



COUNTY of ANNAPOLIS
NATURALLY ROOTED



GRANVILLE FERRY SOURCE WATER PROTECTION PLAN

*Prepared by
The Granville Ferry Source Water Protection
Advisory Committee*

2018

PREFACE

This Source Water Protection Plan (SWPP) was prepared under the guidance of the Source Water Protection Advisory Committee (SWPAC). The objective of the SWPP is to present a plan, which when implemented, will protect existing and future municipal drinking water sources.

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ACRONYMS USED

ACWU	Annapolis County Water Utility
ASTM	American Society for Testing and Materials
BMPs	Best Management Practices
DND	Department of National Defence
GIS	Geographic Information System
MCA	Municipality of the County of Annapolis
MSDS	Material Safety Data Sheets
NSE	Nova Scotia Environment
NSTIR	Nova Scotia Transportation and Infrastructure Renewal
PW	Production Well
REMO	Regional Emergency Management Organization
SWPZ	Source Water Protection Zone
SWPAC	Source Water Protection Advisory Committee
SWPP	Source Water Protection Plan
USGS	United States Geological Survey
WPA	Water Protection Area

DEFINITIONS

The units used in this report are metric: m (meters), mm (millimeters), km (kilometers), mg/L (milligrams per liter), L/min (Liters per minute) or m³/day (cubic meters per day), with igpm (imperial gallons per minute) shown in brackets for yield estimates. Technical terms used are defined as follows.

Aquifer: An aquifer is an underground layer of water-bearing rock. Water-bearing rocks are permeable, meaning that they have openings that liquids and gases can pass through. Sedimentary rock such as sandstone, as well as sand and gravel, are examples of water-bearing rock. The top of the water level in an aquifer is called the water table.

Contaminant: Biological, chemical, physical, or radiological substance (ordinarily absent in the environment) which, in enough concentration, can adversely affect living organisms through the air, water, soil, and food.

Chlorination: The method that serves not only for disinfection, but as an oxidant for other substances (iron, manganese, cyanide, and so forth) and taste and odor control in water and wastewater.

GUDI: GUDI (Groundwater Under Direct Influence of surface water) refers to the groundwater sources such as constructed wells, where surface water can travel from nearby surface water to the groundwater sources.

MoD flow: The U.S. Geological Survey (USGS) modular finite difference flow model, which is a computer code that solves groundwater flow equations. The program is used by hydrogeologists to simulate the flow of groundwater through aquifers.

Pesticide: A substance, usually synthetic although sometimes biological, used to kill or contain the activities of pests; includes herbicides (pesticides used to kill unwanted plants).

Permeability: The state or quality of a material or membrane that causes it to allow liquids to pass through.

Wellhead Protection Areas (WHPAs): Areas where water travels through the ground to a municipal well, i.e., 2, 5 and 25-year capture zones (also called Source Water Protection Zone).

EXECUTIVE SUMMARY

Annapolis Royal is a beautiful waterfront community nestled in the Annapolis Valley. From grassroots community projects to provincial government strategies and legislation, people across Annapolis Royal and Granville Ferry are working together to ensure safe and sustainable drinking water for generations to come. The protection and enhancement of drinking water sources are paramount for the successful growth of Nova Scotia.

The Source Water Protection Plan (SWPP)

The SWPP is not only a compilation of actions; it is the culmination of a process that has used a science-based approach as its foundation for identifying vulnerable areas and the risks posed to municipal water systems. The first stage of the document was the development of Terms of Reference, which would be the work plan for the development of the Source Water Protection Plan. The second step was to identify a comprehensive drinking water strategy. The strategy outlines a multi-barrier approach to achieving this goal, and the Nova Scotia Environment (NSE) has established a five-part guide to implementing source protection for water supplies. It includes an action plan for protecting the water supply through the implementation of a range of options and techniques known as the ABCs of source water protection.

ABCs

NSE guidelines define the tools available for plan development and operation. The tools are:

- Acquisition of land
- Bylaws
- Best management practices
- Contingency plans
- Designation

Three documents support this plan:

1. Groundwater Model – Granville Ferry Municipal Well Field, Nova Scotia (2006)
2. Municipal Well Field Expansion Program (2004)
3. Water system Assessment Report, (2013)

Use Table 5 (Page 16) to locate management options that address potential risks to the drinking water source, for each.

- **Education**

Strategies are grouped
as:

- Management Plan
- Action Plan
- Monitoring Plan

Strategies

This SWPP identifies strategies for protecting our drinking water supply. The SWPAC evaluated management options and ranked them by appropriateness and effectiveness for managing each risk. Actions were developed to implement the selected management options, including activities and timelines, as well as establishing an ongoing monitoring program. Most importantly, the SWPP provides the Municipality of the County of Annapolis (MCA) and the residents of the Annapolis Royal region with the necessary foundation, information, and agenda to support and carry out the province's ongoing commitment to protecting our precious drinking water source.

1.0 PLAN PURPOSE, OBJECTIVE, AND VISION

The most cost-effective way to ensure a safe water supply source is to prevent drinking water problems from developing in the first place. This is best achieved with an effective SWPP. The overall purpose of this SWPP is to manage land uses within the defined source water protection zone (SWPZ) to assure the continued supply of good quality water to the Granville Ferry water supply system.

1.1 Plan objectives

The goal of the SWPP may be achieved through the accomplishment of specific objectives:

1. Establish lines of protection, which will take the form of different initiatives for different types of contaminants. These initiatives will address vulnerable areas by identification of potential sources of pollutants and with possible mitigation measures for the SWPP. It includes physical isolation from ongoing potential contaminant sources, changes in practice, changes in land access agreements, educating the public about responsible behavior within the boundaries of a drinking-water supply watershed, and developing effective contingency plans to mitigate an incident, if one does occur.
2. Provide a plan that is flexible and can be adapted or improved, if there are changes in contaminants (or activities of concern). The management plan must address both existing and potential future land uses. It is essential to incorporate ongoing public and stakeholder input into the management plan, to design a well-integrated plan that builds upon existing programs and resources.
3. Provide a management plan that allows the contamination sources to be efficiently and economically monitored. The degree of monitoring and management should depend on the locations of the potential contaminant sources and their proximity to the water source.

1.2 Vision

The overall vision of the Granville Ferry SWPAC, in partnership with the public, NSE and MCA, is to protect the quantity and quality of present and future sources of drinking water in Granville Ferry SWPZ.

2.0 INTRODUCTION TO WELL FIELD

The Granville Ferry Well Field is in the Annapolis Valley, approximately 7 km north of the community of Annapolis Royal. The location is shown in the system diagram in Figure 1. The system provides water to about 900 customers using two wells that are located north of Granville Ferry on lands of Department of National Defence (DND).

Wells, 1 and 3 are identified as Non-GUDI (Groundwater Under Direct Influence of surface water), as summarized in Table 1. PW2, located to the south of Well 3, is no longer used but is maintained as a potential backup supply.

Table 1 Granville Ferry Well Field Development – SWPP

Well Identification	Well 1 (PW1)	PW2	Well 3 (PW3)
Installation Year	1996	1992	2004
Driller	W & R Well Drilling	-	W & R Well Drilling
Capacity (L/min)	454	227	828

The water is treated using gas chlorination at a Level 1 treatment facility. The water is then stored in a 910 m³ standpipe before distribution. The area surrounding the wells is mostly forested with an access road passing nearby. Access to the site is limited to utility workers and DND.

Information presented in this report is based on the groundwater model prepared in 2006 for the Well Field using the general investigations of groundwater conditions in the study area. The modeling was revised by Stantec Consulting Ltd. (Stantec) in July 2017 as part of this SWPP to include the 90-day capture zone, update the 2-year capture zone and remove PW2 from the model. More detail on the hydrogeology of the Granville Ferry Well Field is included in Appendix A.

3.0 PROCESS TO DEVELOP SOURCE WATER PROTECTION PLAN

NSE has published a five-part series of technical documents that provide detailed guidance for those who have to deliver effective source water protection plans. NSE Guidance outlines a five-step process for the development of a SWPP. Granville Ferry has followed the suggested method including the five steps as follows:

- **Step One:** Form a Source Water Protection Advisory Committee
- **Step Two:** Delineate the Source Water Protection Area Boundary
- **Step Three:** Identify Potential Contaminants and Assess Risks
- **Step Four:** Develop and Adopt a Source Water Protection Management Plan and
- **Step Five:** Monitor and Evaluate the Plan

Table 2 Summary of SWPP Process

Step 1	The Annapolis County Water Utility (ACWU) is responsible for forming an advisory committee to develop the SWPP. The Granville Ferry SWPAC includes municipal councillors, the Director and Manager of Municipal Operations, DND, residents of Granville Ferry area and consultants.
Step 2	The second step involves delineation of source water protection zone, depending on wellhead capture zones and completed using a groundwater model.
Step 3	The third step is to identify and document potential sources of contamination and to assess the risk they pose to the source water supply. The intent of this is to provide the SWPAC with an understanding of the types of activities and associated contaminants.
Step 4	<p>Management options are developed in Step 4. The SWPP is often based on a combination of the most appropriate management practices for the source water supply area:</p> <ul style="list-style-type: none"> - Acquisition of Land - By-Laws - Best Management Practices - Contingency Plan - Designation - Education <p>Once the SWPAC identifies the range of options available to manage the drinking water supply, NSE can review the plan.</p>
Step 5	One of the critical components of the SWPP is to monitor for water quality contaminants entering the SWPZ. Both the SWPAC and MCA will need to continue to work with stakeholders to ensure that the management practices incorporated into the SWPP are contributing to the maintenance of water quality and quantity.

