Memo

Stantec

To:	Drew Semple Regional Municipality of Niagara	From:	Rajan Sawhney Stantec Consulting Ltd. Kitchener, Ontario
File:	1611 10576/10	Date:	June 20, 2007

Reference: PILOT OFF-STREAM RESERVOIR

BACKGROUND

As part of the Niagara Feasibility Phase 2 project, irrigation options are required to be ascertained for the agricultural lands in the Niagara Peninsula. Areas below the Niagara escarpment can be serviced by Lake-based irrigation systems. A separate Engineering Report has been prepared as part of this project and evaluates pipe and gravity servicing alternatives.

A Lake-based system was not considered economically feasible for areas above the escarpment due to the high capital and operating cost associated with pumping, and as such, was not considered for areas above the escarpment. Some other options for servicing considered for these areas were:

- Groundwater
- Storage Reservoir

In order to ascertain the availability of groundwater, a separate groundwater report has been prepared and submitted to the Region. The report concludes that it is not feasible to develop a comprehensive groundwater-based irrigation system for areas above the escarpment, primarily due to lack of sufficient aquifer capacity.

The purpose of this memo is to discuss the suitability of the off-stream reservoir system to store rainwater/runoff and provide irrigation water for areas above the escarpment. The overall system was envisaged to be such that individual farmers would construct reservoirs on their own properties, and the size would vary based on the water requirement of individual farm. It should be recognized that a portion of potentially usable farmland would be lost to the storage reservoir.

ANALYSIS

It was proposed to select one location for the construction of a pilot reservoir. Background investigation was required to be carried out as part of this assignment, with the actual construction beyond the scope of this project. As part of this exercise, the

A. Moyer farm located at 160 Elm Tree Road West in Grimsby was identified, and the owner was willing to proceed with the construction of a Pilot Reservoir on his field.

In order to identify a preferred reservoir location on the field, Agriculture and Agri-Food Canada was retained to conduct a background review and perform an Electromagnetic (EM) survey to ascertain the underlying soil conditions. They submitted their findings and provided their comments via email in April 2007. A copy of the e-mail is attached with this memo. The e-mail provides a review of the Town of Grimsby – Kemp Road and Mountain Road Secondary Plan – Background and Options Report, dated May 2006, and indicates that:

- surficial soils in the area consist of glaciolacustrine clays overlying till;
- the combined overburden thickness varies from about 1 m to more than 13 m, and is typically 5 to 6 m;
- the thickness of glaciolacustrine clay increases towards the south; and
- the underlying formations comprise a bedrock aquifer, which is considerably more permeable than the overburden due to an interconnected fracture network.

A quaternary geology map of the area from the Regional hydrogeology report was also reviewed and confirmed the presence of glaciolacustrine deposits. It was thought that overburden at the identified farm at 160 Elm Tree Road West could be relatively thin.

Agriculture and Agri-Food Canada also reviewed the water well database provided by Stantec. Out of the four wells in the vicinity of the site, three indicated no overburden, while one indicated 6 m of overburden overlying the aquifer. Such variability in wells in close proximity was considered unusual.

In order to receive further information specific to the identified farm, an electromagnetic (EM) survey was conducted by Agriculture and Agri-Food Canada. The figure presenting the survey results is contained in the e-mail from Agriculture and Agri-Foods Canada, which is attached along with this memo. The figure presents a variety of surficial soils based on a legend shown at the bottom of the figure. The majority of the area comprises of yellow colour, which is indicative of lesser clay and more sand content. Some areas however are in blue colour, which is indicative of clay, and is typically present in the southern portion of the EM survey area. However, based on a review of the background information, there is a strong possibility that no clay is present on the site, and if present, it is likely to be thin and/or of limited aerial extent. Therefore, this site seems to be unsuitable for construction of an irrigation storage reservoir.

If it is decided to go ahead with the construction of a reservoir at this site, detailed field investigation is warranted, wherein soil samples should be taken at various locations in the blue and green areas shown on the EM survey and examined in a laboratory. The candidate sites for the soil samples should also be reviewed with the land owner to obtain input on suitable areas and permission for the access.

CONCLUSION

Based on a review of the background reports and drawings, and the results of the EM survey, it is concluded that the identified site is not suitable for constructing an on-site storage reservoir. In case the Region decides to further pursue the suitability of providing a storage reservoir at this site, to develop a reservoir concept, and to generate an opinion of probable cost associated with this concept, detailed soil investigation would be required in order to further evaluate the underlying soil conditions. If desired, we could coordinate hiring a geotechnical engineering firm to carry out detailed field sampling and laboratory testing. This would be extra to our scope of work.

Please do not hesitate to contact the undersigned in case you have any questions.

