

APPENDIX II

LEVEL 1 GROUND WATER SUPPLY ASSESSMENT

Final Report:

**LEVEL 1 GROUNDWATER SUPPLY ASSESSMENT
PROPOSED COTTAGE LOT DEVELOPMENT
OCEAN POND, NEWFOUNDLAND AND LABRADOR**

DATE: January 2014

(SJM-00215494-A0)



• **EDINBURGH GROUP LIMITED**

Level I Groundwater Supply Assessment

Final Report

Project Name

Proposed Cottage Lot Development
Ocean Pond, Newfoundland and Labrador

Project Number

SJN-00215494-A0

Prepared By:

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Date Submitted

January 2014

Appendix II – Phase 1 Groundwater Assessment

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Legal Notification

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1 INTRODUCTION

Exp Services Inc. (exp) was retained by Mr. Albert Williams, with *Edinburgh Group Limited*, to complete a Level I Groundwater Supply Assessment (GSA) at a proposed Cottage Development near Ocean Pond, Newfoundland and Labrador, hereinafter referred to as the 'Site'. It was exp's understanding that the Level I GSA is required as part of the Newfoundland and Labrador Department of Environment and Conservation (NLDEC) - Lands Branch approval process.

1.1 Objective

Exp understands that the proponent requires this Level I GSA to provide a qualified opinion of the likelihood of obtaining an adequate supply of potable water for the proposed development. A Level I GSA is a systematic qualitative process to assess the geology, hydrogeology, and characterize the Site to determine the potential likelihood that the lots within the sub-division will have an adequate supply and acceptable quality of water. The Level I GSA was completed in general accordance with "Groundwater Supply Assessment and Reporting Guidelines for Sub-divisions Served by Individual Private Wells" document, dated November 2009, and provided by the Newfoundland and Labrador Department of Environment and Conservation - Water Resources Management Division. Subject to this standard of care, exp makes no express or implied warranties regarding its services, and no third-party beneficiaries are intended. Limitation of liability, scope of report, and third-party reliance, are outlined in Section 8 of this report.

1.2 Scope of Work

The Scope of Work for this project is outlined as follows:

- reviewing and compiling local water well records obtained from the Province's Drilled Well Database;
- collecting, collating, and reviewing of all existing pertinent geological, climatological, hydrological, and hydrogeological data;
- contacting Provincial agencies, town councils, and local well contractors, to gather pertinent information regarding the Site and surrounding areas;
- conducting interviews with residents containing wells within a 500 m radius of the Site;
- reviewing and summarizing any available water quality analyses, groundwater studies, land uses, large-water users, and pumping tests for the proposed aquifer source;
- reviewing topographic, hydrogeological, and geological mapping for the area;

- reviewing the historical occupancy of the Site through the use of available archived and relevant municipal and business directories, fire insurance plans, topographical maps, and aerial photographs;
- conducting interviews with designated Site representative(s) and/or persons familiar with the subject property as a resource for current and historical Site information;
- reviewing the current uses of the Site and any land use practices that may have impacted the environmental conditions at the Site;
- from the Site and publically-accessible areas, reviewing the current use of the surrounding properties and any land use practices that may have impacted the environmental condition of the Site; and,
- preparing a report to document the findings. In completing the scope of work, **exp** did not conduct any intrusive investigations, including sampling, analyses, or monitoring of materials.

Exp personnel who conducted assessment work for this project included Ms. Meghan J.J. Colbourne, B.Sc., Environmental Scientist, Mr. Cyril J. Pumphrey, B.Sc., B.E.S., P.Geo., Project Manager, and Mr. Fred Baechler, M.Sc., P.Geo., Senior Reviewer.

2 PROJECT DETAILS

2.1 Site Description

The property is located on the northwest side of Ocean Pond, approximately six km east of the Town of Whitbourne, Newfoundland and Labrador. Access to the Site is via a gravel-surfaced access road, a distance of approximately 6 km southwest from the Trans-Canada Highway (TCH) as shown on *Figure 1: Site Location Plan* and *Figure 2: Site Plan* (refer to the Appendix). Overall, the property is approximately 48.6 hectares in size (excluding road rights-of-way) and is comprised of privately-owned, undeveloped land. The Site is located on property adjacent to the shoreline of a portion of Ocean Pond and a smaller pond (labelled Pond #1) located west of Ocean Pond.

