



WEST HANTS REGIONAL MUNICIPALITY REPORT

Information <input type="checkbox"/>	Recommendation X	Decision Request <input type="checkbox"/>	Councillor Activity <input type="checkbox"/>
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To: Members of Planning and Heritage Advisory Committee (PAC/HAC)

Submitted by: _____
 Alex Dunphy, Planner

Date: October 13th, 2022

Subject: 697 Greenhill Road, Greenhill PID 45026010 - Rezoning

LEGISLATIVE AUTHORITY

Section 210 of the Municipal Government Act.

RECOMMENDATION

... that PAC recommends that Council give First Reading and hold a Public Hearing to consider amending Schedule A of the West Hants Land Use By-law by rezoning 697 Greenhill Road, Greenhill (PID 45026010) from the Agricultural Priority Two (AR-2) zone to the Rural Residential (R-4) zone, provided a hydrogeological study can be provided to determine that the development will have no negative affect on the existing water table.

BACKGROUND

Property X	Public Opinion <input type="checkbox"/>	Environment <input type="checkbox"/>	Social <input type="checkbox"/>	Economic <input type="checkbox"/>	Councillor Activity <input type="checkbox"/>
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Application

The completed application was submitted by Doug Faulkner on August 15th, 2022 to change the zoning of a 52 acre property located at 697 Greenhill Road, Greenhill (PID 45026010) from the Agricultural Priority Two (AR-2) zone to the Rural Residential (R-4) zone to permit the construction of a private road and subdivided lots for residential purposes.

Surrounding Context

The subject lot is a 52 acre, mostly undeveloped lot with frontage on Greenhill Road and located within the community of Greenhill. Adjacent properties on the northern side of Greenhill Road are primarily residential with open fields, while uses on the southern side of Greenhill Road tend to be either residential or undeveloped.

DISCUSSION

The subject lot is currently designated Agriculture on the Generalized Future Land Use Map (GFLUM) of the West Hants Municipal Planning Strategy (MPS) (Figure 1). The subject lot is currently zoned Agricultural Priority Two (AR-2) on Schedule A of the West Hants Land Use By-law (LUB) (Figure 2).

The applicant had requested to amend the zoning of the subject lot to Rural Residential (R-4) in order to subdivide and construct a private road for personal use. Lots which are zoned Agricultural Priority Two (AR-2) are able to be considered for rezoning to the Rural Residential (R-4) zone based on a report prepared by a professional agrologist, pursuant to Policy 8.9.3.

Municipal Planning Strategy Document Review

Policy 8.9.3 is the primary enabling policy to be considered for this application. This policy permits Council to consider a Land Use By-law amendment to change the zoning of a property from Agricultural Priority Two (AR-2) to Rural Residential (R-4) based on a report prepared by a professional agrologist. In order to use this policy, the agrologist's report must show that the site has little, or no agricultural capability and development of the site will not adversely affect existing agricultural operations or the agricultural character of the area.

Policy 8.6.1 provides the criteria which must be met by an agrologist report in order to permit the consideration of rezoning a lot for non-farm development. The full list of criteria is included with this report in Attachment A. In summary, the proposal meets the criteria since:

- the subject lot exhibits constraints with regard to land fertility, slope, and drainage;
- the author of the report is a professional agrologist who performed a site visit;
- the report includes a site plan showing the study area; and
- the report identifies site features and reasons that the subject lot would not be productive agricultural land.

Policy 16.3.1 provides the general criteria that must be considered for all LUB amendments. The full list of criteria is included with this report in Attachment A. In summary, the proposal meets the criteria, provided a hydrogeological report can be carried out prior to rezoning since:

- the proposal is not considered premature or inappropriate for the area;
- no municipal costs related to the proposal are anticipated; and
- the Fire Chief, Development Officer, Manager of Building and Fire Inspection Services, District Manager of the Nova Scotia Department of Public Works, and Inspector Specialist of the Nova Scotia Department of Environment and Climate Change have no concerns which have not been addressed in this report.

Comments from the Public

Concerns have been received from two members of the public regarding the potential straining of available potable water through increased well extraction in the area. The applicant has reported no shortage of potable water to the existing well on the subject lot. Clause (b) of Policy 16.3.1 reads “*whether the development is serviced, or capable of being serviced, by a potable water supply and either central sewer or an approved on-site sewage disposal system*”. This clause must be addressed prior to development. Due to this, I am recommending the suggested action from the Nova Scotia Department of Environment and Climate Change to request a hydrogeological report to confirm that the proposed development will not negatively affect the water table of the area.

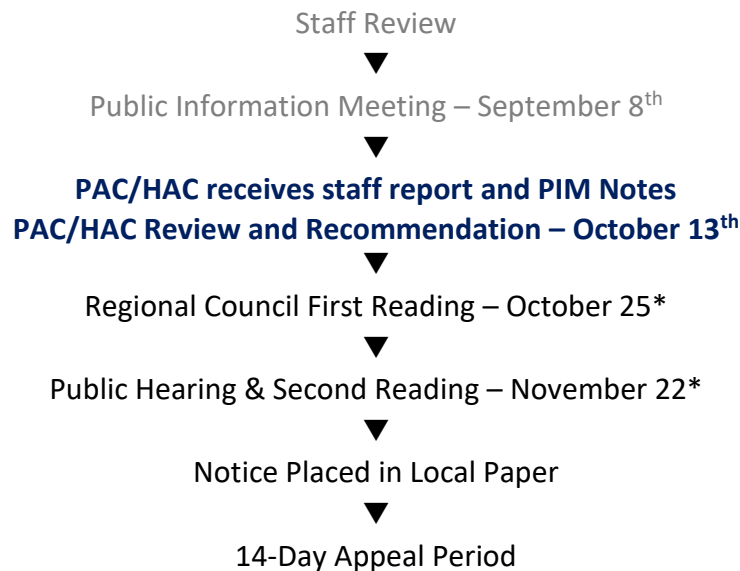
Comments from the Nova Scotia Department of Public Works

An Engineering Aide from the Nova Scotia Department of Public Works confirmed that a maximum of three (3) residential lots can be accommodated by the existing access to the subject lot and that developing a private road would not be permitted.

NEXT STEPS

Discussion from PAC will be incorporated into the report and presentation to Council.

Process



*anticipated dates; final dates are set by Council

FINANCIAL IMPLICATIONS

There are no financial implications to the Municipality with regard to the filing of this report.

ALTERNATIVES

The Planning and Heritage Advisory Committee (PAC/HAC) may:

- provide alternative direction, such as requesting further information on a specific topic.

ATTACHMENTS

Figure 1	GFLUM Extract
Figure 2	Current Zoning Map Extract
Figure 3	Proposed Zoning Map Extract
Attachment A	Policy Summary for Amendment to a Land Use By-law
Attachment B	Public Information Meeting Notes
Attachment C	Agrologist Report