Yours truly,

STANTEC CONSULTING LTD.

Rajan Sawhney (By E-mail)

Rajan Sawhney, M.E. (Env), P.Eng.
Senior Project Manager
rajan.sawhney@stantec.com

Attachment

c. Mr. Bruce Shewfelt (Agriculture and Agri-Food Canada)
Mr. Wade Morrison (Agriculture and Agri-Food Canada)
Mr. Guy Le Patourel (Stantec)
Mr. Nathan Sherwood (Stantec)

Oliveira, Alison

From: Morrison, Wade [morrisonw@AGR.GC.CA]
Sent: Friday, April 27, 2007 2:53 PM
To: Sawhney, Rajan
Subject: FW: Moyer farms, Niagara Region Note 1 of 2

Several weeks ago you had asked for a report on the electromagnetic survey we had completed for Saaed at the Alfred Moyer farm. I am forwarding the attached letter from the geotechnical engineer who has completed most of interpretation on EM surveys completed for irrigation reservoir in southern Manitoba.

A second email will include a file of the survey results and my own initial thoughts on the site

-----Original Message-----
From: Klassen, Vic
Sent: Wednesday, April 25, 2007 4:55 PM
To: Morrison, Wade
Subject: Moyer farms, Niagara Region

Hi Wade

This correspondence is in regards to A. Moyer farm, 160 Elm Tree Road West, Grimsby, Niagara Peninsula, Ontario. Although we were unable to inspect the site last fall when I was in Ontario, an EM survey was completed and has been processed into map form which we have reviewed. Additional information has been reviewed and is described in this correspondence as it relates to interpreted site characteristics and recommendations for an initial site investigation. Arrangements for an investigation as well as payment of costs and interpretation of results would be the responsibility of others. Design considerations would evolve from the investigation if suitable conditions are identified.

General information regarding site conditions is provided in the Town of Grimsby - Kemp Road and Mountain Road Secondary Plan - Background and Options Report dated May 2006. Sections 3.2.3 Geology and 3.2.4 Hydrogeology indicate that surficial soils in the area consist of glaciolacustrine clays overlying till. The thickness of these units, particularly the glaciolacustrine clay, increases towards the south. The combined overburden thickness varies from about 1m to more than 13m and is typically 5-6m. The bedrock underlying the overburden is called the Lockport Formation and in the southern region the Amabel formation also exists. Both these Formations comprise a bedrock aquifer which is considerably more permeable than the overburden due to an interconnected fracture network.

The quaternary geology map of the area from the regional hydrogeology report that you sent to me from a different report confirms the presence of surficial glaciolacustrine deposits. The location of 160 Elm Tree Road West at the northern edge of the glaciolacustrine plain close to a till moraine exposure which parallels the Niagara Escarpment suggests that overburden at the site could be relatively thin.

The water well database provided by Stantec indicates that there are 4 water wells in the vicinity of the site. Three of these indicate no overburden while one indicates 6m of overburden overlying the aquifer. It seems unusual that such variability would exist in close proximity; however, information from water well databases do not always provide clear information.

The EM survey was conducted on either side of a small creek located about 400m north of the house. The majority of the readings are about 60
corresponding to a yellow colour on the EM map with some of the southern area showing slightly higher readings of 80 to 90 corresponding to a blue colour. Since the higher readings are generally more indicative of clay content, there may be potential for clay to be present in the southern area of the EM survey.

The available information reviewed in this correspondence indicates that there is a small chance that some amount of clay is present at the site; however, if present, it is likely to be thin and/or of limited areal extent, and therefore probably insufficient for construction of an irrigation storage reservoir. If others decide that an investigation is warranted and decide to proceed, the investigation should initially focus on the blue area in the south part of the EM survey and expand towards the green area if favourable conditions are encountered. If soil samples from the investigation are provided to you and warrant classification and laboratory testing, you could ship the samples to our laboratory to perform that work.

I trust this information satisfies your requirements at the present time. I f you have any questions or comments, please feel free to contact me.

Vic

Vic Klassen P.Eng., M.Eng.
Senior Geotechnical Engineer
PFRA Geoenvironmental Unit
Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada
Telephone/Téléphone: (306) 780-8703
Facsimile/Télécopieur: (306) 780-5998
1800 Hamilton St./1800, rue Hamilton
Regina SK S4P 4L2
klassenvr@agr.gc.ca

Agriculture and Agri-Food Canada Agriculture et Agroalimentaire Canada

Oliveira, Alison

From: Morrison, Wade [morrisonw@AGR.GC.CA]
Sent: Friday, April 27, 2007 3:18 PM
To: Sawhney, Rajan
Subject: FW: Moyer farms, Niagara Region Note 2 of 2
Attachments: MoyerFarmKey Plan.doc; Moyer Farm site plan.doc; EM31_Moyer_STD.pdf

My initial thoughts are that the taupe and orange areas may represent bedrock near surface on the north side of the creek. The most probable location for potential earthern reservoir investigation would be to complete testpits in two blue zones south of the stream. This roughly correlates with one of the areas that Mr Moyer indicated as a preferred site when we were on site in the fall .

