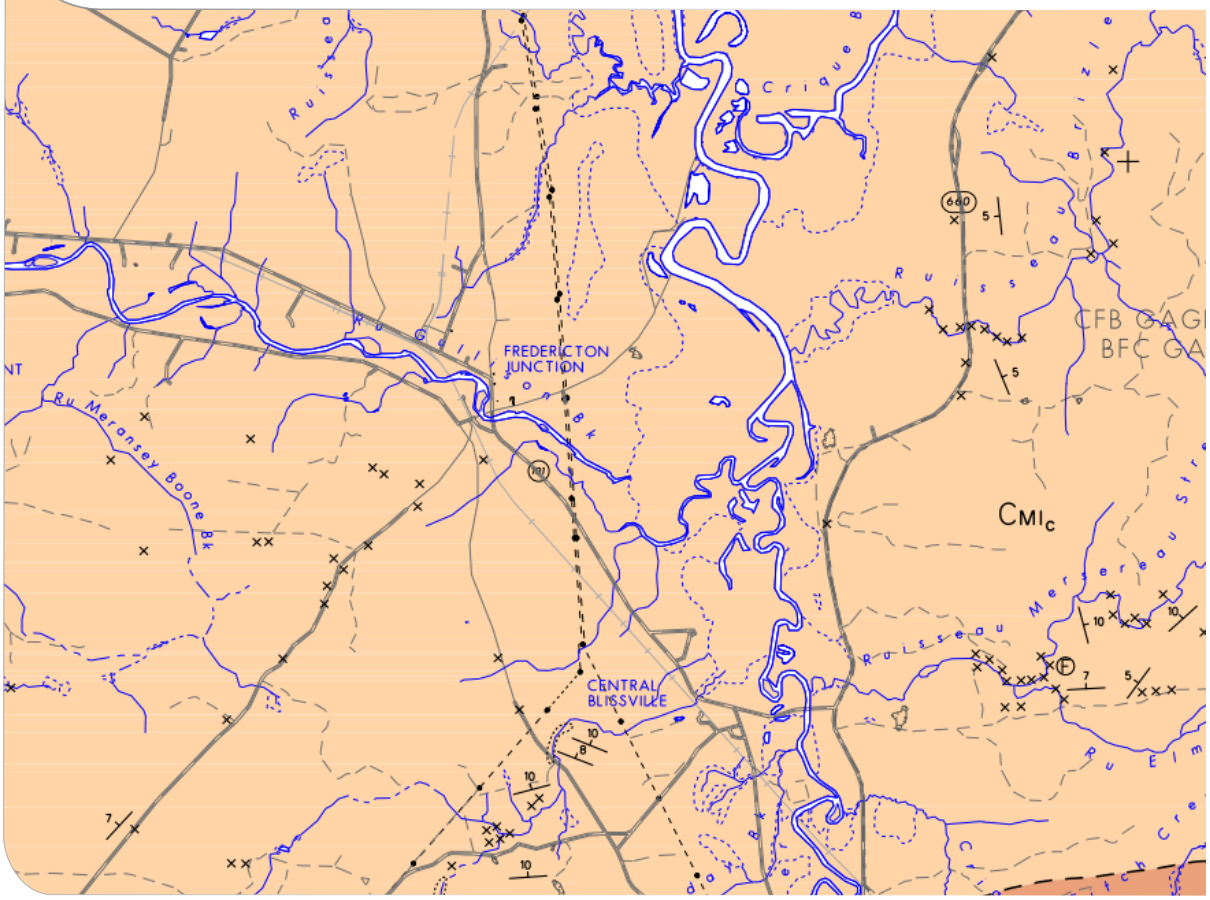
DILLON CONSULTING

VILLAGE OF FREDERICTON JUNCTION

Environmental Impact Assessment Registration (Final)

Groundwater Exploration Program



Cover Photo: Credit of New Brunswick Department of Energy and Mines

June 2018 – 18-7534

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1.0 Introduction

This Environmental Impact Assessment (EIA) Registration document has been created to initiate the regulatory process for the Water Supply Source Assessment (WSSA) project for a new municipal water supply in Fredericton Junction, NB (hereinafter referred to as "the Project").

The Fredericton Junction WSSA project will include the following components:

- Well Siting;
- Construction of temporary access culvert;
- Drilling of Test/Observation wells;
- Drilling of municipal water supply wells; and
- Hydraulic testing of Test/Observation and municipal water supply wells.

An EIA Registration is required pursuant to item "s" of Schedule A of the New Brunswick *Environmental Impact Assessment Regulation* under the *Clean Environment Act*.

1.1 The Proponent

1.1.1 Name of Proponent

The Village of Fredericton Junction
Fredericton Junction, NB

1.1.2 Project Manager

Mrs. Cindy Ogden
Chief Administration Officer
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1.1.3 Principal Contact Person

The principal contact person for the purposes of the Environmental Impact Assessment registration is:

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Phone: 506-444-8820

1.2 Property Ownership

Currently, four drill target options have been proposed to the Village of Fredericton Junction ("the Village") for the purpose of its water exploration program. The four drill target options, along with their corresponding property owner information, are outlined in **Table 1**.

Table 1: Proposed Drill Target Option Property Ownership Summary

Option	Property Ownership Summary
1	This proposed drill target is located on parcel identifier (PID) No. 60122009 owned by Gladstone Curling Club Inc. Access to the property for the purpose of drilling exploratory water wells will be obtained prior to any work being completed.
2	This proposed drill target is location on a vacant parcel of land owned by the Village of Fredericton Junction and is located on PID No. 60014180. Access to this property will be obtained prior to any work being completed.
3	This proposed drill target is located on PID No. 60013612 owned by a family residing in Ontario. Permission to access the property for the purposes of exploratory water wells will be obtained prior to any work being completed.
4	The proposed location is located on PID No. 60015013 owned by Resident No. 1. Access to the property will be obtained prior to any work being completed.

2.0 The Undertaking

2.1 Name of the Undertaking

Groundwater Exploration Program for the Village of Fredericton Junction, NB.

2.2 Project Overview

The Village of Fredericton Junction (the Village) is currently provided potable water from one municipal water supply well. A back-up municipal water supply well also exists but is scarcely used.

In 2017, The Village of Fredericton Junction completed testing of its back-up municipal water supply well. The back-up well exhibited concentrations of *E.Coli* bacteria, exceeding the applicable Health Canada guidelines for drinking water quality, and it was subsequently disconnected from the supply system. To address growing water quantity concerns with the sole operating municipal well in relation to future population growth and past well performance, the Village of Fredericton Junction has initiated a water exploration program to identify a viable alternative water supply source.

Development of the proposed groundwater source will result in withdrawal of groundwater in excess of 50 m^3/d. Given this withdrawal rate, the Project is therefore considered an 'undertaking' on Schedule A of the New Brunswick *Environmental Impact Assessment Regulation* 87-83 (EIA Regulation) under the *Clean Environment Act*, and therefore must be registered with the Environmental Assessment Section of the New Brunswick Department of Environment and Local Government (NBDELG) and undergo an environmental impact assessment review. Projects listed as 'undertakings' on Schedule A must obtain a Minister's Decision (approval) before any work can be initiated.

The development or modification of a groundwater supply source requires preliminary identification of potential targets for drilling wells and subsequent testing of those wells to confirm long term yield and water quality. It is necessary to test the wells prior to completing the EIA review because the exact location of the wells is critical to assessing the potential effects on local groundwater regimes. Following identification and testing of suitable wells, the EIA review can be completed based on the collected information. In order to allow these preliminary activities to occur without a Minister's Decision, the Water Supply Source Assessment (WSSA), Initial Application, has been developed to enable proponents to complete the preliminary hydrogeological assessment and yield testing in advance of completing the EIA review.

2.3 Purpose/Rationale/Need for the Undertaking

The Village of Fredericton Junction currently has one operational municipal water supply well, approximately 98 feet deep, located on the property owned by Resident No. 2. This water supply well provides potable water to >95% of the Village residents and businesses on the north side of the Oromocto River (i.e., the Village center). In the fall of 2017, the back-up well for the village exhibited concentrations of *E.Coli* bacteria. The back-up well has since been shut down and is currently undergoing temporary modifications to accommodate the installation of an ultraviolet (UV) treatment system. Without the back-up well in operation, the primary water supply well is required to operate at the maximum allowable pumping rate and with minimal recovery time. Continued operation of the primary water supply well at maximum capacity is putting the aquifer at risk of being over pumped. An emergency funding request was therefore submitted by the Village to the Small Communities Fund to locate and commission an alternate water supply.

2.4 Siting Considerations

This groundwater exploration program consists of four proposed test well locations. The test well locations have been selected and prioritized based upon the findings of a desktop review which included the following components:

- Previously conducted studies as part of the Village's groundwater supply,
- Property and land use mapping,
- Interviews with Village representatives/staff,
- Geological mapping,
- Review of aerial photographs and local geomorphology,
- Well construction, yield and quality information obtained from the NBDELG's Online Well Log System (OWLS),
- Water quality and/or quantity (pumping test) data completed in the region from previous assessments,
- Discussions with local drilling contractors with experience drilling in the region,
- Identifying potential environmental constraints such as watercourses, wetland, and sensitive habitats within the potential drilling target areas,
- Identifying political and municipal boundary constraints such as maximum distance from current infrastructure and Village limits, and
- Site reconnaissance of potential drilling sites to assess the results of the desktop review.

