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## 13.0 HYDROGEOLOGY OF SPRINGDALE ADA

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### 13.1 General Description of Area

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#### 13.1.1 Location & Extent

The Springdale ADA is located in along the west side of Notre Dame Bay in north central Newfoundland. The ADA includes five adjacent zones (Zone I to Zone V) covering a combined area of approximately 12,408 hectares. Zones I, II and III are situated at the head of Halls Bay near the community of Springdale, while Zones IV and V are situated approximately 16 km north, at the head of Southwest Arm near the community of King's Point. The boundary of the Springdale ADA is shown on Drawing No. 1034406-13-1 in Appendix 13a.

No communities are present within the boundaries of the ADA.

The main access to Zones I and II of the Springdale ADA is provided by the Trans Canada Highway, and Provincial Highway Route 390 (Springdale Road), which leads northwest to Springdale from the Trans Canada Highway approximately 12 km west of South Brook. Provincial Highway Route 380 branches off the Trans Canada at South Brook and provides access to Zone III, while secondary Highway Route 391 (Harry's Harbour Road) branches off Highway Route 390 approximately 8 km west of Springdale and provides access to Zones IV and V of the ADA. In addition, various graveled roads and ATV trails leading from the Trans Canada and Highway Routes 380, 390 and 391 also provide access to some areas within the ADA.

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#### 13.1.2 Physiography, Topography & Drainage

The Springdale ADA is located along the western margin of the physiographic region referred to as the Northeast Trough. This physiographic region is characterized by lowlands with elevations typically ranging from sea level up to 150 m above sea level, but rises to elevations of up to 300 m above sea level along local ridges, as well as along its western boundary with the adjoining Atlantic Upland Region, and the Topsail Plateau. The Springdale ADA is characterized by undulating to rolling terrain the trends northeast towards the coast. Maximum elevations ranging from approximately 400 – 600 m above sea level are present in the Topsail Plateau area, located approximately 60 km southwest of the Springdale ADA. Coastal areas in the vicinity of the ADA are irregular and incised by long, narrow, bays and inlets, including Southwest Arm and Halls Bay.

The most significant stream and river drainage systems underlie Zones I and II of the Springdale ADA. Zone I of the Springdale ADA encompasses the lower course of the West Brook – Barneys Brook drainage system, and the west and east boundary borders the lower courses of Burnt Berry Brook and South Brook, respectively. Zone II of the Springdale ADA encompasses the lower courses of the Indian Brook and Burnt Berry Brook drainage systems. Zone IV of the ADA encompasses the lower course of the Paddys Brook drainage system. A number of other smaller unnamed watercourses are also present in the ADA in the vicinity of Zones I and IV. No significant stream and river drainage systems are present in the vicinity of Zones III and V of the ADA. Small ponds are scattered throughout the drainage catchment area of the ADA, the most significant of which include South Pond, West Pond, and Gull Pond.

No Public Protected Water Supply Areas (PPWSA) are present within the Springdale ADA. However, the northern boundary of Zone II borders the Springdale – Sullivan’s Pond PPWSA, and the northern boundary of Zone IV borders the King’s Point – Bulley’s Pond PPWSA. In addition the eastern boundary of Zone I borders an unprotected water supply at South Pond.

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### 13.1.3 Climate, Vegetation & Agricultural Land Use

The Springdale ADA is located within the Northshore ecoregion, a long narrow zone about 20 km wide along the northeastern coast of Newfoundland. Within this zone, summers are relatively warmer and drier than other coastal areas in the province, and soil moisture deficiencies may occur. The vegetation season is shorter and cooler than in central Newfoundland, but the frost-free period is several weeks longer. Climate normal data obtained from Environment Canada’s Springdale monitoring station dating back to 1971 indicates a monthly mean temperature in the area of 3.3°C, ranging from a high of 16.5°C in July to a low of -9.3°C in February. Average annual precipitation in the area is 1,000.3 mm, of which 75% falls as rainfall and 25% as snowfall. October is typically the wettest month, and February is typically the driest month (Environment Canada, 2008). In the ADA, there are an average of 1,238 growing degree days (base temperature 5°C) for the year and 1,160 growing degree days for the vegetative season (i.e., May to September).

Vegetation in the vicinity of the Springdale ADA generally consists of continuous forest of black spruce and balsam fir, except where heathland barrens dominate coastal headlands. Local stands of white spruce forests occur within a narrow zone along the coast. In addition, scattered fen and dome and slope bogs occur throughout. Based on agricultural land use information provided by the NL Department of Natural Resources Agrifoods Division, approximately 322 hectares (i.e., 3% of the total landmass of the ADA) is currently utilized for agriculture, with vegetable crop, pasture and fallow land representing the most significant proportion of the ADA’s agricultural land use.

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## 13.2 Geology

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### 13.2.1 Surficial Geology

The surficial geology of the Springdale ADA is summarized in Drawing No. 1034406-13-2 in Appendix 13a, and is based on most recent 1:50,000 scale mapping of the area by Liverman, et al. (2000) and Liverman and Scott (2000), as well as descriptions of surficial geology provided in Kirby, et al. (1997). For the purposes of this study, surficial geological units on existing maps have been simplified into four (4) groups, including exposed bedrock, areas of bog, areas of till and areas of sand and gravel.

Till deposits are present throughout the ADA occurring as both thin discontinuous veneer (typically less than 2 m thick), and more extensive moraine deposits with local thicknesses up to 20 m. The composition of the veneer and moraine tills are variable and bedrock-controlled, but generally consist of a moderately stony, sandy loam derived from granitic intrusive rocks, felsic volcanic and volcanoclastic rocks, and minor siliciclastic sediments. The veneer and moraine tills are locally eroded and dissected, particularly along stream and river channels, and are dissected with numerous meltwater channel scars. In addition, small areas of both hummocky and ridge till are locally present within the ADA, with ridged landforms associated with crag and tail features. Within the ADA, sand and gravel material of glacial outwash and fluvial origin is also widespread, occurring primarily as plain and terrace deposits along major stream and river valleys. The most significant occurrences of sand and gravel are present

along West Brook, Barneys Brook and South Brook in Zone I, Indian Brook in Zone II and Paddys Brook in Zone IV. Local deposits of sand and gravel are also present along a number of other smaller unnamed watercourses present in the ADA. Sand and gravel units shown in Drawing No. 1034406-13-2 in Appendix 13a also include un-subdivided marine terraces that contain various silt and clay deposits in addition to sands and gravels and occur locally within the ADA, particularly along coastal areas at the head of Hall's Bay and Southwest Arm. Along with glacial units, local deposits of organic and peaty soils are scattered throughout the ADA, overlying either till or bedrock. Numerous ridges and knobs of bedrock outcrop are exposed within the till and various other surficial deposits that underlie the ADA, and typically occur as areas of high ground and coastal cliffs. Bedrock outcrops may be partially or fully concealed by a thin mat of vegetation and sparse forest. However, where exposed bedrock outcrops are commonly streamlined and display glacial striations. Streamlined glacial features in the area indicate north to northeastward-directed ice flow. Available well logs indicate an average overburden thickness in the Springdale ADA and surrounding area of approximately 17 m.

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### 13.2.2 Bedrock & Structural Geology

The bedrock geology of the Springdale ADA is summarized in Drawing No. 1034406-13-3 in Appendix 13a, and is based on the regional 1:250,000 scale compilation mapping by Colman-Sadd and Crisby-Whittle (2005), as well as a description of bedrock geology provided in Kean, *et al.* (1995).