Developing storage directly in stream is not likely an option that would be permitted in this area since the site is just off the escarpment and close to protected conservation lands.

R.Wade Morrison
PFRA/ARAP-Agriculture and Agri-Food Canada/Agriculture et Agroalimentaire Canada
Telephone/Téléphone: 519-837-5857
Facsimile/Télécopieur: 519-837-9782
174 Stone Road West
Guelph, Ontario
N1G 4S9

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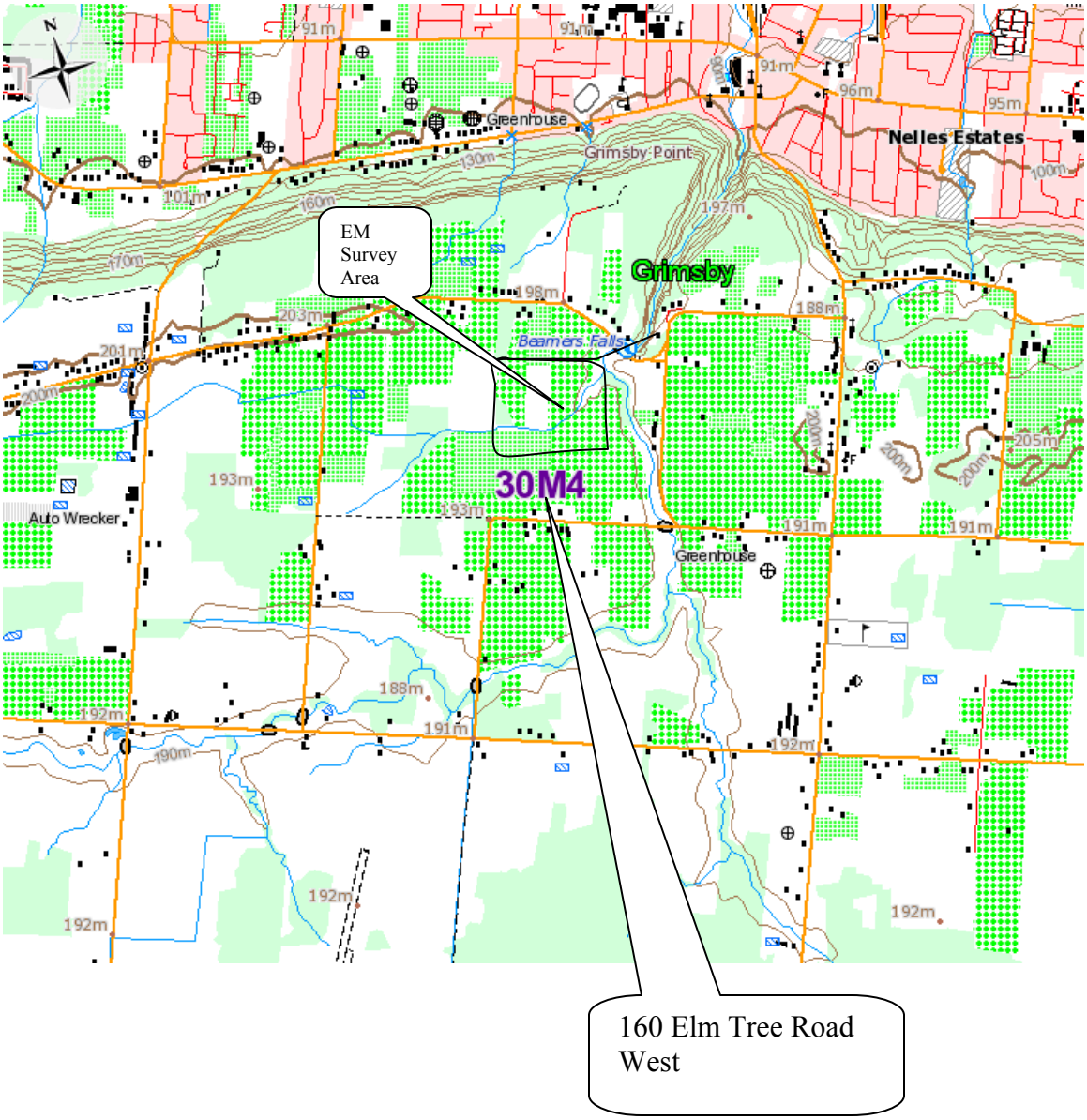
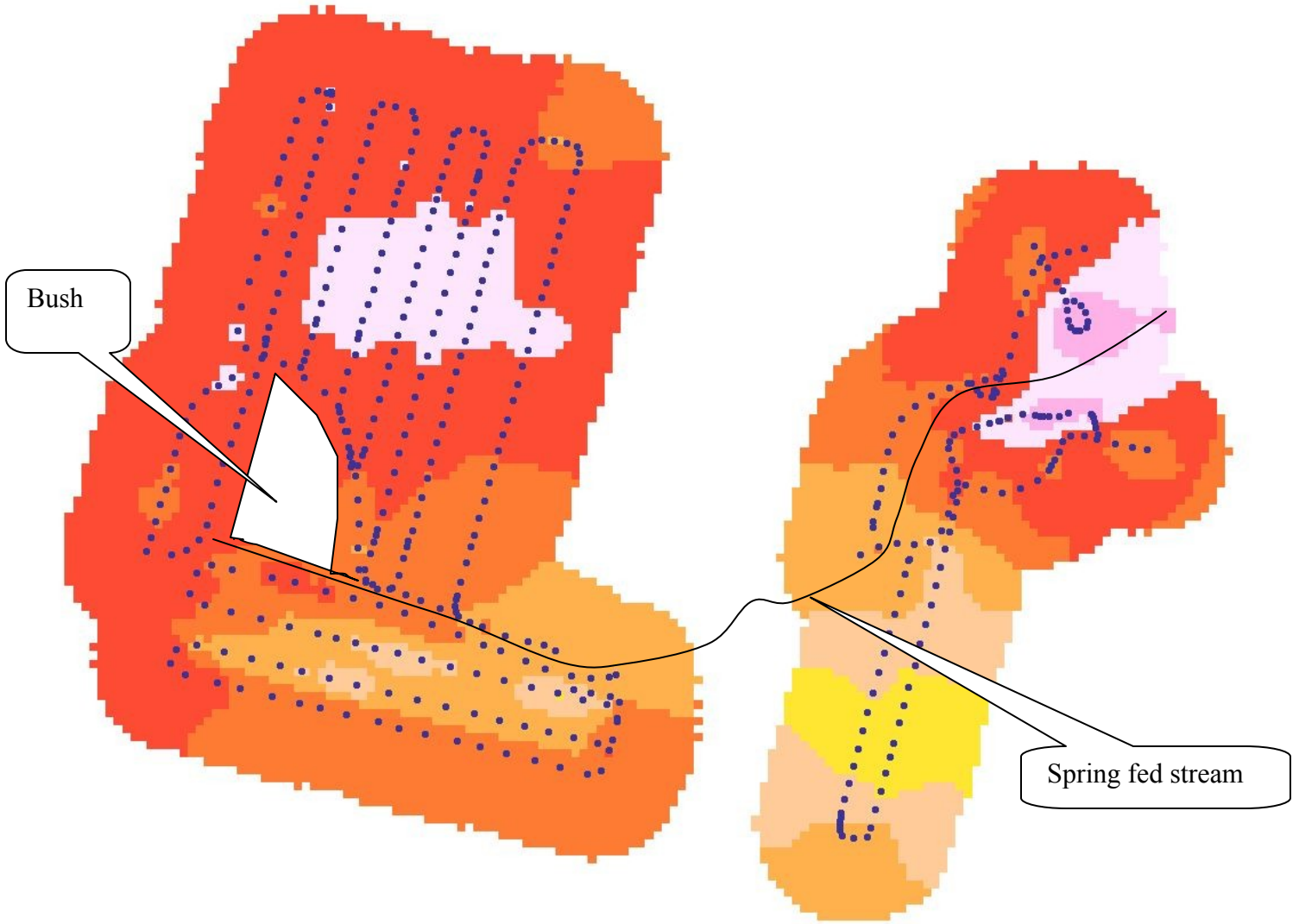

EM Survey Area
Grimsby
30M4
160 Elm Tree Road West
Greenhouse
Grimsby Point
Nelles Estates
Beamers Falls
Auto Wrecker
Greenhouse


Bush
Spring fed stream

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Canada

Moyer Farms: EM31 Survey

0 50 100 200 300 400 500

Meters

N

Legend

• Sensors

EM Readings

Count:	501
Min:	25
Max:	88
Mean:	51

EM Grid

Sand — *Clay*

0 40 80 100

Leamington Area

Field survey done October 2006 by N. Lyon

Map Design: Sonia Solivar, PFRA Winnipeg

File Reference: W:\data2\EM31\Projects\Ontario\Niagara\EM31_Moyer.mxd

Map Revised: January 18, 2007