
9.0 HYDROGEOLOGY OF TERRA NOVA ADA

9.1 General Description of Area

9.1.1 Location & Extent

The Terra Nova ADA is located along the western boundary of Terra Nova National Park in eastern Newfoundland, and encompasses the community of Terra Nova. The ADA includes two adjacent zones (Zone I and Zone II) covering a combined area of approximately 550 hectares. The boundary of the Terra Nova ADA is shown on Drawing No. 1034406-9-1 in Appendix 9a.

The main access to the Terra Nova ADA is provided by Provincial Highway Route 301 (Terra Nova Road), which starts at the Trans-Canada Highway (Route 1) approximately 10 km north of the Charlottetown and leads west to Terra Nova, where it branches into a network of roads through the community. In addition, various graveled roads and ATV trails leading from Highway Route 301 also provide access to some areas within the ADA.

9.1.2 Physiography, Topography & Drainage

The Terra Nova ADA is located on the northeast margin of a broad upland region in the interior of the province referred to as the Central Plateau. This physiographic region is characterized by gentle relief and elevations exceeding 150 m above sea level. The Terra Nova ADA is situated at the transition zone between the Central Plateau and the adjacent lowlands of the Northeast trough and is characterized by undulating to hummocky terrain, and elevations ranging from approximately 100 to 200 m above sea level. Maximum elevations of up to 375 m above sea level are present in the Mount Sylvester area, located approximately 60 km southwest of the Terra Nova ADA.

The Terra Nova ADA borders the Terra Nova River and Lake system along its northwest boundary, and encompasses the lower courses of several small tributary systems, the most significant of which is the Pitts Pond System located in the vicinity of Zone I of the Terra Nova ADA. The headwaters of these stream and pond systems are local and originate in a narrow ridge of high ground located approximately 8 km southeast of the ADA that separates surface drainage between Terra Nova River in the north and Dunphy's Pond in the south. No Public Protected Water Supply Areas are present within the drainage catchment areas of the Terra Nova ADA.

9.1.3 Climate, Vegetation & Agricultural Land Use

The Terra Nova ADA is located within the Central Newfoundland Ecoregion, which is the second largest ecoregion, covering approximately one-third of the central and northeastern portion of the island. The Terra Nova ADA is located within the Northcentral Subregion, and is characterized by higher summer maximum temperatures, lower rainfall and higher fire frequency than anywhere else in Newfoundland. Climate data obtained from Environment Canada's Terra Nova National Park monitoring station dating back to 1971 indicates a monthly mean temperature in the area of 4.4°C, ranging from a high of 16.1°C in August to a low of -7.2°C in February. Average annual precipitation in the area is 1,184 mm, of which 74% falls as rainfall and 26% as snowfall. December is typically the

wettest month, and April is typically the driest month (Environment Canada, 2008). In the ADA, there are an average of 1,295 growing degree days (base temperature 5°C) for the year and 1,190 growing degree days for the vegetative season (i.e., May to September).

Vegetation in the vicinity of the Terra Nova ADA consists of sparsely forested heath and moss barrens broken by large areas of patterned fens and sloping bogs. Patches of well developed Black Spruce and Balsam Fir forest occur primarily in protected valleys and on some hilltops and steep slopes. Based on agricultural land use information provided by the NL Department of Natural Resources Agrifoods Division, approximately 55 hectares (i.e., 10% of the total landmass of the ADA) is currently utilized for agriculture, with forage and sod land representing the most significant proportion of the ADA's agricultural land use.

9.2 Geology

9.2.1 Surficial Geology

The surficial geology of the Terra Nova ADA is summarized in Drawing No. 1034406-9-2 in Appendix 9a, and is based on regional scale compilation by Liverman and Taylor (1990), as well as descriptions of surficial geology provided by Heringa and Woodrow (1991), and Batterson and Taylor (2001). 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.