Additional consideration will be given to a number of factors which could ultimately decide the feasibility of the new well (and associated protected wellfield) location, such as:

- Is there adequate supply for current and future uses?
- What is the long-term safe yield of the aquifer?
- What is the potential storage of the aquifer?
- Is the water quality anticipated to meet current guidelines?
- What types of activities occur in the watershed?
- Land access (Crown/municipal title)?
- Will restrictions have to be placed on land-uses within the watershed?
- What testing will be required (e.g., pumping test, water quality analysis, groundwater modelling, management and protection plans, etc.)?

The Village requires approximately 150 m^3/day of water to support the community. Ideally, this volume of water would be found as a separate redundant water supply source as part of this program. This volume of water will be best acquired through a water supply well(s) constructed into unconsolidated sands and gravels. Adjacent to the Gladstone Curling Rink (Option 1) has been identified based upon

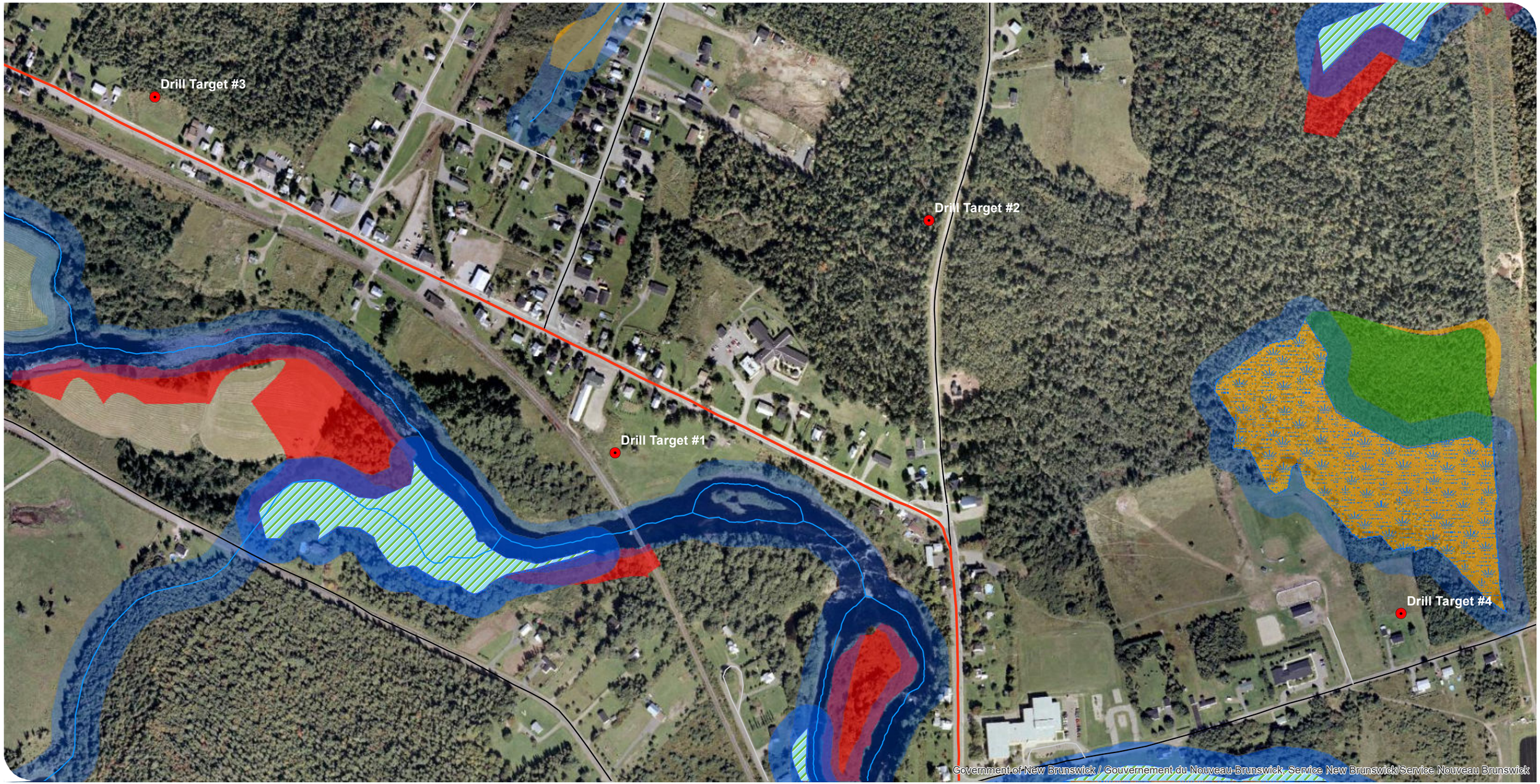
geological knowledge and highest potential of intercepting an unconsolidated deposit. The remaining three proposed drill target locations are anticipated to be installed within bedrock aquifers, and were chosen as potential targets based on topographical drainage areas, areas with known moderate water yields, and ease of connection to the current distribution system.

This project will take place at one to four of the proposed drill target locations as outlined in **Table 2** pending NBDELG approval and results of the drilling and testing program. An overview figure of the drill target locations is provided in **Figure 1**. Each of the proposed drill target options are displayed on **Figures 2 - 5**. These figures also illustrate geologic mapping available for the area geo-referenced on available aerial photography from 2010.

Table 2: Proposed Drill Target Options

Option	Drill Target Location Summary
1	This option is located adjacent to the Gladstone Curling Club with the Village limits approximately 100 meters southeast of the Village Office. The proposed location is approximately 80 meters from Sunbury Drive and 70 meters from the North Branch of the Oromocto River, which is outside the 30 meter setback from a designated watercourse and/or wetland. The drill target location of this option is displayed on **Figure 2**.
2	This option is located within Fredericton Junction Village limits adjacent to Horseman Road booster station. The proposed location is located approximately 385 meters from the North Branch of the Oromocto River and is outside the 30 meter setback from a designated watercourse and/or wetland. The approximate location of this option is displayed on **Figure 3**.
3	This option is located within Fredericton Junction Village limits on a vacant parcel of land adjacent to Sunbury Drive approximately 550 meters west of Village office. The proposed location is located approximately 280 meters from the North Branch of the Oromocto River and is outside the 30 meter setback from a designated watercourse and/or wetland. The approximate location of this option is displayed on **Figure 4**.
4	This option is located within Fredericton Junction Village adjacent to the Tri-County Complex, approximately 320 meters from the North Branch of the Oromocto River and is outside the 30 meter setback from a designated watercourse and/or wetland. The approximate location of this option is displayed on **Figure 5**.

Additional information relating to each of the proposed drill target options is presented in Section 3.0.



Village of Fredericton Junction

Project: 18-7534

Figure 1.
Drill Locations - Groundwater Exploration Program

Drill Locations

Watercourse and Wetland 30 m buffer

Watercourse

Regulated Wetlands

Provincially Significant Wetlands

Road Network

Expressway / Highway

Collector

Local / Street

NBDELG Draft Beta Wetland Mapping (unregulated)

Provincially Significant Wetlands

Intermediate Wetlands

Forested Wetlands

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DILLON CONSULTING

MAP LOCATION: \\dillon.ca\DILLON_DFS\Fredericton\Fredericton CAD\CAD\GIS\187534 Fredericton Junction Replacement Well
DATA PROVIDED BY: GEONB
MAP CREATED BY: SCN
MAP CHECKED BY: AFG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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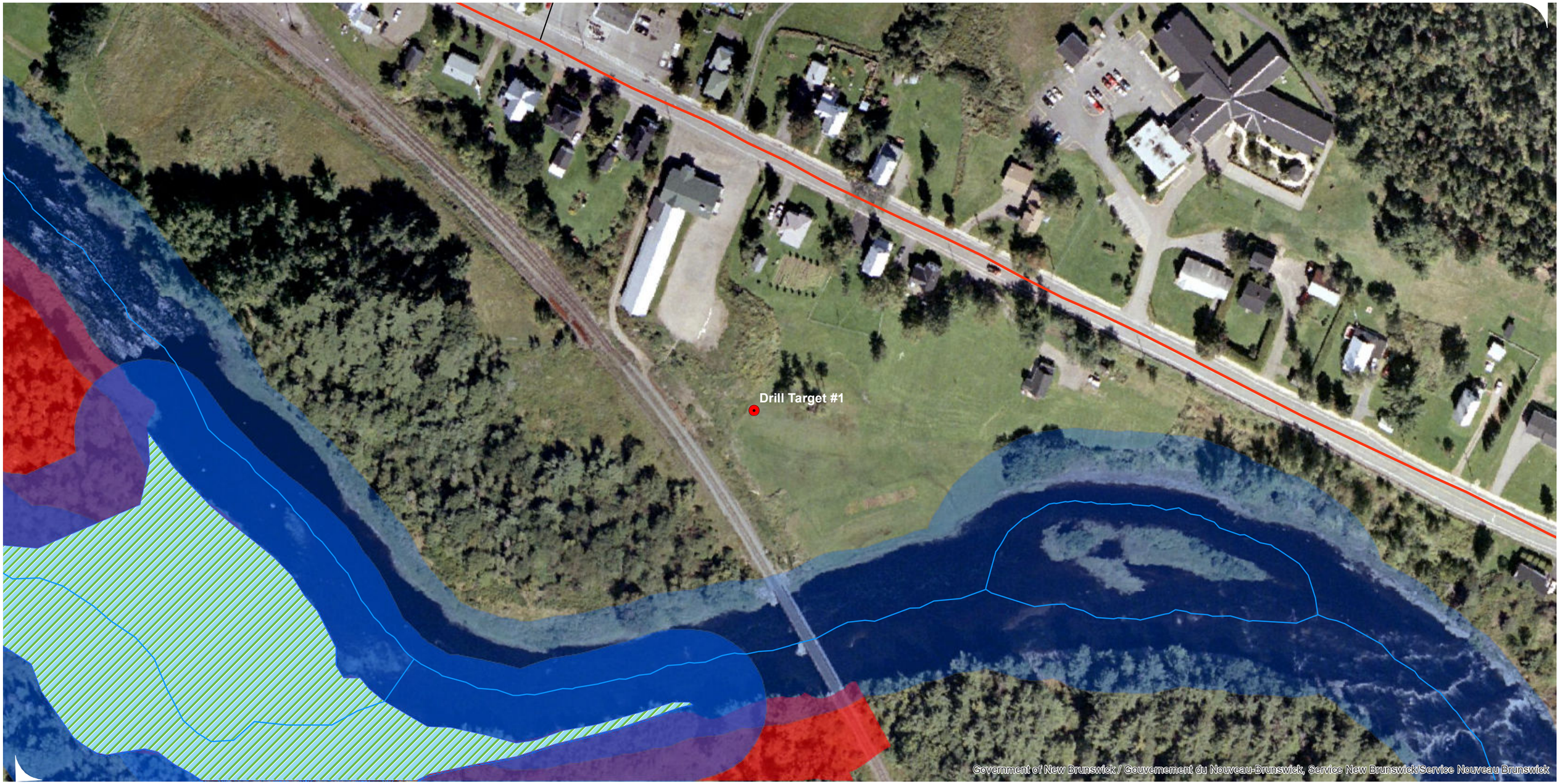
SCALE 1:4,500