4.0 SOURCE WATER PROTECTION ADVISORY COMMITTEE

The first and most crucial step in developing the SWPP is to form a fully representative Advisory Committee. This step includes the formation, selection, and identification of responsibilities and objectives of the Source Water Protection Advisory Committee (SWPAC).

The mandate of the committee includes addressing issues such as:

- Identification of stakeholders (listed in Appendix B)
- Water quantity and quality concerns
- Actual and potential sources of contamination
- Management strategies
- The effectiveness of the SWPP.

The terms of reference, which define the SWPAC's composition, roles, and responsibilities of committee members, operations and reporting hierarchy, and committee members' length of term, is provided in Appendix C.

The committee will oversee the preparation and review of the following deliverables:

- Protection area boundary description
- Identification of contaminants and associated risks
- Source water management plan
- Set time frames for the completion of initiatives
- Implementation of the monitoring program
- Preparation of the draft SWPP
- Continuous evaluation of the effectiveness of the protection plan by the SWPAC, which is to meet on an annual basis

5.0 DELINEATION OF PROTECTED WATER AREA BOUNDARY

A conceptualized hydrogeological model of the Granville Ferry Well Field was developed by considering available regional topographic mapping (Figure 2), geological mapping (Figures 3 and 4) and well record information from NSE Well Logs Database. The groundwater modeling was conducted under the framework of standard modeling approaches discussed in ASTM Standard ASTM D 5447-93. It was constructed using Visual MoD flow Pro (version 4.1. Waterloo Hydrogeological, 2004) which is an integrated groundwater modeling package based around three-dimensional, finite difference groundwater flow modeling code (MoD flow) developed by USGS. The modeled capture zones include:

- the 90-days capture zone
- the 2-year capture zone
- the 5-year capture zone
- the 25-year capture zone

The outer boundary of the SWPZ (Figures 2 through 6) includes the 25-year capture zone and takes into consideration surface water flow towards this capture zone based on topography. To be conservative, PW2 was included in the SWPZ. The groundwater flow in the Granville Ferry Well Field is expected to be generally southward, originating in the topographic high at North Mountain and discharging into Annapolis River to the south with several smaller tributary rivers that arise on the south side of North Mountain.

Land use immediately surrounding and up-gradient (north) of the Well Field included forested areas that form a protective barrier to the water source within the inferred capture zone near the well. Most of the land is owned by DND (Figure 5 and 6). The only building within the SWPZ is a water treatment building near Well 1.

6.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

As per NSE guidelines for developing the SWPP, Step 3 aims to identify known and suspected point sources of contaminants (that are released from a specific, known location) and non-point sources (diffuse in nature, difficult to locate and hard to identify the source) that may impact groundwater quality impact within the SWPZ. It provides a qualified opinion on the level of risk to the underlying groundwater resource.

6.1 Activities within the Source Water Supply Zone

A detailed inventory of land use within the SWPZ was developed based on a desktop survey, site visit, and discussion with the SWPAC. Please refer to the Figure 5 for current land uses and Figure 6 for property ownership. Land use information within the SWPZ boundary for the Granville Ferry Well Field development is summarized below:

- A. **Land Ownership:** The total land involved in the Granville Ferry SWPZ is 401.3 acres for the two wells (Well 1 and Well 3). Percentage of property owned by DND is approximately 95 %; 3 % by MCA and 2% is Private.
- B. **Number of buildings/structures:** Based on the graphic information system (GIS) data, information provided by DND and MCA, and the site visit, the range is located completely outside the SWPZ, but DND does carry out other activities at this location (i.e., navigation, orienteering, search and rescue exercises).
- C. **Percentage of Land use:** The land use is a combination of forest area, alders, forest regrowth, DND, MCA, and Private sector and the approximate breakdown is:

1. Forest	85.61 %
2. Forest Dead/ Regrowth	10.87 %
3. Forest (Alders)	2.73 %
4. Non- Forest Misc.	0.55 %
5. Waterbody	0.23 %
<hr/>	
Total	100.00

6.2 Potential Sources of Contamination

When assessing the level of risk of a potential contaminant, consideration was given to the chemical and physical properties of the contaminant, the features of the aquifer materials, especially overburden, and the contaminant source location within the SWPZ. The risk ranking is based on the perceived severity of impact, should a significant release occur, and an estimate of the probability of such an occurrence. Refer to Appendix D for a summary of how risk factors, including severity and likelihood, were calculated. Refer to Figure 5 (Land Use) for Map ID numbers showing the locations of potential point sources of contamination.

Table 3 Potential Sources of Contaminants

Potential Contaminant	Description	Risk Factor	
		Probability + Severity	Rank
Point Sources			
Access Roads (within the study area) MAP ID 1	Road salt	4	Medium
	Dust suppression	4	Medium
	Potential Spills	6	High
Range and Training Area MAP ID 2	Wastewater Lagoon (i.e., microbial)	<2	Low
	Shell casings residues (i.e., metals)	4	Medium
Abandoned well (Observation Well, OW) MAP ID 3	Potential conduit for contaminant transport	5	High
Water Treatment Building near Well 1 MAP ID 4	Chlorine storage (liquid)	<2	Low
	Temporary fuel storage	<2	Low
Powerlines MAP ID 5	Transformer spill (mineral oil)	5	High
Non-Point Sources			
Forestry/Silviculture MAP ID 6	Cutting – erosion and sedimentation	2	Low
	Fire suppression chemicals	5	High
	Pesticides/ herbicides	5	High
	Illegal dumping	3	Medium
	Potential Spills	3	Medium

Access roads/Potential spills/Dust suppression: There are unpaved access roads very close to the wells. If these roads are paved in the future and were salted, there would be a risk of salt infiltration to groundwater. The likelihood of large-volume spills along the access roads is low because we do not have transport of fuel along the roadways within the capture zone. However, the proximity of the roadway and the slope down to Well 1, raises concern. If a vehicle went off the road, it could impact Well 1. The closer a spill occurred to the Wells, the higher the likely impact. DND periodically applied dust suppressants to the access roads (as needed); current dust suppressants used are non-toxic and safe for potable water supplies.

Range and training area: A wastewater lagoon located on the edge of the study area, outside the capture zone, is being decommissioned by DND and replaced with an engineered septic field. The firing range is a potential source of metals (including lead) from shell casings. The amount of lead and other metals from this source can vary. Introduction of metals into the subsurface is primarily of concern closer to the wells.

Abandoned wells: An abandoned private well (Observation Well) located within the 2-year capture zone could pose a potential risk of groundwater contamination. Abandoned wells can serve as a path for contaminants from the surface to the water table. Land lease with MCA and DND includes identifying wells that they have installed on DND lands and intent for MCA to decommission wells and older water pipelines within right of way of Mills Mountain road and other DND lands.

Chemical/ temporary fuel storage: The nature of the chemical being stored and its quantity, as well as its location relative to the Wells, will determine its potential risk. The water treatment facility located near Well 1 and outside the capture zone but within SWPZ, stores a liquid form of chlorine. In addition, fuel may be temporarily stored at this location if a backup generator is required.

Transformer spill: There is one utility pole with a transformer near Well 1. Given the proximity of the pole to Well 1, a release of mineral oil from the transformer is a potential risk.

Fire Suppressants: With forested areas found throughout SWPZ, fire is a risk. Fire suppressant foams used by first responders could reach the water supply through groundwater infiltration or surface runoff. The possible introduction of these chemicals is of greatest

concern closest to the wells, but also of concern throughout the SWPZ since these chemicals tend to be persistent and not degrade.

Sedimentation: Forestry operations result in the cleared land, which reduces the forest canopy and increases runoff volumes. This can increase the sediment load in watercourses throughout the watershed. Like logging and development, forest fires remove canopy and ground cover and can lead to increased erosion and consequent sedimentation. Forestry operations in the SWPZ are expected to be minimal based on federal land ownership.

Herbicides/Pesticides: The possible introduction of herbicides and pesticides into the subsurface is of greatest concern closest to the wells. However, the pesticides and herbicides can be persistent and should be considered a potential risk throughout the SWPZ. If herbicides or pesticides reached the water supply through groundwater infiltration or surface runoff, they are not easily removed by water treatment and could pose significant health risks. ACWU and DND have indicated that they do not use herbicides to control vegetation growth along roads. The most significant concern is the potential future use of pesticides on forested land within the SWPZ.

Illegal Dumping/Potential Spills: Although access to land within the SWPZ is limited by federal land ownership, there is a risk of illegal access and potential spills or illicit dumping associated with this.

Priority wise ranking was determined via consultation with the SWPAC. It considered such factors as the calculated Risk Factor and how readily the issue could be addressed. The results are summarized in Table 4.