The majority of the ADA is underlain by thick deposits of glacial outwash and fluvial sand and gravel that occur within the Terra Nova River valley as a relatively flat flood plain, with local areas of undulating raised terraces, and remnant eskers. The glaciofluvial deposits are locally eroded and dissected, and marked by meltwater channel scars and kettle holes. A stony glacial till derived from granites, shale, siltstone and sandstone, and forming both thin discontinuous veneer (typically less than 2 m thick), and more extensive moraine deposits with local thicknesses up to 20 m border the glaciofluvial sand and gravel deposits at higher elevations along the south side of the Terra Nova River Valley. In addition, areas of lineated till are locally present south of the ADA and are associated with crag and tail and flute features. Along with glacial units, deposits of organic and peaty soils are common in the vicinity of ADA, overlying either till or bedrock. The most significant area of bog occurs along a ridge of high ground south of Zone II of the ADA. Local ridges and knobs of bedrock outcrop are exposed within the till and various other surficial deposits in the vicinity of the ADA, and typically occur as areas of high ground. Bedrock outcrops may be partially or fully concealed by thin mat vegetation and sparse forest. However, where exposed bedrock outcrops are commonly streamlined and display glacial striations. Streamlined glacial features in the area indicate dominantly eastward-directed ice flow. Available well logs indicate an average overburden thickness in the Terra Nova ADA and surrounding area of approximately 20 m.

9.2.2 Bedrock & Structural Geology

The bedrock geology of the Terra Nova ADA is summarized in Drawing No. 1034406-9-3 in Appendix 9a, and is based on the regional 1:1,000,000 scale compilation mapping by Colman-Sadd, *et al.*, (1990), as well as descriptions of bedrock geology provided in O'Brien and King (2005).

The Terra Nova ADA lies within the Avalon tectonostratigraphic zone, and is mainly underlain by Devonian granitic plutonic rocks. Along the western boundary of the ADA, the Devonian granitic

plutonic rocks are in intrusive contact with bimodal submarine to subaerial volcanic rocks, as well as minor volcanoclastic and sedimentary rocks of the Love Cove Group.

No significant structural features are present in the vicinity of the Terra Nova ADA.

9.3 Hydrogeology

9.3.1 Hydrostratigraphy

The groundwater potential of the various geological units within the Terra Nova 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 two (2) drilled bedrock wells and 42 drilled surficial wells from the community of Terra Nova 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. 1034406-9-3 in Appendix 9a.

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 Terra Nova ADA 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 ADAs and surrounding areas. Therefore, in the absence of this data, the groundwater potential of the various geological strata in the Terra Nova ADA is defined based on the estimated well yields obtained from the driller's records.

9.3.1.1 Surficial Hydrostratigraphic Units

The surficial deposits within the Terra Nova 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 9.1. 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

A stony glacial till derived from granites, shale, siltstone and sandstone, and forming both thin discontinuous veneer (typically less than 2 m thick), and more extensive moraine deposits is locally

present at higher elevations along the south side of the Terra Nova River Valley. There are no documented data on their groundwater potential in the Terra Nova 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 underlie the majority of the ADA. These deposits are potentially significant groundwater aquifers. Forty-two (42) wells from the community of Terra Nova 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 2 to 225 L/min at well depths of 8 to 45 m, and an average yield of 67 L/min at 21 m depth. However, median yield and depth estimates of 48 L/min at 18 m depth are more likely representative of the typical groundwater potential of this unit.

Table 9.1 Summary of Overburden Drilled Well Information for Terra Nova ADA

Overburden Unit	Communities	No. of Wells	Well Depth (m)		Well Yield (L/min)	
			Mean (Median)	Range	Mean (Median)	Range
Till*	St. John's ADA	6	21.3 (19.6)	9.5 - 35	39.5 (33.5)	10 - 70
Sand & Gravel	Terra Nova	42	20.6 (18.3)	7.6 – 45.1	67 (48)	2 - 225

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

9.3.1.2 Bedrock Hydrostratigraphic Units

Well record information is available for the Devonian granitic rocks present in the ADA. The well yield and depth characteristics of this unit is summarized in Table 9.2.

No water well information was available for the bimodal volcanic rocks and sedimentary rocks of the Love Cove Group, present along the western boundary of Zone I of the ADA. Therefore groundwater potential within this unit is inferred based on well records for similar lithologies in the Lethbridge, Winter Brook and Musgravetown ADAs and surrounding areas.

Love Cove Group

No documented data is available for the groundwater potential of the Love Cove Group rocks that occur along the western boundary of Zone I of the ADA. However, based on well data from the Lethbridge, Winter Brook and Musgravetown ADAs, the Love Cove Group strata are considered capable of providing wells with low yields, having water yields ranging from 0.6 to 135 L/min at well depths of 18 to 125 m, and an average yield of 17 L/min at 62 m depth. However, median yield and depth estimates of 4 L/min at 58 m depth are more likely representative of the typical groundwater potential of this unit.