The area is not presently serviced with water or sewer, and the surrounding property is essentially virgin and undeveloped. The nearest existing development is a gravel-surfaced cottage access road located approximately 500 m northeast of the Site. There are approximately 12 cottages along the last 500 m of this road (these front onto Western Gull Pond), though none occur within a 500 m radius of the property. Future access to the proposed development will be way of an extension to this existing road.

At the time of the Site visit, the property was completely undeveloped land and was comprised of a mixture of bog and heavily-treed forest. Portions of the site were accessed on foot during the site visit using open bog areas and some existing trails. Photographs of the Site are included in the Appendix.

2.2 Surrounding Properties

Properties surrounding the proposed development may be described as follows:

- | | |
|--------|--|
| North: | The Site is bounded to the north by undeveloped wooded land and bog. A gravel-surfaced cottage access road is located approximately 500 m northeast of the property. |
| East: | The Site is bounded to the east by Ocean Pond. |
| South: | The Site is bounded to the south by undeveloped woodland (east portion) and Pond # (west portion). |
| West: | The site is bounded to the west by undeveloped woodland and bog. |

2.3 Project Description

The proposed development will consist of private, individual cottage building lots. Up to 107 lots may be developed overall, however, the development will follow a phased approach, the details of which have not been finalised. The lots are proposed to have an average size of 4542 m². Each of the building lots is to be serviced by individual private water wells and septic systems. Wells will consist of properly-constructed dug or drilled wells. It is understood that most lots will be developed for use as cottages, though some may have a year-round usage. Although the sites are not presently serviced with electrical power, it is assumed that service will be extended into the lots in the future.

3 HYDROGEOLOGICAL SETTING

3.1 Topography

Surface topography over the subject property ranges from approximately 72 m to 93 m above sea level (masl). Most of the study area is relatively flat to gently sloping; in general the land slopes towards one of two area ponds, Ocean Pond and Pond #1, which have approximate surface elevations of 71 m and 77 m, respectively.

3.2 Hydrogeology

Based on surficial geological mapping available for the area, the site sub-surface is characterised by glacial till; forming narrow, elongated ridge features that rise above the surrounding terrain (during the site visit, several such ridges were apparent in the area); forming a series of closely-spaced gullies or deeply-incised channels; and forming hummocks having a random assemblage of knobs, mounds, ridges, and depressions. Based on a sieve analysis completed on a Till sample from approximately 1 km northeast of the Site, the Till is classified as a Sand and Gravel, with some silt. Minor bog is mapped within the property limits, though bog is more abundant on the adjacent lands. Outcrop exposures were not evident during the site visit (November 26, 2013), though the site was lightly snow-covered at the time. Groundwater flow is expected to approximate topography, and is assumed to discharge towards the two ponds adjacent to the site (Ocean Pond and Pond #1).

According to the *Water Resources Atlas of Newfoundland* (1992), the groundwater yield from bedrock in the study area is characterised as high, with a mean yield of 58 Litres Per Minute (LPM). Based on information presented in *Hydrogeology of the Avalon Peninsula* (1984), the Site is underlain by Bedrock Hydrostratigraphic Unit C and is characterised as having a moderate to high yield (mean yield of 43.0 LPM and mean depth of 49.7 m). The surficial deposits in the area were estimated as having a low potential well yield (< 9 LPM) in the above-noted study (assuming hydraulic conductivities of 10^{-7} m/sec to 10^{-10} m/sec for a 2 m deep well, 1 m in diameter, with full drawdown).

Bedrock in most of the study area is reported to consist of Gibbett Hill Formation lithologies; primarily thickly-bedded, light grey sandstone; locally thinly-bedded, greenish-grey to red sandstone, siltstone, tuff and conglomerate. That portion of the property located south of Pond #1 is mapped as wavy bedded, grey to green tuffaceous siltstone and arkose of the Big Head Formation (King, A. F., 1988). There is no indication of bedrock types that could be prone to karst development. Based on 1:250,000 scale mapping by King, A. F., 1988, a north-northeast to south-southwest-oriented synclinal structure (Snows Pond Syncline) is mapped near the west side of the Site. No other large-scale structural features that would constitute

a preferential drilled well target were identified within the proposed development or wider study area. Groundwater storage, distribution, and flow in bedrock would therefore be expected to be controlled by other structural features such as fractures, joints, and bedding planes. Given the hydrogeological and geological findings, the potential for bedrock to produce wells with a sufficient yield for domestic purposes is considered good.

There are no areas of known mineral potential or existing mineralisation within the host bedrock that might influence water quality within the study area.