The Springdale ADA lies within the Dunnage tectonostratigraphic zone and is underlain by a complex assemblage comprising Cambro-Ordovician subduction zone-related rocks, Silurian through Carboniferous sedimentary and volcanic cover rocks, as well as various Ordovician and Silurian plutonic rocks. The oldest rocks in the area underlie Zones II, IV, and V, and comprise an ophiolitic complex dominated by mafic volcanic and intrusive rocks, as well as related volcanoclastic, sedimentary and ultramafic rocks of the Early to Middle Cambrian Lushs Bight Group. Within Zones II and IV, the Lushs Bight Group is structurally overlain by Early to Middle Ordovician mafic volcanic and volcanoclastic rocks of the Catcher's Pond Group. The majority of Zones I and II is underlain by the Early to Late Silurian Springdale Group, which unconformably overlies the Lushs Bight and Catcher's Pond Groups, and comprises subaerial felsic, intermediate and mafic volcanic and pyroclastic rocks, and fluvial red sandstones and conglomerates. The Early to Late Silurian King's Point Group, interpreted as a correlative of the Springdale group, is in structural contact with the Lushs Bight Group along the northern boundary of Zone IV. Within Zone IV, the Lush Bight Group is unconformably overlain by much younger Carboniferous siliciclastic sedimentary cover rocks. Zone III is underlain by the Early Ordovician Hall Hill – Mansfield mafic plutonic complex, which structurally overlies volcanic and sedimentary rocks of the Middle Ordovician Roberts Arm Group east of the ADA. In addition, rocks within the ADA have been intruded by various Silurian - Devonian plutonic rocks, including the Topsail Igneous Suite, present along the eastern boundary of Zone I.

The rocks that underlie the ADA have undergone a complex structural history and have been subjected to Ordovician pre- to syn-obduction Taconian deformation, as well as Silurian Salinic and Devonian Acadian orogenesis. Rocks in the area are folded into northeast-trending folds with steep limbs, and are cut by major north-northeast-trending and northwest-trending faults; many of which have a thrust component. The most significant structural feature in the area is the Lobster Cove Fault, which runs through Zone II of the ADA and juxtaposes Early to Middle Cambrian Lushs Bight Group against the Silurian Springdale Group.

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## 13.3 Hydrogeology

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### 13.3.1 Hydrostratigraphy

The groundwater potential of the various geological units within the Springdale ADA was assessed utilizing available records for water wells completed within each unit obtained from the NLDEC-Water Resources Management Division Drilled Water Well Database for wells drilled between 1950 and March, 2008. The data provided in the well records are organized by community and includes information on the well depth and yield, well casing depth and diameter, depths to water bearing zone(s), plus data on the quality and use of the water and the driller's description of the depth and lithology of the overburden and bedrock units encountered.

A total of 64 drilled bedrock wells and 52 drilled surficial wells from eight (8) communities in the ADA and surrounding area had adequate well data to evaluate the groundwater potential of various surficial and bedrock strata in the ADA. Since lithologic information provided in the well records was of insufficient detail to define the bedrock encountered in each individual drilled well, the wells were assigned to their respective geologic units based on the community in which the wells were located and the corresponding underlying geologic unit, as shown on the bedrock geology map provided in Drawing No. 1034406-13-3 in Appendix 13a.

The groundwater potential of each geological unit was quantified by assessing the reported well yields and depths from the records of wells completed within each unit. Reported yields for drilled wells in the Springdale ADA and surrounding area is based on airlift testing carried out by the driller at the time of well installation to obtain a rough estimate of well capacity, and does not necessarily represent the short or long term safe yield of the well, or the groundwater yield characteristics of the corresponding aquifer. To accurately determine such values, aquifer testing, including step drawdown and constant rate pump testing must be conducted, ideally with monitoring of groundwater levels in nearby observation wells. No aquifer testing has been carried out on any of the drilled wells in the ADA and surrounding area. Therefore, in the absence of this data, the groundwater potential of the various geological strata in the Springdale ADA is defined based on the estimated well yields obtained from the driller's records.

#### 13.3.1.1 Surficial Hydrostratigraphic Units

The surficial deposits within the Springdale ADA have been subdivided into two broad hydrostratigraphic units, including one comprised of till deposits, and the other predominantly of sands and gravels. The yield and depth characteristics of these units are summarized on Table 13.1. No water well information was available for the till deposits present in the ADA. Therefore groundwater potential within this overburden unit was inferred based on well records for similar overburden material in the St. John's ADA.

##### Till Deposits

Till deposits form both thin veneer and more extensive moraine deposits over much of the ADA and comprises of a moderately stony, sandy loam. There are no documented data on their groundwater potential in the Springdale ADA. However, based on records of water wells within similar till material in the St. John's ADA, the range of yields from wells within the till can be expected to vary from 10 to 70 L/min at depths of 9.5 to 35 m. The average yield is estimated to be approximately 40 L/min at 21 m

depth. However, median yield and depth estimates of 34 L/min at 20 m depth are more likely representative of the typical groundwater potential of this unit.

### Sand and Gravel Deposits

Sand and gravel deposits of glacial outwash and fluvial origin are also widespread within the ADA, occurring primarily as plain and terrace deposits along major stream and river valleys. The most significant occurrences of sand and gravel are present along West Brook, Barneys Brook and South Brook in Zone I, Indian Brook in Zone II and Paddys Brook in Zone IV. Local deposits of sand and gravel are also present along a number of other smaller unnamed watercourses present in the ADA. Marine-derived sand and gravel units also occur locally, particularly along coastal areas at the head of Hall's Bay and Southwest Arm. These deposits are potentially significant groundwater aquifers. Fifty-two (52) wells from the communities of South Brook, Springdale, and Springdale Junction were available to characterize the groundwater potential of this unit in the ADA. Based on well data, the sand and gravel deposits are considered capable of providing wells with moderate to high yields, having water yields ranging from 9 to 683 L/min at well depths of 10 to 149 m, and an average yield of 106 L/min at 25 m depth. However, median yield and depth estimates of 68 L/min at 25 m depth are more likely representative of the typical groundwater potential of this unit.

**Table 13.1 Summary of Overburden Drilled Well Information for Springdale ADA**

Overburden Unit	Communities	No. of Wells	Well Depth (m)		Well Yield (L/min)	
			Mean	Range	Mean	Range
Till*	St. John's ADA	6	21.3 (19.6)	9.5 - 35	39.5 (33.5)	10 - 70
Sand & Gravel	South Brook, Springdale, Springdale Junction	52	24.7 (25.3)	10.4-48.7	105.9 (67.5)	9-683

\* Groundwater yield estimates for the till deposits based on well data from the St. John's ADA

### 13.3.1.2 Bedrock Hydrostratigraphic Units

Well record information is available for the majority of bedrock units located within the Springdale ADA, including the combined Cambrian to Middle Ordovician island-arc and subduction zone-related volcanic and associated sedimentary rocks of the Lushs Bight, Catchers Pond and Roberts Arm groups, as well as the Springdale and Kings Point groups, and the Carboniferous sedimentary cover rocks. The well yield and depth characteristics of these various strata are summarized in Table 13.2.

No water well information was available for the Cambrian to Ordovician mafic intrusive rocks that underlie the majority of Zone III of the ADA, or the areas of Silurian - Devonian granitic rocks that occur within the ADA. Therefore groundwater potential within these units was inferred based on well records for similar lithologies in other areas. The groundwater potential within the Silurian – Devonian granitic rocks was inferred based on well records for wells completed within similar intrusive rocks in the Terra Nova ADA. No hydrogeologic information was available from any of the other ADAs investigated with which to evaluate the groundwater potential of the Cambrian to Ordovician mafic intrusive rocks within the ADA. However, this unit is expected to have low permeability similar to that of the Silurian - Devonian granitic rocks present in the ADA, as well as the granitic rocks used to characterize the groundwater potential of this unit present in the Terra Nova ADA.