DATE: 05/18/2018



Village of Fredericton Junction

Project: 18-7534

Figure 2.
Drill Target 1 - Groundwater Exploration Program

Drill Locations

Watercourse and Wetland 30 m buffer

Watercourse

Provincially Significant Wetlands

Road Network

Expressway / Highway

Collector

NBDELG Draft Beta Wetland Mapping (unregulated)

Provincially Significant Wetlands

N W E S

DILLON CONSULTING

MAP LOCATION: \\dillon.ca\DILLON_DFS\Fredericton\Fredericton CAD\CAD\GIS\187534 Fredericton Junction Replacement Well
DATA PROVIDED BY: GEONB
MAP CREATED BY: SCN
MAP CHECKED BY: AFG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

0 10 20 40 Meters

SCALE 1:1,500

DATE: 05/18/2018

Village of Fredericton Junction

Project: 18-7534

Drill Locations

Collector Road

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Figure 3.
Drill Target 2 - Groundwater Exploration Program

DILLON CONSULTING

MAP LOCATION: \\dillon.ca\DILLON_DFS\Fredericton\Fredericton CAD\CAD\GIS\187534 Fredericton Junction Replacement Well
DATA PROVIDED BY: GEONB
MAP CREATED BY: SCN
MAP CHECKED BY: AFG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

0 10 20 40 Meters

SCALE 1:1,500

DATE: 05/18/2018

Village of Fredericton Junction

Project: 18-7534

Figure 4.
Drill Target 3 - Groundwater Exploration Program

Drill Locations

Watercourse

Watercourse 30 m buffer

Road Network

Expressway / Highway

Local / Street

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DILLON CONSULTING

MAP LOCATION: \\dillon.ca\DILLON_DFS\Fredericton\Fredericton CAD\CAD\GIS\187534 Fredericton Junction Replacement Well
DATA PROVIDED BY: GEONB
MAP CREATED BY: SCN
MAP CHECKED BY: AFG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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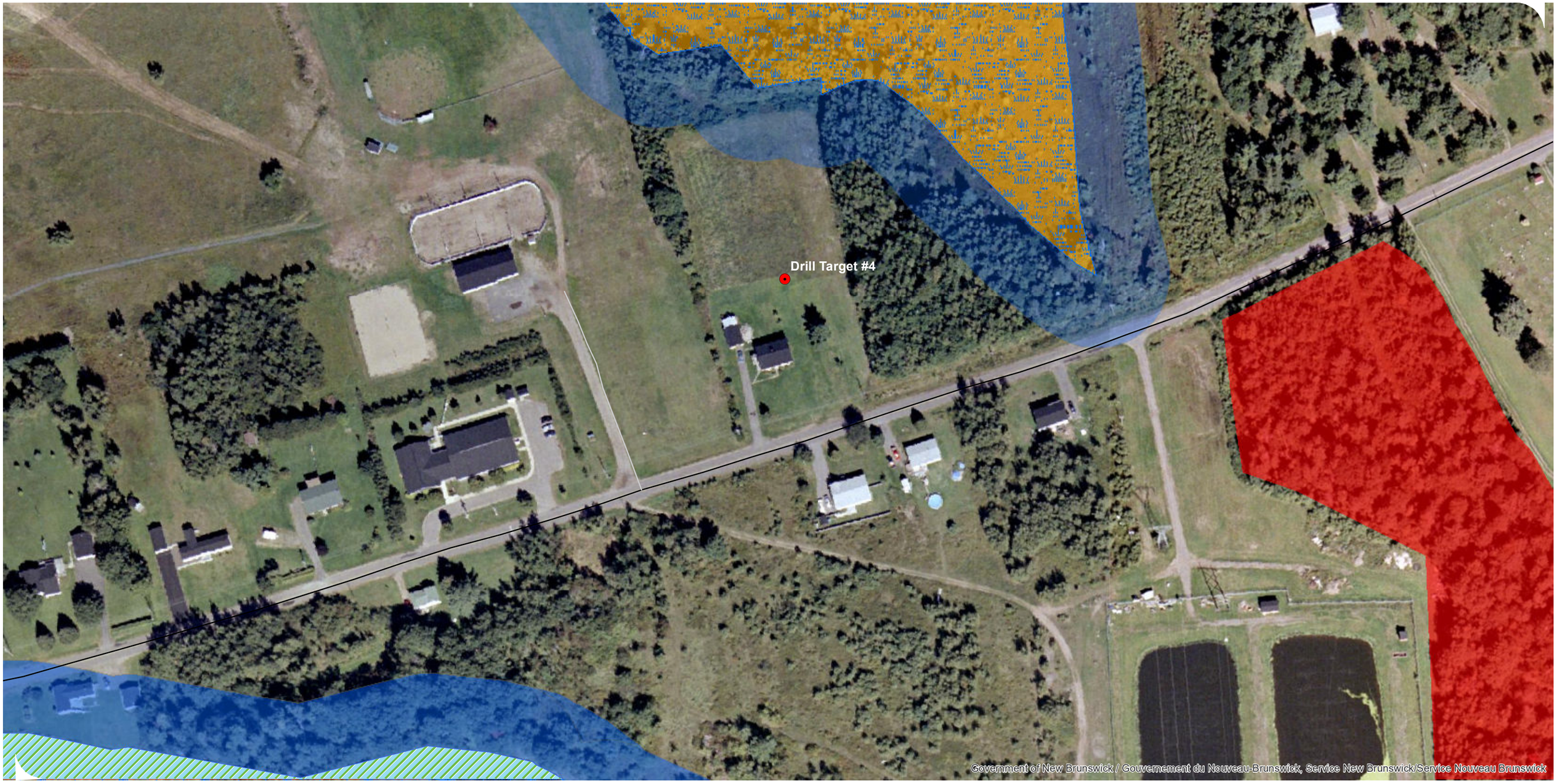
DATE: 05/18/2018



Village of Fredericton Junction

Project: 18-7534

Figure 5.
Drill Target 4 - Groundwater Exploration Program

Drill Locations

Wetland 30 m buffer

Regulated Wetlands

Provincially Significant Wetlands

Road Network

Collector

Local / Street

NBDELG Draft Beta Wetland Mapping (unregulated)

Provincially Significant Wetlands

Intermediate Wetlands

N
W E
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DILLON CONSULTING

MAP LOCATION: \\dillon.ca\DILLON_DFS\Fredericton\Fredericton CAD\CAD\GIS\187534 Fredericton Junction Replacement Well
DATA PROVIDED BY: GEONB
MAP CREATED BY: SCN
MAP CHECKED BY: AFG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

0 10 20 40 Meters

SCALE 1:1,500

DATE: 05/18/2018

2.5 Physical Components of the Project

The undertaking pertains to the construction and testing of one or more wells in one or more of the proposed drill target option locations. Once the wells have been drilled and developed, additional information related to infrastructure requirements (i.e., pipelines, pump house, etc.) will be provided to NBDELG prior to completing the work. Commissioning activities are not intended to be a part of this scope.

This undertaking is not expected to require work being completed within 30 meters of a wetland or watercourse. Should work be required within 30 meters of a wetland or watercourse, a Watercourse and Wetland Alteration Permit (WAWA) application will be submitted to NBDELG prior to any work being completed.

2.5.1 Well Construction and Hydraulic Testing Details

Test well drilling and hydraulic testing activities will be carried out by a licensed well driller under the supervision of a qualified professional as per the New Brunswick *Clean Water Act*.