3.3 Hydrology

Much of the subject property surface water drains towards one of the two ponds present within the property limits: either Ocean Pond in the east, or Pond #1 in the west. Ocean Pond is a relatively large pond (approximately 400 000 m² in size) which drains southwest into Round Pond West, approximately 2.5 km from the Site; from there it flows into Brazil's Pond and then Third Pond (both near Whitbourne) before draining into the Hodge River, ultimately discharging into the ocean approximately 20 km to the south at Colinet. Pond #1 is much smaller (approximately 80 000 m² in size) and it flows into East Pond, a much smaller Pond located approximately 200 m west of Pond #1, before flowing into Hooper's Pond, near Whitbourne. Hooper's Pond then drains to the south via the Hodge River.

Based on Environment Canada Canadian Climate Normals for Colinet (STN. 8401200), the nearest available climate station located approximately 26 km to the southwest, the mean annual precipitation for the area is 1392.1 mm total, with 1229.2 mm falling as rain, and 162.9 mm as snow.

3.4 Existing Reports

There were no previous Level 1 GSA reports available for the area.

4 SUMMARY OF AREA WATER WELL INFORMATION

Much of the study area is completely undeveloped and wooded. The nearest well user is more than 500 m from the Site along the existing gravel access road (located to the north).

Information provided by Mr. Albert Williams (proponent) indicates that both dug and drilled wells are utilised by cottage owners in the wider Ocean Pond area. Mr. Williams is aware of numerous dug wells in the area and all report more-than-adequate water quantity and quality.

4.1 Dug Water Wells

As indicted above, there were no dug-well users identified in the immediate study area and no data on dug-well water quality/quantity outside the study boundaries. Anecdotal evidence suggests that dug wells have proven quite effective in supplying adequate quantity and quality of water in the surrounding area.

4.2 Drilled Water Wells

There were no drilled well users identified within the study area, however, approximately 12 cottages were identified in the range of 500 m to 1000 m from the Site. Most of these owners were not available at the time of the Site visit and could not be identified. Data provided from the NLDEC - Water Resources Division, indicates that there are 35 drilled wells listed for the Ocean Pond area. Wells with co-ordinates provided were plotted on 1:50,000 scale mapping and all of these were located more than 1 km from the Site. Overall, well yields in the data set provided ranged from 1.2 LPM to 300 LPM, with a mean yield of approximately 29.3 LPM and median yield of 12 LPM.

A summary of the well yield information from all sources is provided in *Table 1: Study Area Well Yield Summary* below:

TABLE 1: STUDY AREA WELL YIELD SUMMARY
OCEAN POND – NEWFOUNDLAND AND LABRADOR

Information Source	Hydrostratigraphic Unit (HU)		No. of Wells
	Overburden HU (Till)	Bedrock HU (Signal Hill/Musgravetown Groups)	
1. Water Resources Atlas. 1991	N/A	Mean Yield = 58 LPM	N/A
2. Hydrogeology of The Avalon Peninsula. 1984	< 9 LPM	Mean Yield = 43 LPM	N/A
3. Provincial Water Well Data. 2013	N/A	Mean Yield = 29.3 LPM	35 Well Data Set

N/A = Not available

4.3 Land Use/History

We understand that the subject site is owned by Mr. James Garland. The proponent is in the process of purchasing this property. Based on observations made during the site visit, information provided by Mr. Albert Williams and on a review of recent air-photos, there is no indication of any historic development on or near the subject property. The nearest development is a cottage access road and some new cottages approximately 500 m to the northeast.

5 CONCLUSIONS

Based on the information gathered for this assessment, the following conclusions are presented:

- The potential for the shallow aquifer at this site to supply sufficient water quantity and quality for the proposed residential development is considered poor to good, and dependent upon the site specifics (primarily location and groundwater depth) of the given lot. In the event that a shallow dug well is impractical/inappropriate for one or more of the proposed lots due to siting constraints, low yield, or depth limitations, then a drilled bedrock well or wells may be completed to supply the property.
- The potential for the bedrock aquifer to supply sufficient water quantity for the proposed residential lots at this site is considered good. Little is known about the naturally-occurring groundwater chemistry for the bedrock aquifer in this area. There are potential treatment options available for various inorganic chemistry issues that may arise (such as iron, manganese, etc.). Bedrock wells may also be susceptible to decreases in yield in situations where multiple drilled wells are installed into the same producing-fracture system.

The above conclusions assume proper septic field design, siting, and installation by others. Drinking-water wells are assumed to be constructed by qualified and or accredited well drillers/contractors following all applicable regulations and using industry-accepted standards. Open-loop groundwater-sourced heat pumps are not permitted in unserviced sub-divisions.