Report Prepared by: _____

Alex Dunphy, Planner

Report Approved by: _____

Madelyn LeMay, Director of Planning and Development

Figure 1 – GFLUM Extract

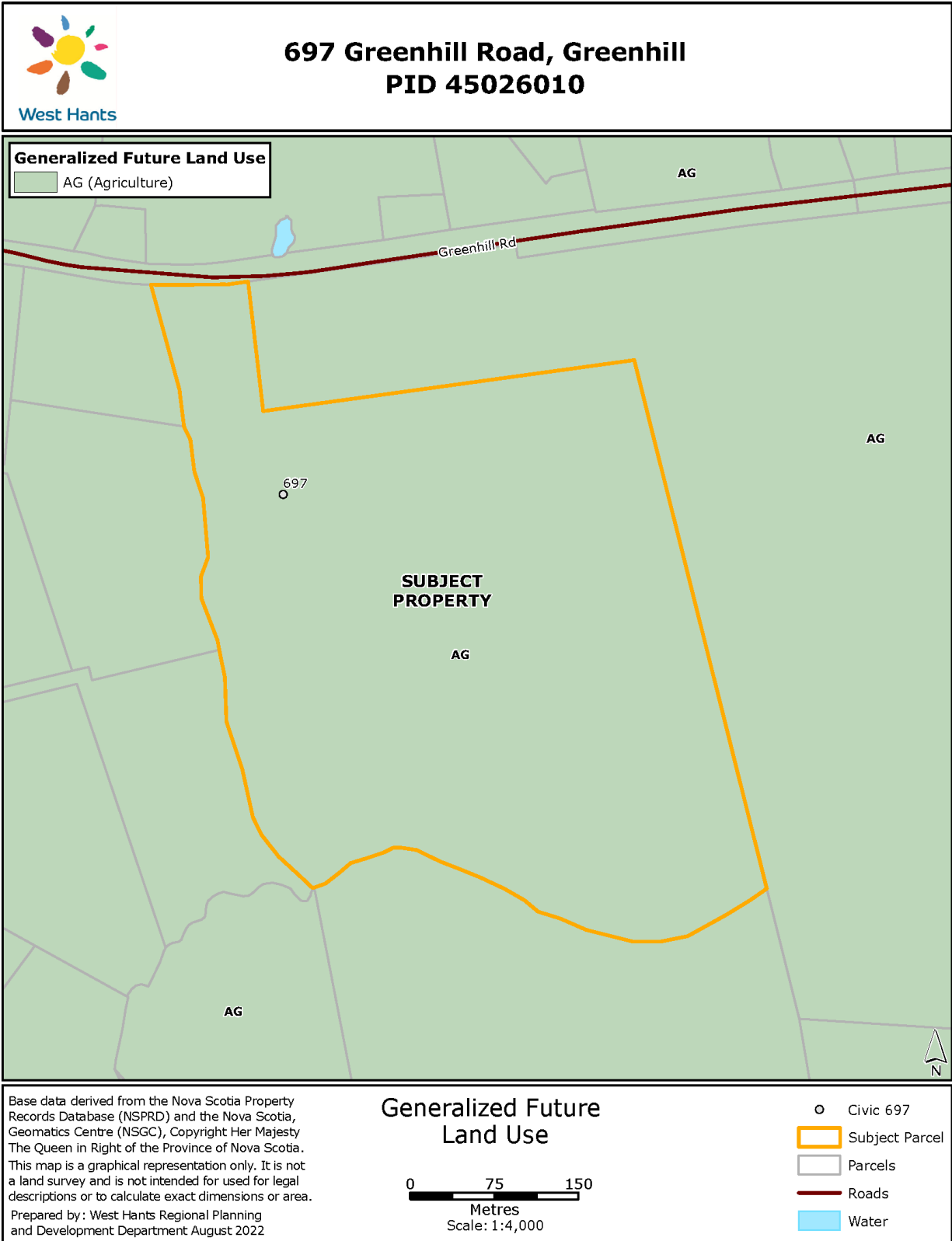


Figure 2 – Current Zoning Map Extract

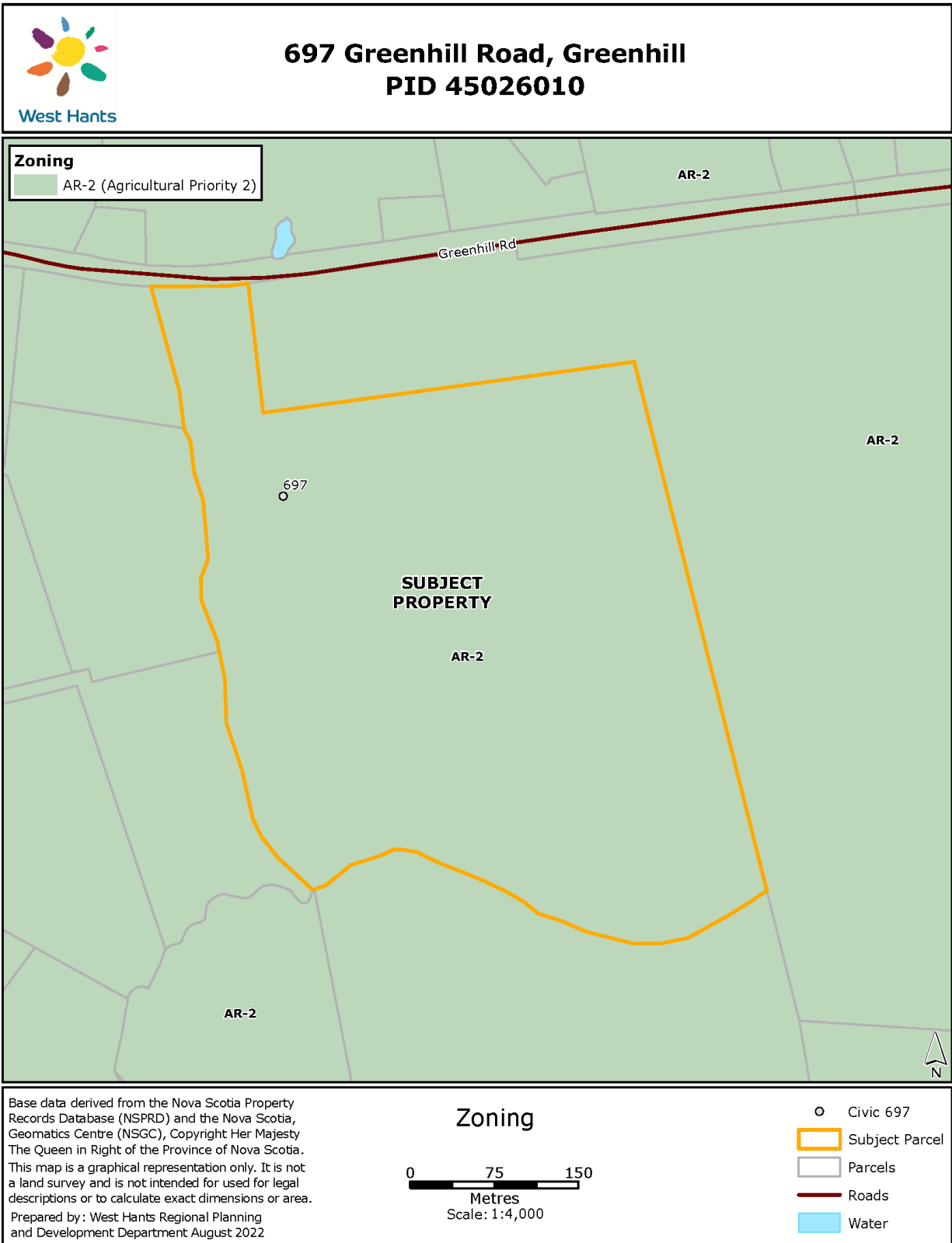
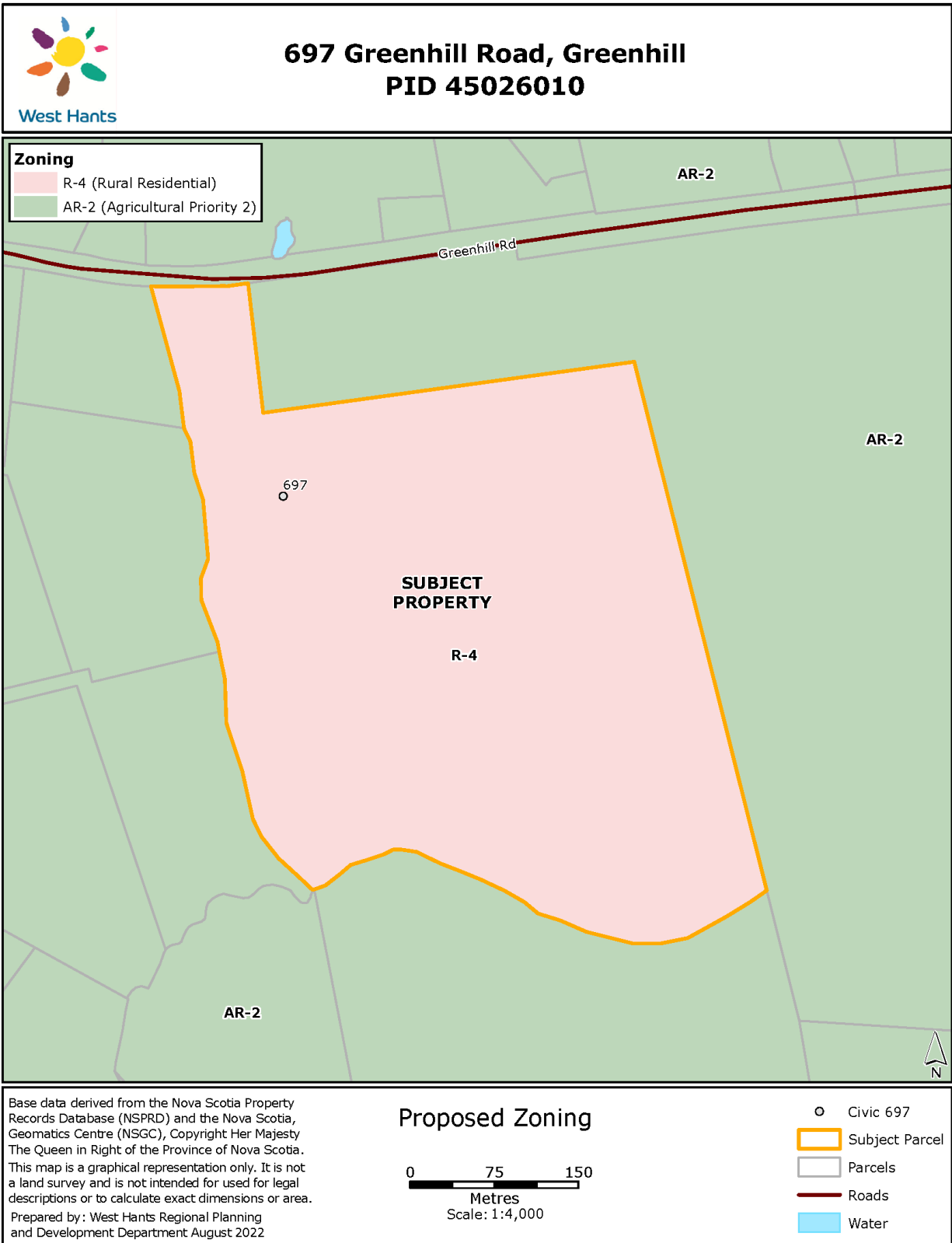