Table 4 Rationale Ranking

Item	Contaminant Source	Rationale	Priority Ranking
1.	Access Roads (within the study area)	<ul style="list-style-type: none"> • Roadways are located within the 90-day capture zone • Road salt not currently used • Material for dust suppression is safe for potable water supply • Limited traffic on access roads 	Medium
2	Range and Training Area	<ul style="list-style-type: none"> • DND has BMPs for shell casings/residues under range safety program • DND is decommissioning wastewater lagoon 	High
3	Abandoned Well (OW)	<ul style="list-style-type: none"> • Decommission planned 	High
4	Water treatment Building	<ul style="list-style-type: none"> • Located outside the capture zone • Liquid chlorine storage • A backup generator is planned, and fuel will be stored on site when the generator is in use 	Medium
5	Transformer Spill	<ul style="list-style-type: none"> • New pole, no PCBs; inside 90-day capture zone 	High
6	Forestry - Sedimentation	<ul style="list-style-type: none"> • Cutting/erosion 	Low
7	Forestry; Pesticides/Herbicides	<ul style="list-style-type: none"> • The potential for pesticide spraying within the capture zone 	Medium
8	Forest Fires	<ul style="list-style-type: none"> • Potential for fire suppressant chemicals used in the capture zone 	Medium
9	Potential Spills/Illegal Dumping	<ul style="list-style-type: none"> • Not expected in capture zones due to site access restrictions 	Medium

7.0 MANAGEMENT PLAN

Step 4 of the NSE guidelines to develop a municipal SWPP focuses on the development and implementation of the management plan within the SWPZ boundary. According to the identified potential sources of contaminants in Step 3 (NSE guidelines), Step 4 develops management options for those risks to water quality.

Steps for making the management plan:

- Set management goals and objectives
- Identify management options for issues and identified in Step 3 (NSE guidelines)
- Develop a contingency plan
- Solicit input from stakeholders and the public
- Draft the management plan
- Update information

7.1 Goals and Objectives

The purpose of the Granville Ferry SWPP is to protect the groundwater supply from contamination and keep it safe for current and future drinking water use. MCA should take all reasonable measures to achieve this goal as outlined in the Management Plan.

Objectives:

- Educate stakeholders and the public as to value our groundwater source and what they can do to help keep it safe.
- Adopt sound management practices to avoid contamination of the water supply.
- Develop contingency plans to limit contamination of the water supply by events such as contaminant spills or natural disasters.

7.2 Management options

The NSE guideline requires the assessment of alternative source water protection management options. The following list of management options, with a general statement as to their effectiveness, cost, usefulness, and acceptability, is provided by NSE for the use of SWPP advisory committees:

- A. **Acquisition of Land:** Typically, the most expensive option, but also the most effective, as it gives the Municipality direct control over the land usage and development. In Granville Ferry SWPP, a lease between DND and MCA will permit “exclusive use of lands” as Leased Area on survey plan prepared for the lease.
- B. **Best Management Practices (BMPs):** Methodologies used by landowners/users within the SWPZ to define practical and effective means of protecting source water areas. In the case of the water utility and other institutions, such as NSTIR, BMPs may require education or even regulations.
- C. **By-Laws:** They are enacted under Municipal Planning Strategies and allow the municipality to restrict land usage and activities in sensitive areas.
- D. **Contingency Planning:** Not all risks to the SWPZ can be mitigated. Contingency Planning defines emergency response protocols, in case of dangerous contamination occurrence within the SWPZ.
- E. **Designation:** Regulations enacted under the Nova Scotia Environment Act, Section 106. Regulations can be drafted that would enable the Municipality to define allowable activities within the protected area.
- F. **Education and Stewardship:** The Municipality can work to develop and deliver educational materials to inform residents and landowners of the importance of protecting source waters, and to recommend practices for doing so.

7.3 Source Water Protection Management Recommendations

For each potential contaminant within the Granville Ferry SWPZ, the management options presented in the NSE guidelines were evaluated. Table 5 provides a summary of the expected effectiveness of the available management options on the identified potential contaminants. The management options were ranked by assigning a “1” to the possibility that was deemed to be the most effective. Choices judged to be progressively less likely to be effective are numbered with sequentially higher numbers.

The SWPAC is responsible for evaluating the application of these various management options to the identified potential contaminants within the SWPZ, considering effectiveness, cost, maintenance, useful life, adverse effects, and public acceptability of each option, to develop suitable management options. Although specific management options are judged to be more

effective than others for contaminant source activities, the SWPAC recognizes that the most effective initiatives would make use of two or more management options in a coordinated fashion. The rationale for the assigned priorities is presented in the sections that follow. It is noted that given the federal land ownership in the area, land use bylaws were not considered an applicable management option. Also, acquisition of land is not an option at this time. However, a land lease is currently being renegotiated between MCA and DND, which would incorporate access control. Finally, the applicability of designation as a Water Protection Area (WPA) requires further assessment.

Table 5 Management Options

Potential Contaminants	Acquisition of Land (Access Control via Lease)	BMPs	Contingency Planning	Designation	Education and Stewardship
Road salt/dust suppression	1	2			3
Roadway spills (petroleum hydrocarbons – gasoline/diesel from vehicles)	2		1 (+physical barriers)		3
Wastewater lagoon (microbial)	Decommission				
Shell casings/residues (metals)		1 (existing DND Range Safety Program + groundwater monitoring)			2
Abandoned well	Decommission				
Chemical storage (e.g. chlorine; temporary fuel)		1	2		3
Utility pole transformer spills (mineral oil, potential PCBs)			1		
Sediment (from forestry)		2			1 – DND Forestry Management Plan, practices and policies
Fire suppression chemicals (forest fire)			1 – Fire Response Plan (maybe inter-organizational)	2	3
Pesticides/Herbicides (forestry)				2	1 – DND Forestry Management Plan, practices and policies
Illegal dumping / potential spills	1		3		2

7.3.1 Road Salt and Dust Suppression

Acquisition of Land (via Land lease): The land lease document between MCA and DND will cover liabilities and environmental concerns. This will give ACWU control of access roads near the supply wells and is ranked as the most effective management option.

Best Management Practices: BMPs define practical and effective means of protecting source water that can be directly adopted and applied by water utilities. Examples of BMPs to address potential use of road salt and dust suppressants on access roads include:

- Do not use road salt/dust suppression in 90 days well head capture zone, if it can be safely avoided.
- Do not use road salt on unpaved surfaces.
- Use only dust suppressants that are shown to be non-toxic.
- Provide appropriate application rates, especially within water protection area.
- Employ proper material storage and handling practices and equipment selection to reduce accidental releases to the environment.
- If applying road salt, follow Environment Canada's BMPs for salt use on private roads, parking lots and sidewalks.

Education and Stewardship: Education and outreach policies are intended to increase public awareness of the benefits of drinking water source protection and encourage positive changes in behavior. ACWU will provide training/reference information on BMPs for road salting and BMPs for dust suppression.

The education and stewardship program could include:

- Written materials
- Training

7.3.2 Roadway Spills

Contingency Planning: Of top priority is the installation of physical barriers to protect the supply wells. MCA will also prepare a contingency plan that will assist in

response to an event that threatens the water supply. Emergency response measures and contact information for emergency response personnel will be included in the contingency plan. It will also review and update or create incident response procedures for spills/releases on municipal and surrounding DND property:

- petroleum hydrocarbon release from vehicles on access roads
- petroleum hydrocarbon release from temporary fuel storage/transport for generator

Land lease document: The land lease document between MCA and DND will cover liabilities and environmental concerns. This will give ACWU control of access roads near the supply wells.

Education and Stewardship: Education and outreach policies are intended to increase public awareness of the benefits of drinking water source protection and encourage positive changes in behavior. ACWU will provide emergency response plans for petroleum hydrocarbon spills from vehicles and fuel for the backup generator.

7.3.3 Shell casings/residues (metals)

Best Management Practices: BMPs define practical and effective means of protecting source water that can be directly adopted and applied by water utilities. Concerning the firing range, BMPs could include:

- DND to ensure Wing Readiness Training Flight (Range and Training Officer) is aware of the SWPP and BMPs for range activities.
- Maintain DND range safety programs.
- Continue DND groundwater monitoring program with results shared with SWPAC.

Education and Stewardship: Education and outreach policies are intended to increase public awareness of the benefits of drinking water source protection and encourage positive changes in behavior. This includes:

- Review of DND range safety plans annually.

- Educate range users on SWPP and interconnectivity with range safety program.

7.3.4 Chemical storage (e.g., chlorine, fuel for backup generator)

Best Management Practices:

BMPs define practical and effective means of protecting source water that can be directly adopted and applied by water utilities. Concerning chemical storage, the BMPs may include:

- Limit chemical storage within the 90-day capture zone.
- Employ proper material storage, transport, and handling practices to reduce accidental releases to the environment.
- Make Material Safety Data Sheets (MSDSs) readily available.
- Provide appropriate awareness/preparedness training to operators and handlers.
- Have contingency and emergency response plans in place to address potentials spills.

Contingency Planning: MCA will prepare a contingency plan to assist in response to an event that threatens the water supply. Contact information for emergency response personnel will be included in the contingency plan.

Education and Stewardship: Education and outreach programs can take many forms, from the simple and relatively economical, such as mailing letters or fact sheets, to comprehensive programs such as training or site visits. An education and outreach program could include written materials, community outreach, and individual activities. This will involve educating municipal operators/maintenance crews about the SWPP and providing training/information on BMPs for chemical handling and storage.

7.3.5 Utility pole transformer spills (mineral oil)

Contingency Planning: MCA will prepare a contingency plan to assist in response to an event that threatens the water supply. Contact information for emergency response personnel will be included in the contingency plan.

7.3.6 Sediment (from forestry)

Education and Stewardship: Education and outreach policies are intended to increase public awareness of the benefits of drinking water source protection and encourage positive changes in behavior. This includes:

- Review the DND forestry management plan, practices, and policies annually.
- Assess whether an updated forestry assessment is warranted.
- Support/provide awareness training for DND staff.
- Develop education materials including water protection responsibilities, regulations, contingency plans, and BMPs. Include information on the potential impact of improper forest management.