### Cambrian to Middle Ordovician Subduction Zone-Related Rocks

A total of 28 well records from the communities of St. Patricks, Coffee Cove, Beachside, and Robert's Arm were used to characterize the groundwater potential of the combined Cambrian to Middle Ordovician island-arc and subduction zone-related volcanic and associated sedimentary rocks of the Lushs Bight, Catchers Pond and Roberts Arm groups. These units underlie portions of Zones II, III, IV, and V of the ADA. Based on well data, the Cambrian to Middle Ordovician subduction zone-related rocks are considered capable of providing wells with low yields, having water yields ranging from 1 to 90 L/min at well depths of 24 to 120 m, and an average yield of 21 L/min at 68 m depth. However, median yield and depth estimates of 12 L/min at 60 m depth are more likely representative of the typical groundwater potential of these units.

### Springdale & Kings Point Groups

A total of 32 well records from the communities of Springdale and Springdale Junction were used to characterize the groundwater potential of the Springdale and King's Point groups in the ADA. These units underlie portions of Zones I, II and IV of the ADA. Based on well data, the Springdale and King's Point groups strata are considered capable of providing wells with low yields, having water yields ranging from 0.25 to 137 L/min at well depths of 11 to 140 m, and an average yield of 24 L/min at 56 m depth. However, median yield and depth estimates of 9 L/min at 49 m depth are more likely representative of the typical groundwater potential of these units.

### Carboniferous Sedimentary Cover Rocks

A total of four (4) well records from the community of Kings Point were used to characterize the groundwater potential of the Carboniferous sedimentary cover rocks. This unit underlies a portion of Zone IV of the ADA. Based on well data, the Carboniferous sedimentary cover rocks strata are considered capable of providing wells with low yields, having water yields ranging from 2 to 7 L/min at well depths of 44 to 93 m, and an average yield of 5 L/min at 71 m depth. However, median yield and depth estimates of 5 L/min at 73 m depth are more likely representative of the typical groundwater potential of this unit.

### Silurian - Devonian Granite and Cambrian to Ordovician Mafic Intrusive Rocks

No documented data is available for the groundwater potential of the Silurian - Devonian granitic rocks and Cambrian to Ordovician mafic intrusive rocks (Hall Hill – Mansfield mafic plutonic complex) that occur locally within the ADA. However, based on records from two (2) water wells within granitic rocks in the Terra Nova ADA, these units are considered capable of providing wells with low yields, reporting yields of 18 L/min at 73 m depth, and 20 L/min at 13 m depth, respectively.

**Table 13.2 Summary of Bedrock Drilled Well Information for Springdale ADA**

Rock Group	Rock Type	Communitie s	No. of Wells	Well Depth (m)		Well Yield (L/min)	
				Mean (Median)	Range	Mean (Median)	Range
Lushs Bight Catchers Pond Roberts Arm	Subduction zone-related volcanic and sedimentary rocks	St. Patricks Coffee Cove Beachside Robert's Arm	28	67.9 (59.9)	24-120	20.7 (11.5)	1-90.9
Springdale Kings Point	Subaerial, bimodal volcanic and pyroclastic rocks, sedimentary rocks and granite	Springdale Springdale Junction	32	56 (48.8)	10.8-140	23.7 (9)	0.25-137
Carboniferous Sedimentary Cover Rocks	Conglomerate, sandstone, shale, siltstone and minor limestone	King's Point	4	70.9 (73.5)	44.2-92.6	4.5 (4.5)	2-6.8
Granitic and Mafic Intrusive Rocks*	Granitic intrusions, including unseparated mafic intrusive rocks	Terra Nova ADA	2	-	13.4, 73.2	-	18, 20

\*Groundwater yield estimates for granitic and mafic intrusive rocks based on well data from the Terra Nova ADA

### 13.3.2 Groundwater Flow System

The Springdale ADA and surrounding area is underlain by an unconfined aquifer system contained within the overburden material and underlying shallow bedrock. The movement of groundwater through the overburden material is controlled by primary porosity, while groundwater flow within the underlying bedrock can be expected to mainly occur within secondary openings, such as fractures and joints, and will be variable depending on the frequency and interconnection of these structural features.

Shallow groundwater flow within the ADA is controlled by water table conditions and local variations in topography. Groundwater is thought to be recharging along areas of high ground and discharging in various wet lowland areas, ponds, lakes and rivers, as well as along the coast. It is expected that the shallow groundwater system in the ADA will be largely controlled by surface runoff and local recharge, while at moderate depths the flow system may be influenced by lateral inflow of groundwater from up-gradient areas located southwest of the ADA. Based on a review of water well records for the area, groundwater levels are generally assumed to be within 10 m of the ground surface and to be a subdued reflection of the topography.

## 13.4 Water Quality

### 13.4.1 Surface Water Quality

Surface water quality data for the Springdale ADA was obtained from two sources, including:

1. Ambient water quality data collected as part of the Canada–Newfoundland Water Quality Monitoring Agreement, from one (1) water quality monitoring sites in the ADA and surrounding area –
  - Indian Brook (NF02YM0001, 1986-2007)

2. Water quality monitoring data collected by the NL Department of Environment - Water Resources Management Division from three (3) protected public surface water supplies in the ADA and surrounding area -

- South Brook - South Brook (WS-S-0668, 2000-2004);
- Springdale - Sullivan's Pond (WS-S-0676, 1987-2007); and,
- Kings Point - Bulley's Pond (WS-S-0388, 1988-2006).

A summary of chemical data obtained from these surface water sources over their respective monitoring periods is provided in Tables 13.3 and 13.4.5 in Appendix 13b, and is compared to the Canadian Drinking Water Quality Guidelines (CDWQG) (Health Canada, 2007), as well as the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (CWQG-AWU) (October, 2005).

Based on major ion chemistry, surface water in the ADA and surrounding area can be classified as a combination of calcium-sodium-bicarbonate-chloride-sulfate ( $\text{Ca-Na-HCO}_3\text{-Cl-SO}_4$ ), calcium-sodium-chloride-sulfate-bicarbonate ( $\text{Ca-Na-Cl-SO}_4\text{-HCO}_3$ ), and sodium-calcium-chloride-sulfate-bicarbonate ( $\text{Na-Ca-Cl-SO}_4\text{-HCO}_3$ ) type waters. Surface water in the area is soft to slightly hard, neutral to slightly acidic, and of low to moderate alkalinity. Classification of surface water according to dissolved-solids and specific conductance indicates fresh conditions.

With the exception of iron and turbidity at the Indian Brook ambient water quality monitoring station, and iron, pH, turbidity and color in several of the public water supplies, concentrations of all other parameters tested meet CDWQG. The guidelines for iron, pH, turbidity and color are aesthetic objectives only and levels of these parameters detected at the surface water locations evaluated do not pose any health concerns, however problems may be experienced such as foul taste, deposition or staining in the case of iron, pH, turbidity and color and corrosion in the case of pH.

Concentrations of all parameters tested at the surface water sites meet CCME CWQG-AWU for irrigation and/or livestock water use.

Based on chemical data, surface water quality within the ADA is generally considered good to excellent, returning average Canadian Water Quality Index (CWQI) values ranging from 90 to 100. However, a negative Langelier Index at all the public surface water supplies indicates that water is unsaturated with calcium carbonate and it will tend to be corrosive, leading to potential leaks in the distribution system. Indian Brook is not considered a potable water source, and would require treatment for disinfection and to improve the aesthetic quality of the water.

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### 13.4.2 Groundwater Quality

The groundwater quality data for the Springdale ADA consists of analyses from two (2) private drilled wells from the community of Springdale, as well as one (1) protected public supply drilled well for the community of Springdale (WS-G-0677) collected by the NL Department of Environment - Water Resources Management Division. A summary of chemical data obtained from these water wells is provided in Tables 13.5 and 13.6 in Appendix 13b, and is compared to the Canadian Drinking Water Quality Guidelines (CDWQG) (Health Canada, 2007), as well as the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (CWQG-AWU) (October, 2005).