Figure 3 – Proposed Zoning Map Extract



Attachment A – Policy Summary for Amendment to Land Use By-law

<p>Policy 8.9.3 <i>It shall be the policy of Council to consider rezoning land zoned AR-2 to Rural Residential (R-4) subject to the following:</i></p>	
<p>(a) <i>the development site has been determined to have little or no agricultural capability in accordance with Policy 8.6.1;</i></p>	<p>The agrologist report listed as Attachment C concludes that the subject lot is not well suited for future agricultural development.</p>
<p>(b) <i>the proposed development will not compromise or adversely affect the operation or integrity of existing agricultural operations;</i></p>	<p>The subject lot is large enough to buffer the development from abutting lots.</p>
<p>(c) <i>the predominant agricultural character of the area will not be adversely affected and the proposed development is compatible with the area in terms of such matters as density, scale and traffic generation;</i></p>	<p>The applicant intends to retain the character of the area by having low-density residential uses on large lot sizes.</p>
<p>(d) <i>adequate separation distances and buffering between agricultural and non-agricultural uses can be provided;</i></p>	<p>The subject lot has sufficient space to maintain setbacks from surrounding properties.</p>
<p>(e) <i>any other matter which may be addressed in a Land Use By-law; and</i></p>	<p>All matters are addressed.</p>
<p>(f) <i>Policy 16.3.1.</i></p>	<p>Refer to Policy 16.3.1 summary.</p>
<p>Policy 8.6.1 <i>It shall be the policy of Council to consider certain non-farm development, pursuant to the relevant specific policies of this Part, on land within the Agricultural designation that has been determined to have little or no agricultural capability. A determination of agricultural capability shall be based on the following:</i></p>	
<p>(a) <i>90 percent or more of the development site is an existing or abandoned resource extraction site such as a sand pit, gravel pit or quarry for which a permit for extraction has been issued by the Province of Nova Scotia. The resource extraction must have been existing or abandoned prior to the effective date of this Strategy; or</i></p>	<p>N/A</p>
<p>(b) <i>if not a resource extraction site, a study has been prepared by a professional agrologist, at the expense of the applicant, which concludes that the proposed development will not adversely affect the viability of surrounding agricultural operations and:</i></p>	
<p>(i) <i>90 percent or more of the development site has soils defined as Class 4 or lower capability for agriculture; or</i></p>	<p>N/A</p>

<p><i>(ii) the soils have a capability for agriculture rating better than Class 4, but 90 percent or more of the development site exhibits severe limitations for agricultural use because of slope, stoniness, salinity, wetness, permeability, depth of soils, size of parcel or proximity to non-farm buildings;</i></p>	<p>The land is rated as Canada Land Inventory (CLI) Class 3 but has constraints which limit the use of the land for agriculture. The amount of effort to convert this property into highly productive land is not feasible, and extensive maintenance on the land would likely be required to maintain agricultural production.</p>
<p><i>(c) the study shall:</i></p>	
<p><i>(i) be prepared by a registered full member of the Nova Scotia Institute of Agrologists;</i></p>	<p>A report was received from Jonathan Wort, who is a Professional Agrologist recognized by the Nova Scotia Institute of Agrologists.</p>
<p><i>(ii) require a site inspection by the agrologist;</i></p>	<p>A site visit was conducted on July 6th, 2022 by Johnathan Wort and Caitlin McCavour.</p>
<p><i>(iii) specify the method used, consistent with the C.L.I. classification methodology, to determine soil capability for agriculture;</i></p>	<p>The Canadian Land Classification system was designed for land that has been previously cleared and does not include forested sites. The agrologist's report did not reclassify the land, but instead used OMAFRA protocol to determine whether the subject lot is suitable for agriculture.</p>
<p><i>(iv) identify any major site features or characteristics which influence or determine soil capability including, but not limited to, slope, soil texture, stoniness, wetness, salinity, permeability, and depth of soils;</i></p>	<p>Refer to Interpretation sections in Attachment C.</p>
<p><i>(v) include a site plan illustrating the area studied and any relevant site features;</i></p>	<p>Included within Attachment C.</p>
<p><i>(vi) identify reasons why the use would be compatible with, or not adversely affect, area farms. Reference should be made to the following where applicable: site and locational constraints; infilling between existing non-farm development; logical extension of existing non-farm development; special use with special locational requirements; current pattern of development; parcel size and shape; surrounding land uses; context within which the parcel fits into the farming area; viability of the parcel and remnant for farming; and existing, past and future use of the parcel and remnant;</i></p>	<p>The proposed residential use is compatible with the surrounding agricultural uses as each lot as part of the subdivision process would have sufficient setback distances and large lot sizes, indicative of agricultural areas.</p>

<i>(vii) indicate the implications of letting the parcel go out of agricultural production; and</i>	There is no evidence to suggest the subject lot has been in agricultural production over the last 50 years.
<i>(viii) indicate the implications of fragmenting the land.</i>	The intent of the application is to maintain large lot sizes. Maintaining the total lot size of 52 acres is not useful as it is not feasible to support agricultural production.

Policy 16.3.1	
<i>In considering development agreements and amendments to the Town of Windsor Land Use By-law, in addition to the criteria set out in various policies of this Strategy, Council shall consider:</i>	
<i>(a) whether the proposal is considered premature or inappropriate in terms of:</i>	
<i>(i) the adequacy of sewer and water services;</i>	The Public Works Department confirmed that there are no municipal services on the subject lot.
<i>(ii) the adequacy of school facilities;</i>	N/A
<i>(iii) the adequacy of fire protection;</i>	The local Fire Chief and Manager of Building and Fire Inspection Services have stated that there is adequate fire protection for the proposed use.
<i>(iv) the adequacy of road networks adjacent to, or leading to the development; and</i>	A Nova Scotia Department of Public Works Engineering Aide confirmed that the existing access would be sufficient for a maximum of three (3) lots and that developing a private road on the lot would not be permitted.
<i>(v) the financial capacity of the Town to absorb any costs relating to the development.</i>	There are no anticipated costs to the Municipality regarding this development.
<i>(b) whether the development is serviced, or capable of being serviced, by a potable water supply and either central sewer or an approved on-site sewage disposal system;</i>	As there have been concerns regarding the supply of potable water access in the area, a hydrogeologist report regarding the potential effects of the development on the existing water table should be pursued.
<i>(c) the suitability with any aspect relative to the movement of auto, rail and pedestrian traffic;</i>	A Nova Scotia Department of Public Works District Manager commented that they do not have any concerns regarding movement relative to the subject lot.
<i>(d) the adequacy of the dimensions and shape of the lot for the intended use;</i>	The Development Officer had no concerns regarding the adequacy of the of the shape

	or size of the subject lot for the intended use.
<i>(e) the pattern of development which the proposal might create;</i>	As the intent of the application is to permit residential lots with large lot size, the type of development is similar to surrounding uses. The Development Officer had no concerns about the pattern of the development.
<i>(f) the suitability of the area in terms of steepness of grade, soil and geological conditions, location of water courses, marshes or bogs and susceptibility of flooding;</i>	See Attachment C.
<i>(g) whether the proposal meets the requirements of the appropriate provincial or federal agencies as well as whether it conforms to all other relevant municipal by-laws and regulations; and</i>	All Municipal, Provincial, and Federal regulations will have to be met.
<i>(h) any other matter required by relevant policies of this Strategy.</i>	All relevant matters have been addressed in this report.