The following describes the work that is to be completed for the drilling of a new water supply well:

- Complete underground utility clearances prior to completing any drilling activities.
- A temporary access ramp will be required to access the drill target area in drill target option 1. Fill material may be required to construct a temporary ramp for drill rig access. It is anticipated that existing fill material in the immediate area will be relocated to serve as an access ramp.
- Install and maintain sediment and erosion control structures where applicable/required over the course of well construction, development and testing.
- Construction of one 150 mm diameter test well at one or more of the drill target locations with 150 mm steel casing. The geology/hydrostratigraphy will be logged by Dillon staff during the drilling process.
- A preliminary yield assessment will be completed using air lift methods following the construction of the test well. Preliminary groundwater samples will be collected should the initial air lift testing indicate desired results.
- If both the preliminary yield assessment and chemistry results are acceptable, a 200 mm diameter well including a stainless steel screen will be constructed proximal to the initial test well. An additional observation well will be constructed for observation purposes if the site configuration will permit. The 200 mm well will undergo step-testing (30 min steps) and a long term pumping test (72 hours) as per the WSSA Guideline. Water levels will be measured in the pumping well as well as the initial test well (observation well) and additional observation well. Pressure transducers will be used in addition to manual water level measurements to record water levels in the pumping and observation wells.

- Water samples will be collected at 0, 24, 48 and 72 hours of pumping and submitted to the Research and Productivity Council (RPC) for analysis of general chemistry, biological parameters, and trace metals.
- The results of the pumping test will be presented in a report as per the New Brunswick WSSA, for review by the NBDELG.
- The drilling of test/observation wells will be completed during daytime hours.
- Water discharged during the construction, development and testing activities will be managed as necessary to limit erosion and sedimentation.
- Refueling of equipment used during the construction activities will be completed off-site, where possible. Spill management kits will be available throughout construction and testing and authorities will be alerted if necessary.

2.6 Project Schedule

Upon completion and receipt of the EIA registration and approval to proceed, Dillon proposes to complete hydrogeological field work in July/August 2018 (subject to approval being received by that time). Commissioning of any new municipal water well(s) is expected to be completed in the Spring of 2019.

3.0 Description of Existing Environment

3.1 Regional Environment

According to the Provincial land classification (2007), the proposed drill targets are located within the Grand Lake Valley Lowlands Ecoregion, and specifically within the Aukpaque Ecodistrict. This area is characterized by rich alluvial soils, warmer climate and an extended growing season compared to other parts of the province. The area hosts an array of southern heat-loving tree species such as ironwood, basswood, northern red oak, silver maple as well as white ash and green ash (both prevalent in areas of ice scour) (NBDERD, 2007). The original forests in this area have been altered by agriculture and forestry. Stands and mixtures of red maple, white birch, grey birch, balsam fir, and trembling aspen are typical of these disturbed areas.

Wetland types within this ecodistrict range from non-peatland (i.e., swamps, marshes, and shallow water pools) to floodplain peatlands. The Oromocto River (main tributary) is located to the east of Fredericton Junction. This tributary exhibits a series of glacially derived ponds and marshes that make up the Oromocto wetland complex (NBDERD, 2007). The Northwest Branch of the Oromocto River bisects the Village of Fredericton Junction. The Northwest Branch and main branch of the Oromocto River provide important habitat for resident and migrating waterfowl as well as many species of aquatic fauna.

The nearest Environment and Climate Change Canada (ECCC) weather station to the proposed project sites is located at Hoyt Blissville, (45°36'00.000" N 66°34'00.000" W; located approximately 8km south east of the general proposed project area).

According to this station, the annual daily mean temperature (1981-2010) is 5.8 degrees Celcius (^{o}C), with extremes ranging from -38.5^{o}C to 37.5^{o}C (Government of Canada, 2018). On average, the warmest periods annually were from June to August, with July being the warmest month with an average daily temperature of 19.3^{o}C. On average, the coolest periods annually were between December and February, with coldest month being January, at an average daily temperature of -8.9^{o}C (Government of Canada, 2018).

The historical precipitation data from the Hoyt Blissville Station recorded an average of 1175.4 millimetres (mm) of precipitation per year with 951.6 mm falling as rain and 223.8 centimetres (cm) as snowfall.

There was no wind speed data for this station. The second closest station to the project area was the Fredericton International Airport station; (45°52'19.670" N 66°31'40.410" W) located approximately 24 km north east of the general proposed project area. According to the Climate Normals, the average annual wind speed (1981-2010) at the Fredericton Airport is 12.0 kilometres/hour (km/h) from the west. The maximum wind speed occurs in April with an average speed of 14.2 km/h from the northwest, while the minimum wind speed occurs in August with an average speed of 9.6 km/h from the south. The prevailing winds are generally from the south in the summer and the west in the winter (Government of Canada, 2018).

3.2 Localized Environment

Environmental features deemed to have specific value to the ecosystem, heritage and/or culture, or are afforded protection by legislation, are identified as Valued Components (VC). The following features have been identified as valued components in relation to the proposed drill targets and project activities:

- Terrestrial Environment;
- Surface Water Environment;
- Groundwater Environment;
- Wildlife and Wildlife Habitat;
- Species of Conservation Concern;
- Migratory Birds;
- Atmospheric Environment; and,
- Heritage and Cultural Features.

A description of the localized existing environment/VC is provided within the following sections.

3.2.1 Drill Target Option 1

3.2.1.1 Terrestrial Environment

The proposed drill target area is located on a semi vacant lot consisting of mixed grasses and weeds. The site is within a residential and commercial area of Fredericton Junction. There are mature white birch (*Betula papyrifera*) and red maple (*Acer rubrum*) as well as shrubs including white meadowsweet (*Spiraea alba*), red raspberry (*Rubus idaeus*), and highbush blackberry (*Rubus allegheniensis*) on the perimeter of the drill target area.

An access ramp from the embankment on the Gladstone Curling Club property will be required to access the drill target location. The shrubs and trees surrounding this drill target area will not be affected during Project activities.

3.2.1.2 Surface Water Environment (Wetlands and Watercourses)

The proposed drill target area is located approximately 80 m north of the Oromocto River (Northwest Branch). A drainage ditch (man-made) is located along the western perimeter of the site, which drains surface water to the river.

Based upon a desktop review of available mapping layers (GeoNB) as well as a site visit conducted on May 16, 2018 by a Dillon biologist trained in wetland identification, delineation and ecology, there are no wetlands within 30 m of the proposed drill target location.

Site elevation is approximately 4.20 meters (14.40 m) above the elevation of the River (13.20 m). It is not expected that flood water would reach the elevation of the drill target area. Elevation data for each drill target option is based upon ArcGIS Earth and elevations obtained from flood contours generated from LiDAR data from the flood extent, depressions and wet areas mapping: Fredericton Junction, NB.

3.2.1.3 Groundwater Environment

The proposed drill target area is located approximately 80 meters north of the Oromocto River (Northwest Branch). The general topography and regional groundwater flow direction is assumed to be towards the Oromocto River. Based upon surficial geology mapping and the localized geomorphology, it is anticipated that this drill target option is potentially located within the area of glaciofluvial or fluvial sediments of the Oromocto River. The operating Village water supply well is located approximately 1.1 km west and, based on geological mapping and topography, is potentially in the same deposit.

This proposed drill target area is located within an area of existing municipal services and therefore not likely within a zone of influence of private potable wells.

The drill target area is not located in a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Program.

3.2.2 Drill Target Option 2

3.2.2.1 Terrestrial Environment

The proposed drill target area is located on a forested lot consisting of mature trees, including: white spruce (*Picea glauca*), balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), northern red oak (*Quercus rubra*), and white birch (*Betula papyrifera*). Dominant understory vegetation consists of bunchberry (*Cornus canadensis*), starflower (*Trientalis borealis*), false lily-of-the-valley (*Maianthemum dilatatum*), bracken fern (*Pteridium aquilinum*), hay-scented fern (*Dennstaedtia punctilobula*), and moss (*Bryophyta spp.*). Minor clearing of trees and grubbing may occur during the Project to allow site access. The area along Horseman Road is maintained by the Village and the site is easily accessible from Sunbury Drive.

3.2.2.2 Surface Water Environment (Wetlands and Watercourses)

Based upon a desktop review of available mapping layers (GeoNB) as well as a site visit conducted on May 16, 2018 by a Dillon biologist trained in wetland identification, delineation and ecology, there are no surface water bodies (i.e., wetlands or watercourses) within 30 m of the proposed drill target area.

The drill target area is located 4.26 meters (19.12 m) above the elevation of the Oromocto River (14.86 m).

3.2.2.3 Groundwater Environment

The proposed drill target area is located on a vacant property adjacent to Horseman Road. The proposed drill target area is located approximately 380 meters from the Oromocto River. The general topography gently slopes to the north, while the regional groundwater flow direction is assumed to be south towards the Oromocto River. Based upon surficial and bedrock mapping, drill target option 2 is located in an area of shallow glacial till deposits and is anticipated to be a bedrock well. Based upon discussion with Village staff and local well drillers, this site was agreed upon with respect to drill rig access and infrastructure commissioning as a future well site.

This proposed drill target area is located within an area of existing municipal services and therefore not likely within a zone of influence of private potable wells. The distribution system for the Village ends at this location and the houses further north on Horseman Road have private potable wells, with the closest property being approximately 160 meters north.

The proposed drill target area is not located in a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Program.

3.2.3 Drill Target Option 3

3.2.3.1 Terrestrial Environment

The proposed drill target area is located on a grass covered vacant lot adjacent to a park and residential area and undergoes regular lawn care maintenance by the Village. There is a mature white pine plantation located directly adjacent and to the north of the proposed drill target location.