Based on major ion chemistry, shallow groundwater in the ADA can be classified as both sodium-calcium-chloride-sulfate-bicarbonate (Na-Ca-Cl-SO<sub>4</sub>-HCO<sub>3</sub>) and calcium-sodium-bicarbonate-chloride-sulfate (Ca-Na-HCO<sub>3</sub>-Cl-SO<sub>4</sub>) type waters. Groundwater in the area ranges from moderately hard to hard, slightly acidic to neutral to slightly basic, and of moderate alkalinity. Classification of groundwater according to dissolved-solids and specific conductance indicates fresh conditions.

With the exception of manganese and pH in some of the private wells and turbidity in the Springdale protected public groundwater supply well, concentrations of all other parameters tested meet CDWQG. The guidelines for manganese, pH and turbidity are aesthetic objectives only and levels of these parameters detected in the wells do not pose any health concerns, however problems may be experienced such as foul taste, deposition or staining in the case of manganese and turbidity, and corrosion in the case of pH.

Concentrations of all parameters tested in groundwater in the drilled wells meet CCME CWQG-AWU for irrigation and/or livestock water use.

Based on chemical data, groundwater quality within the ADA is generally considered excellent, returning average Canadian Water Quality Index (CWQI) value of 100 in the Springdale protected public groundwater supply well. However, a negative Langelier Index indicates that water is unsaturated with calcium carbonate and it will tend to be corrosive, leading to potential leaks in the distribution system. Treatment would be required to improve the aesthetic quality of the groundwater in the water wells.

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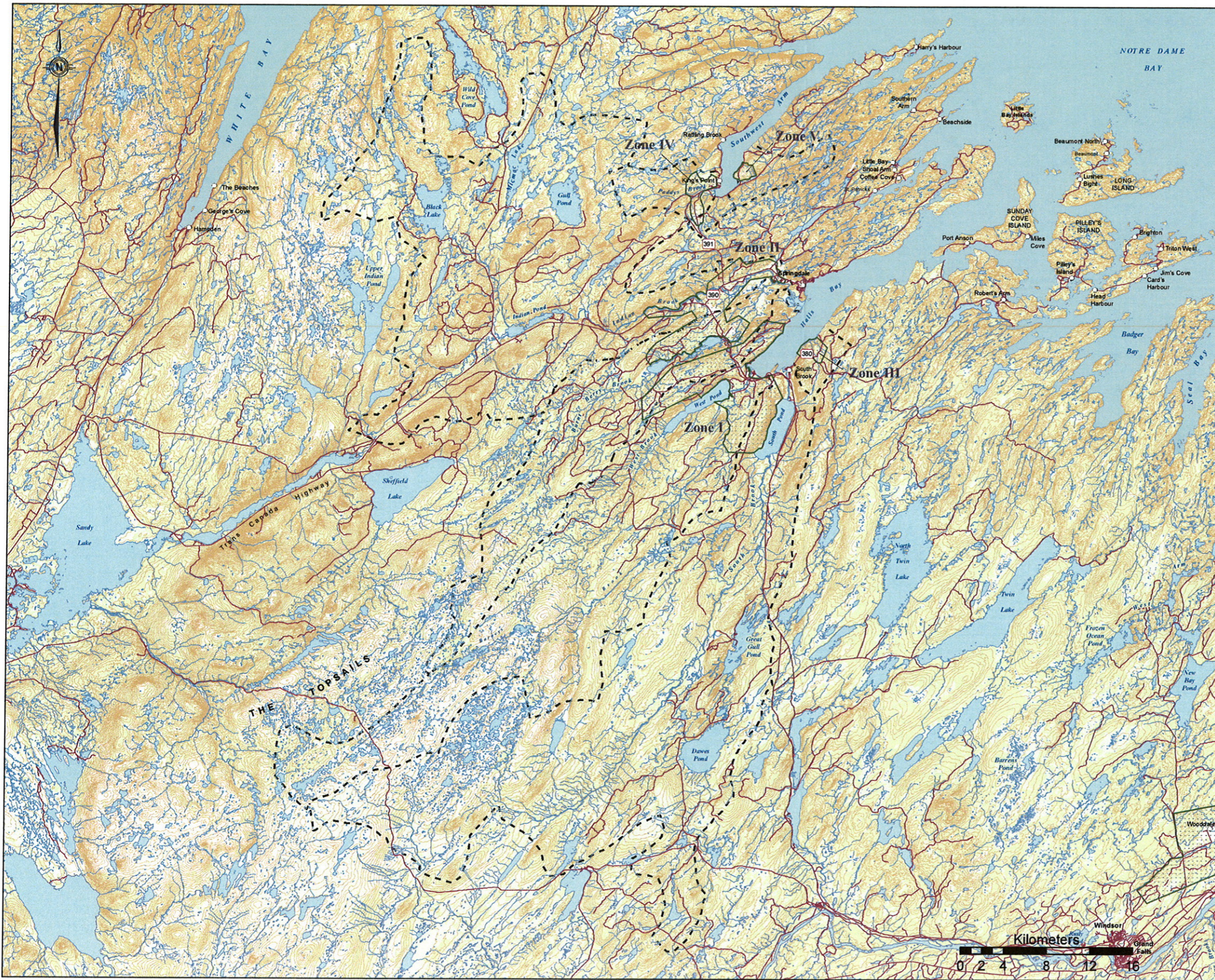
### 13.5 Groundwater Recharge & Availability

Recharge to the shallow groundwater system underlying the ADA is by direct infiltration of rainfall, after runoff and the requirements of evaporation and plant transpiration have been met, and is directly related to rainfall, infiltration characteristics and size of the recharge zone. A common practice in estimating the long term groundwater recharge for an area is to multiply the groundwater catchment area by the percent of precipitation estimated as able to infiltrate. The recharge to groundwater in the Springdale ADA is estimated on the basis of a local groundwater catchment area equivalent to the area of the ADA of approximately 12,408 hectares, and a conservative recharge coefficient of 10% of the mean annual rainfall (i.e., 10% of 1,000 mm, equivalent to 100 mm). Based on these values, the groundwater recharge to the Springdale ADA is estimated at  $1.2 \times 10^7 \text{ m}^3/\text{year}$  or  $1,000 \text{ m}^3/\text{hectares}/\text{yr}$ .

Groundwater use in the ADA is currently limited to minor domestic, municipal, commercial and industrial wells. No information is available regarding existing agricultural (i.e., irrigation and livestock) water demands in the Springdale ADA, thus preventing an accurate balance of groundwater supply and demand to be estimated, and making it difficult to evaluate groundwater supply potential for future agricultural development in the area. However, considering the current, overall under-utilization of groundwater in the area from other users, it is expected that an adequate supply of groundwater of sufficient quality is available to meet and/or augment water supply requirements for various existing and future agricultural needs in the ADA.