Attachment B - Public Information Meeting Notes
September 8th – September 23rd, 2022
File 22-19
697 Greenhill Road, Greenhill PID 45026010

<p>Meeting date and time</p>	<p>A virtual Public Information Meeting was held on September 8th, 2022 beginning at 7:10 p.m. The meeting was live broadcast on the Municipal Facebook page.</p>
<p>Attending</p>	<p>In attendance:</p> <p>Three (1) Councillor:</p> <ul style="list-style-type: none"> • Councillor Ivey (Chair) <p>Four (4) members of staff:</p> <ul style="list-style-type: none"> • Planner Dunphy • Planner Poirier • Director LeMay • Meeting Secretary Lake <p>The following members of the public requested an invitation to the PIM via Zoom:</p> <ul style="list-style-type: none"> • Candace Hillier • Leslie and Jason Bower • Richard Bullock
<p>Applicant Doug Faulkner</p> <p>Property 697 Greenhill Road, Greenhill PID 45026010</p>	<p>Planner Dunphy outlined the amendment application to rezone a 52 acre agriculturally zoned property to permit residential subdivision and construction of a private road.</p>
<p>Comments</p>	<p>Comments from the public could be submitted to Planner Dunphy by mail, e-mail and telephone between September 8th – 23rd, 2022.</p> <p>2 phone calls were received, with an email follow up. The questions and comments from the public are summarized below. The email response is attached.</p> <p>Two phone calls were received during the PIM comment period. Staff responses are included in purple text:</p> <ul style="list-style-type: none"> • Richard Bullock was concerned about the drilling of additional wells on the subject lot, citing issues with water extraction from a dug well.

	<p>Alex confirmed that he would be reviewing access to water as part of the criteria for the rezoning.</p> <ul style="list-style-type: none">• Elizabeth Caverly had concerns regarding the digging of additional wells on the subject lot and potential for the intensity of residential development on the lot. Alex confirmed that potable water access would be reviewed as part of the rezoning process. Alex also responded that the applicant had intended to subdivide the subject lot into approximately 3-5 lots, with each lot being multiple acres in size.
Adjournment	The meeting was adjourned at 7:15 p.m.

Public Email Responses Submitted for the Application PIM

September 22nd, 2022

From: Elizabeth Caverly

To: Alex Dunphy

Good morning Mr. Dunphy –

Further to our conversation on Friday, September 16th, I understand that another meeting is scheduled to discuss the above-noted matter. As indicated to you during our discussion, my main concern involves any impact analysis study which, I assume, must have been conducted regarding the local water table and how a new development will impinge on an already stretched resource. As you know, many neighbouring homes have experienced severe water shortages this season and these new plans will only exacerbate the situation.

I wish to attend the next meeting and to be afforded an opportunity to raise my concerns and to have a better understanding of the scope of the anticipated project. Please provide me with the necessary zoom link at your earliest convenience.

Thank you

Elizabeth

M. Elizabeth Caverly

Director – Directrice

Atlantic Region / région atlantique

Courts Administration Service

Service administratif des tribunaux judiciaires

Attachment C – Agrologist Report

Agrologist Report

697 Greenhill Road

Greenhill, Nova Scotia

PID 45026010

July 25th, 2022

PREPARED BY:
PERENNIA FOOD AND AGRICULTURE INC.

Prepared for: Doug Faulkner

Prepared by: Caitlin McCavour (Soil Specialist) BSc. (Agr.), MSc. (candidate), A. Ag

Re-Zoning PID 45026010 West Hants Municipality.

July 25, 2022.

Caitlin McCavour visited the property in question and conducted a site evaluation on June 8th 2022. She conducted the evaluation as outlined in this report. As a follow up Caitlin and I visited the site together on the 6th of July 2022. Caitlin and I walked the property and she showed me the process that she followed in the evaluation, and we discussed the observations.

Based on the work that was conducted by Caitlin and her knowledge of soils and land classification. I am very comfortable with the conclusions that she has presented in this report.

PID 45026010 is a 52 acre property that is wooded and appears to never have been in agricultural production. It is my opinion that this piece of land would be a very poor site to develop for agricultural production. The cost of clearing and improving this site for agriculture would far exceed its potential value for agriculture because of its poor soil type, low fertility, and poor drainage.

Based on the land assessment that was conducted, this site is not well suited for future development for Agriculture and could be justifiably rezoned for development.

Sincerely Jonathan Wort PAg.



Manager Livestock and Field Crops Perennia.

jwort@perennia.ca

902 890 0303.

Executive Summary

Perennia Food and Agriculture Inc. received a request from Doug Faulkner to conduct an agrologist report for the potential re-zoning of a parcel of land (PID 45026010) from Agriculture Priority 2 (AR-2) to rural residential (R-4). The site characteristics of this property are described in the following table.

Site	Size	52 acres
	Number of Sites	2
	Percent in Agriculture	None
	Usage	Forest
	Goal	To convert to a residential area.
Climate	Mean Annual Temperature	7.4°C
	Annual Precipitation	1309.6 mm
	Degree Days Above 15°C	426.3
	Frost Free Days	145
Soil	Soil Series	Elmsdale/Wolfville
	Texture	Silty Clay Loam
	Drainage	Poorly to Moderately Well

A review of the soil surveys, a field assessment, and a client interview was conducted to determine the suitability of the land for agriculture production. Through this analysis, we found:

- This site is not currently under agricultural production, and there is no evidence of agricultural production over the last 50 years.
- The property was divided into two blocks based on soil type, and drainage. The Southwestern block of the property is poorly drained and drain tile would likely be required for suitable agricultural production. The Northeastern block of the property is imperfectly drained in areas and is more variable.
- Moderate to severe slopes may increase the risk of erosion once the land is cleared.
- The entire site has inherently low fertility, and extensive use of lime and fertilizer would be required to support agriculture production.
- Creating suitable agricultural land would take several years and require extensive resources.

The cost to bring this piece of land up to production would include, but is not limited to, clearing and stumping, drain tile or other drainage practices, field preparation, and high amounts of lime and fertilizer, which is likely, not feasible to support agricultural production within the next few years.

Background

The protection of farmland is important for the municipality of West Hants. Land currently used as agriculture or identified as having potential for agriculture has been classified as such, and this property has been designated for no other purpose.

Within this municipality, agricultural land is classified in three ways: (1) Prime Agriculture (P/Ag), (2) Agriculture Priority Two (AR-2), and (3) Agriculture Priority Three (AR-3). The piece of land discussed in this report is designated as AR-2, which permits agricultural support uses, agricultural uses, churches, community centers and fire halls, forestry and forestry-related activities, indoor storage facilities accessory to agricultural use, manufactured homes, and one and two-unit dwellings. The construction of any structures requires a development permit, and any subdivision of the land is limited to two lots per land area per calendar year. As a result, AR-2 land can be rezoned in areas where there is evidence of low capability for agricultural production.

Rezoning may be considered beyond the allowed two lots per year if the land is proven unsuitable for agriculture. Under the Municipality of the District of West Hants Municipal Planning Strategy

Policy 8.9.3 - It shall be the policy of the Council to consider rezoning land zoned AR-2 to Rural Residential (R-4) subject to the following:

- (a) the development site has been determined to have little or no agricultural capability in accordance with Policy 8.6.1;*
- (b) the proposed development will not compromise or adversely affect the operation or integrity of existing agricultural operations;*
- (c) the predominant agricultural character of the area will not be adversely affected and the proposed development is compatible with the area in terms of such matters as density, scale and traffic generation;*
- (d) adequate separation distances and buffering between agricultural and non-agricultural uses can be*
- (e) any other matter which may be addressed in a Land Use By-law; and*
- (f) Policy 16.3.1.*

And

Policy 8.6.1 - It shall be the policy of Council to consider certain non-farm development, pursuant to the relevant specific policies of this Part, on land within the Agricultural designation that has been determined to have little or no agricultural capability. A determination of agricultural capability shall be based on the following:

- (a) 90 percent or more of the development site is an existing or abandoned resource extraction site such as a sand pit, gravel pit or quarry for which a permit for extraction has been issued by the Province of Nova Scotia. The resource extraction must have been existing or abandoned prior to the effective date of this Strategy; or*