3.2.3.2 Surface Water Environment (Wetlands and Watercourses)

Based upon a desktop review of available mapping layers (GeoNB) as well as a site visit conducted on May 16, 2018 by a Dillon biologist trained in wetland identification, delineation and ecology, there are no surface water bodies (i.e., wetlands or watercourses) within 30 m of the proposed drill target area.

The proposed drill target area is located 9.63 meters (22.87 m) above the elevation of the Oromocto River (13.24 m). It is not expected that flood water would reach the elevation of the drill target area.

3.2.3.3 Groundwater Environment

The proposed drill target area is located on a vacant property adjacent to Sunbury Drive. The proposed drill target area is located approximately 275 meters north of the Oromocto River (Northwest Branch). The general topography and regional groundwater flow direction is assumed to be north towards the River. Based upon surficial and bedrock mapping, drill target option 2 is located in an area of shallow glacial till deposits and will likely be completed as a bedrock well.

Based upon discussion with Village staff and local well drillers, this location was determined to be easily accessed with a drill rig and is located on Village-owned property in close proximity to existing municipal infrastructure.

The proposed drill target area is located within an area of existing municipal services and therefore not likely within a zone of influence of private potable wells.

The drill target area is not located in a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Program.

3.2.4 Drill Target Option 4

3.2.4.1 Terrestrial Environment

The proposed drill target area is located on a residential property and former blueberry field. Dominant vegetation covering the site includes mixed grasses, weeds and sparse shrubs along the perimeter of the site. A stand of mature white birch (*Betula papyrifera*) is located on the eastern border of the property.

During a site visit conducted on May 16, 2018 by a Dillon biologist, signs (i.e., scat and tracks) of white tailed deer (*Odocoileus virginianus*) as well as snowshoe hare (*Lepus americanus*) were observed.

3.2.4.2 Surface Water Environment (Wetlands and Watercourses)

Based upon a desktop review of available mapping layers (GeoNB) as well as a site visit conducted on May 16, 2018 by a Dillon biologist trained in wetland identification, delineation and ecology, there is a regulated wetland located adjacent to the proposed drill target area. The wetland is classified as intermediate shrub and forested wetland. The wetland has been previously disturbed along its boundary with the Heart residential property; a berm extends along the northern and eastern property boundaries. No work is planned to occur within 30 m of the wetland. There are no watercourses within 30 m of the proposed drill target area.

The drill target area is located 4.40 meters (12.40 m) above the elevation of the Oromocto River (8.00 m). It is not expected that flood water would reach the elevation of the drill target area.

3.2.4.3 Groundwater Environment

The proposed drill target area is located on private residential property (property owner: Resident No. 1) to adjacent the Tri-County Complex on Prides Landing Road. The proposed drill target is approximately 320 meters from the Oromocto River. The general topography of the area is flat, with regional groundwater flow expected to be towards the Oromocto River. Based upon surficial geology mapping, drill target option 4 is located within floodplain sediments greater than 2 meters thick; however, the well is anticipated to be completed as a bedrock well.

The Village water distribution network ends at this location and all residential homes to the east have private potable wells. The drill target location is approximately 100 meters from the closest private potable well and is not anticipated to be within a zone of influence of private potable wells.

The drill target area is not located in a wellfield protection area under the New Brunswick Wellfield Protection Program or a designated watershed under the New Brunswick Watershed Protection Program.

3.3 Wildlife and Wildlife Habitat

The terrestrial environment within the proposed drill target areas (described in Sections 3.2.1.2, 3.2.2.2, 3.2.3.2 and 3.2.4.2) may provide suitable habitat for small mammals and urbanized wildlife such as: skunk (*Mephitis mephitis*), raccoon (*Procyon lotor),* meadow voles (*Microtus pennsylvanicus*), squirrels (*Sciurus vulgaris*), chipmunk (*Tamias striatus*), white tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), and coyote (*Canis latrans*). Mammals may use the properties for foraging, migration or denning. The proposed drill target areas do not provide preferential habitat to wildlife, and therefore are not anticipated to adversely affect wildlife and wildlife habitat. Wildlife may continue to utilize the proposed drill target areas upon completion of Project activities.

3.4 Species of Conservation Concern

3.4.1 Fauna (Wildlife) Species of Conservation Concern

Based on a review of the provincial and federal Species at Risk Public Registries (ECCC 2018; NBDERD 2018), the following fauna species of conservation concern may be present within the general Project area. This section excludes bird species of conservation concern (refer to *Section 3.5*). Refer to **Figures 1 - 5** for the proposed drill target locations.

- **Wood Turtle (*Glyptemys insculpta*):**
  "Threatened" under the New Brunswick *Species at Risk Act* (NB *SARA*) and under the federal *Species at Risk Act (SARA)* as well as by the Committee on the Status of Endangered Wildlife in Canada *(*COSEWIC*).*
- **Snapping Turtle (*Chelydra serpentine*):**
  "Special Concern" under NB *SARA* and *SARA/*COSEWIC.
- **Bat Species: Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat or Eastern Pipistrelle (*Perimyotis subflavus*):**
  "Endangered" under NB *SARA* and *SARA/*COSEWIC.

No wildlife species of conservation concern were observed during the field visit conducted on May 16, 2018 by a Dillon biologist. There is no critical or preferential habitat within the proposed drill target areas; however, the wildlife species noted above may occur incidentally within the drill target areas and/or may utilize these areas for foraging purposes. The wildlife species noted above may continue to utilize the proposed drill target areas following the completion of the Project activities and are not expected to be adversely affected by the Project.

3.4.2 Flora Species of Conservation Concern

Based on a review of the provincial and federal Species at Risk Public Registries (ECCC 2018; NBDERD 2018), the following flora species of conservation concern may be present within the general Project area. Refer to **Figures 1 - 5** for the proposed drill target locations.

- **Butternut (*Juglans cinerea*):**
  "Endangered" under NB *SARA and SARA/*COSEWIC.

No flora species of conservation concern were observed within the proposed Project areas during the field visit conducted on May 16, 2018 by a Dillon biologist. Although the proposed drill target option 1 is located within 80 m of the riparian zone of the Oromocto River (Northwest Branch) (i.e., potential preferential habitat for butternut), the area has been previously cleared allowing for early successional species to colonize. Additionally, butternut trees were not observed within the proposed drill target areas during the field visit conducted on May 16, 2018. Flora species of conservation concern are not expected to be adversely affected by the Project.

3.5 Migratory Birds and Bird Species of Conservation Concern

Migratory bird species such as waterfowl and passerines protected under the *Migratory Birds Convention Act*, including species of conservation concern, may occur within the proposed drill target areas; however, there is no critical or preferential habitat identified within the proposed Project areas. The habitat within the proposed drill target areas may continue to be utilized by migratory birds (including species of conservation concern) following the completion of Project activities. Refer to **Figures 1 - 5** for the proposed drill target locations.

The Oromocto River and associated wetland complex is known to provide important waterfowl and shorebird habitat (NBDERD, 2007). As described in Sections 3.1 and 3.2, the Oromocto River (Northwest Branch) bisects the Village, and the main branch of the Oromocto River and associated wetland complex is located approximately 2 km east of the Village.

Based on a review of the provincial and federal Species at Risk Public Registries (ECCC 2018; NBDERD 2018), the following bird species of conservation concern may be present within the general Project area.

- **Bald Eagle (*Haliaeetus leucocephalus*)**
  "Endangered" under NB *SARA; "Not at Risk" under SARA/*COSEWIC
- **Barn Swallow (*Hirundo rustica*)**
  "Endangered" under NB *SARA* and *SARA/*COSEWIC
- **Bank Swallow (*Riparia riparia*)**
  "Threatened" under COSEWIC*/SARA*
- **Bobolink *(Dolichonyx oryzivorus)***
  "Threatened" under NB *SARA* and *SARA/*COSEWIC
- **Canada Warbler *(Wilsonia canadensis)***
  "*Threatened"* under NB *SARA* and *SARA/*COSEWIC
- **Chimney Swift (*Chaetura pelagica*)**
  "Threatened" under NB *SARA* and *SARA/*COSEWIC
- **Common Nighthawk *(Chordeiles minor)***
  "*Threatened"* under NB *SARA* and *SARA/*COSEWIC
- **Eastern Wood Peewee *(Contopus virens)***
  "Special Concern" under NB *SARA* and *SARA/*COSEWIC
- **Evening Grosbeak (*Coccothraustes vespertinus*)**
  "Special Concern" under COSEWIC
- **Rusty Blackbird *(Euphagus carolinus)***
  "Special Concern" under NB *SARA* and *SARA/*COSEWIC
- **Whip-poor-will *(Caprimulgus vociferous)***
  "Threatened" under NB *SARA* and *SARA/*COSEWIC
- **Wood Thrush *(Hylocichla mustelina)***
  "*Threatened"* under NB *SARA* and *SARA/*COSEWIC

No bird species of conservation concern were observed during the field visit conducted on May 16, 2018 by a Dillon biologist. There is no critical or preferential habitat within the proposed drill target areas; however, the bird species noted above may occur incidentally within the Project areas and/or may utilize these areas for nesting or foraging purposes. Nesting may occur within the treed portion of drill target option 2 (Horseman Road).The bird species noted above may continue to utilize the Project areas following the completion of the Project activities and are not expected to be adversely affected by the Project.