6 REFERENCES

- "Geology of the Avalon Peninsula," Newfoundland Department of Mines & Energy - Geological Survey Division, Map 88-1. Scale 1: 250 000. Issued 1988.
- Granular-Aggregate Resources of the Holyrood Map Sheet (NTS 1N/06) Map 2001-04. Newfoundland and Labrador Department of Mines and Energy-Geological Survey. 2001.
- Groundwater Supply Assessment and Reporting Guidelines for Subdivisions Serviced by Individual Private Wells. Newfoundland and Labrador Department of Environment and Conservation. 2009.
- Hydrogeology of the Avalon Peninsula Area. Water Resources Report 2-6. 1984.
- Landforms and Surficial Geology of the Holyrood Map Sheet (NTS 1N/06), Newfoundland Department of Mines and Energy, Geologic Survey , Map 98-70. 1999.
- NL 1:50 000 Topographic Mapping.
- Water Resources Atlas of Newfoundland (1992).

7 LIMITATIONS AND USE OF THE REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the investigation undertaken as of the date of the Report. Should changes occur which potentially impact the condition of the site, the recommendations of **exp** may require re-evaluation. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to **exp** to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to **exp** by the Client and others. The Report has been prepared for the specific site, development, building, design, or building assessment objectives and purpose, as communicated by the Client. **Exp** has relied in good faith upon such representations, information, and instructions, and accepts no responsibility for any deficiency, misstatement, or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation, or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions, or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to **exp**. If new information about the environmental conditions at the Site is found, the information should be provided to **exp** so that it can be reviewed and revisions to the conclusions and/or recommendations can be made, if warranted.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data, and files, whether electronic or otherwise, generated as part of this assignment, form part of the Report. This material includes, but is not limited to, the terms of reference given to **exp** by the Client, communications between **exp** and the Client, other reports, proposals, or documents prepared by **exp** for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations, and opinions expressed in the Report, reference must be made to the Report in its entirety. **Exp** is not responsible for use of portions of the Report by any party.

USE OF REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of **exp**. Any use of the Report, or any portion of the Report, by a third party, is the sole responsibility of such third party. **Exp** is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.

REPORT FORMAT

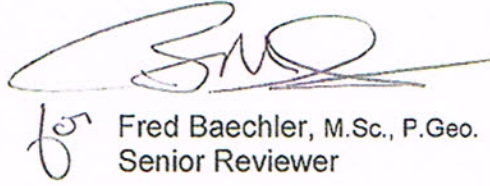
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We trust this report meets your immediate requirements. If you have any questions regarding the information in this report, please do not hesitate to contact this office.

exp Services Inc.