# APPENDIX 13a

Drawings



- Transportation Route
- Drainage Catchment Area
- Contour Line
- Waterbody
- Agricultural Development Area
- Wetland/String Bog
- Vegetated Area

PROJECT TITLE:

**HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR**

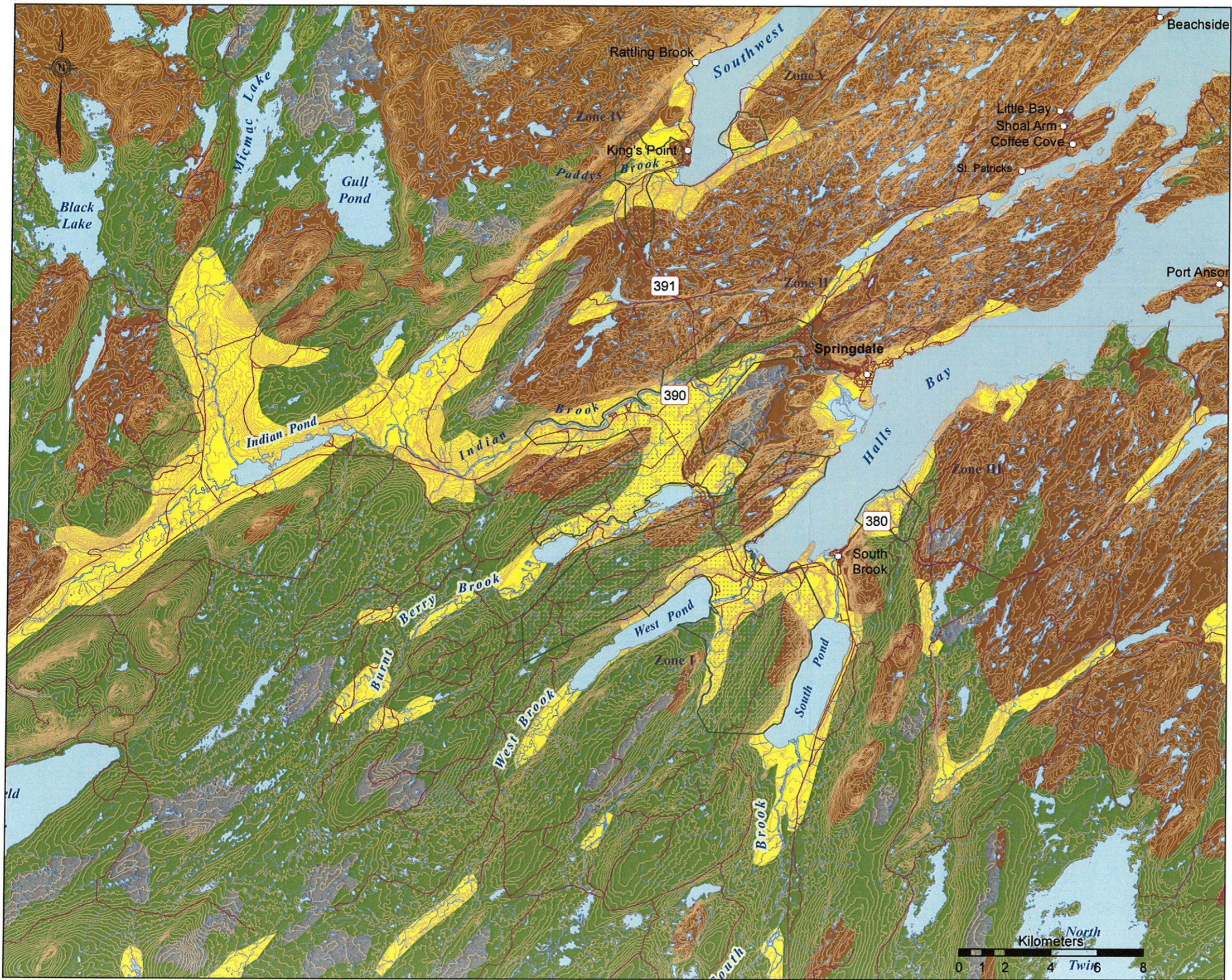
DRAWING TITLE:

**SPRINGDALE ADA LOCATION AND DRAINAGE**

**Jacques Whitford**

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DRAWN BY:	JLB	CHECKED BY:	
EDITED BY:	JLB	REV. No.:	0
DRAWING No.:	1034406-13-1		
MAP FILE:	1034406-XX.MXD		





**Surficial Geology Legend**

- Bog: Poorly drained accumulations of peat, peat moss and other organic matter; developed in areas of poor drainage
- Sand & Gravel: Sands, gravels and silts of glaciofluvial, fluvial, lacustrine or marine terrace origin
- Glacial Till: Till veneer and moraine deposits of varying thickness overlying bedrock. Composed of diamicton (poorly sorted sediment containing a mixture of grain sizes from clay to boulders)
- Rock: Exposed Bedrock, includes areas concealed by vegetation, till veneer, as well as colluvium

- Stream
- Waterbody
- Transportation Route
- Agricultural Development Area
- Contour Line

PROJECT TITLE:

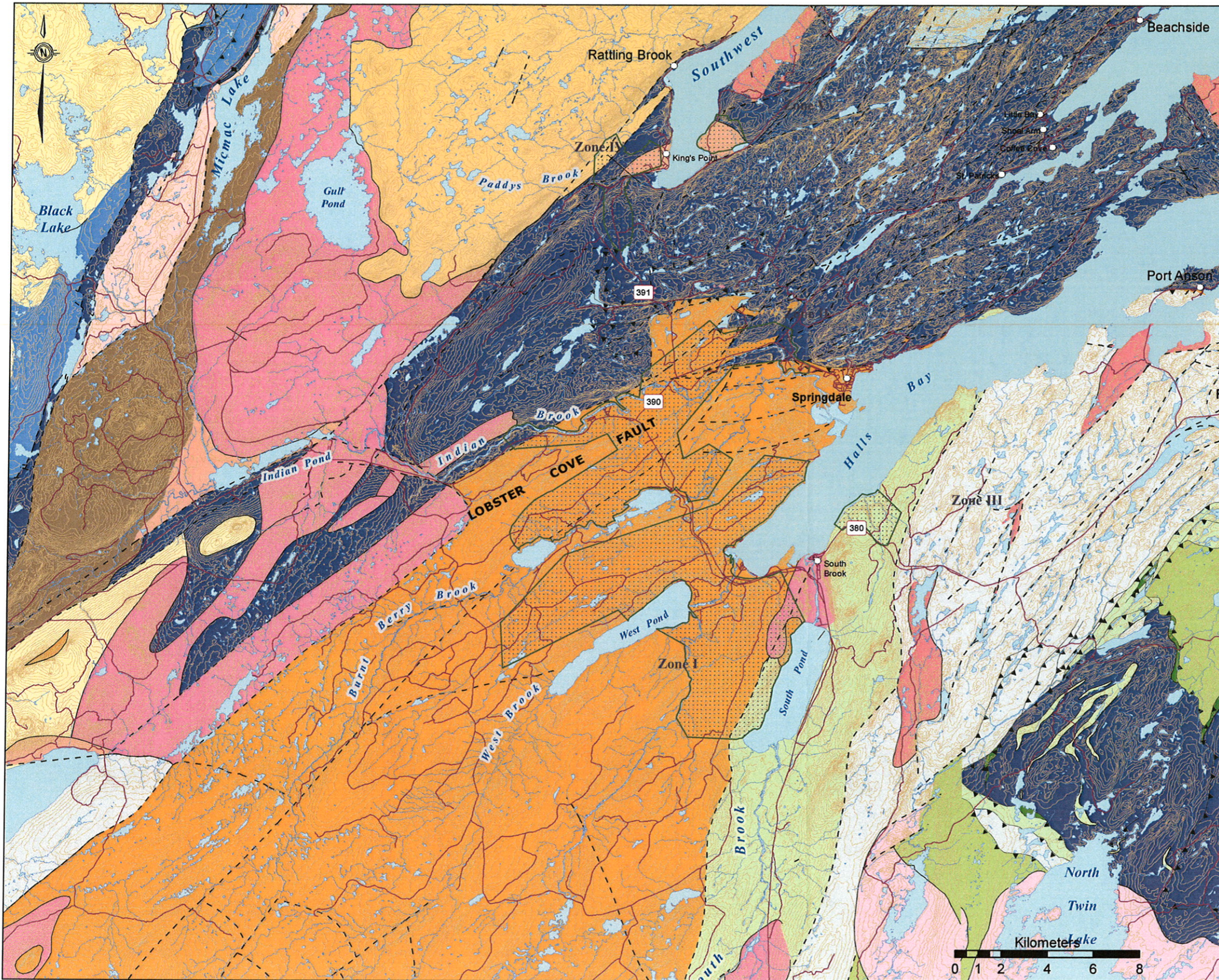
**HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR**