- (b) if not a resource extraction site, a study has been prepared by a professional agrologist, at the expense of the applicant, which concludes that the proposed development will not adversely affect the viability of surrounding agricultural operations and:*
- (i) 90 percent or more of the development site has soils defined as Class 4 or lower capability for agriculture; or*
 - (ii) the soils have a capability for agriculture rating better than Class 4, but 90 percent or more of the development site exhibits severe limitations for agricultural use because of slope, stoniness, salinity, wetness, permeability, depth of soils, size of parcel or proximity to non-farm buildings; Municipal Planning Strategy Municipality of the District of West Hants Page 73*
- (c) the study shall:*
- (i) be prepared by a registered full member of the Nova Scotia Institute of Agrologists;*
 - (ii) require a site inspection by the agrologist;*
 - (iii) specify the method used, consistent with the C.L.I. classification methodology, to determine soil capability for agriculture;*
 - (iv) identify any major site features or characteristics which influence or determine soil capability including, but not limited to, slope, soil texture, stoniness, wetness, salinity, permeability, and depth of soils;*
 - (v) include a site plan illustrating the area studied and any relevant site features;*
 - (vi) identify reasons why the use would be compatible with, or not adversely affect, area farms. Reference should be made to the following where applicable: site and locational constraints; infilling between existing non-farm development; logical extension of existing non-farm development; special use with special locational requirements; current pattern of development; parcel size and shape; surrounding land uses; context within which the parcel fits into the farming area; viability of the parcel and remnant for farming; and existing, past and future use of the parcel and remnant;*
 - (vii) indicate the implications of letting the parcel go out of agricultural production; and*
 - (viii) indicate the implications of fragmenting the land.*

This report provides site information for a request to approve the rezoning of 52 acres of land from AR-2 to R-4. The parcel of land is located at 697 Greenhill Road, Greenhill, NS, PID 45026010 and is owned by Doug Faulkner.

The Canadian Land Classification system was used to determine if this land could be used for agriculture. However, this system is designed for land that has been previously cleared and does not include forested sites. Therefore, these soils were not reclassified, but the parameters for determining agricultural restricting properties were identified. These parameters were identified using an OMAFRA protocol (<http://omafra.gov.on.ca/english/landuse/classify.htm#subd>). While we did not reclassify the site, we used these parameters to determine whether the property is suitable for agriculture.

Report

Site visits were conducted on June 9th and July 6th, 2022, at 697 Greenhill Road, Greenhill, NS. The site visits consisted of a site walkthrough, site assessment, and discussion with the property owner. Information about the site to be used for the consideration of land rezoning can be found in this report.

Site Information

The site is located at 697 Greenhill Road, Greenhill, NS (Figure 1). It is approximately 52 acres (2,265,120 sq. ft.) within the municipality of West Hants. The property is currently forested, and no agriculture production has been conducted on this site to the property owner's knowledge. Some silviculture has been performed recently; however, there is no evidence of agricultural production at the site for the previous 25 years and 25 years+. All surrounding properties are also classified as AR-2; however, only the property across the road (north) is currently used for agriculture. Properties to the East, South, and West are forested, with some having single dwellings upon the property. Additional agricultural land within 5 km of the site is present, with most of the adjacent land being forested. A new road is under construction, and old logging roads are evident near the back of the property.

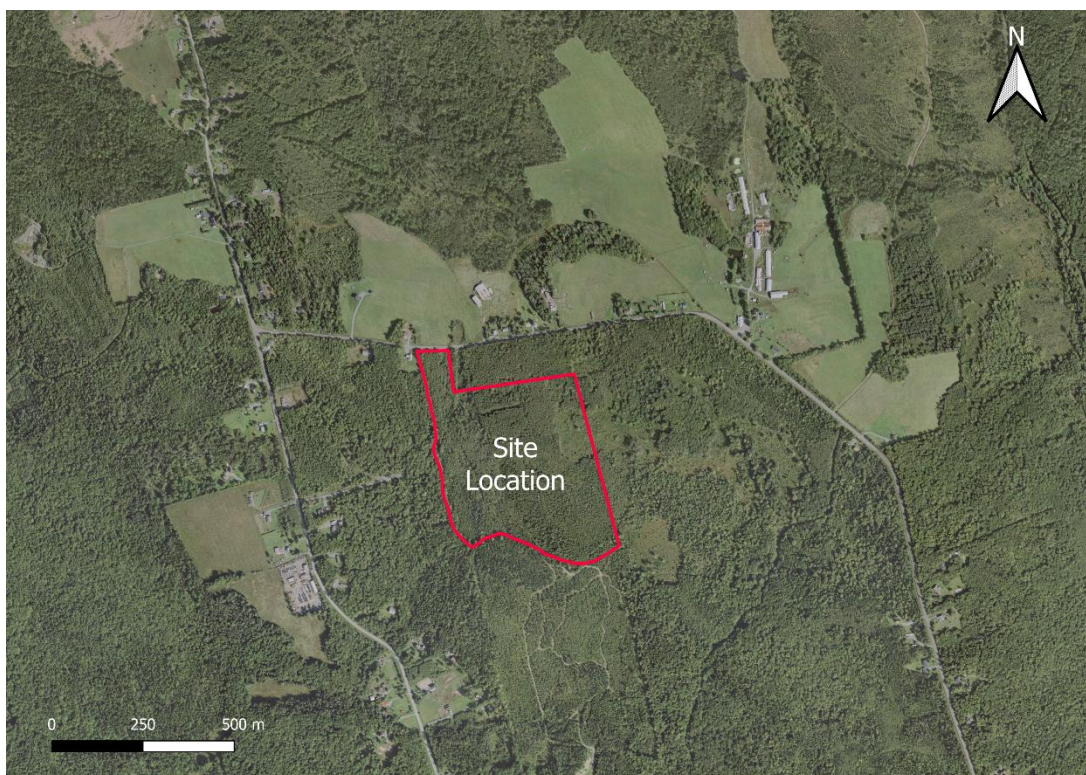


Figure 1 Site Map.

Site Pictures:





Site Description

The soil survey indicates that this is an Elmsdale soil series, and the drainage class is different approximately halfway through the property (Figure 2); however, this location was reclassified as a Wolfville soil series in the more recent soil survey data.

Two blocks were evaluated separately based on the different soil types and vegetation. Block 1 is the area seen in green and identified as EI-PH/2.B4 or NS WFV5~~~~A; Block 2 is seen in yellow and identified as EI-P/2.B5 or NS WFV4~~~~A (Figure 2).

Each block was described using the soil survey information, vegetation, soil pit classification using the Canadian Soil Classification System (Table 1), and other site features. Soil pit classification was verified through auger sampling at random locations throughout the site. Surface stoniness was determined by sampling four 10 m by 10 m plots and evaluating the number, distribution, and size of stones. Soil samples were collected and analyzed at the Nova Scotia Department of Agriculture Analytical Lab. Additional features were assessed using available maps. These features were then compared to the parameters identified by OMAFRA as hindering agricultural production. Results are presented here.

