

**SARNIA AIRPORT STORAGE POOL LIMITED PARTNERSHIP**

December 7, 2017

BY COURIER & RESS

Ms. Kirsten Walli  
Board Secretary  
Ontario Energy Board  
2300 Yonge Street, 27<sup>th</sup> Floor  
Toronto, ON M4P 1E4

Dear Ms. Walli:

**Re: Sarnia Airport Storage Pool Limited Partnership (“SASP”)  
2018 Sarnia Airport Pool Project  
EB-2017-0362**

Enclosed please find two copies of SASP’s Application and Pre-filed evidence for the above-noted project.

In the event that you have any questions on the above or would like to discuss in more detail, please do not hesitate to contact me.

Yours truly,

*[original signed by]*

Jim Redford  
President  
Sarnia Airport Storage Pool Management Inc.  
:sb  
Attach.

cc: N. Marconi  
Z. Crnojacki  
Regulatory Library

**ONTARIO ENERGY BOARD**

IN THE MATTER OF the Ontario Energy Board Act, 1998, S.O. 1998, c.15, Schedule B; and in particular section 38(1) thereof.

AND IN THE MATTER OF an Application by Sarnia Airport Storage Pool Limited Partnership for an Order varying the maximum operating pressure in the Sarnia Airport Pool relating to the allowable pressure gradient in this natural gas storage pool in the City of Sarnia in the County of Lambton.

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**SARNIA AIRPORT STORAGE POOL LIMITED PARTNERSHIP**

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1. Sarnia Airport Storage Pool Limited Partnership (the “Applicant”) is proposing changes to the Sarnia Airport Natural Gas Storage Pool in the City of Sarnia in the County of Lambton.
2. Sarnia Airport Storage Pool Limited Partnership wishes to operate the Sarnia Airport Natural Gas Storage Pool at a maximum pressure gradient of 17.2 kPa/m (0.76 psi per foot) as permitted under the CSA Standard Z341.1-14.
3. Sarnia Airport Storage Pool Limited Partnership therefore applies for leave to operate the Sarnia Airport Natural Gas Storage Pool above the 16.5 kPa/m (0.73 psi/foot) as identified in the EB-2008-0002 proceeding.
4. Sarnia Airport Storage Pool Limited Partnership requests that the following condition be placed on the Sarnia Airport Natural Gas Storage Pool:

*Sarnia Airport Storage Pool Limited Partnership shall not operate the storage pool above a pressure representing a pressure gradient of 17.2 kPa/m (0.76 psi/f) of depth without leave of the Board. Sarnia Airport Storage Pool Limited Partnership shall provide summaries of an engineering study and geological study in support of any leave application and a formal confirmation from the Ministry of Natural Resources and Forestry that operating the pool at the increased operating pressure complies with the requirements of the CSA Z341 standard.*

5. Attached hereto as Schedule “A” is a map showing the general locations of the Sarnia Airport Natural Gas Storage Pool.
6. In order to meet the proposed in-service date of November 2018, the Applicant requests an approval by April 2018. The Applicant therefore applies to the Board for a timely approval of this Application.

Dated at the Municipality of Chatham-Kent, Ontario this 7th day of December, 2017.

*[original signed by]*

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Per: Jim Redford  
President  
Sarnia Airport Storage Pool Management Inc.

Comments respecting this Application should be directed to:

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## 2018 Sarnia Airport Storage Pool Project

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### SCHEDULES

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## **BACKGROUND**

1. Sarnia Airport Storage Pool Limited Partnership (“SASP”) proposes to Delta Pressure the Sarnia Airport Pool to 17.2 kPa/m (0.76 psi/ft) during the 2018 injection season. The general location of the Sarnia Airport Pool can be found at Schedule 1.
2. In the past, the Ontario Energy Board (“The Board”) has imposed conditions of approval limiting the maximum operating pressure on the storage pool.
3. SASP is applying for leave to vary the conditions of approval in relation to delta pressuring the Sarnia Airport Pool (EB-2008-0002). The original condition states:  
  
*“MHP and AltaGas on behalf of SASP LP shall not operate the Sarnia Airport Pool above a maximum operating pressure representing a pressure gradient of 15.8 kPa/m of depth to the top of the reservoir.”*
4. It is SASP’s understanding that the Board approvals will require the applicant to conform to CSA Z341.1-14 Storage of Hydrocarbons in Underground Formations to the satisfaction of the Ontario Ministry of Natural Resources and Forestry (“MNRF”).
5. The following technical information has been provided to the Petroleum Resources Section of the MNRF:
  - An Engineering study completed by Geofirma Engineering Ltd. (“Geofirma”) confirming that the maximum safe operating pressure exceeds 17.2 kPa/m (0.76 psi/ft) for the Sarnia Airport Pool. The approach used by Geofirma is consistent with previous studies

completed for the storage pools currently operated at the elevated pressure gradient of 17.2 kPa.m (0.76 psi/ft).