Devonian Granite

A total of two (2) well records from the community of Terra Nova were used to characterize the groundwater potential of the Devonian granitic rocks. This unit underlies the majority of the ADA. Based on the two well records, the Devonian granitic rocks 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 9.2 Summary of Bedrock Drilled Well Information for Terra Nova ADA

Rock Group	Rock Type	Communities	No. of Wells	Well Depth (m)		Well Yield (L/min)	
				Mean (Median)	Range	Mean (Median)	Range
Love Cove	Submarine to subaerial volcanic rocks, incl. siliciclastic sedimentary rocks	Lethbridge, Winter Bk & Musgravetown ADAs	47	62.1 (57.9)	18-125	16.9 (4)	0.6-135
Devonian Granite	Granite and other granitoid intrusions that are posttectonic relative to mid-Paleozoic orogenies	Terra Nova	2	-	13.4, 73.2		18, 20

*Groundwater yield estimates for Love Cove rocks based on well data from the Lethbridge, Winter Brook and Musgravetown ADAs

9.3.2 Groundwater Flow System

The Terra Nova ADA and surrounding areas are 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 ADAs is controlled by water table conditions and local variations in topography. Groundwater is thought to be recharging along the topographic highs and discharging along the Terra Nova River and Lake system. 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 to the southwest. Based on a review of water well records for the area, groundwater levels are generally assumed to be within 5 m of the ground surface and to be a subdued reflection of the topography.

9.4 Water Quality

9.4.1 Surface Water Quality

Surface water quality data for the Terra Nova ADA is limited to ambient water quality data collected as part of the Canada–Newfoundland Water Quality Monitoring Agreement from the Terra Nova River water quality monitoring site (NF02YS0001) over the monitoring period from 1986 to 2007.

A summary of chemical data obtained from this surface water source over its monitoring period is provided in Tables 9.3 in Appendix 9b, 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 calcium-sodium-chloride-sulfate-bicarbonate (Ca-Na-Cl-SO₄-HCO₃) type water. Surface water in the area is slightly acidic. Classification of surface water according to dissolved-solids and specific conductance indicates fresh conditions.

With the exception of antimony, iron, manganese, pH, and turbidity, concentrations of all other parameters tested meet CDWQG. The guidelines for iron, manganese, pH, and turbidity 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, manganese, and turbidity, and corrosion in the case of pH.

In addition, surface water at the Terra Nova River monitoring station had a maximum concentration of manganese over its monitoring period that exceeds CCME CWQG-AWU for irrigation water use.

Insufficient monitoring data was available to determine Canadian Water Quality Index (CWQI) values for surface water in the ADA. However, available chemical data indicates that surface water in the ADA and surrounding area is generally of good quality. However, Terra Nova River is not considered a potable water source, and would require treatment for disinfection, as well as to improve the aesthetic quality of the water and to reduce antimony levels in areas where it exceeds CDWQG. In addition, a maximum concentration of manganese that exceeds CCME CWQG-AWU was present at the Terra Nova River monitoring station over the monitoring period, and may limit usage of this surface water source as a potential agricultural water supply without appropriate treatment.

9.4.2 Groundwater Quality

The groundwater quality data for the ADAs consists of two (2) private drilled wells from the community of Terra Nova collected by the NL Department of Environment - Water Resources Management Division. A summary of chemical data obtained from these water wells is provided in Table 9.4 in Appendix 9b, 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 a calcium-sodium-bicarbonate-chloride-sulfate (Ca-Na-HCO₃-Cl-SO₄) type water. Groundwater in the area ranges from soft to slightly hard, slightly acidic to slightly basic, and of low alkalinity. Classification of groundwater according to dissolved-solids and specific conductance indicates fresh conditions.

With the exception of iron, manganese, pH and turbidity concentrations in some of the wells, concentrations of all other parameters tested meet CDWQG. The guidelines for iron, 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 iron, manganese, and turbidity, and corrosion in the case of pH.

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

Insufficient monitoring data was available to determine Canadian Water Quality Index (CWQI) values for groundwater in the ADA. However, available chemical data indicates that groundwater in the ADA and surrounding area is generally of good quality. Treatment would be required to improve the aesthetic quality of the water.