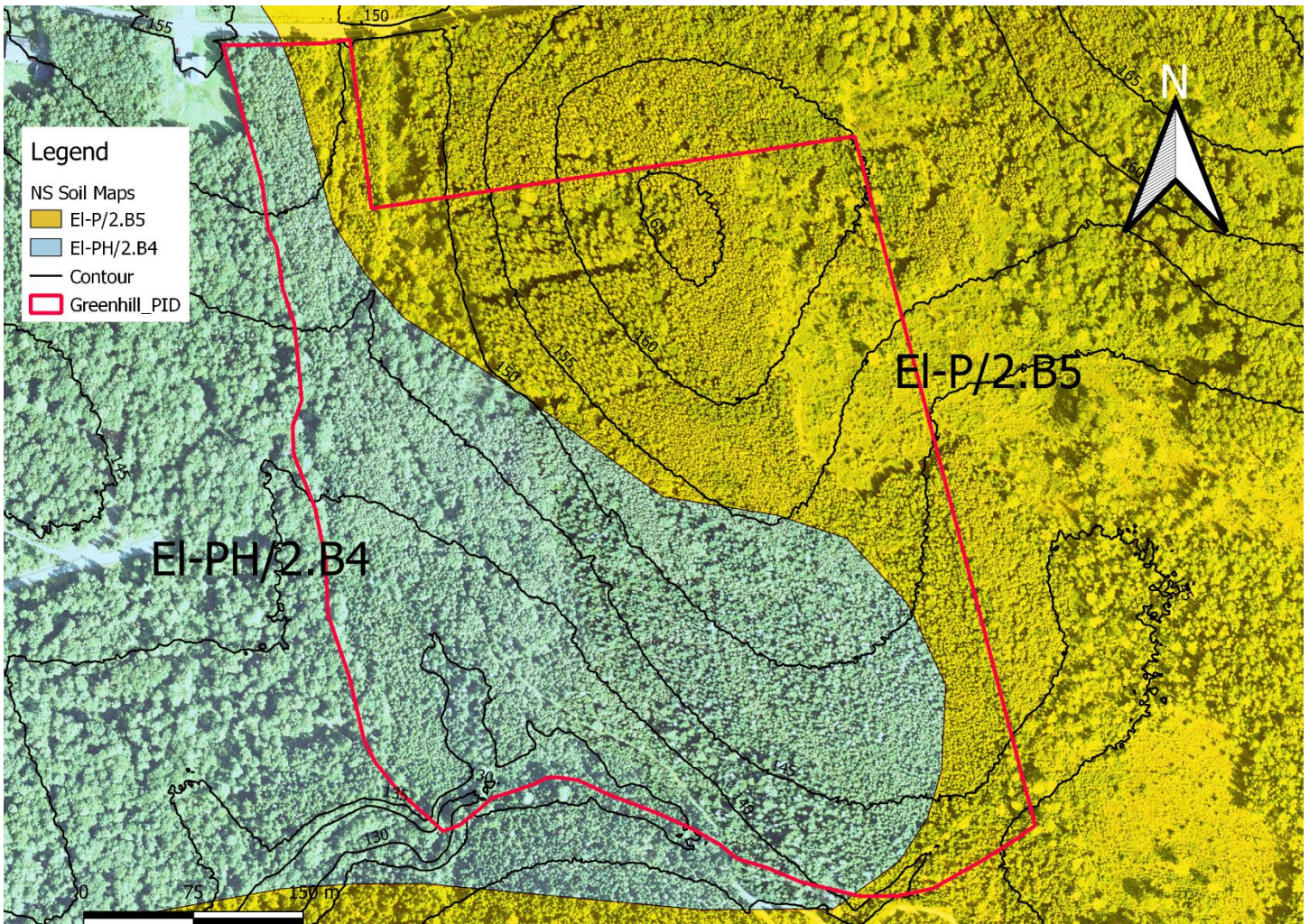


Table 1. Lower case suffixes associated with each soil horizon.

b	A buried horizon
c	An irreversible cemented horizon
ca	Carbonate enrichment, horizon > 10 cm thick
cc	Cemented pedogenic concretions
e	Eluvial horizon
f	Al and Fe enrichment
g	Gleyed horizon mottles
h	Organic matter enrichment
j	Indicates failure to meet limits of suffix it modifies
k	Presence of calcium carbonate
m	Modified, slightly altered horizon
p	Ploughed horizon
s	Horizon with salts including gypsum, crystals or veins can be seen
sa	Secondary salt enrichment horizon thickness >10 cm thick
ss	Slickenslides
t	Illuvial silicate clay present
u	Horizon disrupted by physical or faunal processes
x	Fragipan horizon

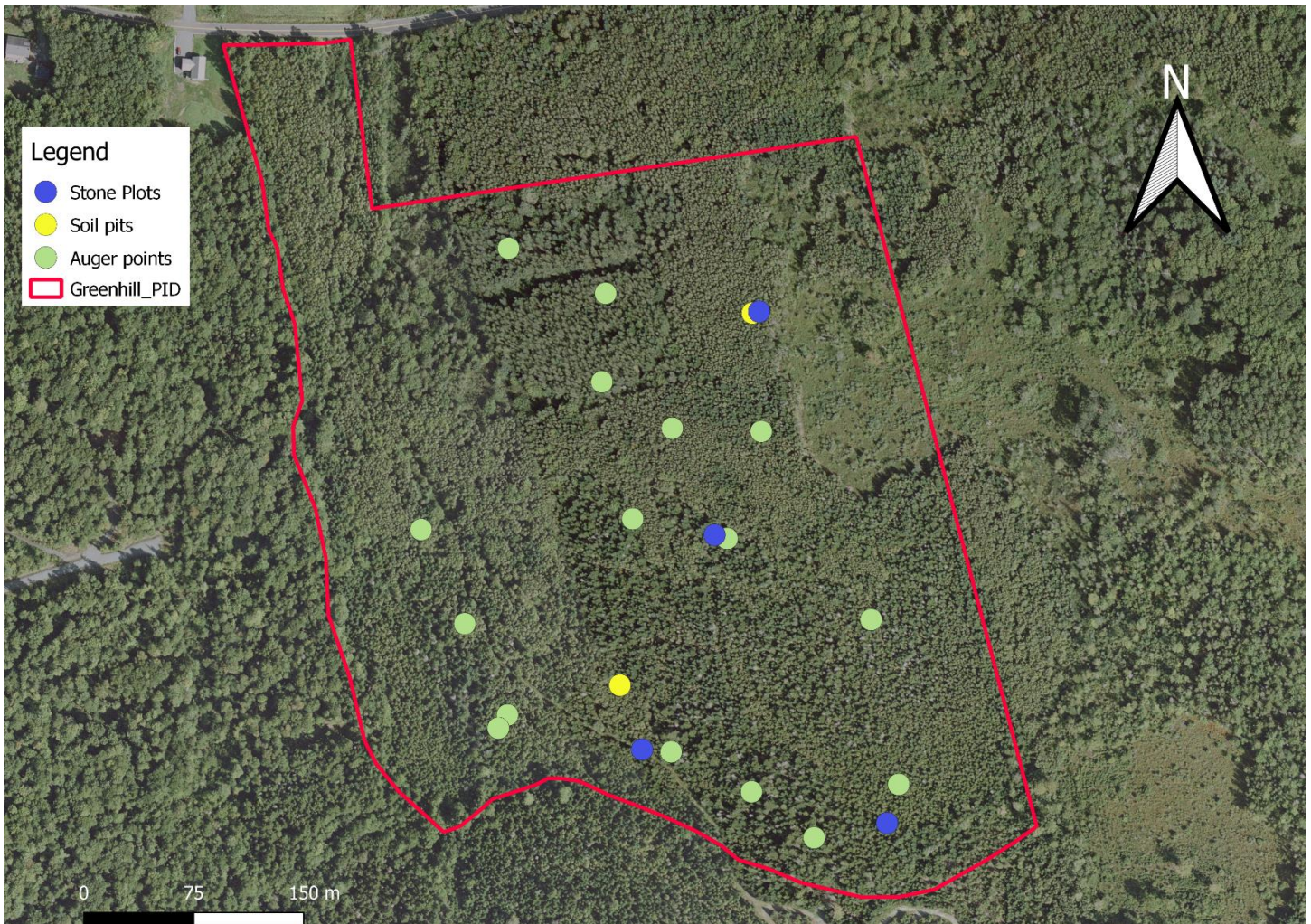


Figure 3. Soil pit, stoniness plot, and auger locations at the Greenhill site.

Soil Test Report Data

Lab #	2204123-001		2204123-002	
Sample ID	GREENHILL 1		GREENHILL 2	
Crop to be Grown	Unknown		Unknown	
Parameter	Analysis	Rating	Analysis	Rating
pH (pH Units)	4.54		4.49	
Buffer pH (pH Units)	7.32		7.34	
Organic Matter (%)	4.1		4.1	
P2O5 (kg/ha)	8		12	
K2O (kg/ha)	61		61	
Calcium (kg/ha)	42		44	
Magnesium (kg/ha)	22		24	
Sodium (kg/ha)	19		17	
Sulfur (kg/ha)	65		83	
Aluminum (ppm)	1427		1458	
Boron (ppm)	< 0.50		< 0.50	
Copper (ppm)	0.70		0.89	
Iron (ppm)	388		313	
Manganese (ppm)	48		54	
Zinc (ppm)	0.52		0.98	
CEC (meq/100 g)	5.7		5.6	
Base sat. K (%)	1.1		1.2	
Base sat. Ca (%)	1.8		2.0	
Base sat. Mg (%)	1.6		1.8	
Base sat. Na (%)	0.7		0.7	
Base sat. H (%)	94.7		94.4	
LR CaCO3 (t/ha to pH 6.5)	10		10	

