from the hydroelectric generators and the alternative diesel generator which could be affected by the flood). It is anticipated that the water level in the Mayo River would raise 10' in 1.8 hours. Over the years more and more wood stoves have been replaced with devices that rely on electricity. This has created a huge reliance on electrical power, particularly in winter when temperatures can remain below -40°C for extended periods.

### **Tour Bus Crash**

An increasing interest in the Silver Trail as a tourism destination is bringing more and larger tour buses into the region served by Mayo based police, fire and medical responders. A vehicular accident involving a tour bus has the potential to create a large number of casualties necessitating a coordinated response from the community in support of the responding agencies.

### **Loss Of Water/Contamination Of Water Supplies/Communicable Disease**

The recent contamination of water supplies at other Canadian communities and the deadly results of those incidents emphasise the possibility and significant ramifications of water supply contamination. Other threats such as weather and earthquakes can also cause an interruption in the supply of potable water. Epidemics of communicable diseases may occur with or without the physical effects of disasters. Earthquakes, for example, may cause diseases such as typhoid or cholera that are present in manageable proportions before the disaster to develop epidemic potential.

### **Dangerous goods/Environmental hazard**

Prediction of a hazardous material accident is uncertain. It is certain, however, that some hazardous materials will be transported into/through the community and may be used at home by the residents. If these materials are released, they can injure people, pets and property.

There are some large propane storage tanks in the village that would pose a significant explosion and fire hazard if an earthquake or flood affected their mounting base.

Chlorine is used at the Mayo pumphouse to purify the village water supply. A chlorine leak would cause a deadly hazard downwind from the pumphouse. (to be discussed – ramification of the most recent leak and scope of the danger foreseen.)

## LEGISLATION

### **YTG Civil Emergency Measures Act**

Section 5 of the Civil Emergency Measures Act mandates that Municipalities shall establish emergency plans. Section 7 describes the procedures for declaring emergencies:

#### *Municipal state of emergency*

*7. (1) The mayor of a municipality may declare that a state of emergency exists in the municipality where*

*(a) the mayor has reasonable grounds to believe and does believe that a substantial danger to public safety or to property in the municipality exists or is imminent as the result of fire, explosion, flood, earthquake, landslide, weather, epidemic, transportation accident, electrical power failure, nuclear accident or any similar disaster, and*

*(b) the mayor is authorized to declare the state of emergency by resolution of the council passed after its consideration of the occurrence of events that reasonably may be expected to lead to the need to declare the state of emergency.*

*(2) A state of emergency declared under subsection (1) shall be published by such means as reasonably will bring the declaration promptly to the attention of the inhabitants of the municipality.*

*(3) A state of emergency declared under subsection (1) commences upon the publication of the mayor's declaration in accordance with subsection (2), and continues for 48 hours, but the state of emergency may be replaced by a declaration of a state of emergency pursuant to section 6 (Commissioner in Executive Council).*

### **YTG Municipal Act**

Section 265 of the Municipal Act requires local authorities to prepare for emergencies and disasters within their corporate boundaries.

### **Mayo Emergency Measures By-law**

The Mayo Emergency Measures By-law establishes an Emergency Measures Commission and an Emergency Plan for the Village of Mayo.

## **TRAINING**

### **Individual Training**

Execution of the plan will be facilitated by training the personnel involved through local courses or by attendance at provincial or territorial training courses.

The overall concept of training is to train as many members of the community as possible to provide redundancy among the members who will be involved in emergencies. The training should be goal oriented and progressive. Self-help training should be made available to all residents of Mayo. This should include making the residents aware of the simple preparations that will mitigate the effect of earthquakes and greatly assist survival in other emergency situations. Community safety inspections that will identify potential problems, such as unprotected fuel storage areas, and programs like "Fire Smart", should be encouraged. Individual training designed to maintain and increase skills should be planned for every year.

Opportunities for training may be forthcoming from Yukon EMO, YTG Health and Social Services or DIAND. Some subjects with wide application are first aid, social services reception centre and communications training. Selected individuals who may be expected to operate in the EOC in an emergency should receive training in emergency management and EOC procedures, emergency planning, preparedness and exercises.

### **Exercising the Plan**

Emergency readiness will be greatly increased if emergency measures exercises are conducted on an annual basis, subject to available funding. Exercises may be progressive in scope and difficulty. Some exercises to be considered are Alert Exercises, Discussion Groups, Paper Exercises, Table Top Exercises, Communications Exercises, and full Response Mock Disaster Exercises.

## **FINANCE**

During an emergency it is important to record expenditures made relating to the emergency to assist in subsequent requests for reimbursement to other levels of government.

Funds may be available through the Joint Emergency Preparedness Program (JEPP) or other territorial or federal programs to finance readiness and training.

## **RESOURCE LIST**

Mayo has a number of assets that may be useful in an emergency response situation.