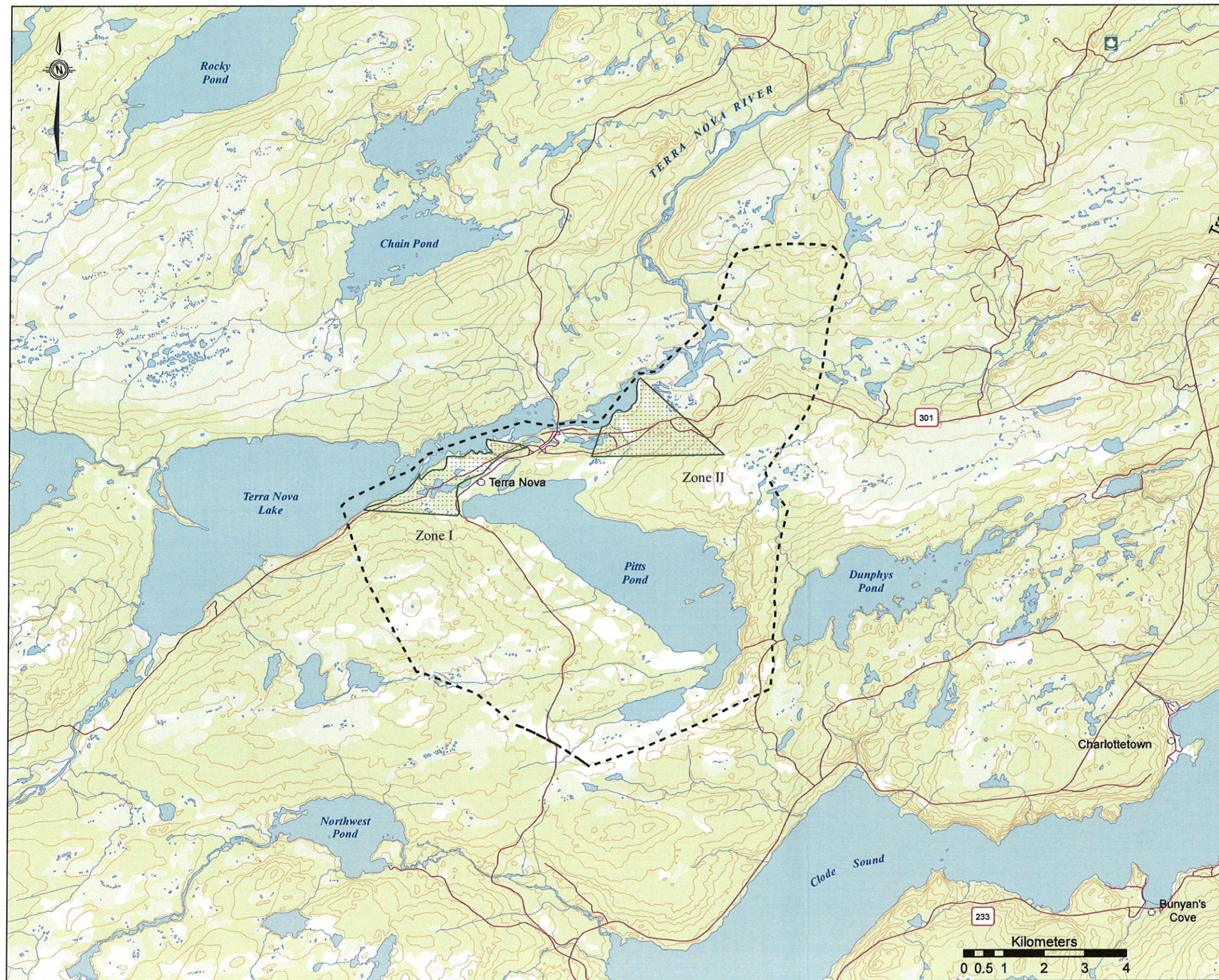
9.5 Groundwater Recharge & Availability

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 Terra Nova ADA is estimated on the basis of a local groundwater catchment area equivalent to the area of the ADA of approximately 550 hectares, and a conservative recharge coefficient of 10% of the mean annual rainfall (i.e., 10% of 1,184 mm, equivalent to 118 mm). Based on these values, the groundwater recharge to the Terra Nova ADA is estimated at $6.5 \times 10^5 \text{ m}^3/\text{year}$ or $1,184 \text{ m}^3/\text{hectares}/\text{yr}$.