- A review of the pool as prescribed by CSA Z341.1-14 Clause 7.2 assessing: a) wells within 1 kilometre; b) operations within 5 kilometres and; c) the integrity of all wells penetrating the storage zone.
  - An analysis of hazards and operability (“HAZOP”) for the storage pool.
6. SASP’s request will result in an increase in pool pressure of approximately 900 kPa resulting in an increase to the working capacity of 17,600  $10^3\text{m}^3$ . This increase is within the limits as prescribed by CSA Z341.1-14.
  7. If this application is approved, SASP will begin operating the pools at higher pressure gradients during the 2018 injection season.
  8. As there are no pipelines to be constructed, a leave to construct application is not required. No new wells are proposed as part of this project and therefore a favourable report from the MNRF is also not required.
  9. No directly affected landowner has raised any concerns regarding these changes.
  10. There are no environmental impacts as a result of the proposed changes in operating pressure.

11. SASP is proposing to increase the pressure in the pool by September 1, 2018. In order to meet this timetable, a Board Decision on SASP's Application is respectfully requested by April, 2018.
12. The day-to-day operation and maintenance services of the Sarnia Airport Pool will continue to be subcontracted to Union Gas Limited ("Union").
13. SASP will review and update operating procedures and Emergency Response Plans prior to operating the pool at the increased pressure level, as required.
14. Emergency shut-down valves ("ESD") capable of isolating the storage facility from the transmission pipeline are currently in place at the pool station with remote operation from the Dawn Operations Centre in accordance with CSA Z341.1-14 Clause 9.3. SASP is proposing to install ESD valves on each injection/withdrawal well at the Sarnia Airport Pool as part of the Project.
15. All above ground piping and wells have been reviewed to ensure compliance with all codes and standards at the increased operating pressure.

### **PROJECT NEED**

16. There continues to be a market demand for new storage space in Ontario. However, the value of storage space is currently at a level where new storage space is difficult to economically develop.



17. Storage developers are looking for low-cost organic storage growth projects, such as delta pressuring programs, to increase storage space. These delta pressuring projects can be economically developed to meet market demand at forecast storage values.
18. This project does not provide any incremental deliverability and therefore SASP contacted the current customer for storage capacity in the Sarnia Airport Storage Pool to determine if they would be interested in purchasing the additional capacity created by this Project. Union has contracted to purchase the incremental storage capacity at market based rates.
19. This Project is part of SASP's un-regulated storage business; as such economics have not been completed for the Project.

### **GEOLOGY AND RESERVOIR ENGINEERING**

20. The Sarnia Airport Pool was discovered in 1981 with the drilling of the Bluewater True Sarnia 2-11-VIII well and was converted to natural gas storage in 2009. A location map showing the Sarnia Airport Pool in relation to the surrounding area is shown in Schedule 2. Currently, the pool is operated and monitored using five injection/withdrawal wells and one Guelph observation well. The Sarnia Airport Pool has a total capacity of  $181,200 \times 10^3 \text{ m}^3$  and a working capacity of  $150,900 \times 10^3 \text{ m}^3$ . The pool operates between a cushion pressure of 2,100 kPaa and a maximum pressure of 10,680 kPaa.
21. A map showing the Sarnia Airport Pool Designated Storage Area, Guelph structure and depth-to-crest is included in Schedule 3. The geological interpretation was completed using 3D seismic data and well information. The map is contoured in 10 m intervals and shows the reef

reaching approximately 120 m above the regional Guelph surface. The minimum depth-to-crest is 718.0 m.