DRAWING TITLE:

**SPRINGDALE ADA SURFICIAL GEOLOGY**

**Jacques Whitford**

	SCALE: 1:250,000	DATE: 03/06/2008
	DRAWN BY: JLB	CHECKED BY:
	EDITED BY: MCH	REV. No.: 0
	DRAWING No.: 1034406-13-2	
	MAP FILE: 1034406-XX.MXD	



- Generalized Bedrock Geology Legend**
- Post Ordovician Units**
- Overlap Sequences**
- Carboniferous**
- Red and grey conglomerate, sandstone, shale, siltstone and minor limestone
- Early to Late Silurian**
- Subaerial felsic, intermediate and mafic volcanic and pyroclastic rocks; fluvialite red sandstone, conglomerate and shale (Springdale Group)
  - Felsic volcanic and sub-volcanic rocks and granite (King's Point Complex)
  - Felsic pyroclastic rocks; mafic to intermediate volcanics; and granite (Sheffield Lake Complex)
  - Felsic volcanic and volcanoclastic rocks, sandstone, conglomerate, and mafic volcanic (Micmac Lake Group)
  - Mafic and felsic volcanic and volcanoclastic rocks, slate and boulder conglomerate (Flatwater Pond Group)
- Intrusive Rocks**
- Silurian to Devonian**
- Posttectonic granitoid suites and minor unseparated volcanic rocks
- Humber Zone (Shelf and Related Rocks)**
- Undifferentiated
- Dunnage Zone (Notre Dame Subzone)**
- Cambrian to Middle Ordovician**
- Marine siliciclastic sedimentary rocks, including slate, shale, argillite, siltstone, sandstone, conglomerate, and minor unseparated carbonate, volcanic and intrusive rocks, and schist, gneiss and migmatite (Cutwell Group)
  - Submarine mafic, intermediate and felsic volcanic rocks, including mafic volcanic rocks of ophiolite complexes; includes unseparated intrusive, sedimentary and metamorphic rocks (Lushs Bight Group, Roberts Arm Group, Catchers Pond Group, Advocate complex)
- Intrusive and Other Plutonic Rocks**
- Cambrian to Ordovician**
- Granitoid intrusions, including trondhjemite of ophiolite complexes
  - Mafic intrusions, including unseparated granitoid rocks and ultramafic rocks of ophiolite complexes
- Dunnage Zone (Exploits Subzone)**
- Undifferentiated

- Fault, Strike-Slip and High Angle
- Contact
- ▲ Fault, Thrust
- Transportation Route
- Contour Line
- Stream
- Waterbody
- Agricultural Development Area

PROJECT TITLE:

**HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR**

DRAWING TITLE:

**SPRINGDALE ADA BEDROCK GEOLOGY**

**Jacques Whitford**

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# APPENDIX 13b

Water Chemistry Data

**Table 13.3 Surface Water Chemistry, NL Ambient Water Quality Monitoring Sites, Springdale ADA Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador**

Parameter	Units	CDWQG	CWQG-AWU		Indian Brook NF02YM0001 (1986-2007) <sup>1</sup>		
			Irrigation Water	Livestock Water	Min	Max	Mean
Alkalinity	mg/L CaCO <sub>3</sub>	na	na	na	0.8	18.7	10.1
Aluminum	mg/L	na	5	5	0.05	0.2	0.13
Ammonia	mg/L	na	na	na	-	-	-
Antimony	mg/L	0.006	na	na	0.000008	0.00002	0.00001
Arsenic	mg/L	0.01	0.1	0.025	0.0002	0.0006	0.0002
Barium	mg/L	1	na	na	0.004	0.01	0.005
Beryllium	mg/L	na	0.1	0.1	0.00001	0.05	0.005
Bicarbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-
Boron	mg/L	5	0.5 - 6	5	0.0004	0.0029	0.0023
Bromide	mg/L	na	na	na	-	-	-
Cadmium	mg/L	0.005	0.005	0.08	0.000001	0.0001	0.00001
Calcium	mg/L	na	na	na	-	-	-
Carbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-
Chloride	mg/L	250*	100 - 700	na	2.22	17.8	2.75
Chromium	mg/L	0.05	na	na	0.0003	0.001	0.0005
Copper	mg/L	1*	0.2 - 1	0.5-5	0.0002	0.0009	0.0004
Dissolved Organic Carbon	mg/L	na	na	na	-	-	-
Fluoride	mg/L	1.5	1	1 - 2	-	-	-
Hardness	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-
Iron	mg/L	0.3*	5	na	0.10	0.33	0.19
Kjeldahl Nitrogen	mg/L	na	na	na	-	-	-
Langelier Index	-	na	na	na	-	-	-
Lead	mg/L	0.01	0.2	0.1	0.00002	0.0004	0.0001
Magnesium	mg/L	na	na	na	-	-	-
Manganese	mg/L	0.05*	0.2	na	0.01	0.04	0.02
Mercury	mg/L	0.001	na	0.003	0.00001	0.00001	0.00001
Nickel	mg/L	na	0.2	1	0.0009	0.0027	0.002
Nitrate	mg/L N	45	na	na	-	-	-
Nitrate + Nitrite	mg/L N	na	na	100	-	-	-
Nitrite	mg/L	na	na	10	-	-	-
Orthophosphate	mg/L P	na	na	na	-	-	-
pH	Units	6.5-8.5*	na	na	6.64	7.42	6.93
Potassium	mg/L	na	na	na	-	-	-
Reactive Silica	mg/L SiO <sub>2</sub>	na	na	na	1	7.2	1
Selenium	mg/L	0.01	0.02 - 0.05	0.05	0.0001	0.0001	0.0001
Silver	mg/L	na	na	na	0.000001	0.0001	0.00002
Sodium	mg/L	200*	na	na	-	-	-
Specific Conductance	uS/cm	na	na	na	24.5	86.9	41.6
Sulphate	mg/L	500*	na	1,000	0.78	1.26	0.85
Sulphide	mg/L H <sub>2</sub> S	0.05*	na	na	-	-	-
Thallium	mg/L	na	na	na	0.000001	0.00002	0.000005
Tin	mg/L	na	na	na	-	-	-
Total Dissolved Solids	mg/L	500*	500 - 3,500	3,000	-	-	-
Total Organic Carbon	mg/L	na	na	na	-	-	-
Total Phosphorus	mg/L	na	na	na	-	-	-
Total Suspended Solids	mg/L	na	na	na	-	-	-
True Color	TCU	15*	na	na	-	-	-
Turbidity	NTU	0.3/1.0/0.1**	na	na	0.53	2.48	1.09
Uranium	mg/L	0.02	0.01	0.2	0.00007	0.0002	0.00009
Vanadium	mg/L	na	0.1	0.1	0.0002	0.0004	0.0002
Canadian Water Quality Index	-	-	-	-	-	-	94.19
Zinc	mg/L	5*	1 - 5	50	0.0005	0.00	0.001

**Notes:**

CDWQG = Health Canada Canadian Drinking Water Quality Guidelines (March, 2007)

CWQG-AWU = CCME Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Irrigation and Livestock Water) (October, 2005)

1 = Summary statistics calculated using chemical data obtained from the NL Ambient Water Quality Database available through the Canada and Newfoundland/Labrador Aqua Link (CANAL) website.

na = No applicable criteria

\* = Aesthetic objective

\*\* = Operational guideline value based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