Groundwater use in the area is currently limited to minor individual domestic, commercial, industrial and public supply wells. No information is available regarding existing agricultural (i.e., irrigation and livestock) water demands in the Terra Nova 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 9a

Drawings



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

PROJECT TITLE:

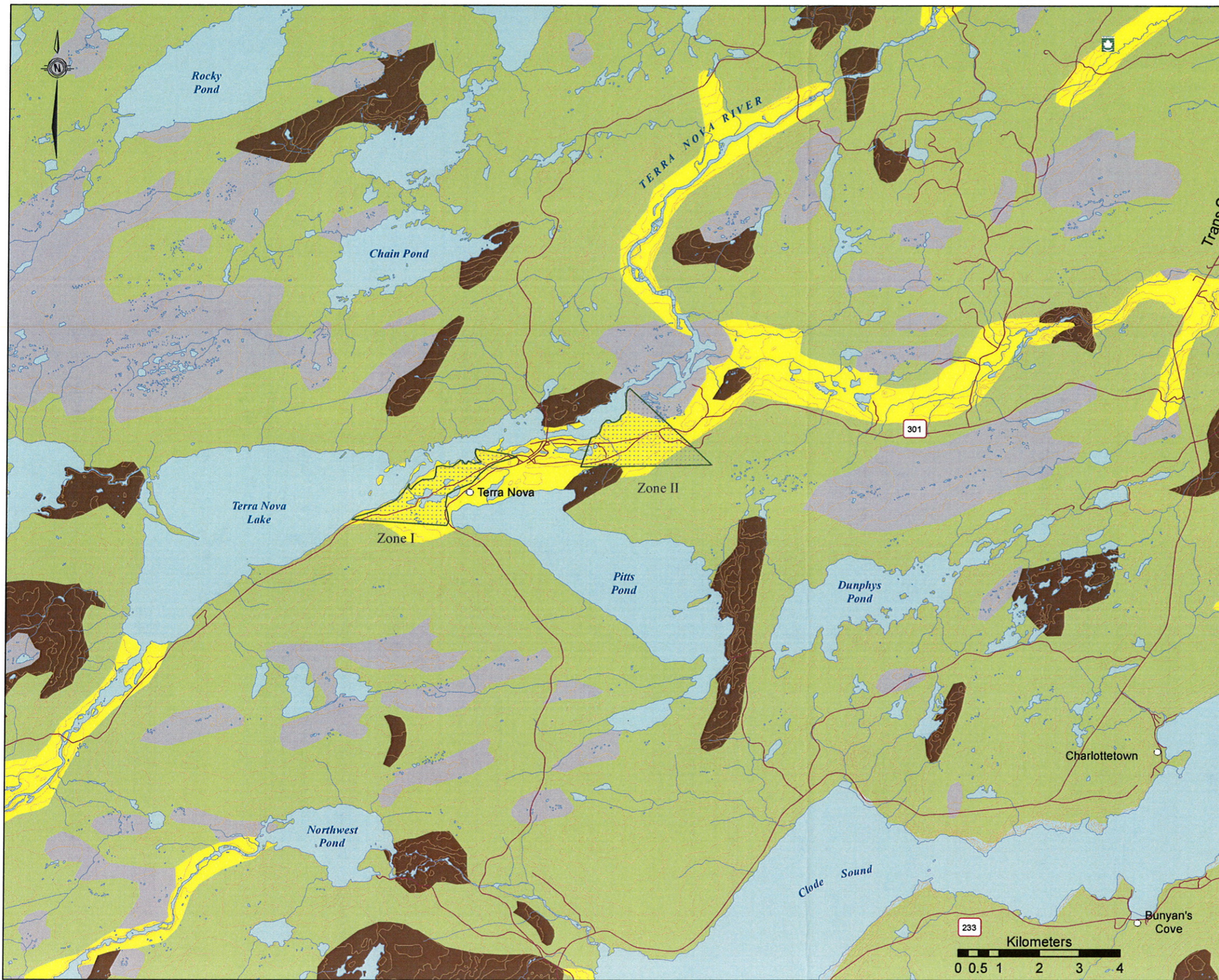
HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR

DRAWING TITLE:





TERRA NOVA ADA LOCATION AND DRAINAGE






Jacques Whitford

	SCALE: 1:100,000	DATE: 11/03/2008
	DRAWN BY: JLB	CHECKED BY:
	EDITED BY: JLB	REV. NO. 0
	DRAWING No.: 1034406-9-1	
	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