Cyril J. Pumphrey, B.Sc., B.E.S., P.Geo.
Project Manager

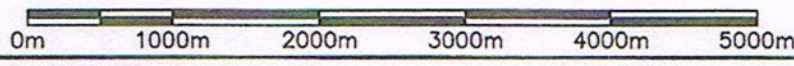
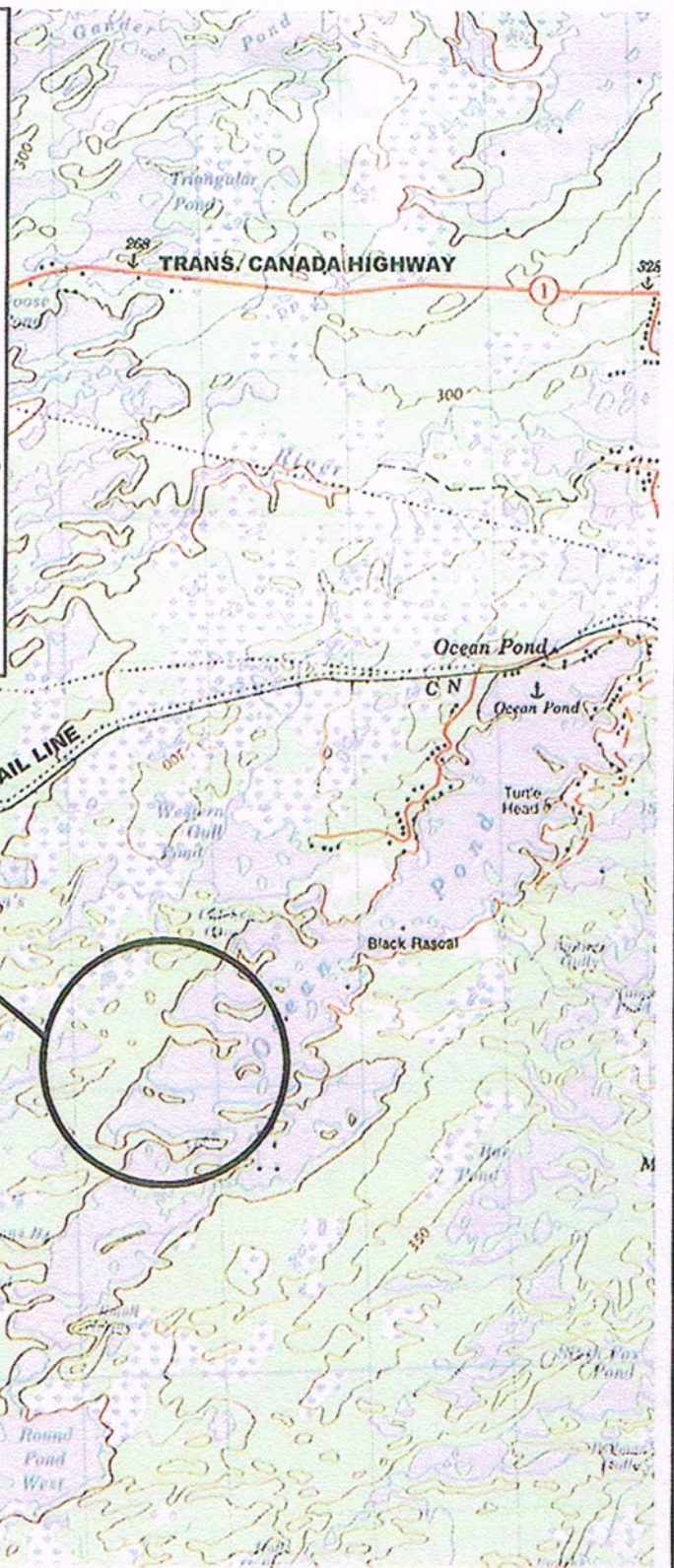
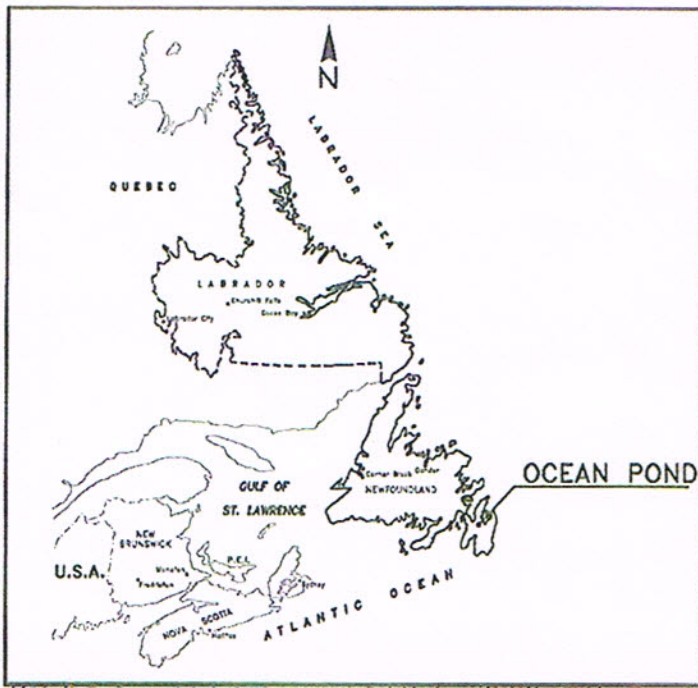