Best Management Practices: Cutting in the SWPZ is expected to be minimal due to land ownership. However, should cutting occur, the following BMPs should be followed:

- Avoid clear-cutting. If clearing land is required, expose a smallest practical area of land for the shortest possible time.
- Limit the length and steepness of the designated slopes to reduce runoff volumes and velocity and install velocity lowering structures as needed.
- Do not allow camping or accommodation trailers or buildings in the SWPZ

7.3.7 Fire suppression chemicals (forest fire)

Contingency Planning: It is critical to identify likely forest fire responders (federal, provincial, municipal) and advise them of the presence of the SWPP. Establish and agree upon Fire Response Plan, including fire-fighting protocols and incident response. Identify the avoidance of chemical fire suppressants as a BMP.

Designation: If possible, draft regulations for activities that cannot be addressed at the municipal level (e.g., fire suppression, pesticide/herbicide usage in forested areas), as part of designation application to be a Water Protection Area

Education and Stewardship: Education and outreach policies are intended to increase public awareness of the benefits of drinking water source protection and encourage positive changes in behavior. An education and outreach program could include written materials, community outreach, and special activities.

7.3.8 Pesticides/Herbicides (forestry)

Education and Stewardship: Activities may include:

- Review the DND forestry management plan, practices, and policies annually.
- Support/provide awareness training for DND staff and other relevant organizations.
- Develop educational materials including water protection responsibilities, regulations, contingency plans, and BMPs. Include information on the potential impact of pesticide usage.

Designation: If feasible, draft regulations for activities that cannot be addressed at the municipal level (e.g., fire suppression, pesticide/herbicide usage in forested areas), as part of designation application to be a Water Protection Area

7.3.9 Illegal dumping / potential spills

Acquisition of land: The land lease document between MCA and DND will cover liabilities and environmental concerns. This will give ACWU control of access roads near the wells and is ranked as the most effective management option.

Education and Stewardship: Develop educational materials including water protection responsibilities, regulations, contingency plans, and BMPs. Include information on the potential impact of illegal dumping, spills, improper forest management. An education and outreach program include written materials, community outreach, and special activities.

Contingency Planning: DND have standard operating procedures (SOPs) for damage control – related to environmental and fuel spills and other disasters.

8.0 IMPLEMENTATION PLAN

To bring about the desired level of source water protection, the SWPAC recommended several initiatives. Each one addresses one or more of the prioritized risks identified by the committee using one or more management options deemed most effective. These initiatives, including the individual actions they entail, estimated costs and suggested implementation dates, are listed in Table 6.

The SWPAC anticipates that MCA will elect to complete most of these initiatives with the assistance of consultants or contractors. The costs presented in Table 6 represent the estimated values of assistance. Where some of the recommended actions appear to be readily incorporated into the tasks usually assigned to ACWU staff, the cost reflects only the portion that would involve a consultant or outside contractor. These costs listed are estimates and will be reviewed and updated annually.

Table 6 Action Plan and Implementation Schedule

INITIATIVE (The initiatives are not presented in order of priority.)	COMPLETION DATE	ESTIMATED COST
1. Access Control Via Land Lease with DND		\$TBD
(a) Negotiate interim license agreement with DND to allow for access to wells and to carry out tasks listed under Item 3 – Wellhead Protection.	March 31, 2019	\$1,500
(b) Negotiate appropriate land lease with DND.	March 31, 2020	\$2,000
(c) Assess road upgrade concerning required permits.	March 31, 2019	\$2,000
(d) Complete road upgrade, including attaining required permits (schedule to be adjusted dependent on item c).	March 31, 2021	TBD
(e) Implement and maintain appropriate site access restrictions (locked gate, etc.).	March 31, 2021, onwards	\$700/year
2. Contingency / Emergency Response Planning		\$4,000
(a) Review and update current municipal contingency plans towards the potential for reduction in water quality or quantity.	March 31, 2020	\$1,000
(b) Review and update or create incident response procedures for spills/releases (refer to REMO) on municipal and surrounding DND property: <ul style="list-style-type: none"> petroleum hydrocarbon release from vehicles on access roads petroleum hydrocarbon release from temporary fuel storage/transport for generator transformer oil spill discharge of chlorine in water treatment building other spills/releases (e.g., illegal dumping) 	March 31, 2020	\$2,000
(c) Identify likely forest fire responders (federal, provincial, municipal) and advise them of the presence of the SWPP. Establish and agree upon Fire Response Plan, including fire-fighting protocols and incident response. Identify the avoidance of chemical fire suppressants as a BMP. Invite forest fire responders to participate in the SWPAC.	March 31, 2020	\$1,000
3. Wellhead Protection / Limit Preferential Pathways		\$18,000+
(a) Protect Well 1 and Well 3 wellheads with bollards, jersey barriers, or equivalent.	March 31, 2020	\$10,000
(b) Apply grout around top 1.5m of Well 1.	March 31, 2020	\$1,500
(c) Decommission abandoned well (OW)	March 31, 2020	\$3,000
(d) Complete periodic inspection of municipal wellheads (Well 1 and Well 3) and surrounding area.	Monthly	\$1,800/year

INITIATIVE (The initiatives are not presented in order of priority.)	COMPLETION DATE	ESTIMATED COST
(e) Review data from groundwater monitoring program completed at DND's range site annually.	Annually	\$1,000/year
(f) Review water supply quality and chemistry data annually to identify trends and concerns, if any, as part of the annual report to NSE.	Annually	\$1,000/year
4. Education and Stewardship / Implement BMPs		\$18,000+
(a) Educate Municipal operators/maintenance crews and applicable DND staff about SWPP. Provide training/reference information on: <ul style="list-style-type: none"> • BMPs for road salting • BMPs for dust suppression • BMPs for chlorine handling and storage • Emergency response plans for petroleum hydrocarbon spills from vehicles, fuel for the backup generator, transformer spill, or chlorine release. 	March 31, 2021	\$1,000
(b) Review the DND Range Safety Program annually.	Annually	\$250/year
(c) Educate Range users on SWPP and interconnectivity with Range Safety Program.	Annually	\$250/year
(d) Review the DND Forestry Management Plan, practices and policies annually.	Annually	\$500/year
(e) DND to advise whether an updated Forestry Assessment is warranted by March 31, 2019. If warranted, DND to procure an updated Forestry Assessment.	March 31, 2020	TBD
(f) Agree upon forestry management BMPs, including steps to limit sedimentation during cutting and avoidance of pesticides/herbicides in wellhead capture zone. Support/provide awareness training for DND staff.	March 31, 2022	\$1,000
(g) Develop educational materials including water protection responsibilities, regulations, contingency plans, and BMPs. Include information on the potential impact of illegal dumping, spills, improper forest management.	March 31, 2023	\$5,000
(h) Distribute educational materials to residents through various media.	March 31, 2024	\$5,000
5. Designate Protected Water Area		\$19,500

INITIATIVE (The initiatives are not presented in order of priority.)	COMPLETION DATE	ESTIMATED COST
(a) Examine whether Designation is practical given federal land ownership. Coordinate with DND and NSE. If deemed useful, move forward with Steps 2 through 7. If not considered possible, seek an alternate method of protection – explicitly managing fire suppression and pesticide/herbicide usage. It may be determined that Designation is only possible in the event of federal land divestiture.	March 31, 2021	\$2,000
(b) Cooperate with NSE to determine acceptable formats for the submission of a formal boundary for the SWPZ. Prepare a formal boundary.	March 31, 2022	\$3,500
(c) Draft regulations for activities that cannot be addressed at the municipal level, as part of re-designation application (e.g., fire suppression, pesticide/herbicide usage in forested areas)	March 31, 2022	\$5,000
(d) Submit the designation application (boundary and regulations) to NSE for review/comment.	March 31, 2023	\$3,000
(e) Cooperate with NSE to revise the application and obtain finalized designation.	March 31, 2023	\$4,000
(f) Publish designation in Registry of Deeds and local papers.	March 31, 2024	\$500
(g) Post signs which include regulations at the new boundaries of the SWPZ.	March 31, 2024	\$1,500

9.0 MONITORING PLAN

9.1 Purpose

The purpose of the monitoring plan is to ensure that:

- The SWPP is regularly updated if it is not meeting its objectives.
- Changes in the state of groundwater within the SWPZ are evaluated.
- The SWPP remains current with changing conditions and priorities in the SWPZ.

9.2 Ground Water Monitoring Parameters and Schedule

In coordination with the regulatory compliance monitoring required under Granville Ferry's Approval to Operate and Approval to Withdraw water, a groundwater monitoring program will be implemented. The groundwater monitoring program considers the potential contaminants that were identified in Section 6.0. The monitoring schedule is outlined in Table 7, below.

Table 7 Source Water Protected Area Monitoring Parameters

Parameter	Location	
	Water Supply Well 1	Water Supply Well 3
Turbidity	Weekly	Weekly
Chlorine residual	Weekly or continuous	Weekly or continuous
pH (field)	Daily grab or continuous	Daily grab or continuous
Total Coliform and E. coli	Weekly	Weekly
Total Trihalomethanes	Quarterly	Quarterly
Bromodichloromethane	Quarterly	Quarterly
Haloacetic acids	Quarterly	Quarterly
Parameters outlined in Guidelines for Monitoring Public Water Supplies (NSE), including Fluoride, arsenic, antimony, and lead	Every two years	Every two years
Parameters with Maximum Allowable Concentrations (MAC) in Guidelines for Canadian Drinking Water Quality (Health Canada), including Volatile Organic Compounds	Every five years	Every five years

Recognized and established protocols for water quality sampling will be followed for all sampling programs and will be conducted by qualified personnel. Baseline data is available for many of

the testing parameters and will be used as a comparison over time to identify changes in the raw water quality.