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



PROJECT TITLE:

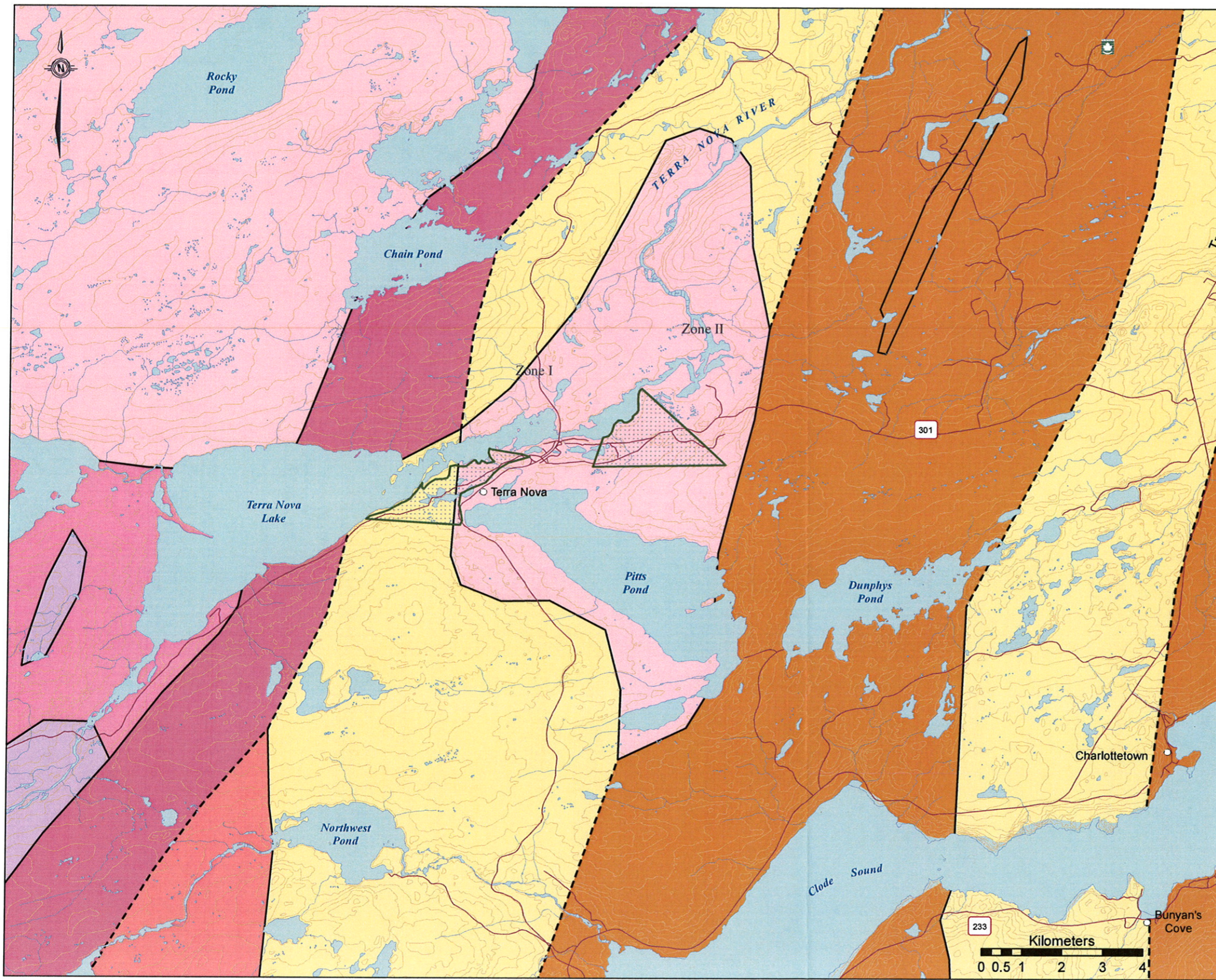
HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR

DRAWING TITLE:

TERRA NOVA ADA SURFICIAL GEOLOGY

Jacques Whitford

	SCALE: 1:100,000	DATE: 11/03/2008
	DRAWN BY: JLB	CHECKED BY: 
	EDITED BY: JLB	REV. No. 0
	DRAWING No.: 1034406-9-2	
	MAP FILE: 1034406-XX.MXD	