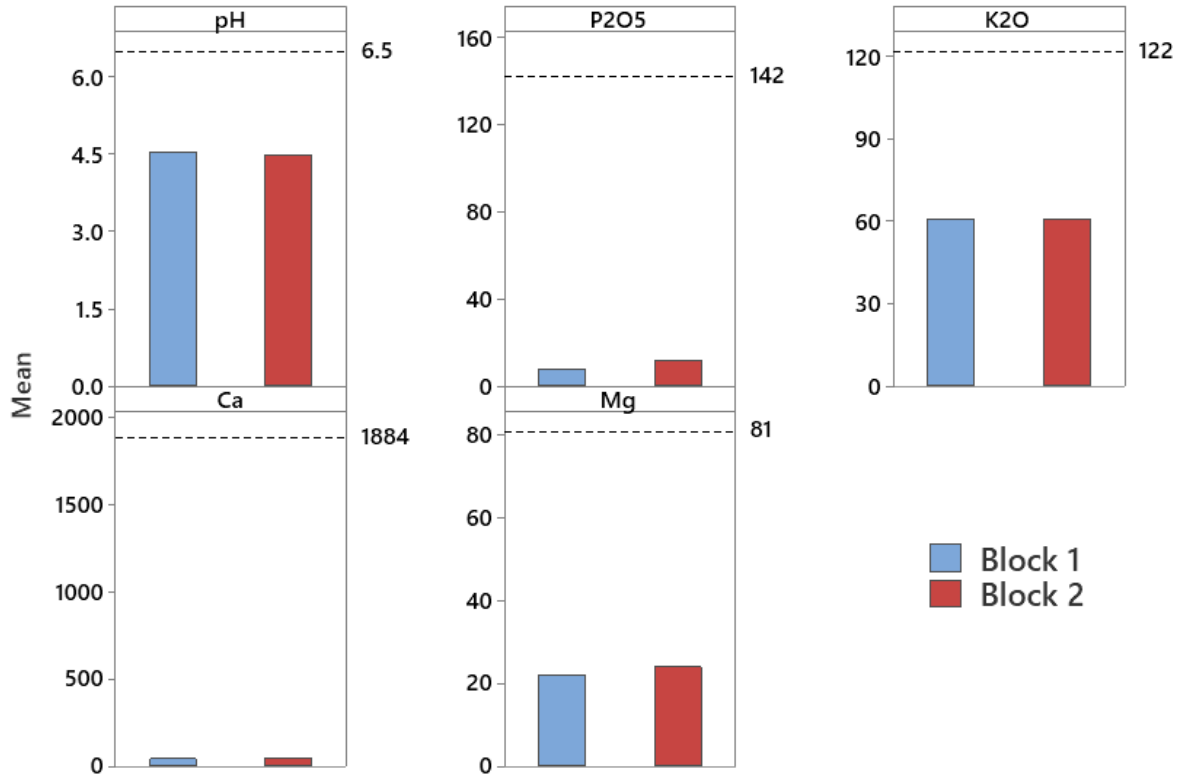


Figure 4. Soil test report data for pH and macronutrients (kg/ha) with threshold values for the minimum required to achieve a medium score on the soil test report for grain crops and forages.

Block 1

Table 2. Soil description based on the Nova Scotia soil surveys (Cann et al. 1954; Government of Canada, 2019).

Category	Characteristic	Description
Classification	Gleyed Humo-Ferric Podzol	Movement of humified organic matter, aluminum and iron to lower horizons. Evidence of mottles which indicate water being held in the soil within 1m of the surface.
Water Table	Always Present	The water table is present throughout all seasons.
Root Restrictions	Third Layer	Plant root growth is restricted by the soil's third layer.
Drainage	Imperfectly Drained	Water is removed from soil sufficiently slowly in relation to supply. Excess water moves slowly downward.
Stoniness	Moderately Stony	Enough stone to interfere with cultivation unless removed.
Topography	Moderately Sloping Complex Slopes	6-9% Slopes with an irregular or rough surface.
Deposition	Till (Morainal)	Soil was deposited by glacial ice.
Texture	Medium	Loam to Sandy Clay Loam
Chemical Properties	Extremely/Strongly Acidic	pH <5.6 (may be different due to historic practices).
Typical Soil Horizons	Ap	A – Mineral horizon near-the surface (0-15 cm deep). p – Plow layer, disturbed by human activity.
	Bfgj	B – Mineral horizon characterized by enrichment of organic matter, change of colour, or development of soil structure (15-50 cm deep). f – A horizon enriched with amorphous material, mainly aluminum, iron, and organic matter. g – A horizon characterized by gray colours and/or prominent mottling. j – A modifier, used to indicate an expression of but failure to meet all requirements for other suffixes.
	Cg	C – Mineral horizon relatively unaffected by soil-forming processes (50cm+) g – As above

Field Characterization

In block 1, the forest stand consisted mainly of black spruce and balsam fir trees with some red maple, gray birch, and white birch. In cut areas, grey birch sprouts were dominant. The ground vegetation often consisted of sphagnum moss and grass species which are indicators of a wet site. Additionally, lambkill and wild blueberry were found throughout the site, indicating acidic soil.

Stand Pictures:





Sphagnum Moss

Soil pit 1 was dug approximately one-third up the slope (Figure 4) in a site deemed representative of the NS WFV5~A soil series. Soils were classified using the Canadian System of Soil Classification, 3rd edition and as outlined in “Soils Illustrated: Field Descriptions, 1st edition (Watson, 2014). Horizons (A, B, C) were classified based on different soil properties such as colour, structure, texture, consistence, chemical, biological, and mineral composition. These horizons are further described using a lower-case suffix to represent the dominant soil property in that horizon.



Horizon	Description	Pit 1
L	Leaf litter.	Moss
Fm	Dark brown, semi-decomposed, fibrous layer.	5-1
Hh	Black, mostly decomposed layer often greasy.	1-0
Ahe	Light grey, elluviated horizon with some humus (7.5YR 4/1).	0-5
Bg	Gleyed matrix (5YR 5/1 with 5YR 5/8), sandy loam or loam, enriched.	5-32
Cg	Yellowish-brown (10YR 3/6 or 10YR 3/4), sandy loam or loam.	32+

Interpretation

Site features that can be considered a hindrance to agriculture production include undesirable soil structure and/or low permeability, risk of erosion, low natural fertility, inundation by streams or lakes, moisture deficiency, high stoniness, shallow depth to bedrock, adverse topography, excess water, and adverse climate. Based on the above site characterization, each potential agricultural hindrance was assessed for the site.

Undesirable soil structure and/or low permeability:

The texture of the B horizon was a silty clay with approximately 40-60% clay. Therefore, a clayey horizon (>35% clay) >15cm thick was present within the first 40 cm of the soil surface. High levels of clay in the upper mineral soil would likely slow water infiltration and water penetration through the soils. Soils with greater clay content are often susceptible to compaction from farm machinery. Depending on the crop, extensive soil preparation, such as subsoiling, tillage, drainage, or raised beds, may be required to increase the infiltration and pore space of the soil before cultivation.

Risk of erosion:

The slope of these soils ranges from 5-20%, and the erosion hazard has the potential to be high. However, no visible signs of topsoil loss were observed as the site was still heavily vegetated. The area with the steepest slope had a small gully with visible signs of organic matter loss. There will likely be a high risk of erosion after land clearing, and erosion mitigating techniques will likely be required. There was a potential loss of topsoil, and mixing of soil horizons was evident in some cut areas. Ruts were observed from machinery in some of the cut areas.



Low natural fertility:

The inherent fertility of the soil is low, as shown by the podzolization of the A horizon, acidic indicator species, and the soil test report. Liming and fertilization would be required after clearing for several years to increase soil fertility.

The soil test report indicated highly acidic soils with a pH of 4.54. the organic matter content is adequate. Phosphorous, potassium, calcium, and magnesium are all well below the suitable range for crop growth (Figure 5). Particularly, phosphorous and calcium would require large amount of inputs to increase to suitable ranges for crop production. In addition, aluminum concentrations are high which can be potentially damaging to crop roots.

Inundation by streams or lakes:

No flooding is likely in this block, and it does not reside on a floodplain. A small stream is located near the edge of the southern and western boundary of the property.

Moisture deficiency:

These soils are classed as loamy or finer and likely do not have low moisture-holding capacity.

Stoniness:

Two sites of 10m by 10m were sampled for surface stoniness. No evidence of surface stoniness was observed within the soil pit. The average diameter of surface stones was approximately 15cm. Stones of this size were located approximately every 1-5m. Less than 1% of the block was occupied by stones >15cm, and approximately 25% of the block was occupied by stones (or gravel) <15cm. Only one boulder (>60cm) was present at the site. There is no evidence that the stoniness would impact machinery use if their site were cleared; however, some stones may have to be removed for improved crop growth. The high amounts of gravel in the soil may impact crop growth and crop type.

Depth to bedrock:

The presence of bedrock extended below 100cm and therefore does not restrict agriculture.