Fred Baechler, M.Sc., P.Geo.
Senior Reviewer

APPENDIX



Figures 1 and 2



SCALE 1:50,000
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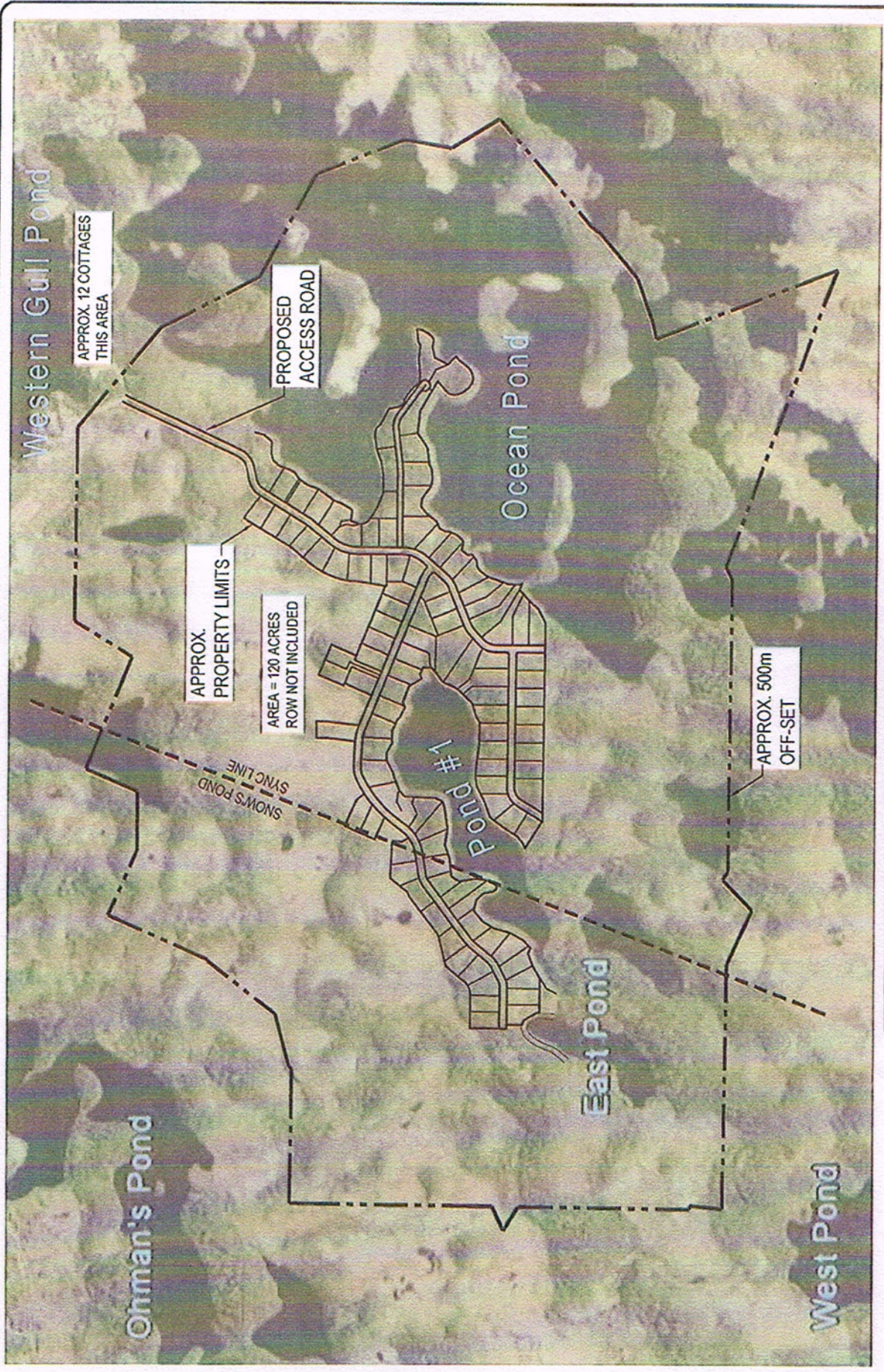
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Project Title
**LEVEL 1 GROUNDWATER SUPPLY
ASSESSMENT
OCEAN POND, NL**

Dwg. Title
SITE LOCATION

Drawn By: D.R.R.	Project No. SJN-00215494-A0
Dwg. Standards Ckd. By:	Dwg. No. FIGURE 1
Designed By: C.J.P.	Dwg. Design Ckd. By:
	Rev. No.



SCALE 1:15,000
This drawing is not to be scaled

Drawn By: D.R.R.	Project No. SJN-00215494-A0
Dwg. Standards Ckd. By:	Dwg. No. FIGURE 2
Designed By: C.J.P.	Dwg. Design Ckd. By:
	Rev. No. RevNo