- Generalized Bedrock Geology Legend**
- POST-ORDOVIAN INTRUSIVE ROCKS**
- Devonian and Carboniferous**
- Granite and high silica granite (sensu stricto), and other granitoid intrusions that are posttectonic relative to mid-Paleozoic orogenies
- Silurian and Devonian**
- Gabbro and diorite intrusions, including minor ultramafic phases.
- GANDER ZONE**
- Stratified Rocks**
- Cambrian(?) and Ordovician**
- Quartzite, psammite, semipelite and pelite, including minor black slate, conglomerate, limestone, mafic and felsic volcanic rocks, and unseparated migmatitic rocks
 - Migmatitic schist, gneiss, and minor amphibolite, derived in whole, or in part from Cambrian(?) and Ordovician protoliths
- AVALON ZONE**
- Stratified Rocks**
- Precambrian to Early Ordovician**
- Shallow marine, mainly fine grained, siliciclastic sedimentary rocks, including minor unseparated limestone and volcanic rocks (Adeyton and Harcourt groups)
- Precambrian**
- Fluvialite and shallow marine siliciclastic sedimentary rocks, and minor bimodal volcanic rocks (Musgravetown Group)
 - Sandstone and shale turbidites, including minor unseparated tillite, olistostromes and volcanic rocks (Conception Group)
 - Bimodal, submarine to subaerial volcanic rocks, including minor siliciclastic sedimentary rocks (Love Cove Group)
- Intrusive Rocks**
- Neoproterozoic to Cambrian**
- Mafic intrusions
 - Granitoid intrusions, including unseparated mafic phases

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

PROJECT TITLE:

HYDROGEOLOGY OF AGRICULTURAL DEVELOPMENT AREAS, NEWFOUNDLAND AND LABRADOR

DRAWING TITLE:

TERRA NOVA ADA BEDROCK GEOLOGY

SCALE:	1:100,000	DATE:	11/03/2008
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EDITED BY:	JLB	REV. No.:	0
DRAWING No.:	1034406-9-3		
MAP FILE:	1034406-XX.MXD		



APPENDIX 9b

Water Chemistry Data

Table 9.3 Surface Water Chemistry, NL Ambient Water Quality Monitoring Sites, Terra Nova ADA Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador

Parameter	Units	CDWQG	CWQG-AWU		Terranova River@Terranova NF02YS0001 (1986-2007) ¹		
			Irrigation Water	Livestock Water	Min	Max	Mean
Alkalinity	mg/L CaCO ₃	na	na	na	-	-	-
Aluminum	mg/L	na	5	5	0.06	0.33	0.11
Ammonia	mg/L	na	na	na	-	-	-
Antimony	mg/L	0.006	na	na	0.002	0.056	0.016
Arsenic	mg/L	0.01	0.1	0.025	0.0001	0.0006	0.0002
Barium	mg/L	1	na	na	0.001	0.06	0.002
Beryllium	mg/L	na	0.1	0.1	0.05	0.06	0.05
Bicarbonate	mg/L CaCO ₃	na	na	na	-	-	-
Boron	mg/L	5	0.5 - 6	5	0.001	0.003	0.002
Bromide	mg/L	na	na	na	-	-	-
Cadmium	mg/L	0.005	0.005	0.08	0.000003	0.0004	0.0001
Calcium	mg/L	na	na	na	0.92	1.36	1.13
Carbonate	mg/L CaCO ₃	na	na	na	-	-	-
Chloride	mg/L	250*	100 - 700	na	1.90	7.97	2.69
Chromium	mg/L	0.05	na	na	0.0001	0.002	0.0004
Copper	mg/L	1*	0.2 - 1	0.5-5	0.0001	0.0096	0.0008
Dissolved Organic Carbon	mg/L	na	na	na	-	-	-
Fluoride	mg/L	1.5	1	1 - 2	-	-	-
Hardness	mg/L CaCO ₃	na	na	na	-	-	-
Iron	mg/L	0.3*	5	na	0.07	3.23	0.24
Kjeldahl Nitrogen	mg/L	na	na	na	-	-	-
Langelier Index	-	na	na	na	-	-	-
Lead	mg/L	0.01	0.2	0.1	0.00004	0.003	0.0005
Magnesium	mg/L	na	na	na	0.35	0.49	0.39
Manganese	mg/L	0.05*	0.2	na	0.007	0.28	0.03
Mercury	mg/L	0.001	na	0.003	0.00001	0.00002	0.00001
Nickel	mg/L	na	0.2	1	0.0000	0.004	0.0003
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	5.67	6.89	6.21
Potassium	mg/L	na	na	na	0.13	0.22	0.18
Reactive Silica	mg/L SiO ₂	na	na	na	0.40	2.58	1.63
Selenium	mg/L	0.01	0.02 - 0.05	0.05	0.0001	0.0002	0.0001
Silver	mg/L	na	na	na	0.000001	0.000064	0.000009
Sodium	mg/L	200*	na	na	1.10	1.68	1.43
Specific Conductance	uS/cm	na	na	na	13.9	711.0	26.3
Sulphate	mg/L	500*	na	1,000	0.65	1.43	0.82
Sulphide	mg/L H ₂ S	0.05*	na	na	-	-	-
Thallium	mg/L	na	na	na	0.000001	0.00002	0.000004
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	0.15	4	0.54
Uranium	mg/L	0.02	0.01	0.2	-	-	-
Vanadium	mg/L	na	0.1	0.1	0.0001	0.0009	0.0002
Canadian Water Quality Index (CWQI)	-	-	-	-	-	-	-
Zinc	mg/L	5*	1 - 5	50	0.0003	0.04	0.002