22. A cross section illustrating the reef structure of the Sarnia Airport Pool is provided as Schedule 4. The cross section illustrates the relationship of the pinnacle reef to the surrounding formations. The A2 Salt, A1 Carbonate and A1 Anhydrite units pinch out against the flanks of the reef providing lateral seals. The A2 Anhydrite, A2 Shale, and A2 Carbonate drape over the reservoir forming an effective caprock seal ranging in thickness from 39.6 to 45.8 m. The A2 Anhydrite is continuous over the reef and ranges in thickness from 9.0 to 15.5 m.
23. SASP is proposing to operate the Sarnia Airport Pool at 11,580 kPaa. This equates to a pressure gradient of 17.2 kPa/m (0.76 psi/ft). This will increase the working capacity from 150,900  $10^3\text{m}^3$  to 168,500  $10^3\text{m}^3$ , which is an incremental capacity gain of 17,600  $10^3\text{m}^3$ .
24. In order to ensure the proposed maximum pressure gradient complies with CSA Z341.1-14, an engineering study was conducted by Geofirma for the Sarnia Airport Pool. This engineering study incorporated data from geomechanical and regional in-situ tests completed on the reservoir and caprock formations.
25. It is SASP's understanding that the Board approvals will require the applicant to conform to CSA Z341.1-14 Storage of Hydrocarbons in Underground Formations to the satisfaction of the MNRF.

26. A meeting was held with MNRF on October 13, 2017 to introduce and explain the Project. A copy of the presentation given to MNRF can be found at Schedule 5. MNRF was also provided copies of the following reports:

- Engineering studies completed by Geofirma confirming that the maximum safe operating pressure exceeds 17.2 kPa/m (0.76 psi/ft) for the Sarnia Airport Pool. The approach used by Geofirma is consistent with previous studies completed for the storage pools currently operated at the elevated pressure gradient of 17.2 kPa.m (0.76 psi/ft).
- A review of the pool as prescribed by CSA Z341.1-14 Clause 7.2 assessing: a) wells within 1 kilometre; b) operations within 5 kilometres and; c) the integrity of all wells penetrating the storage zone.
- An analysis of hazards and operability (“HAZOP”) for the storage pools.

Summaries of these reports can be found at Schedule 6.

27. The MNRF informed SASP that they would be participating in this hearing process including asking interrogatories and filing submissions.

28. It is SASP’s understanding that the MNRF will provide its comments on the Engineering and Geological studies and SASP’s compliance with code requirements as part of its final submissions.

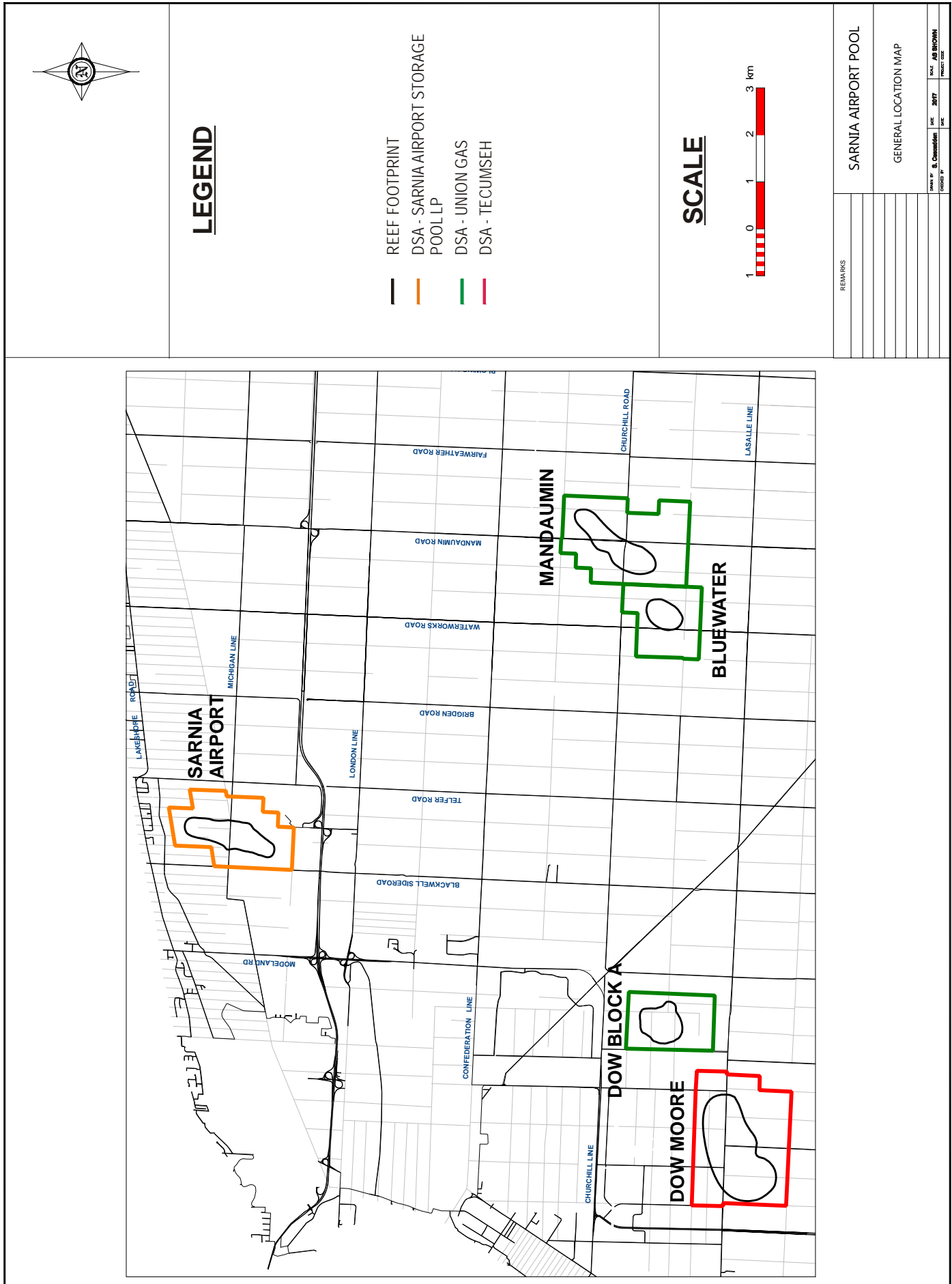
29. In addition, a review of well casings, wellheads, gathering pipelines, storage pipelines and other related surface facilities was completed. As a result of this review, five wells in the Sarnia