Also, MCA will request from DND the results of their annual groundwater and surface water sampling program at the Granville Ferry Rifle Range. The results for monitoring well MW1591 will be reviewed to assess potential changes in groundwater chemistry upgradient of the water supply wells.

9.3 Source Water Protection Zone Inspection

MCA will regularly (assumed at least monthly) visually inspect the well heads and the 90-day capture zone. On a minimum annual basis, the MCA and the SWPAC will meet with DND to identify any new or changing land uses or activities within the 25-year capture zone that may impact source water quality. Every 3 to 5 years, or more frequently if a concern is identified, MCA will survey the SWPZ with DND and other landowners within the SWPZ.

The visual inspections and surveys, in addition to regular discussions with property owners, will assist in:

- assessing whether BMPs are being followed
- determining if additional educational efforts are required
- identifying problems that are not being adequately addressed and
- identifying activities that violate regulations that have been put in place to protect water quality

9.4 Monitoring Records and Reporting

The ACWU will maintain records of ongoing monitoring, analyze results, document trends and changes in water quality, and report findings annually to the SWPAC and NSE.

9.5 Plan Review and Update

The SWPAC will review the SWPP annually and will update if necessary. Information gathered during the groundwater sampling, and monitoring program and the SWPZ inspections will be considered during the plan review process. The review will include:

- analysis of monitoring results to evaluate the effectiveness of management options

- identification of any changes to risks in the area (including potential impacts from climate change)
- review of Action Plan and updating of action items completed over the year, adding new action items, as needed
- consideration of new legislation

10.0 TIMELINE & TARGETS

DATES	MEETINGS/ ACTIVITIES	DETAILS
October 2004	Municipal Well Field Expansion Program	Developed third production well for County.
April 2005	Ground Water Model – Source Water Protection Plan	Electronic GIS map overlaid for the predicted Well Field capture area and protection zones
July 2017	Source water protection model revised	To include 90-day capture zone and remove Well 2 (PW2)
July 26, 2017	SWPAC Meeting	Appointment and Election of the chair; overview of TOR
October 26, 2017		Reviewed and reconciled the risk table
November 30, 2017		Prioritized risks and tabulated management options
December 14, 2018	Tour for SWPAC members	
January 18, 2018	SWPAC Meeting	Discussed Tour notes and revised risk table
April 09, 2018		The revised draft action plan
June 6, 2018	Public Meeting - 1	
June 20, 2018	SWPAC Meeting	Reviewed and added comments of public meetings in the draft plan and set a target date for the draft review
September 13, 2018		Passed motion to present the SWPP to the Committee of The Whole on Oct 9, 2018
October 9, 2018	Committee of the Whole (COTW)	Pursuant to the recommendation of COTW, Deputy Warden Robert moved, seconded by Councilor Gunn, that municipal council approve the Granville Ferry Source Water Protection Plan prepared under the guidance of SWPAC and forward the plan to the Department of Environment for their consideration. Motion carried Unanimously.

References

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- Nova Scotia Environment. (2004). *Developing a Municipal Source Water Protection Plan: A Guide for Water Utilities and Municipalities*. Nova Scotia, Canada.
- Nova Scotia Environment. (2005). *Best Management Practices/Forest Planning in Municipal Drinking Water Supply*.
- NS Amendment of Approval - #2009-065809-A02. (2018, March 26). Water Supply System Serviced by Non-GUDI Wells with Disinfection only. *APPROVAL NO- 2009-065809-101*.
- Washburn and Gillis Associates Ltd.. (1998). *Field Survey/ Qualitative Risk Assessment - Granville Ferry Range*. Granville Ferry, NS.
- World Health Organization. (1999, August). Hazard Prevention and Control in the Work Environment: Airborne Dust. WHO/SDE/OEH/99.14.

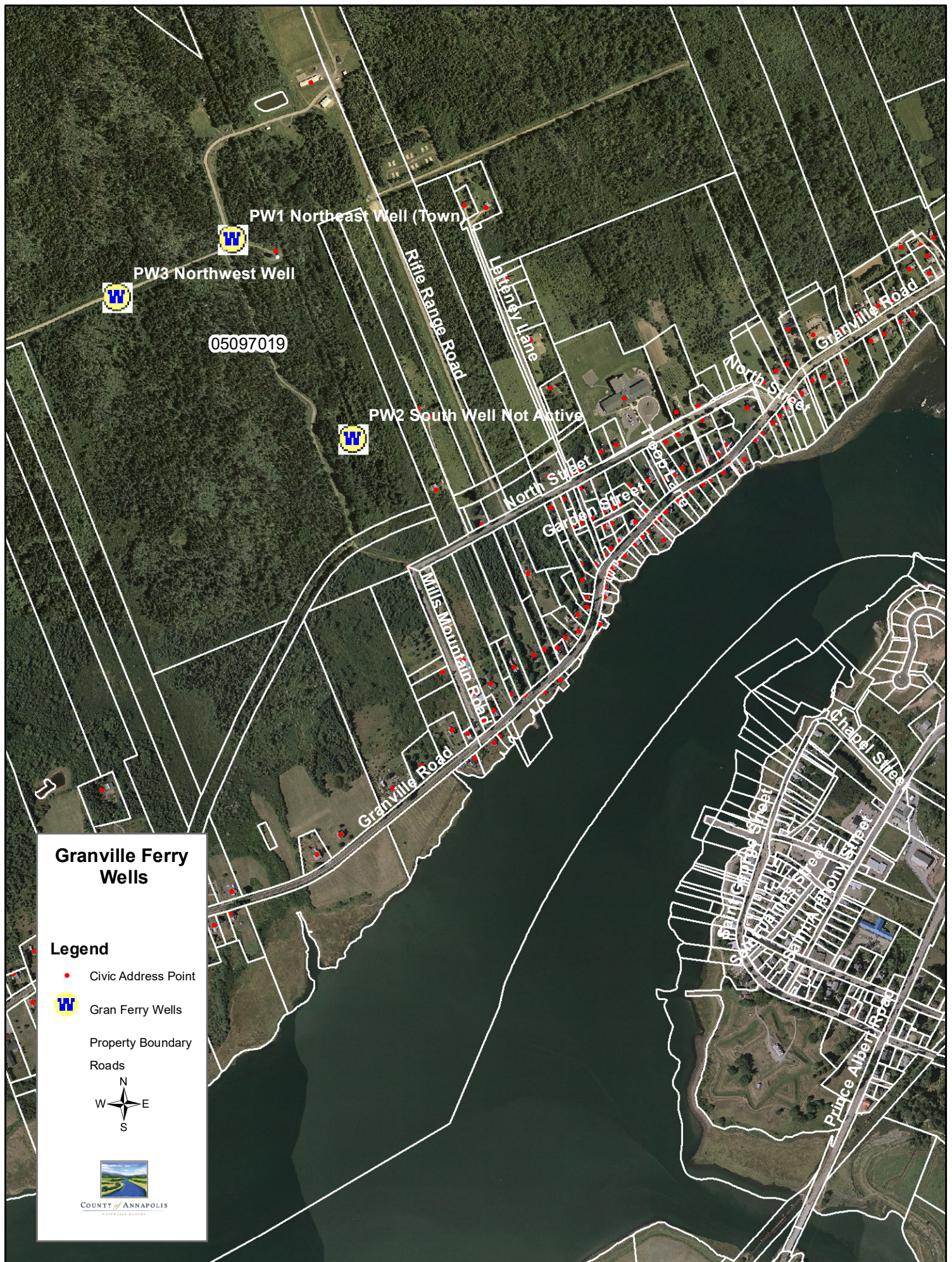
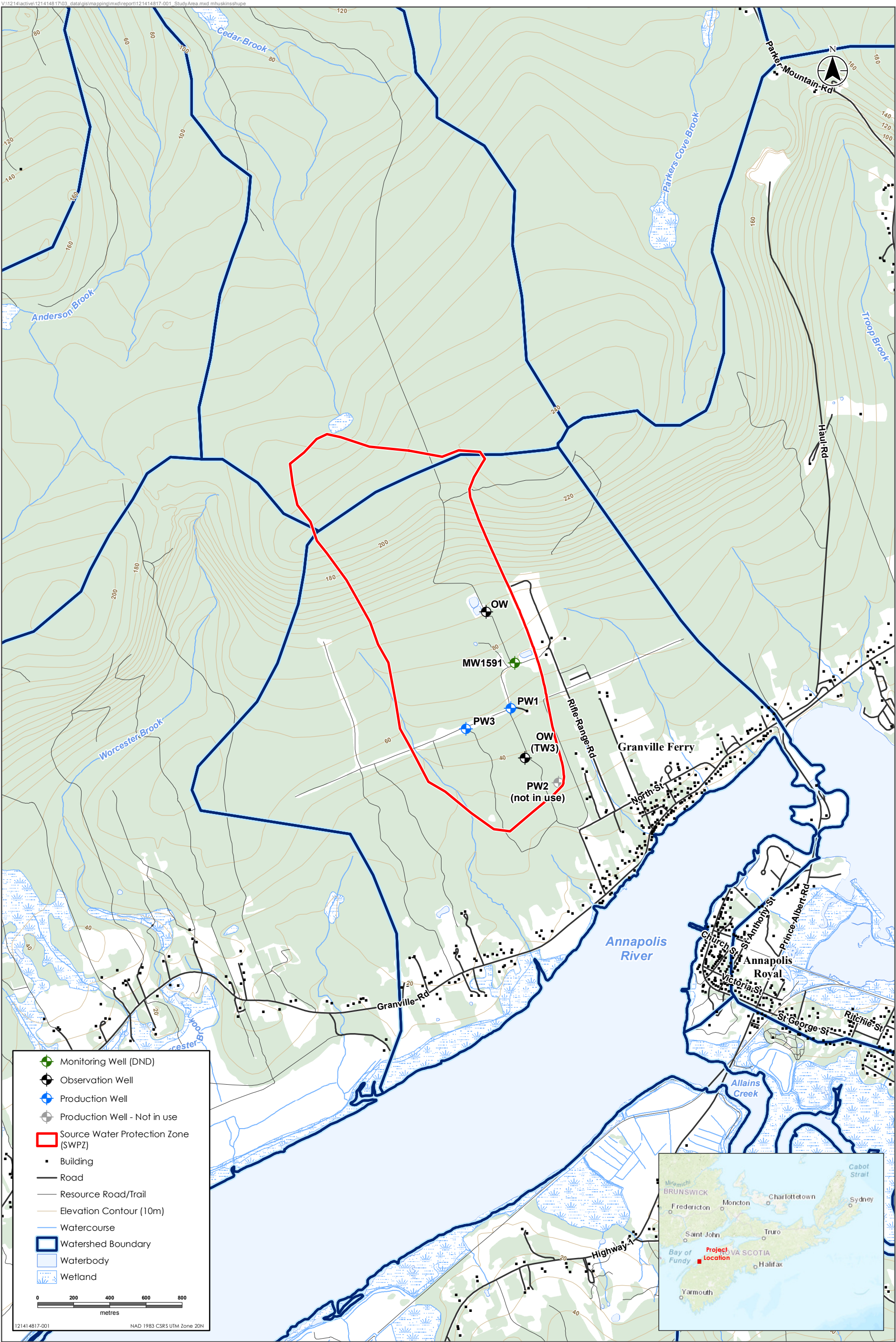