SITE PLAN

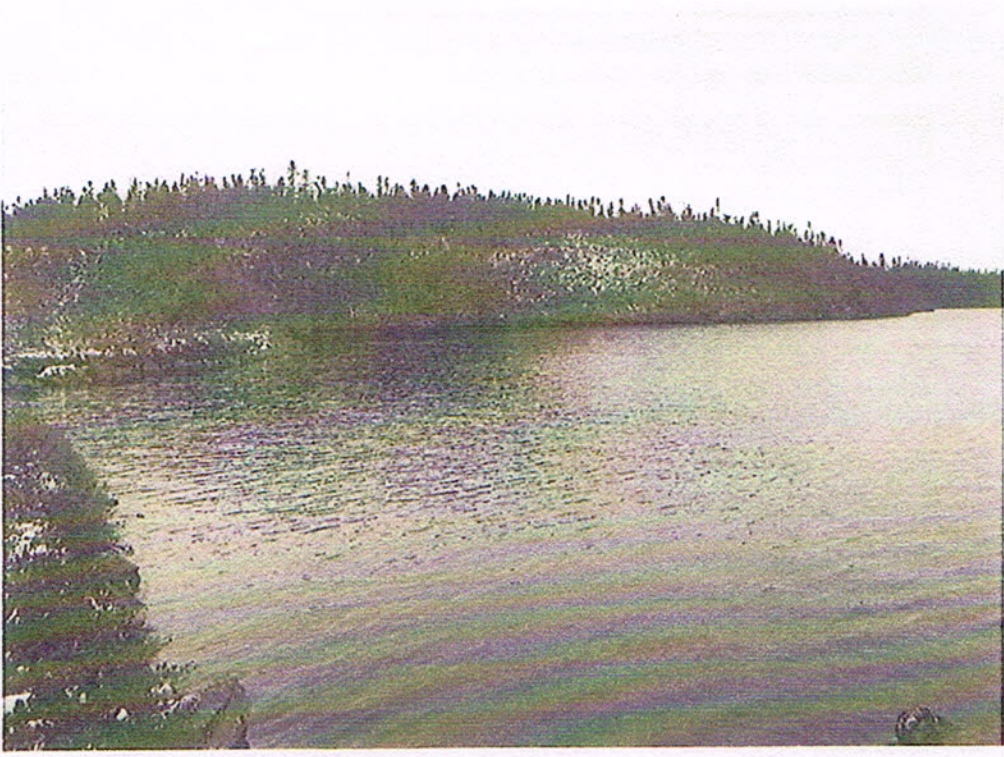
Project Title
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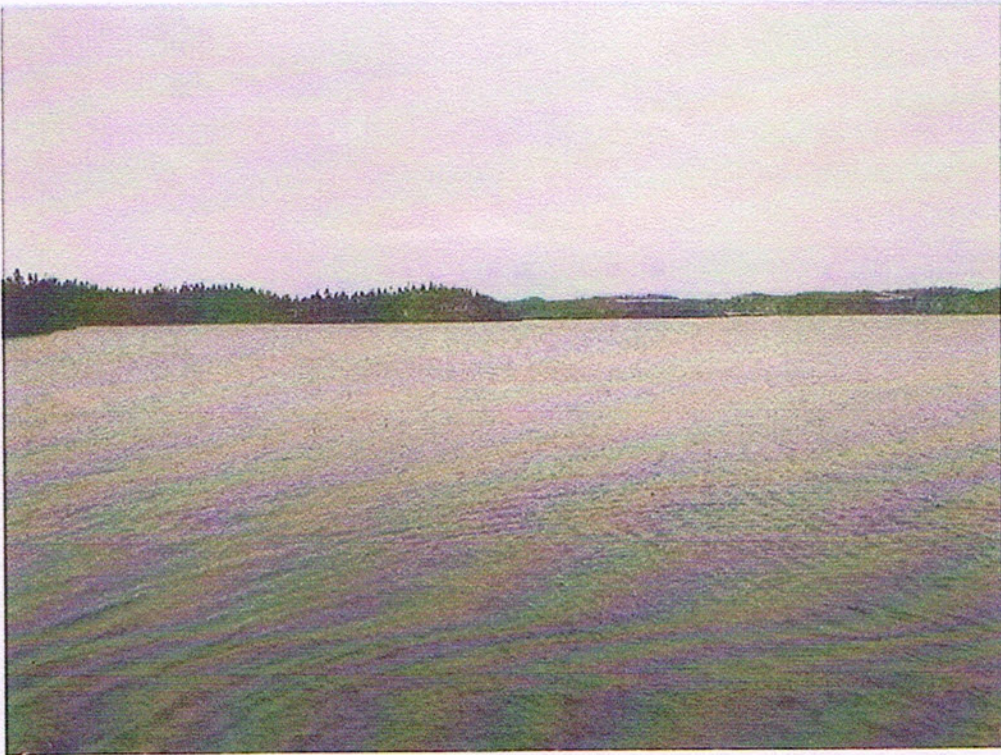
BUILDINGS - EARTH & ENVIRONMENT - ENERGY - INDUSTRIAL INFRASTRUCTURE - SUSTAINABILITY



Site Photographs



Photo# 1 – Looking northeast from Ocean Pond shoreline – background and right is peninsula at eastern edge of Site.