3.6 Atmospheric Environment

3.6.1 Ambient Air Quality

Existing ambient air quality was evaluated through the closest NBDELG ambient air monitoring stations to the proposed project that are located in Fredericton NB, approximately 40 km north of the project The Fredericton monitoring station reports on fine particulate matter ($PM_{2.5}$), relative humidity, barometric pressure, wind speed and wind direction, ambient temperature, carbon monoxide (CO), nitrogen dioxide (NO_2), total reduced sulfur (TRS) and ground level ozone (O_3) (NBDELG, 2017a).

Ambient air quality is not anticipated to be adversely affected by the proposed project.

3.6.2 Ambient Noise Quality

Existing sound quality conditions in the vicinity of the project location were not measured for this assessment. Land uses within 250 m of the project location are primarily residential. Given the setting of this project component, existing sound pressure levels in vicinity of the project are expected to be typical of a rural residential area.

3.7 Heritage and Cultural Features

The Archaeological Services Branch of the New Brunswick Department of Tourism, Heritage and Culture has been contacted to confirm that there are no known or registered archaeological sites within 100 m of any of the proposed drill target locations.

Archaeological features are generally known to be at a higher archaeological potential within the first 50 meters from a watercourse, while the following 30 meters are ascribed as moderate archaeological potential. All of the potential drill target option locations exist within already developed lands and/or between 70 and 385 meters from the Northwest Branch of the Oromocto River, thus placing them in areas of low archaeological potential. Refer to **Figures 1 - 5** for the proposed drill target locations.

4.0 Identification of Environmental Interactions

The identification of potential interactions between the Project and the environments has been undertaken in consideration of the nature of the Project, its planned activities, as well as potential accidental events/malfunctions.

4.1 Approach to Project Components

As presented in Section 2, this EIA Registration recognizes two main distinct Project components for the groundwater exploration program. The potential interactions with the surrounding environment have been considered in terms of each distinct component.

The two components of the Project are:

- *Drilling of Observation/Test Well*(s) – i.e. 'construction phase'; includes drilling of 150 to 250 mm diameter test and observation wells; and
- *Hydraulic Testing of Test Well(s)* – includes step-drawdown testing of larger diameter test well followed by a 72 hour pumping test.

Additionally, accidents and malfunctions will be considered.

4.2 Project Interaction Matrix

This initial screening assists in determining if an interaction between the Project and the valued environmental component is possible and is presented in **Table 3**.

Table 3: Project Interaction with Environmental Components

Valued Environmental Components	Project Components		
	Well Construction	Hydraulic Testing (72 Hour)	Accidents and Malfunctions
Terrestrial Environment	✓		✓
Groundwater Environment		✓	✓
Surface Water Environment			✓
Wildlife and Wildlife Habitat	✓		✓
Species of Conservation Concern	✓		✓
Migratory Birds	✓		✓
Atmospheric Environment	✓		
Heritage and Cultural Features			✓

Those interactions for which a checkmark is provided indicates that the Project activity may interact with the VEC, and thus an environmental effects assessment is warranted in Section 5.0 below. Those activities for which no interaction was noted with a VEC are not carried forward or discussed further in this EIA Registration.

5.0 Environmental Effects Assessment and Mitigation

Mitigation is identified for each interaction and/or effect in an attempt to prevent the interaction from occurring if possible, or to reduce the severity, magnitude or duration of the interaction. Best management practices (based on industry guidelines and regulatory guidance documents) have been identified as appropriate mitigative measures. In addition, several acts, codes, regulations and guidelines may require appropriate actions be conducted as mitigative measures prior to or during the interaction. A variety of provincial and federal Acts, codes, regulations and guidelines have been consulted in the development of the mitigative measures.

The federal and provincial legislation and codes that apply to the proposed Project include (however, may not be limited to):

- *Canadian Environmental Assessment Act, 2012* (CEAA 2012), and Regulations;
- *Canadian Environmental Protection Act*, 1999 (CEPA), and Regulations ;
- *Fisheries Act*, 1985;
- *Migratory Birds Convention Act*, 1994;
- *Species at Risk Act*, 2002;
- The Federal Policy on Wetland Conservation, 1991;
- New Brunswick *Clean Environment Act*, 1973, and Regulations;
- New Brunswick *Clean Water Act*, 1989, and Regulations;
- New Brunswick *Clean Air Act*, 1996, and Regulations;
- New Brunswick *Occupational Health and Safety Act*, 1988, and Regulations; and,
- New Brunswick *Species at Risk Act*, 2013, and Regulations.

5.1 Standard Mitigation of Potential Environmental Effects

The following mitigation measures have been identified to reduce the likelihood of occurrence, or minimize potential extent of effects of the Project on the VECs identified during the identification of potential environmental interactions in Section 4.0. A list of standard mitigation measures applicable to more than one VEC is provided below:

- The Contractor will ensure that there is basic fire-fighting equipment available on-site and all personnel will be familiar with the equipment and equipment location the event of a spill or accidental fire;
- The contractor will be required to provide spill response training to construction personnel and will ensure that spill response equipment is readily available on-site and each piece of machinery is equipped with a spill response kit;
- Remedial action, or engineered controls, for any spills or leaks that occur will be completed;
- During construction, nearby residents will be notified of the schedule for construction activities and the likely duration;
- Proper labeling of chemical storage containers will be completed and appropriate material safety data sheets (MSDS) for stored chemicals and drill mud additives will be stored on-site to reduce likelihood of accidents or spills and to ensure the safety of workers on-site;
- Proper sediment control measures will be installed and checked regularly and prior to and after storm events to ensure they are continuing to operate properly to minimize potential effects to adjacent habitat;
- A plan for handling fill and construction materials for the site will be communicated to the contractor (i.e. if stockpiling is required, materials will be stored away from any watercourse or wetland in predefined areas or removed from site to a predetermined location) with an intent to minimize soil stockpiled, and duration soil is stockpiled, at the site; and,
- Exposed soils will be stabilized as soon as practical to minimize emissions of fine particulate matter.

Potential effects and mitigation measures specific to each VEC is discussed within the following sections.

5.2 Terrestrial Environment

5.2.1 Well Construction

5.2.1.1 Potential Effects

The potential environmental effects on the Terrestrial Environment associated with the construction and testing of the proposed test and/or production wells will be minimal and localized. Drill option 1 will require a small access road be built off of the Gladstone Curling Club's parking lot (no tree clearing required) and drill option 2 will require clearing of trees to create a small access point off of Horseman Road. The remaining two drill options will require no tree clearing or access roads. Ground disturbance will be limited to the immediate area of the drilling.

5.2.1.2 Mitigation

In general, ground disturbance will be minimized where possible, and areas with trees and shrubs will be avoided with the exception of the proposed drill target option 3, where minor clearing and grubbing may be required for site access.

Temporary access is also required at drill site option 1; however, the ground will not be excavated to expose soils, and tree clearing will not be required. Clean fill material will be used to construct the roadway. The temporary access will be placed such that an accessible grade will be achieved allowing a drill rig to drive onto the property.

General mitigation measures include the following:

- Where possible, vegetation will be preserved to maintain wildlife habitat;
- The source of any new fill material will be approved and the material shall be inspected by Dillon personnel prior to construction;
- Roads and erosion/sedimentation measures will be monitored and mitigated with hay bales as required; and,
- Where possible existing roads and trails will be utilized.

With this proposed mitigation, interactions between the Project and the Terrestrial Environment during both well construction and hydraulic testing are not expected to be substantive.

5.3 Groundwater Environment

5.3.1 Hydraulic Testing

5.3.1.1 Potential Effects

There is a potential for neighboring private potable wells to be affected as a result of completing a long term pumping test (72 hours) in the area of drill target option 2 and 4. The closest potable well is located approximately 160 meters north and 230 meters east of the drill locations.

In the unlikely event that neighboring wells were to be affected by hydraulic testing, it would be considered an accidental event and response procedures would be initiated to cease the effect or to provide alternative means of supplying water to the affected wells. Further information is provided in Section 5.8 below.

5.3.1.2 Mitigation

Should drill target option 2 or 4 undergo hydraulic testing, select adjacent private potable wells may be selected for monitoring over the course of the pumping test to ensure relative negative effects are not being observed. Home owner permission and wellhead access will be determined, should hydraulic testing be required. Additionally, observation wells will be installed and positioned such that the radial effects of pumping will be monitored as a means to assess the risk to neighboring potable wells.

With this proposed mitigation, interactions between the Project and the Groundwater Environment during hydraulic testing are not expected to be substantive.

5.4 Surface Water Environment

5.4.1 Well Construction

5.4.1.1 Potential Effects

During the well construction phase, there is the potential for erosion and sedimentation due to water and drill cuttings generated from the drilling and development of a well.

5.4.1.2 Mitigation

During the well construction phase, the following mitigation measures will be applied:

- If any work is to be conducted within 30 m of the Oromocto River or other waterbody, a Watercourse and Wetland Alteration permit application will be submitted to the NBDELG prior to proceeding;
- Erosion and sediment control structures will follow specifications as outlined in the Watercourse and Wetland Alteration technical guidelines (Site and Surface Water Management, p.19-21), should they be required;
- Siltation prevention measures (i.e., silt fences) shall be installed at the onset of the construction activities and added wherever necessary. Sediment control structures shall be monitored and maintained on a regular basis; and,
- Where possible, vegetation will be preserved.

With the implementation of these mitigation measures, interactions between the Project and the Surface Water Environment during well construction are not expected to be substantive.