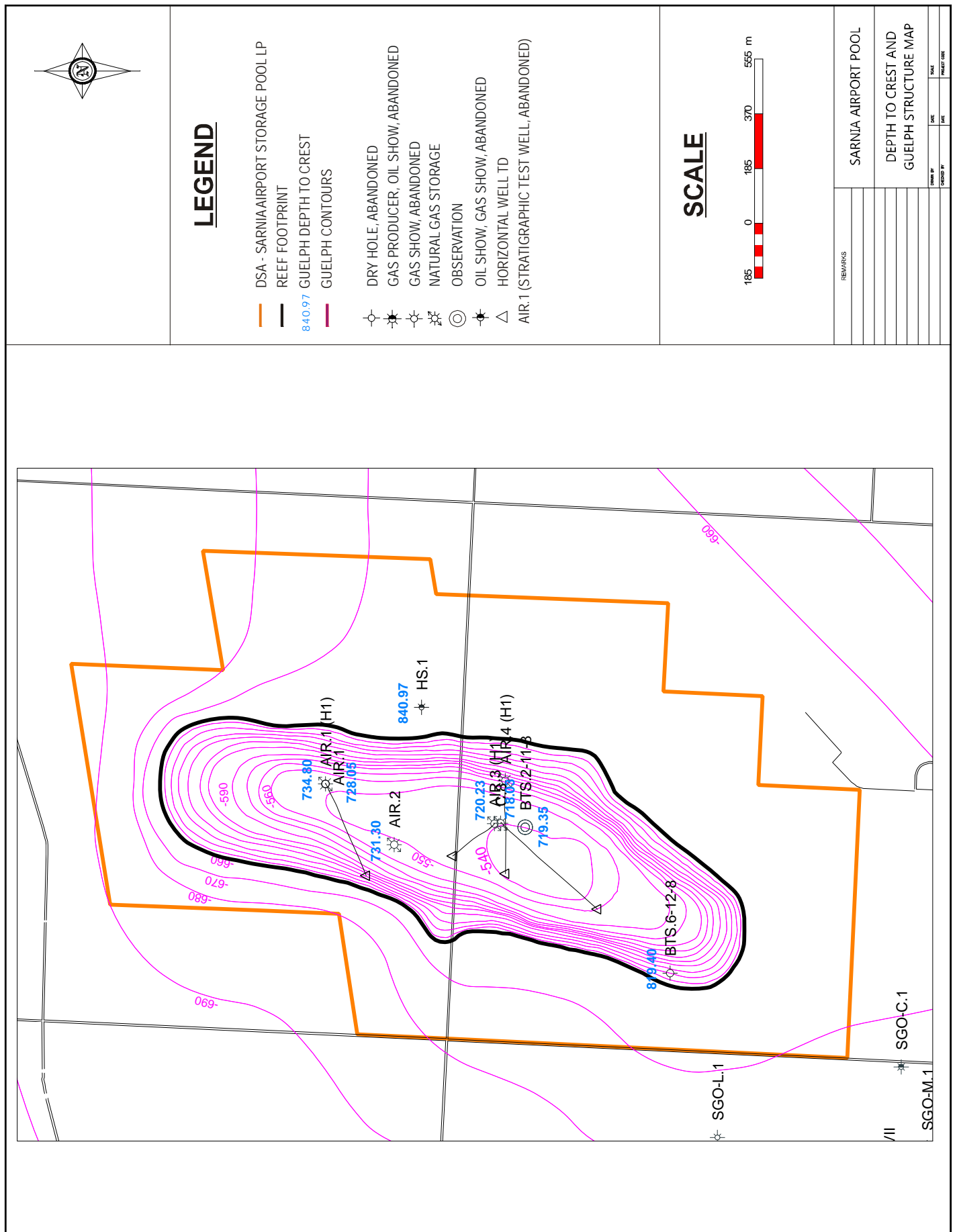
Airport Pool will receive new wellheads and master valves. A workover will be completed on one well to replace a portion of the production casing. In addition, a wellhead ESD valve will be installed on all 5 injection/withdraw wells in the pool. This work is scheduled to be completed prior to delta pressuring. No other upgrades are required. The MOP of the physical facilities in the pool is 12,065 kPa.