Photo# 2 – Looking northeast across Ocean Pond – peninsula end at right of centre.



Photo# 3 – Looking southeast with Pond #1 (east end) in background.



Photo# 4 – Looking southwest with southwest end (north edge) of Site at treeline in background.



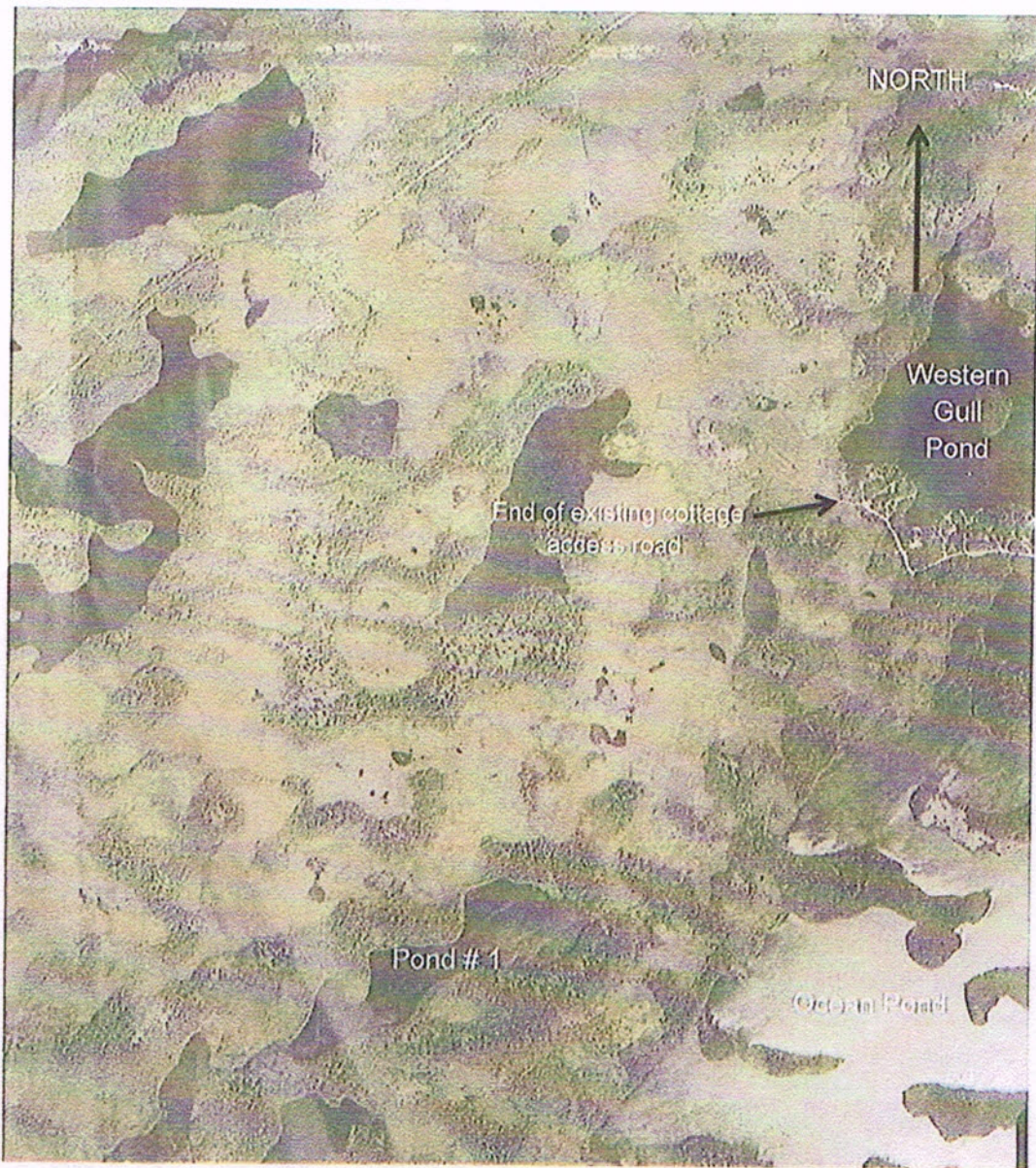
Photo# 5 – Looking south at edge of site – near western end of property. Treeline marks northern boundary.



Photo# 6 – Looking west from east end of Pond #1.



Aerial Photograph



Airphoto - 1990