5.4.2 Hydraulic Testing

5.4.2.1 Potential Effects

During the hydraulic testing phase, there is the potential for erosion and sedimentation to occur due to the large volume of water anticipated to be discharged from the pumping/test well. A 72 hour pumping test will be completed to assess water quantity and quality via the use of a service truck, pump, piping, flow meter and an electrical source (direct current or portable generator pending access/availability). Groundwater will be discharged onto the ground surface at sufficient distance away from the wellheads to restrict interference and recharge from discharged water. Surface water is not anticipated to be affected by the Project activities.

5.4.2.2 Mitigation

During the hydraulic testing phase, the following mitigation measures will be applied:

- If any work is to be conducted within 30 m of the Oromocto River or well water is anticipated to be discharged directly to a watercourse, a Watercourse and Wetland Alteration permit application will be submitted to the NBDELG prior to proceeding;
- Erosion and sediment control structures will follow specifications as outlined in the Watercourse and Wetland Alteration technical guidelines, should they be required (Site and Surface Water Management, p.19-21);
- Siltation prevention measures (i.e., silt fences and hay bales) shall be installed at the onset of the hydraulic testing activities and added wherever necessary. Sediment control structures shall be monitored and maintained on a regular basis;
- Efforts will be made to discharge to natural drainage channels away from residential properties; and,
- Where possible, vegetation will be preserved.

With the implementation of these planned mitigation measures, interactions between the Project and the Surface Water Environment during hydraulic testing are not anticipated to be substantive.

5.5 Wildlife (Fauna), Wildlife Habitat, and Wildlife Species of Conservation Concern

5.5.1 Well Construction

5.5.1.1 Potential Effects

During the well construction phase, there is the potential for species of conservation concern to be affected by tree clearing, collisions with vehicles, or encounters with humans.

5.5.1.2 Mitigation

During the Project activities, the following mitigation measures will be applied:

- Where possible, vegetation will be preserved to maintain wildlife habitat;
- To minimize wildlife encounters, the site and working areas shall be kept clean of food scraps and garbage and will be removed from the site daily;
- In the case of wildlife encounters, the following shall be implemented:
    - No attempt will be made by any worker at the Project site to chase, catch, divert, follow or otherwise harass wildlife by vehicle or on foot.
    - Equipment and vehicles will yield the right-of-way to wildlife.
    - If the nest of a wood turtle is encountered during construction activities, work around the nest shall cease until the Village dispatches a biologist to assess the situation and appropriate mitigations are applied.
    - If a nest or nesting turtle is encountered, contact Hubert Askanas, Species at Risk Biologist at ERD (506) 453-5873 or by email Hubert.Askanas@gnb.ca.

- Any stockpiled of sand/gravel should be covered at the end of day from June to early July to reduce the risk of a wood turtle to attempt nesting within the stockpiled material.

- Any nuisance wildlife as identified under the *Nuisance Wildlife Regulation* (97-141) of the *Fish and Wildlife Act* identified as disrupting Project-related activities may only be removed by a licensed Nuisance Wildlife Control Officer or a licensed trapper;
- To minimize disruptions with bat activity at night, the Project construction activities will be limited to daylight hours. If night work is required, approval from the Village will be required; and,
- All workers will adhere to the provincial and federal *Species at Risk Acts*.

With the implementation of planned mitigation above, interactions between the Project and Wildlife (Fauna), Wildlife Habitat, and Wildlife Species of Conservation Concern during well construction are not expected to be substantive.

5.6 Migratory Birds and Bird Species of Conservation Concern

5.6.1 Well Construction

5.6.1.1 Potential Effects

During the well construction phase, there is the potential for nesting migratory birds to be affected due to tree clearing within Drill Target Option 2 (Horseman Road).

5.6.1.2 Mitigation

During the Project activities, the following mitigation measures will be applied:

- Where possible, vegetation will be preserved to maintain bird habitat;
- Consultation with a bird specialist and a site visit will be undertaken to ensure that birds are not nesting within the Project footprint prior to any tree clearing;
- All workers will adhere to the *Migratory Birds Convention Act, 1994* (MBCA) and the *Migratory Birds Regulations* (MBR);
- If a nest is encountered during construction activities, work around the nest shall cease until the Village dispatches a biologist to assess the situation and appropriate mitigation measure is applied; and,
- To minimize disruptions with bird activity at night, the Project construction activities will be limited to daylight hours. If night work is required, approval from the Village will be required. Lighting requirements will meet ECCC standards to minimize the potential effects on migratory birds.

With the implementation of planned mitigation, interactions between the Project and Migratory Birds and Bird Species of Conservation Concern during well construction are not expected to be substantive.

5.7 Atmospheric Environment

There is potential for elevated noise levels from construction/drilling equipment and drilling activities to occur during the construction phase of the proposed project. In addition, there is the potential for the minor increase of emissions of NOX, CO, VOCs and SO2 from construction/drilling equipment.

5.7.1 Mitigation

During the construction phase of the project, the following mitigative measures for the atmospheric environment will be employed:

- A noise reduction plan will be established and communicated to the contractors prior to construction;
- Where practical, construction activities will be planned during daylight hours so as to reduce noise disturbance to nearby residence;
- During construction, nearby residents will be notified of the schedule for construction activities and the likely duration;
- Contractors are to ensure that vehicles, tools, and equipment will be properly maintained according to emission and noise suppression standards;
- All construction equipment will be turned off when not in active use to minimize idling;
- Monitoring of weather (wind conditions) and stabilization of soil stockpiles and bare slopes to minimize a potential increase in fine particulate matter;
- Water will be used to reduce dust, where necessary;
- Exposed soils will be stabilized as soon as practical; and,
- Complaints related to noise from the construction will be addressed by the contractor.

With the implementation of planned mitigation, interactions between the Project and the Atmospheric Environment are unlikely to occur.

5.8 Heritage and Cultural Features

It is unlikely that heritage and cultural features will be encountered at the drill target locations based upon the limited ground disturbance required to drill 150 mm to 250 mm test wells and the drill target locations being situated outside of the prescribed high and moderate potential archaeological zones.

5.8.1 Mitigation

If heritage or cultural features are identified at any point over the course of the project, the following mitigative measures for archaeological resources will be employed:

- Work in the area must cease immediately and the Archaeological Services Branch of the New Brunswick Department of Tourism, Heritage and Culture will be contacted at (506) 453-3014 for further mitigation;

- Until a qualified archaeologist arrives at the scene, no one shall disturb, move or re-bury any uncovered artifact; and,
- Activities at the site may resume only when authorized by Archaeological Services and once mitigative measures have been completed.

With the implementation of planned mitigation, interactions between the Project and Heritage and Cultural Features are unlikely to occur.

5.9 Accidents and Malfunctions

There is a potential for unplanned releases related to any construction project. During the construction phase, the following mitigative measures will be followed:

- To avoid/minimize potential hazardous materials spills, spill response kits will available within the proposed Project area during all phases of the Project;
- Any spills or leaks that occur will be reported to the appropriate regulatory authorities, if applicable, as soon as possible;
- Remedial action, or engineered controls, for any spills or leaks that occur will be completed;
- Refueling, oiling, and maintenance of equipment will be completed in specifically designated areas located at least 30 m away from any watercourse, wetland, or well to minimize potential effects that could arise in the event of a spill;
- Servicing of equipment will be completed off-site by a licensed mechanic; however if required to be completed on-site, the work will be completed over an impervious surface or trap;
- Rubbish and waste materials will be kept at minimum quantities and burning of this material will be prohibited;
- Oily rags will be stored in approved receptacles and disposed of at approved waste facilities;
- Chemical and petroleum hydrocarbons will be stored in appropriate containers and in specifically designated areas to reduce potential for leaks. Where applicable, secondary containment of chemicals or petroleum hydrocarbons will be employed;
- Work entailing use of toxic or hazardous materials, chemicals, or otherwise creating hazard to life, safety of health, will be conducted in accordance with National Fire Code of Canada to minimize the potential for spills or fires; and,
- Where applicable, double walled fuel storage tanks will be required for refueling.

With the implementation of planned mitigation, and with the careful development and implementation of contingency and emergency response plans to be applied in the unlikely occurrence of an accident, malfunction, or unplanned event, interactions between the Project and the environment arising from an accidental event are not expected to be substantive.

5.10 Summary of Proposed Mitigation

Specific mitigation and best management practices will be observed during the well drilling and hydraulic testing activities, specifically to remain in compliance with the applicable acts and regulations (refer to Section 5.0) to ensure that adverse environmental effects do not occur.

Upon completion of the WSSA, and should a production well(s) be approved as a source, additional work will be required to commission the well and connect to the existing municipal infrastructure. Details regarding this work would be provided to the NBDELG prior to commissioning activities.

It should be noted that if any of the drill target option areas are ultimately developed as a wellfield, land use and sources of contamination will further be assessed.

6.0 Public Involvement

The Village of Fredericton Junction will seek and consider public input in relation to the proposed Project. Individuals, companies, agencies, organized interest groups, and others that may be affected by the Project will be contacted, made aware of the undertaking, explained the purpose of the Project and asked to provide comment where applicable. Letters will be delivered to all residents within 500 meters of a drill location, to notify them of upcoming work. Documentation of the public involvement process will be provided to NBDELG.

7.0 Approval of the Undertaking

The following permits, licenses, approvals, and permissions are required for this undertaking:

- Water Supply Source Assessment Initial Application by NBDELG (attached as **Appendix A**).