FIGURE 1: LOCATION OF GRANVILLE FERRY WELLS



Sources: Government of Nova Scotia
Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

FIGURE 2: SOURCE WATER PROTECTION ZONE

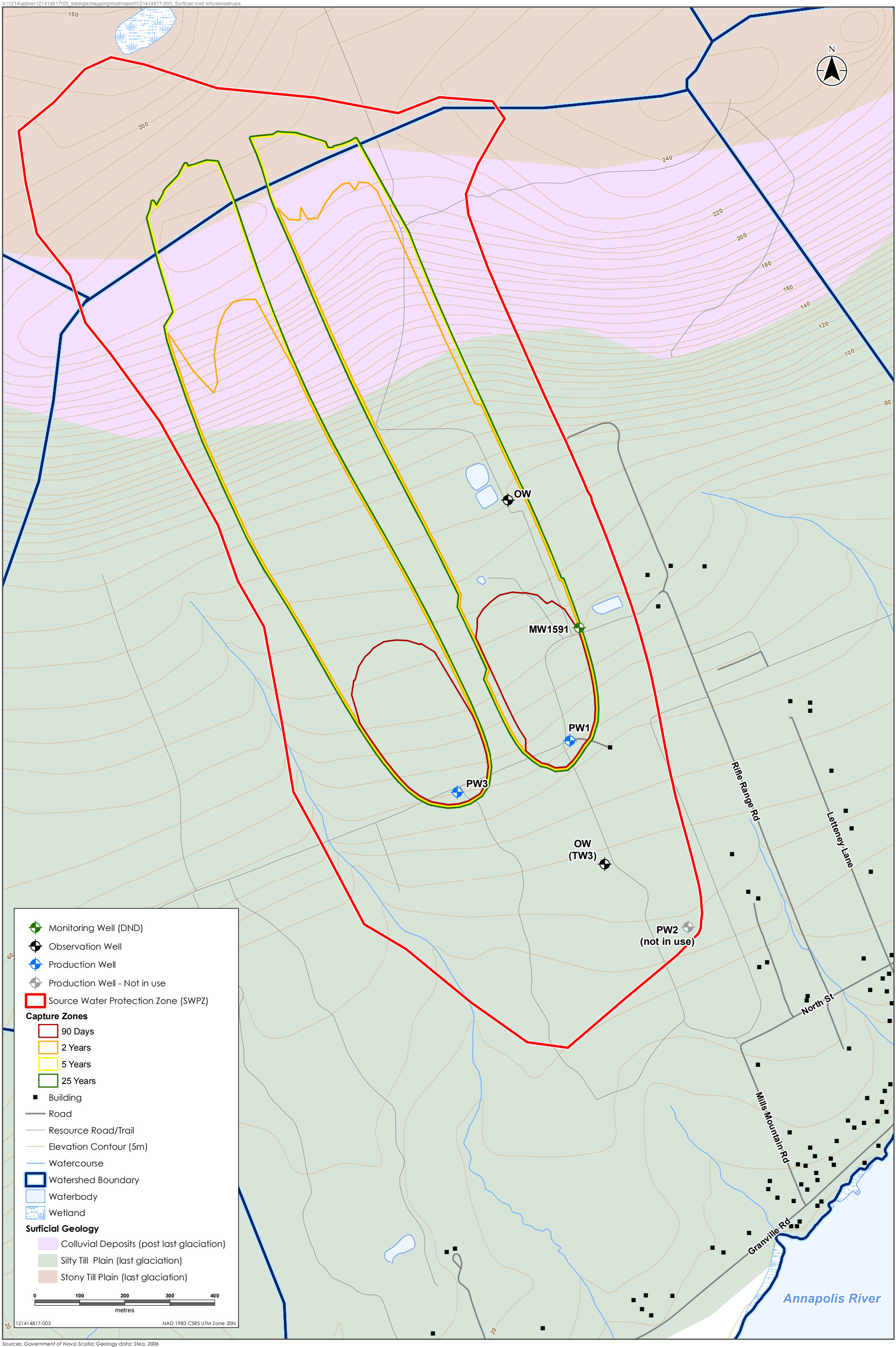


FIGURE 3: SURFICIAL GEOLOGY

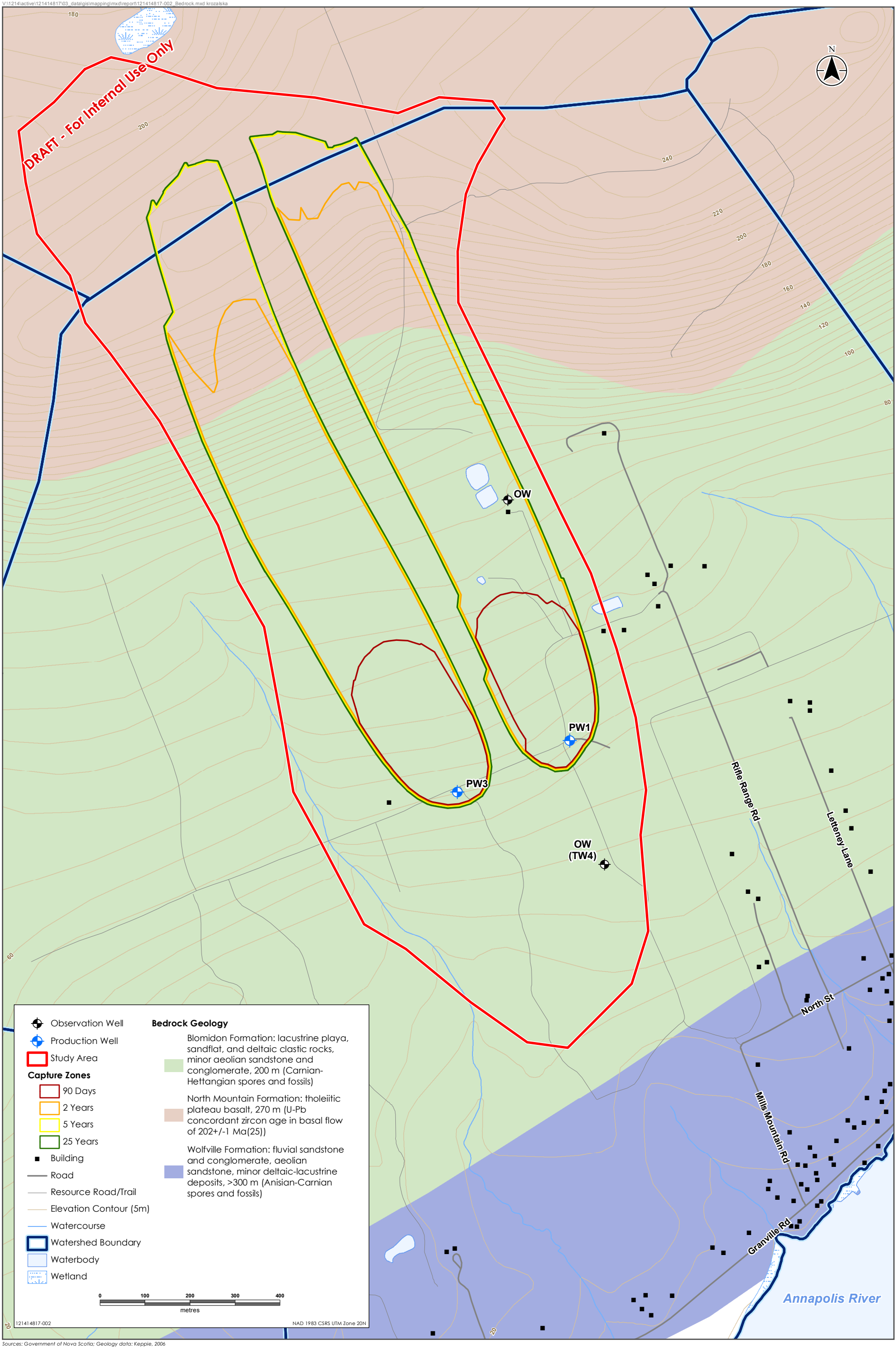


FIGURE 4: BEDROCK GEOLOGY

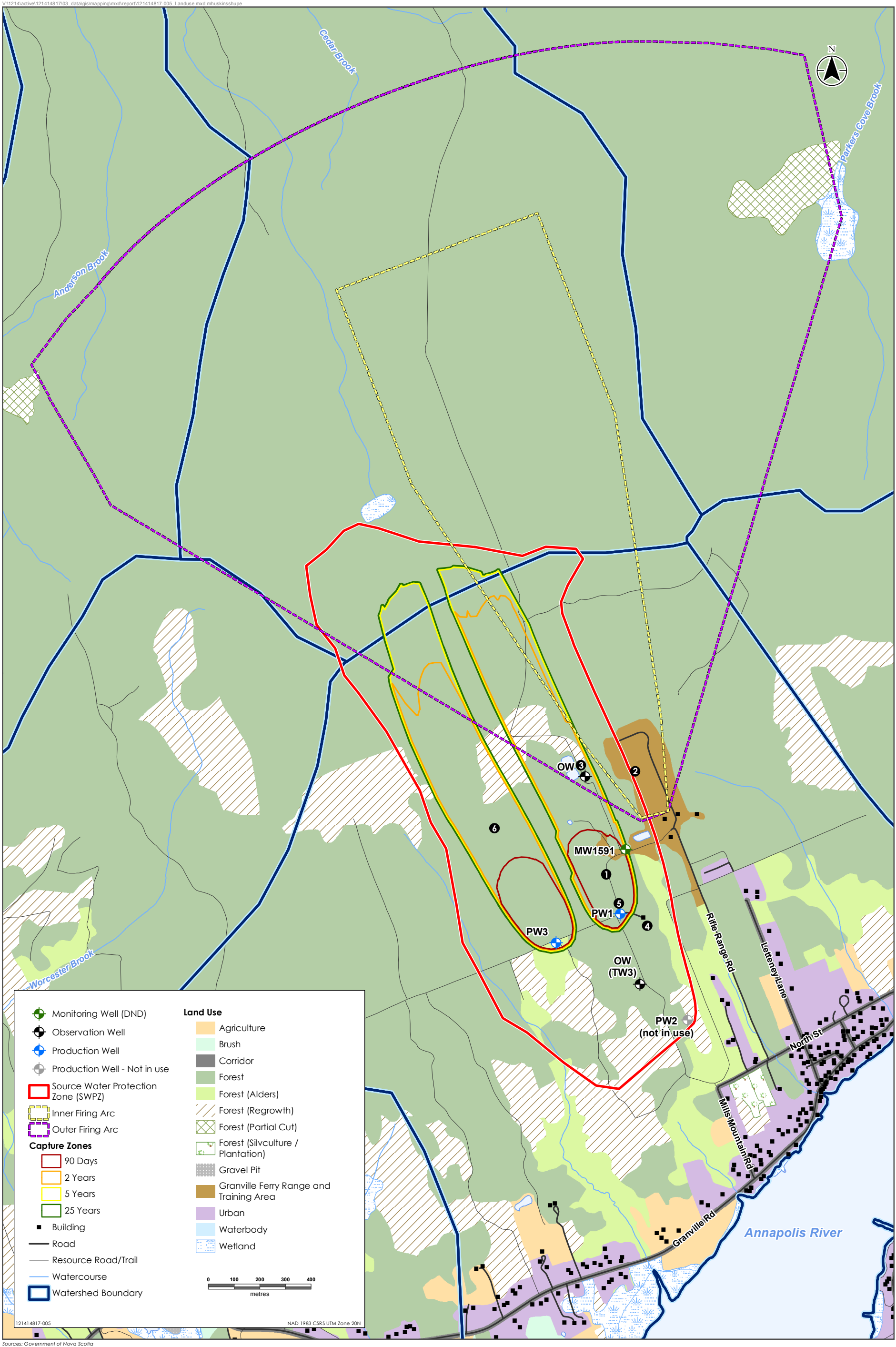
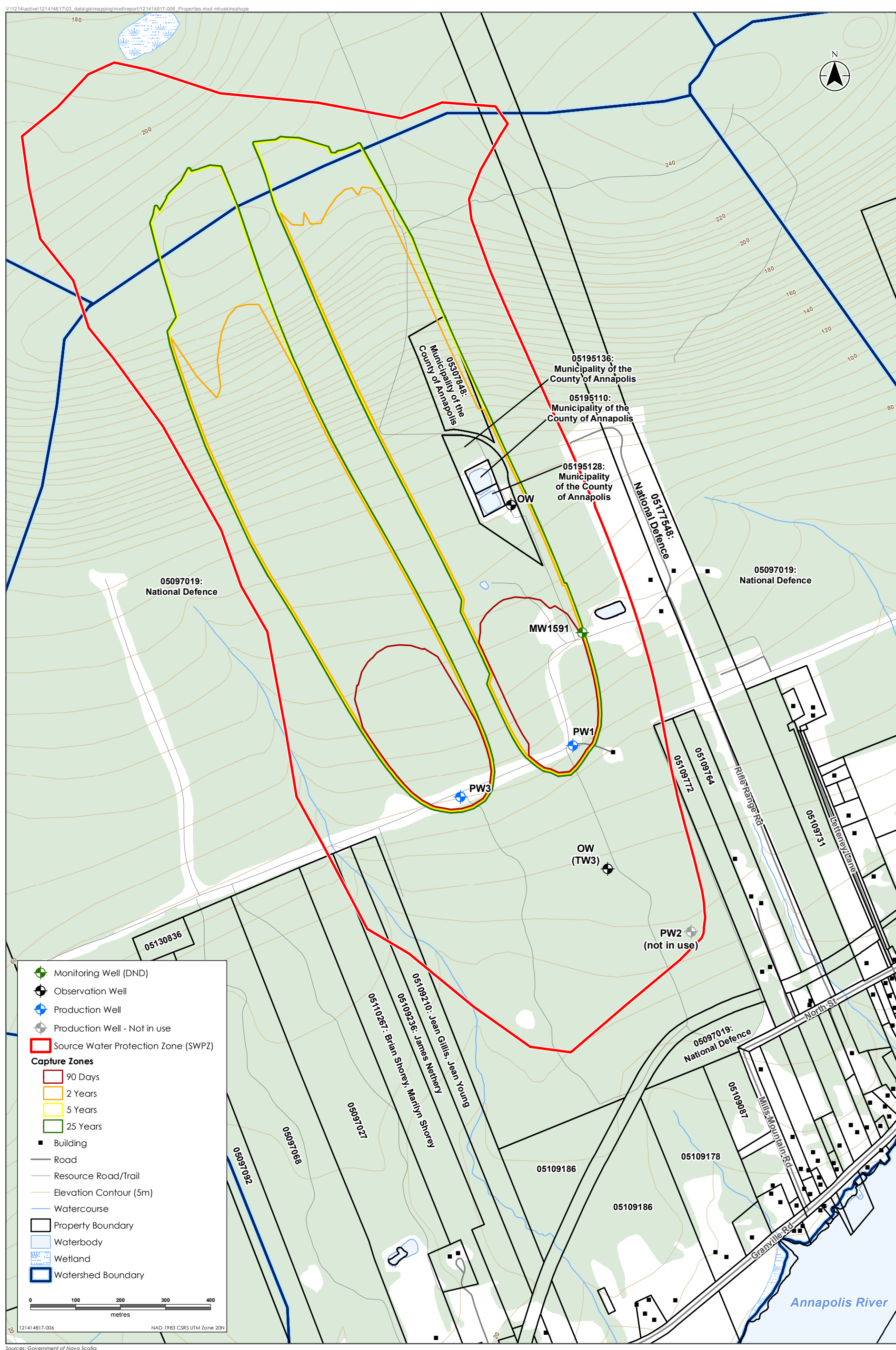


FIGURE 5: LAND USE IN SOURCE WATER PROTECTION ZONE



APPENDIX A: HYDROGEOLOGY OF THE GRANVILLE FERRY WELL FIELD

Groundwater flow in the Granville Well Field is expected to be generally southward, originating in the topographic high at North Mountain and discharging into Annapolis River to the south and several smaller tributary rivers that originate on the south side of North Mountain. Groundwater recharge occurs across much of area, except for localized discharge occurring as seeps and springs near the rivers. Groundwater recharge is expected to be between 20 % to 30 % of available annual precipitation. Records from the municipal wells logs indicate that the water table typically lies between 15 m and 30 m depth across the Well Field area.

The regional surficial geology is described as a compact silty till plain. A review of approximately 40 local NSE well records indicated that the overburden averages 12 m in thickness in the study area. Lithology descriptions from the municipal water well records show that the bedrock in the Well Field area consists of an upper, low permeability siltstone sequence which overlies a more permeable sandstone sequence which likely grades into the underlying Wolfville Formation.