Topography:

The slopes at this site range from 5-20%. Slopes greater than 9% may impact agricultural practices, and considerations for erosion and improving water-holding capacity may have to be made.

Excess water:

These soils showed reduction/oxidation (redox) features dominant within the top 30 cm of mineral soil. Water pooled at a depth of approximately 35 cm, and there was evidence of water indicator species throughout the site, such as sphagnum moss. There is clayey textured soil near the surface of the mineral soil, extending over 40 cm. Installing drainage is not feasible unless the land is cleared and stumped.

Some organic matter leaching was observed in the A horizon but not enough to give it an h designation; the horizon was too thin to sample. The OM content of the B horizon was 4.1%.

Based on the evidence of dominant redox features within the top 30cm of soil, the presence of wet indicator species, and water present within the pit, this soil can be classified as poorly drained.

Climate:

Corn crop heat units were available for Nova Scotia and show a value of greater than 2300; therefore, the climate would likely not inhibit agriculture production in this area.



Redox
Features

Block 2

Category	Characteristic	Description
Classification	Orthic Humo-Ferric Podzol	Podzolic B horizon at least 10cm thick and but not a Bh horizon, no evidence of a gleied horizon within the top 1 m of the surface.
Water Table	Always Present	The water table is present throughout all seasons.
Root Restrictions	Third Layer	Plant root growth is restricted by the soil's third layer.
Drainage	Moderately Well Drained	Water is removed from the soil somewhat slowly in relation to supply. Excess water moves somewhat slowly downward.
Stoniness	Moderately Stony	Enough stone to interfere with cultivation unless removed.
Topography	Steeply Sloping Complex Slopes	10-15% slopes with an irregular or rough surface.
Deposition	Till (Morainal)	Soil was deposited by glacial ice.
Texture	Medium	Loam to Sandy Clay Loam
Chemical Properties	Extremely/Strongly Acidic	pH <5.6 (may be different due to historic practices).
Typical Soil Horizons	Ap	A – Mineral horizon near-surface (0-15 cm deep). p – Plow layer, disturbed by human activity.
	Bf	B – Mineral horizon characterized by enrichment of organic matter, change of colour, or development of soil structure (15-50 cm deep). f – A horizon enriched with amorphous material, mainly aluminum, iron, and organic matter.
	C	C – Mineral horizon relatively unaffected by soil-forming processes (50cm+).

Field Characterization

In block 2, the forest stand was slightly different and consisted of more hardwood species such as red maple and white birch, in addition to balsam fir. The ground vegetation consisted of bunchberry, lily of the valley, aster, starflower, and raspberry. However, this block was more variable throughout, with some wet areas more similar to block 1. Approximately half of this area was cut, and the vegetation differed slightly in those locations. Moving southward, softwoods dominated the forest stand, mainly balsam fir and black spruce. Acid indicator species such as lambkill and wild blueberry were found throughout the site, but not where the pit was dug.





Soil pit 2 was dug approximately at two-thirds of the slope (Figure 3) in a site deemed representative of the NS WFV4~A soil series. Soils were classified using the Canadian System of Soil Classification, 3rd edition and as outlined in “Soils Illustrated: Field Descriptions, 1st edition (Watson, 2014). Horizons (A, B, C) were classified based on different soil properties such as colour, structure, texture, consistence, chemical, biological, and mineral composition. These horizons are further described using a lower-case suffix to represent the dominant soil property in that horizon. The lowercase suffixes are defined in Table 1.



Horizon	Description	Pit 2
L	Leaf litter.	Moss
Fm	Dark brown, semi-decomposed, fibrous layer.	5-0
Hh	Black, mostly decomposed layer often greasy.	Trace
Ahe	Light grey, elluviated horizon with some humus (7.5YR 4/1).	0-3
Bfh	B horizon with some Al or Fe enrichment (7.5 YR 4/3)	3-28
Bfgj	B horizon with some Al or Fe enrichment and non-dominant redox features (7.5 YR 4/4)	28-46
Cg	Yellowish-brown (10YR 3/6 or 10YR 3/4), sandy loam or loam.	46+

Interpretation

Undesirable soil structure and/or low permeability:

The texture of the upper 40 cm of soil is a silt loam and the clay content of the soil increased with depth. Therefore, a clayey horizon (>35% clay) >15cm thick was not present within the first 40cm of the soil surface.

Risk of Erosion:

The slope of this section ranged from 6-17%, and the erosion hazard has the potential to be high. However, no visible signs of topsoil loss were observed at the site as the site was still heavily vegetated. There were no visible signs of soil organic matter loss; however, the potential for forest floor loss is often high in these soil types. There was a potential loss of topsoil in some of the clearcut areas, and mixing of soil horizons occurred in some cut areas. Ruts were observed from machinery in some of the cut areas.

Low natural fertility:

The inherent fertility of the soil is low, as shown by the podzolization of the A horizon, acidic indicator species, and the soil test report. Liming and fertilization would be required after clearing for several years to increase soil fertility.

The soil test report indicated highly acidic soils with a pH of 4.49. the organic matter content is adequate. Phosphorous, potassium, calcium, and magnesium are all well below the suitable range for crop growth (Figure 5). Particularly, phosphorous and calcium would require large amounts of inputs to increase to suitable ranges for crop production. In addition, aluminum concentrations are high which can be potentially damaging to crop roots.

Inundation by streams or lakes:

No flooding is likely in this block; it does not reside on a floodplain and is located upslope.

Moisture deficiency:

These soils are classed as loamy or finer and likely do not have low moisture-holding capacity.

Stoniness:

No evidence of surface stoniness was observed within the soil pit. No evidence of stones was observed within the site, and there is no that rocks would impact machinery use or crop yield if the site were used for agriculture.

Depth to bedrock:

The presence of bedrock extended below 100cm and therefore does not restrict agriculture.

Topography:

The slopes at this site range from 6-17%. Slopes greater than 9% may greatly impact agricultural practices, and considerations for erosion and improving water-holding capacity may have to be made.

Excess water:

These soils showed non-dominant redox features within the top 30 cm of mineral soil. Water pooled at a depth of approximately 45 cm. There was no evidence of wet indicator species at the pit location; however, there was some evidence on the site walkthrough. Redox features were present at approximately 25 cm deep, indicating water saturation for prolonged periods.

The texture of the B horizon was a silty loam to silty clay loam. Some organic matter leaching was observed in the A horizon but not enough to give it an h designation; the horizon was too thin to sample. The organic matter content of the B horizon was 4.1%. Based on the evidence of some redox features within the top 30cm of soil, no presence of wet indicator species, and water present within the pit, this soil can be classified as moderately well to imperfectly drained.

Climate:

Corn crop heat units were available for Nova Scotia and show a value greater than 2300; therefore, the climate would likely not inhibit agriculture production in this area.

Summary and Conclusion

The Nova Scotia soil survey identified this 52-acre plot as having two soil types with different drainage classes. This was confirmed by the field characterization, and the assessment was conducted using the boundary for these two soil types, dividing the site into two blocks. Block 1 (southwest) was poorly drained. Extensive soil manipulation, including site preparation and drainage, would likely be required for crops to grow. In addition, the drainage is poor and may be restricted to shallow-rooted crops or crops with a high tolerance for water. The site had a moderate to severe slope which may be prone to erosion when cleared. The site had inherently low fertility, and extensive use of lime and fertilizer would be required to support agricultural production. Block 2 (northeast) was located further upslope and was moderately well to imperfectly drained. The site varied more throughout, and drainage may be required in some locations. The site had a moderate to severe slope which may be prone to erosion when cleared. The site had inherently low fertility, and extensive use of lime and fertilizer would be required to support agricultural production.

This land is rated as CLI Class 3 but has constraints that may limit the use of the land for agriculture. These constraints include but are not limited to the drainage, the slope, and the low inherent fertility. There was no indication that the site had been previously used or was going to be used for agricultural purposes. The amount of effort to convert this property into highly productive agricultural land is not feasible, and extensive maintenance on the land would likely be required to maintain agricultural production. Practices that would be required to improve the land for high agriculture production include but are not limited to:

- Land clearing
- Land grubbing and stumping
- Soil preparation such as subsoiling, tillage, raised beds, etc.
- Fertilization
- Liming
- Drain tile or other water management techniques
- Erosion management such as terracing
- Soil organic matter amendments such as compost or manure
- Use of short-rooted crops in clay-rich areas

Overall, to be considered for agricultural production, this land would require extensive preparation and maintenance and would likely still be restricted in the types of crops which would thrive.

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