"-" = Not analyzed

Shaded = Value does not meet applicable criteria

Bolded = Value does not meet CWQG-AWU for irrigation and/or livestock water

**Table 13.4 Surface Water Chemistry, Public Water Supply, Springdale ADA  
Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador**

Parameter	Units	CDWQG	CWQG-AWU		South Brook - South Brook WS-S-0668 (2000-2004) <sup>1</sup>			Springdale - Sullivan's Pond WS-S-0676 (1987-2007) <sup>1</sup>			Kings Point - Bulley's Pond WS-S-0388 (1988-2006) <sup>1</sup>		
			Irrigation Water	Livestock Water	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Alkalinity	mg/L CaCO <sub>3</sub>	na	na	na	8	46	27	13.4	22	17.2	0	11	4
Aluminum	mg/L	na	5	5	0.03	0.88	0.21	0.01	0.36	0.06	0.08	0.72	0.21
Ammonia	mg/L	na	na	na	0.01	0.05	0.03	0	0.05	0.01	0	0.044	0.018
Antimony	mg/L	0.006	na	na	0	0.0005	0.0003	0	0.0005	0.0002	0	0.0005	0.0003
Arsenic	mg/L	0.01	0.1	0.025	0	0.005	0.001	0	0.005	0.001	0	0.003	0.001
Barium	mg/L	1	na	na	0	0.03	0.007	0	0.025	0.006	0	0.005	0.003
Beryllium	mg/L	na	0.1	0.1	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-	-	-	-	-	-	-
Boron	mg/L	5	0.5 - 6	5	0	0.03	0.02	0	0.03	0.01	0	0.03	0.02
Bromide	mg/L	na	na	na	0	0.03	0.02	0	0.03	0.02	0	0.03	0.02
Cadmium	mg/L	0.005	0.005	0.08	0	0.001	0.0004	0	0.001	0.0004	0	0.0005	0.0002
Calcium	mg/L	na	na	na	1	16	8.86	3.86	10	5.57	0.46	2	1.18
Carbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-	-	-	-	-	-	-
Chloride	mg/L	250*	100 - 700	na	2	17	9	2	4	2	1	5	2
Chromium	mg/L	0.05	na	na	0	0.005	0.002	0	0.005	0.002	0	0.0025	0.00085
Copper	mg/L	1*	0.2 - 1	0.5-5	0	0.005	0.003	0.001	0.01	0.003	0	0.005	0.002
Dissolved Organic Carbon	mg/L	na	na	na	0.3	6.60	2.49	1.4	5.6	3.3	2.6	10.6	6.0
Fluoride	mg/L	1.5	1	1 - 2	0	0.12	0.04	0	0.05	0.02	0	0.1	0.05
Hardness	mg/L CaCO <sub>3</sub>	na	na	na	3	52	23	10	29	17	0.5	5	3
Iron	mg/L	0.3*	5	na	0.01	0.10	0.04	0.005	0.11	0.04	0.08	0.31	0.18
Kjeldahl Nitrogen	mg/L	na	na	na	0.025	0.27	0.14	0.1	0.41	0.21	0.07	0.46	0.19
Langelier Index	-	na	na	na	-2.31	-1.04	-1.89	-3.6	-0.13	-2.07	-7.62	-4.28	-5.65
Lead	mg/L	0.01	0.2	0.1	0	0	0	0	0.001	0.001	0	0.001	0.0008
Magnesium	mg/L	na	na	na	0	3	2	0	1.2	0.9	0	0.5	0.3
Manganese	mg/L	0.05*	0.2	na	0	0.02	0.01	0	0.03	0.01	0.003	0.03	0.012
Mercury	mg/L	0.001	na	0.003	0	0.0005	0.0002	0	0.0005	0.0002	0	0.00005	0.00003
Nickel	mg/L	na	0.2	1	0	0.005	0.003	0	0.005	0.003	0	0.005	0.002
Nitrate	mg/L N	45	na	na	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L N	na	na	100	0	0.42	0.22	0	0.07	0.02	0	0.13	0.03
Nitrite	mg/L	na	na	10	-	-	-	-	-	-	-	-	-
Orthophosphate	mg/L P	na	na	na	-	-	-	-	-	-	-	-	-
pH	Units	6.5-8.5*	na	na	6.2	7.3	6.9	6.5	7.4	7.0	5.4	6.6	6.1
Potassium	mg/L	na	na	na	0	0.69	0.42	0	0.5	0.2	0	0.5	0.3
Reactive Silica	mg/L SiO <sub>2</sub>	na	na	na	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.01	0.02 - 0.05	0.05	0	0.005	0.001	0	0.005	0.001	0	0.001	0.001
Silver	mg/L	na	na	na	-	-	-	-	-	-	-	-	-
Sodium	mg/L	200*	na	na	0	11	6	0	2	2	0	2	1
Specific Conductance	uS/cm	na	na	na	23	158	93	34.3	53.5	46.2	11.1	32	17.7
Sulphate	mg/L	500*	na	1,000	3	8	4	0	4	2	1	4	2
Sulphide	mg/L H <sub>2</sub> S	0.05*	na	na	-	-	-	-	-	-	-	-	-
Thallium	mg/L	na	na	na	-	-	-	-	-	-	-	-	-
Tin	mg/L	na	na	na	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	500*	500 - 3,500	3,000	15	96	58	20	39	30	8	30	16
Total Organic Carbon	mg/L	na	na	na	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	na	na	na	0.005	0.05	0.01	0	0.01	0.004	0.003	0.02	0.007
Total Suspended Solids	mg/L	na	na	na	1	1	1	1	2	1	1	2	2
True Color	TCU	15*	na	na	1	56	19	5	27	15	30	68	48
Turbidity	NTU	0.3/1.0/0.1**	na	na	0.04	0.60	0.28	0.08	1.2	0.4	0.21	1.5	0.62
Uranium	mg/L	0.02	0.01	0.2	0	0	0	0	0	0	0	0	0
Vanadium	mg/L	na	0.1	0.1	-	-	-	-	-	-	-	-	-
Canadian Water	-	-	-	-	97	100	98.2	95	100	97.4	90	93	92
Zinc	mg/L	5*	1 - 5	50	0	0.005	0.004	0	0.005	0.004	0	0.08	0.01

**Notes:**

CDWQG = Health Canada Canadian Drinking Water Quality Guidelines (March, 2007)

CWQG-AWU = CCME Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Irrigation and Livestock Water) (October, 2005)

1 = Summary statistics calculated using chemical data obtained from the NL Department of Environment - Water Resources Management Division Drinking Water Quality Database.

na = No applicable criteria

\* = Aesthetic objective

\*\* = Operational guideline value based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

\*\*- = Not analyzed

Shaded = Value does not meet applicable criteria

Bolded = Value does not meet CWQG-AWU for irrigation and/or livestock water



**Table 13.5 Groundwater Chemistry, Private Drilled Wells, Springdale ADA  
Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador**