Model Limitations

The wellhead protection modeling is based upon a general investigation of groundwater conditions in the study area. The framework adopted for physical hydrogeologic interpretation assumes a relatively simple hydrogeologic flow system within a potentially complex fracture flow porous medium and considers steady-state conditions that do not incorporate the potential for short-term seasonal variations in individual well-pumping rates and duration, groundwater level or flow directions. This is reasonable since annual water level fluctuations are expected to be minor (about 1 to 3 m depending on elevation).

Water Demand

The average daily water consumption recorded at the facility, as provided by Jacques Whitford Limited, 2004 (now Stantec) varied from 472 to 838 m³/day over the period 1999 to 2003. Total maximum water demand over the same period ranged from 696 to 2,107 m³/day, with higher demand occurring in the summer months.

Aquifer Hydraulic Properties

The bedrock aquifer underlying the Granville Ferry Well Field is classified as a confined to semiconfined fractured bedrock aquifer.

GUDI Assessment

A preliminary review of the Granville Ferry Well Field was performed using the NSE Groundwater Under The Direct Influence of surface water (GUDI) protocol. GUDI refers to groundwater sources such as constructed wells, where surface water can travel from nearby surface water to groundwater source. If a groundwater source shows no evidence of existing or potential hydraulic connection with surface water, it is considered as non-GUDI. The GUDI protocol consists of three steps, beginning with a screening step (Step 1) that provides a method to rapidly identify obvious Non-GUDI groundwater sources that do not require a detailed investigation. Sources that fail the screening step are considered potentially GUDI and proceed to Step 2 to determine whether there is a hydraulic connection which allows rapid recharge to the groundwater source (i.e., well) from the surface water.

The GUDI screening Step 1 review water source setting, proximity to surface water, well construction, and water quality. If any of these four criteria are not met, the groundwater source is potentially GUDI. Table A.1 summarizes the result of the GUDI screening that was performed in 2004 for both the wells.

Table A.1 GUDI Screening

GUDI STEP 1	Well 1	Well 3
1. Sensitive settings	Pass	Pass
2. The proximity to surface water	Pass	Pass
3. Well construction	Pass	Pass
4. Water quality	Pass	Pass
Step 1 classification	Non-GUDI	Non-GUDI

APPENDIX B: SOURCE WATER PROTECTION ADVISORY COMMITTEE

Chairperson – Keith Crysler

Councilor – Burt MacNeil

Councilor – Gregory Heming

Councilor – John Kinsella

Citizen Member – Peter Malon

NS Environment, Watershed Planner – Dawn MacNeill

Department of National Defence representative – Kimberley Kelsey, Alan Nag and
Stephen Sauveur

Stantec Consultant – Donald Carey (formerly Maylia Parker)

Director of Municipal Operations, MCA – Stephen McInnis

Other Contacts

Greg Price, Manager of Municipal Operations, MCA

Shivani Gilhotra, Engineering Student Intern, MCA

APPENDIX C: TERMS OF REFERENCE

Granville- Municipality of the County of Annapolis, Nova Scotia Source Water Protection Advisory Committee

1. Introduction

Provision of adequate and safe water supply to consumers is the top priority for the Province and the Municipality of the County of Annapolis. This is achieved through a Multiple-Barrier Approach - a series of steps which together provide multiple layers of protection to ensure that safe water is delivered to the consumer in Nova Scotia the barriers defined in the Drinking Water Strategy are as follows:

- Keeping it Clean - ensure the water source is protected from contamination
- Making it Safe - provide the required treatment
- Proving it Safe - continuous testing and monitoring

Granville Ferry is located within District 4 of the Municipality of the County of Annapolis (hereinafter referred to as the County). The community has a population of approximately 110 residents (2016 Census), and the wellhead protection area for Northeast Well (Town) is 21.62 acres, and Northwest Well is 5.82 acres. The community currently has a complete program of water treatment, testing and monitoring in full compliance with provincial and federal regulations to provide a finished product which meets or exceeds the Guidelines for Canadian Drinking Water Quality as published by Health Canada.

To satisfy the requirements of the multiple barrier approaches the community must develop a Source Water Protection Plan to ensure the source water remains clean. Nova Scotia Environment has clearly defined the steps in developing a Source Water Protection Plan, the first being the establishment of a Source Water Protection Advisory Committee. Before the establishment of the committee, a Terms of Reference must be developed. The purpose of the Terms of Reference is to define:

- the mandate of the committee;
- the composition;
- the roles and responsibilities of committee members;
- reporting hierarchy and operation; and

- Length of the term.
- The subsequent sections will detail the aforementioned.

2. Mandate

The Source Water Protection Advisory Committee hereinafter referred to as the Committee, is tasked with developing a source water protection plan and providing the Municipality of the County of Annapolis with direction on land use issues, water quality, levels and flows within the catchment area.

This will include addressing issues such as:

- a. Identification of stakeholders;
- b. Water quantity and quality concerns;
- c. Actual and potential sources of contamination;
- d. Management strategies; and
- e. The effectiveness of the Source Water Protection Plan.

In achieving their mandate, the Committee will undertake the following tasks:

- i. review all activities within the catchment area and provide recommendations to the County;
- ii. provide recommendations to the County on the development of land use by-laws to ensure the continued protection of the source water protection area;
- iii. review all pertinent information and reports relating to water quality and quantity;
- iv. liaise with government departments and agencies on all issues related to the source water protection area;
- v. draft the SWP and recommend to Council; and
- vi. Administer the development of education programs and best management practices for residents, stakeholders and other users with the source water protection area.

3. The composition of the Committee

The structure of the Committee must represent all members of the community. In achieving this, the first step is to identify stakeholders. For Granville Ferry, the suggested composition of the Committee would include:

Voting Members

- Councilor
- Business member
- Resident/landowner
- Agriculture

Non-Voting Members

- County Director of Municipal Operations
- County Director of Community Services
- NS Environment member
- Consultant

4. Roles and Responsibilities

To develop and maintain an active committee, the roles and responsibilities must be clearly defined and agreed upon.

Voting Members

Councilor: It is the responsibility of the Councilor to represent the interests of the stakeholders served by the protection area

Business: Member will represent the interests of local business owners and their specific water quality/quantity concerns and needs. Member will also report on the number and nature of businesses within the protection area.

Residents/Land Owners: Residents and landowners represent the end-users of the water supply system and provide fundamental insight into any issues relating to day-to-day and seasonal issues that may be encountered. Additionally, these members will provide information on land use practices within the protection area that may impact water quality and quantity.

Agriculture: Represent agricultural members within the protection area and ensure that they are informed of any issues relating to farming and water protection. Additionally, the member is to notify the committee of agricultural activities occurring within the protection area.

Non-Voting Members

Municipal Staff (Public Works, Planning): Municipal staff will work with the Committee providing information and advising on topics relating to source water protection, watershed management, land use and the operation of the water treatment and distribution procedures and infrastructure. Staff will bring forth concerns relating to water quality and watershed management.

Nova Scotia Environment (NSE): NSE provides information and advice on topics related to source water protection and regulations.

Consultant: The Consultant will provide technical input as required.

5. Deliverables

The Committee will oversee the preparation and review of the following deliverables:

- Protection area boundary description and map
- Identification of contaminants and associated risks
- Source water management plan
- Implementation of the monitoring program
- Committee close-out report – at which point monitoring and SWPP updates will be completed by the Water Utility operators

6. Hierarchy and Operation

- The committee will appoint a Chair and Vice-Chair annually.
- The positions will be re-offered in the fourth quarter of each year.
- The Chair and Vice-Chair must be voting members.
- The Chair will be the spokesperson for the committee.
- The committee will strive to make decisions on a consensus-based approach whenever possible.
- The committee will meet as required and no less than once per year.
- The committee will prepare an annual report.
- The Terms of Reference may be modified by the County.

7. Term

There is no restriction on the number of years that a member may fulfill a role on the Committee. The Chair and Vice-Chair will serve a minimum of one year before the positions are re-offered.

APPENDIX D: RISK INDEX CALCULATIONS

Risk Factor scores resulted in the following Ranks: 0-2 = Low, 3-4 = Medium, 5-6 = High.

For Risk Factor, the Probability and Severity were calculated and summed.

Probability ranges from 1 to 3 with 1 being low and 3 being high. Probability ranking generally considered:

- Is the contaminant present in the capture zone now? Points: Yes = 1, No = 0 (For non-point sources, this is 0.)
- If so, which area of the capture zone is it present in - Points: 5 and 25-year capture zones = 0, 2-year capture zone = 1, 90-day capture zone = 2
- If not, is it likely to be present in the capture zone in the future? Yes = 1, No = 0.
- If so, which zone?

Points: 5 and 25-year capture zones = 0, 2-year capture zone = 1, 90-day capture zone = 2

- In some cases, a point was added or removed based on the nature of the contaminant, i.e., is it likely to be mobile and persistent enough to reach the well?
- <1 is used to indicate very low probability.
- The non-point source activity of forestry/silviculture is not likely to take place within the 90-day capture zone, except for potential fire suppression and pesticide spraying.

Severity ranges from 1 to 4 with 1 being low and 4 being extremely high. Severity ranking considered factors such as:

- The amount of contaminant likely to reach the well, with a higher ranking for a greater volume.
- The impact of the contaminant on human health if it did reach the well, with a higher ranking for greater toxicity.
- The difficulty in mitigating the contaminant impact to the well, with a higher ranking for contamination issues that would be more challenging to alleviate.