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 9.4 Groundwater Chemistry, Private Drilled Wells, Terra Nova ADA
Hydrogeology of Agricultural Development Areas, Newfoundland & Labrador**

Parameter	Units	CDWQG	CWQG-AWU		Community ¹	
			Irrigation	Livestock	Terranova	
					16591	18142
Alkalinity	mg/L CaCO ₃	na	na	na	42.2	15.5
Aluminium	mg/L	na	5	5	-	0.05
Ammonia	mg/L	na	na	na	0.02	0.01
Antimony	mg/L	0.006	na	na	-	0.01
Arsenic	mg/L	0.01	0.1	0.025	-	0.01
Barium	mg/L	1	na	na	-	0.5
Beryllium	mg/L	na	0.1	0.1	-	-
Bicarbonate	mg/L CaCO ₃	na	na	na	-	-
Boron	mg/L	5	0.5 - 6	5	-	0.1
Bromide	mg/L	na	na	na	-	-
Cadmium	mg/L	0.005	0.005	0.08	-	0.0005
Calcium	mg/L	na	na	na	8.6	4.2
Carbonate	mg/L CaCO ₃	na	na	na	-	-
Chloride	mg/L	250*	100 - 700	na	4	3.4
Chromium	mg/L	0.05	na	na	-	0.005
Copper	mg/L	1*	0.2 - 1	0.5-5	0.005	0.02
Dissolved Organic Carbon	mg/L	na	na	na	-	-
Fluoride	mg/L	1.5	1	1 - 2	0.39	0.07
Hardness	mg/L CaCO ₃	na	na	na	30.2	13.3
Iron	mg/L	0.3*	5	na	0.71	2.15
Kjeldahl Nitrogen	mg/L	na	na	na	-	-
Langelier Index	-	na	na	na	-	-
Lead	mg/L	0.01	0.2	0.1	-	0.001
Magnesium	mg/L	na	na	na	2.13	0.68
Manganese	mg/L	0.05*	0.2	na	0.06	0.03
Mercury	mg/L	0.001	na	0.003	-	-
Nickel	mg/L	na	0.2	1	-	0.005
Nitrate	mg/L N	45	na	na	-	-
Nitrate + Nitrite	mg/L N	na	na	100	0.004	0.015
Nitrite	mg/L	na	na	10	0.001	0.001
Orthophosphate	mg/L P	na	na	na	-	-
pH	Units	6.5-8.5*	na	na	7.98	5.77
Potassium	mg/L	na	na	na	1.48	0.56
Reactive Silica	mg/L SiO ₂	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	7.3	3.05
Specific Conductance	uS/cm	na	na	na	91.3	38.3
Sulphate	mg/L	500*	na	1,000	2.7	1.1
Sulphide	mg/L H ₂ 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	61	33
Total Organic Carbon	mg/L	na	na	na	-	0.5
Total Phosphorus	mg/L	na	na	na	0.02	0.01
Total Suspended Solids	mg/L	na	na	na	-	5
True Color	TCU	15*	na	na	-	-
Turbidity	NTU	0.3/1.0/0.1**	na	na	4.76	110
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