Parameter	Units	CDWQG	CWQG-AWU		Community <sup>1</sup> Springdale	
			Irrigation Water	Livestock Water	14254	10311
Alkalinity	mg/L CaCO <sub>3</sub>	na	na	na	45.9	69.4
Aluminum	mg/L	na	5	5	-	-
Ammonia	mg/L	na	na	na	-	-
Antimony	mg/L	0.006	na	na	-	-
Arsenic	mg/L	0.01	0.1	0.025	-	-
Barium	mg/L	1	na	na	-	-
Beryllium	mg/L	na	0.1	0.1	-	-
Bicarbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-
Boron	mg/L	5	0.5 - 6	5	-	-
Bromide	mg/L	na	na	na	-	-
Cadmium	mg/L	0.005	0.005	0.08	-	-
Calcium	mg/L	na	na	na	20	27
Carbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-
Chloride	mg/L	250*	100 - 700	na	19	<b>130</b>
Chromium	mg/L	0.05	na	na	-	-
Copper	mg/L	1*	0.2 - 1	0.5-5	-	-
Dissolved Organic Carbon	mg/L	na	na	na	-	-
Fluoride	mg/L	1.5	1	1 - 2	0.07	0.07
Hardness	mg/L CaCO <sub>3</sub>	na	na	na	68.9	90.9
Iron	mg/L	0.3*	5	na	0.03	0.12
Kjeldahl Nitrogen	mg/L	na	na	na	-	-
Langelier Index	-	na	na	na	-	-
Lead	mg/L	0.01	0.2	0.1	-	-
Magnesium	mg/L	na	na	na	4.6	5.7
Manganese	mg/L	0.05*	0.2	na	0.005	<b>0.054</b>
Mercury	mg/L	0.001	na	0.003	-	-
Nickel	mg/L	na	0.2	1	-	-
Nitrate	mg/L N	45	na	na	-	-
Nitrate + Nitrite	mg/L N	na	na	100	0.004	0.45
Nitrite	mg/L	na	na	10	0.001	-
Orthophosphate	mg/L P	na	na	na	-	-
pH	Units	6.5-8.5*	na	na	6.36	-
Potassium	mg/L	na	na	na	0.36	1.4
Reactive Silica	mg/L SiO <sub>2</sub>	na	na	na	-	-
Selenium	mg/L	0.01	0.02 - 0.05	0.05	-	-
Silver	mg/L	na	na	na	-	-
Sodium	mg/L	200*	na	na	7	86
Specific Conductance	uS/cm	na	na	na	186.6	-
Sulphate	mg/L	500*	na	1,000	3.5	7
Sulphide	mg/L H <sub>2</sub> S	0.05*	na	na	-	-
Thallium	mg/L	na	na	na	-	-
Tin	mg/L	na	na	na	-	-
Total Dissolved Solids	mg/L	500*	500 - 3,500	3,000	246	308
Total Organic Carbon	mg/L	na	na	na	-	-
Total Phosphorus	mg/L	na	na	na	0.04	0.03
Total Suspended Solids	mg/L	na	na	na	-	-
True Color	TCU	15*	na	na	-	-
Turbidity	NTU	0.3/1.0/0.1**	na	na	-	-
Uranium	mg/L	0.02	0.01	0.2	-	-
Vanadium	mg/L	na	0.1	0.1	-	-
Zinc	mg/L	5*	1 - 5	50	0.005	0.01

**Notes:**

CDWQG = Health Canada Canadian Drinking Water Quality Guidelines (March, 2007)

CWQG-AWU = CCME Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Irrigation and Livestock Water) (October, 2005)

1 = Chemical data obtained from the NL Department of Environment - Water Resources Management Division Drinking Water Quality Database

na = No applicable criteria

\* = Aesthetic objective

\*\* = Operational guideline value based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

"-" = Not analyzed

Shaded = Value does not meet applicable criteria

Bolded = Value does not meet CWQG-AWU for irrigation and/or livestock water

**Table 13.6 Groundwater Chemistry, Protected Public Drilled Wells, Springdale ADA Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador**

Parameter	Units	CDWQG	CWQG-AWU		Springdale (Industrial Park) WS-G-0677 (2003-2006) <sup>1</sup>		
			Irrigation Water	Livestock Water	Min	Max	Mean
Alkalinity	mg/L CaCO <sub>3</sub>	na	na	na	90	107	95
Aluminum	mg/L	na	5	5	0	0.17	0.03
Ammonia	mg/L	na	na	na	0	0.03	0.01
Antimony	mg/L	0.006	na	na	0	0.0005	0.0002
Arsenic	mg/L	0.01	0.1	0.025	0.001	0.002	0.002
Barium	mg/L	1	na	na	0.01	0.02	0.01
Beryllium	mg/L	na	0.1	0.1	-	-	-
Bicarbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-
Boron	mg/L	5	0.5 - 6	5	0.01	0.03	0.02
Bromide	mg/L	na	na	na	0	0.03	0.01
Cadmium	mg/L	0.005	0.005	0.08	0	0.00005	0.00002
Calcium	mg/L	na	na	na	31	39	34
Carbonate	mg/L CaCO <sub>3</sub>	na	na	na	-	-	-
Chloride	mg/L	250*	100 - 700	na	21	32	25
Chromium	mg/L	0.05	na	na	0	0.002	0.0009
Copper	mg/L	1*	0.2 - 1	0.5-5	0	0.013	0.003
Dissolved Organic Carbon	mg/L	na	na	na	0	0.6	0.2
Fluoride	mg/L	1.5	1	1 - 2	0	0.15	0.11
Hardness	mg/L CaCO <sub>3</sub>	na	na	na	94	122	105
Iron	mg/L	0.3*	5	na	0	0.02	0.01
Kjeldahl Nitrogen	mg/L	na	na	na	0	0.49	0.12
Langelier Index	-	na	na	na	-0.72	-0.13	-0.47
Lead	mg/L	0.01	0.2	0.1	0	0.004	0.001
Magnesium	mg/L	na	na	na	4	6	5
Manganese	mg/L	0.05*	0.2	na	0	0.012	0.003
Mercury	mg/L	0.001	na	0.003	0	0.00005	0.00002
Nickel	mg/L	na	0.2	1	0	0.003	0.001
Nitrate	mg/L N	45	na	na	-	-	-
Nitrate + Nitrite	mg/L N	na	na	100	0.21	0.46	0.31
Nitrite	mg/L	na	na	10	-	-	-
Orthophosphate	mg/L P	na	na	na	-	-	-
pH	Units	6.5-8.5*	na	na	7.1	7.9	7.6
Potassium	mg/L	na	na	na	0	1	0.4
Reactive Silica	mg/L SiO <sub>2</sub>	na	na	na	-	-	-
Selenium	mg/L	0.01	0.02 - 0.05	0.05	0	0.001	0.0003
Silver	mg/L	na	na	na	-	-	-
Sodium	mg/L	200*	na	na	11	18	13
Specific Conductance	uS/cm	na	na	na	248	315	273
Sulphate	mg/L	500*	na	1,000	6	9	7
Sulphide	mg/L H <sub>2</sub> S	0.05*	na	na	-	-	-
Thallium	mg/L	na	na	na	-	-	-
Tin	mg/L	na	na	na	-	-	-
Total Dissolved Solids	mg/L	500*	500 - 3,500	3,000	161	205	177
Total Organic Carbon	mg/L	na	na	na	-	-	-
Total Phosphorus	mg/L	na	na	na	0.03	0.07	0.05
Total Suspended Solids	mg/L	na	na	na	-	-	-
True Color	TCU	15*	na	na	0	1	0.3
Turbidity	NTU	0.3/1.0/0.1**	na	na	0	1.1	0.3
Uranium	mg/L	0.02	0.01	0.2	0	0	0
Vanadium	mg/L	na	0.1	0.1	-	-	-
Water Quality Index (WQI)	-	-	-	-	100	100	100
Zinc	mg/L	5*	1 - 5	50	0	0.02	0.01

**Notes:**

CDWQG = Health Canada Canadian Drinking Water Quality Guidelines (March, 2007)

CWQG-AWU = CCME Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Irrigation and Livestock Water) (October, 2005)

1 = Chemical data obtained from the NL Department of Environment - Water Resources Management Division Drinking Water Quality Database. Note in the data base, prior to March 31, 2004 analytical results less than detection limit were reported as half of the detection limit, while after March 31, 2004 analytical results less than the detection limit were reported as zero.

na = No applicable criteria

\* = Aesthetic objective

\*\* = Operational guideline value based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

-" = Not analyzed

Shaded = Value does not meet applicable criteria

Bolded = Value does not meet CWQG-AWU for irrigation and/or livestock water