### **Infrastructure**

The Airport – usually C-130 capable (except during break-up), possible alternative EOC  
The School – kitchen, 12 classrooms with back up power  
Nursing Station – a backup generator and heated space  
Village Office  
YTG Administrative Building  
Community Hall – space for 150 people, kitchen, bathrooms  
Curling Lounge  
Arena  
Bedrock Hotel  
North Star Motel  
Silver Trail Inn  
Catholic Church Rectory  
Na-Cho Nyak Dun Lands Office  
Highways Maintenance Shop  
Village of Mayo Shop – possible alternative EOC

### **People and Teams**

Canadian Ranger Patrol and Junior Rangers  
The SAR Society  
Volunteer Fire Department  
RCMP Detachment  
The Nursing Station  
Yukon Ambulance  
DIAND Fire Response Teams  
YTG Conservation Officers  
YTG Highways Crews  
YTG Social Services  
Na-Cho Nyak Dun First Nation  
YEC  
Northwestel

### **Vehicles and Equipment**

Satellite phones – DIAND, Na-Cho Nyak Dun, RCMP, YEC  
Radios – Fire, Police, Rangers, SAR, Conservation Officers, DIAND, Northwestel, YEC,  
Nursing Station, Ambulance  
Vehicles with radios – YTG Highways, YTG Conservation Officers  
Bus – Takhini Transportation, Mayo Taxi  
Camp supplies (78 person camp) – DIAND Fire Service  
Portable Casualty Collecting Stations (2) – stored at the airport and the nursing station  
Boats – RCMP, SAR Society, DIAND, YTG Conservation Officers, YEC, Na-Cho Nyak Dun  
Pumps – DIAND, YEC, YTG Highways  
Water Tankers – Na-Cho Nyak Dun, Keno, AMT Elsa Properties

## **OUTSTANDING REQUIREMENTS**

Two measures that would increase the effectiveness of an emergency response are:  
An EMO “ready box” with telephone extension cable, stationary, place cards, flash lights; and  
A 15 kw emergency generator and the wiring capacity at the Village Hall to provide emergency power to the building.

**MAP**

(To be provided)

## AGENCY PLANS

(To be developed)

### Outline for Agency Plans

In formulating agency plans, supervisors may find the following headings useful as a guide:

#### Objective

- The purpose of a statement of the objective may be to orient members of the agency to the MAYO EMO and how they may assist in the mitigation of an emergency situation.

#### Organization

- An organization chart may be useful to familiarize other users of the plan with agency resources. The chart can indicate people, phone #s, equipment, roles of sections, etc.

Agency contact points for others and Agency assembly instructions

#### Possible tasks

- Some may be evident from the list of individual and particular responsibilities listed for the Emergency Planning Commission and ECG in the overall plan.
- List the tasks and under each task indicate:
  - who can do it
  - who should be consulted or advised
  - how it can be done
  - what other resources will be required to do it
- **Alternatively** List key personnel by appointment title and allocate them the possible tasks including who to consult, how to carry out the task and some indication of what resources are required and how to get them.

#### Communications

- Consider how communications could be effected between people in the department in the case of telephone system failure or in the case of people working away from phones. This could be a general description or could require particular solutions for particular tasks.

Self-help plans for members of the agency and their families, particularly for those who can expect to be away from home.

**ESSENTIAL PHONE NUMBERS (updated April 2013)**

Appointment/Name		Home #	Work #	Cell#
Mayor	Scott Bolton	996-2434	996-2276	
Councillor	Bill Leary	996-2051	996-2568	
Councillor	Trevor Ellis	996-2150	996-2256	
Councillor	Joann Aird	996-2448	996-2275	
Councillor	Kris Pavlovich	996-2023		
Chief Administrative Officer	Margrit Wozniak	996-2943	996-2317	332-1913
Clerk/Treasurer	Barb Barchen	996-2508	996-2317	332-4012
Village Manager EH,PW&PS	Scott Hamilton	996-2155	996-4303	332-4908
Village Foreman	William Hummel	996-2865	996-2317	332-1213
VoM EH/PW Worker	Dale Hutton	996-2149	996-2317	332-1212
VoM Infrastructure Worker	Eddie Olsen	996-2710	996-2317	332-1211
YTG Highways Foreman	Calvin Hoogland	996-2665	996-2232/2506	
Fire Chief/Deputy Chief	Trevor Ellis/Ian Spencer	996-2317/996-2256		332-1210
YTG Conservation Officer	Kevin Johnstone	996-2327	996-2202	
Local Medical Officer	Dr. M. Bakri	996-4444	996-4444	
NIC Mayo Nursing Station	Linda Heasley	996-4444	996-4444	
Yukon Ambulance Supervisor	Darlene Hutton	996-2155	996-4444	
YTG Social Worker Mayo	Lee Carruthers		996-2283	
Northwestel Service Tech Mayo	Manfred Wozniak	996-2337	996-2300	
YEC Supervisor Mayo	Gary Jones	996-2977	996-2387	
Principal JV Clark School	Silke Wissner	996-2023	996-2275	
YTG Airport Manager	Shauna Heasley	996-2200	996-2334	
Na-Cho Nyak Dun Representative			996-2265	
Mayo RCMP Members	Chris Hutchings/ John Collins	996-5555 996-5555	996-2677 996-2677	
	Shannon Stelter			
YTG EMO			667-5220	