8.0 Funding

The Proposed project is being funded by the Small Communities Fund (SCF). Contact information for the departments involved in the partnership are presented below:

Village of Fredericton Junction
102 Wilsey Road
Fredericton Junction, NB
E3B 3H4

Community Funding Branch
Province of New Brunswick
Department of Environment and Local Government
P.O. Box 6000
Fredericton, NB
E3B 5H1

9.0 Closure

This report was prepared by Dillon on behalf of the Village of Fredericton Junction. Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Yours truly,

DILLON CONSULTING LIMITED

Mr. Parrish Arnott, P.Geo.
Project Manager

Appendix A

WSSA Initial Application

June 25, 2018

New Brunswick Department of Environment and Local Government
20 McGloin Street, Marysville Place
Fredericton, NB
E3B 5H1

Attention: Ms. Lee Swanson

WSSA Initial Application – Fredericton Junction Water Exploration EIA

Dear Ms. Swanson,

Dillon Consulting Limited (Dillon) was retained by the Village of Fredericton Junction to complete an Environmental Impact Assessment (EIA) including a Water Supply Source Assessment (WSSA) in relation to the Woodstock Water Exploration Program.

This document has been prepared as a means to satisfy the minimum requirements for a WSSA initial application, as per the NBDELG Environmental Impact Assessment WSSA Guidelines (Appendix B).

Name of Proponent

Village of Fredericton Junction
Mrs. Cindy Ogden
Chief Administration Officer
Village of Fredericton Junction
102 Wilsey Road
Fredericton Junction, NB
E3B 3H4
Email: fredjct@nb.aibn.com
Phone: 506-368-2628

Principle Contact Person

Parrish Arnott, P.Geo
Project Manager
Dillon Consulting Limited
1149 Smythe Street, Suite 200
Fredericton, NB
E3B 3H4
Email: parnott@dillon.ca
Phone: 506-444-8820

Location of drill targets

The Village of Fredericton Junction currently has one operational municipal water supply well, approximately 98 feet deep, located on the property owned by Resident No. 2. This water supply well provides potable water to >95% of the residents and businesses on the north side of the Oromocto River. In the fall of 2017, the backup well for the town was found to contain concentrations of E. Coli bacteria. The secondary well has since been shut down and is currently undergoing repairs, causing the main production well to be at risk, not allowing for proper aquifer recharge.

The purpose for the undertaking is to identify an alternate water supply source for the Village of Fredericton Junction within a reasonable distance from the current municipal infrastructure.

Drill Target 1
This option is located adjacent to the Gladstone Curling Rink with the Village limits approximately 100 meters southeast of the Village Office. Proposed location is approximately 80 meters from Sunbury Drive and 70 meters from the North Branch of the Oromocto River, which is outside the 30 meter setback from a designated watercourse and/or wetland. The drill target location is displayed on Figure 2.

Drill Target 2
This option is located within Fredericton Junction Village limits on a vacant parcel of land adjacent to Horseman Road. The proposed location is located approximately 400 meters from the North Branch of the Oromocto River and is outside the 30 meter setback of any designated wetland or watercourse. The approximate location of this drill target is displayed on Figure 3.

Drill Target 3
This option is located within the Fredericton Junction Village limits and is adjacent to the Tri-County Complex on Prides Landing Road. The site is located approximately 350 meters away from the Oromocto River. A designated wetland is in close proximity to the site and the 30 meter buffer zone will be applied and respected in the final well location. The approximate location of this drill target is displayed on Figure 4.

Drill Target 4
This option is located within Fredericton Junction Village limits on a vacant parcel of land adjacent to Sunbury Dr. The proposed location is located approximately 275 meters from the North Branch of the Oromocto River and is outside the 30 meter setback from a designated watercourse and/or wetland. The approximate location of this drill target is displayed on Figure 5.

Required Water Quantity

The Village of Fredericton Junction requires approximately 150 m^3/day.

Alternate Water Supply Sources in Area

The Village of Fredericton Junction is currently installing a UV treatment system into a backup well to relieve the current well until an alternate source has been found.

Hydrogeology as it relates to the project requirements

The approximate location of Drill Target 1 is located adjacent to the Gladstone Curling Club and approximately 70 meters from the Oromocto River and roughly 80 meters from Sunbury Drive on a grassy plain. The general topography and regional groundwater flow direction is assumed to be towards the Oromocto River.

The approximate location of Drill Target 2 is located adjacent to Horseman Road near the bottom of a small hill. The proposed location is located approximately 385 meters from the Oromocto River. The general topography and regional groundwater flow direction is assumed to be towards the Oromocto River.

The approximate location of Drill Target 3 is located within Fredericton Junction Village limits on a vacant parcel of land adjacent to Sunbury Dr. The proposed location is located approximately 280 meters from the North Branch of the Oromocto River. The general topography is relatively flat with regional groundwater flow expected to be towards the Oromocto River.

The approximate location of Drill Target 4 is located adjacent to the Tri-County Complex approximately 320 meters from the Oromocto River. The general topography is relatively flat and the regional groundwater flow direction is assumed to be towards the Oromocto River.

Outline of the proposed hydrogeological testing and work schedule

Test well drilling and hydraulic testing activities will be carried out by a licensed well driller under the supervision of a qualified professional as per the New Brunswick Clean Water Act.

The following describes the work that is to be completed for the drilling of a new water supply well:

- Complete underground utility clearances prior to completing any drilling activities.
- A temporary access ramp may be required to access Drill Target 1. Fill material may be required or a bulldozer to construct the required ramp.
- Install and maintain sediment and erosion control structures where applicable/required over the course of well construction, development and testing.
- Construction of one 150 mm diameter test well at one or more of the drill target locations with 150 mm steel casing. The geology/hydrostratigraphy will be logged by Dillon staff during the drilling process.
- A preliminary yield assessment will be completed using air lift methods following the construction of the test well. Preliminary groundwater samples will be collected should the initial air lift testing indicate desired results.
- If both the preliminary yield assessment and chemistry results are acceptable, a 200 – 250 mm diameter well will be constructed. Aadditional observation wells will be constructed for observation purposes if the site configuration will permit. The 200 – 250 mm well will undergo step-testing (30 - 45 min steps) and a long term pumping test (72 hours) as per the WSSA Guideline. Water levels will be measured in the pumping well as well as additional observation wells. Pressure transducers will be used in addition to manual water level measurements to record water levels in the pumping and observation wells.
- Water samples will be collected at 0, 24, 48 and 72 hours of pumping and submitted to the Research and Productivity Council (RPC) for analysis of general chemistry and trace metals and micro biology.
- The results of the pumping test will be presented in a report as per the New Brunswick WSSA Guidelines.
- The drilling of test/observation wells will be completed during daytime hours.
- Water discharged during the construction, development and testing activities will be managed as necessary to limit erosion and sedimentation.

- Refueling of equipment used during the construction activities will be completed off-site, where possible. Spill management kits will be available throughout construction and testing and authorities will be alerted if necessary.

Potential contamination hazards within 500 m of the proposed drill targets

Drill target 1 is in a residential and developed area and the proposed property is bounded to the north, east, and west by developed properties and to the south by the Oromocto River. A petroleum retail outlet is located 270 meters to the northwest of the target location. No other potential contamination hazards are known to exist within 500 meters of drill target 1.

Drill target 2 is in an undeveloped portion of the Village. A construction depot is located along the Wilsey Road and is within a 500 meter radius of the drill target.

Drill target 3 is located within a residential/commercial area of Fredericton Junction. The Tri-County Complex is located adjacent to the property as well as the Lgion Estates Manor. The Village lagoon is located 220 meters to the southeast. No other sources of potential contamination have been identified within 500 meters of the drill target location.

Drill Target 4 is located within a residential area of Fredericton Junction. This location is located approximately 400 meters west of the petroleum retail outlet in the Village of Fredericton Junction. No other potential sources of contamination have been identified within 500 meters of the drill target location.

Groundwater use problems that have occurred in the area

The current municipal water system for the Village of Fredericton Junction undergoes treatment due to the presence of E.Coli within the water source (localized issue). The current treatment of the water undergoes chlorination and passes through a UV light to eliminate microorganisms. In previous drilling programs, salt water has been intercepted at varying depths originating from ancient sea water. The depth of these ancient sea waters were intercepted at approximately 300 feet. Manganese is a common issue in New Brunswick water sources and could potentially require treatment in a new Village water supply.

Watercourse(s) within 60 m of the proposed drill targets

Drill Target 1 is situated 70 metres away from the Oromocto River, and it is situated 4.20 meters above the elevation of the Oromocto River. It is not expected that flood water would reach the elevation of the drill target area.

Drill Target 2 is located 385 meters away from the Oromocto River and is elevated by 4.26 meters above the Oromocto River. It is not expected that flood water would reach the elevation of the drill target area.

Drill Target 3 is located 275 meters away from the Oromocto River and is elevated 9.63 meters above the Oromocto River. It is not expected that flood water would reach the elevation of the drill target area.

Drill Target 4 is located 320 meters away from the Oromocto River and is elevated by 4.40 meters above the Oromocto River. It is not expected that flood water would reach the elevation of the drill target area.

Site supervisory personnel

Consultant Field Staff

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Site Maps

Site plans showing the proposed well site option locations are attached.

Should you have any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

Parrish Arnott, P.Geo.
Project Manager

PHA:afg

Enclosure(s)

Our file: 18-7534

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