### **CONSULTATION**

30. Letters have been sent to all landowners within the Sarnia Airport Pool informing them of the proposed changes to the pool. No landowners have identified any issues with increasing the pressure in the Sarnia Airport Pool.
31. Before any work is completed on wells in the Sarnia Airport Pool landowners will be notified one week ahead of work commencing.
32. Letters have been sent to all local Indigenous communities in the vicinity of the pool. No community has identified any issues with increasing the pressure in the Sarnia Airport Pool.













# Sarnia Airport Pool Enhancement Project

Ministry of Natural Resources and Forestry  
October 13, 2017

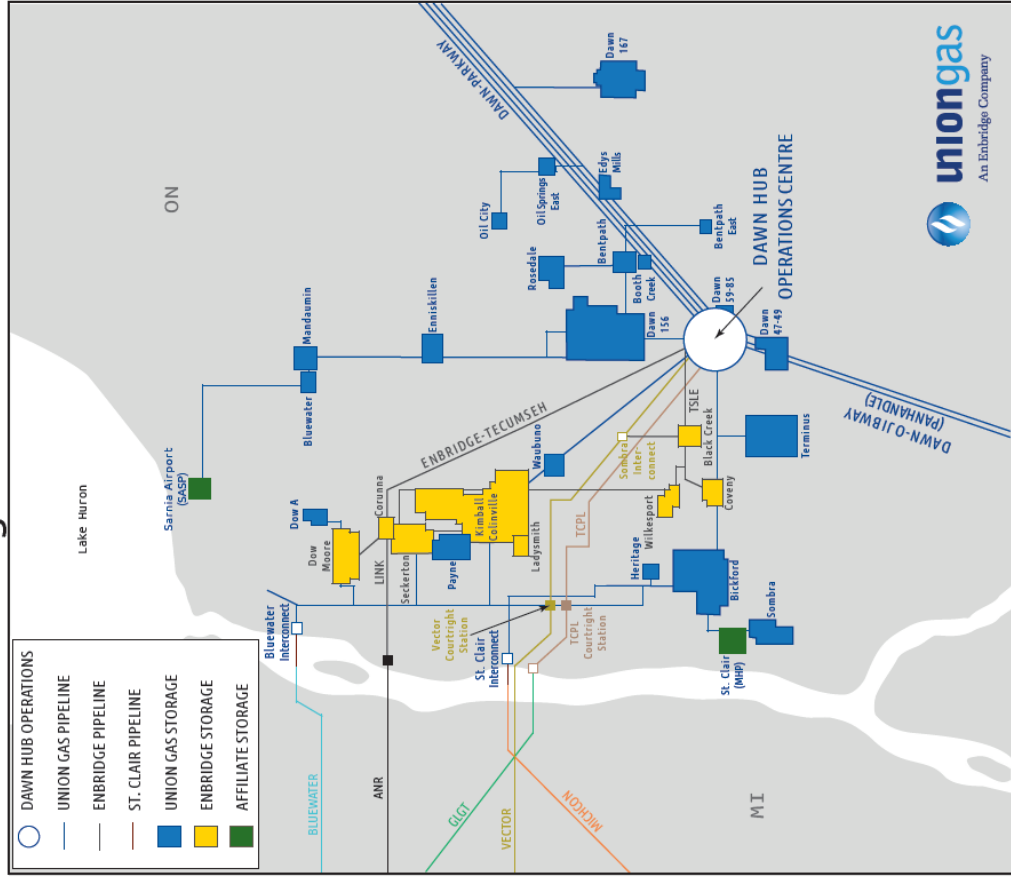


# Project Purpose

Increase storage capacity by 17,600  $10^3\text{m}^3$  (0.6 Bcf) through the delta pressuring of the Sarnia Airport Pool to 17.2 kPa/m (0.76 psi/ft) in 2018

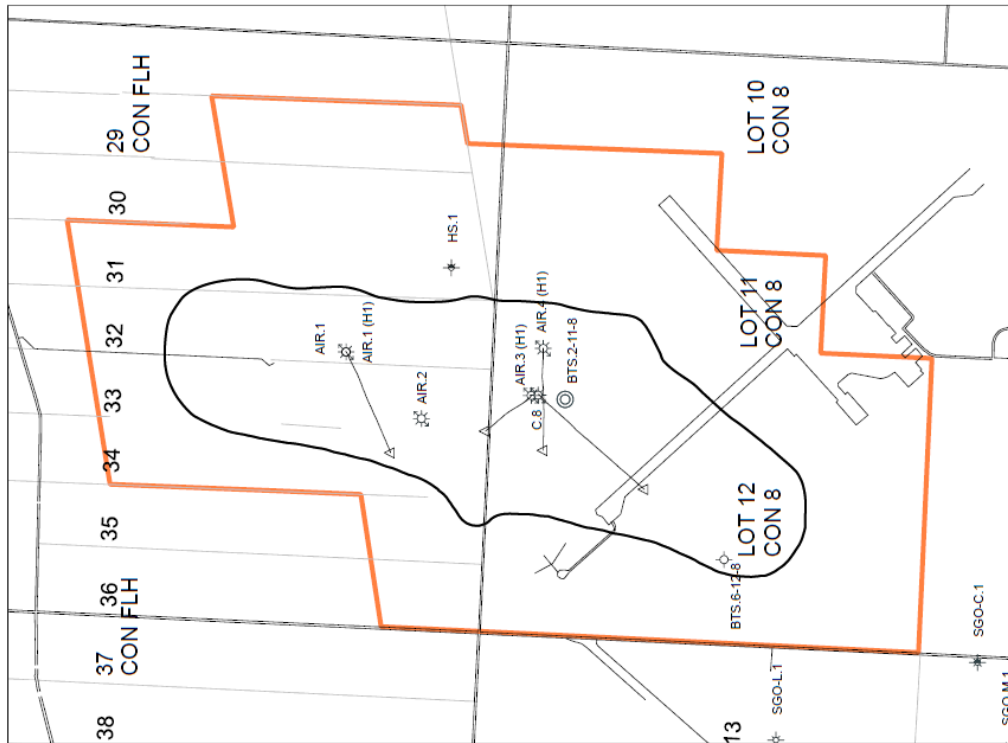
# Pool Location

## Dawn Area Storage



- The Sarnia Airport Pool is owned by Sarnia Airport Storage Pool LP (SASP)
- SASP is a partnership between Market Hub Partners Management Inc. (MHP) and Alta Gas Ltd.
- The Sarnia Airport Pool is operated by Union Gas.

# Pool Map



# Increase Storage Capacity

- Delta pressure the Sarnia Airport Pool to 17.2 kPa/m (0.76 psi/ft)
  - Increase the operating pressure to 11,580 kPa (900 kPa)
  - Increase total capacity to 168,500 10<sup>3</sup>m<sup>3</sup> (17,600 10<sup>3</sup>m<sup>3</sup>)
- Airport facilities required
  - All wells will be upgraded to meet CSA Z341.1-14
  - Wellheads will be replaced on 5 wells
  - ESV's will be installed on all I/W wells
  - Replace top two joints of casing for well C.8
- Project will be in-service by November 1, 2018

- New/updated reports for the Sarnia Airport Pool were generated for this project:
  - Engineering Assessment of the Sarnia Airport Pool—Geofirma Engineering Ltd.
  - Risk Assessment – “What If” Analysis of Hazards and Operability Issues Report (“HAZOP”)
  - Assessment of Neighbouring Activities



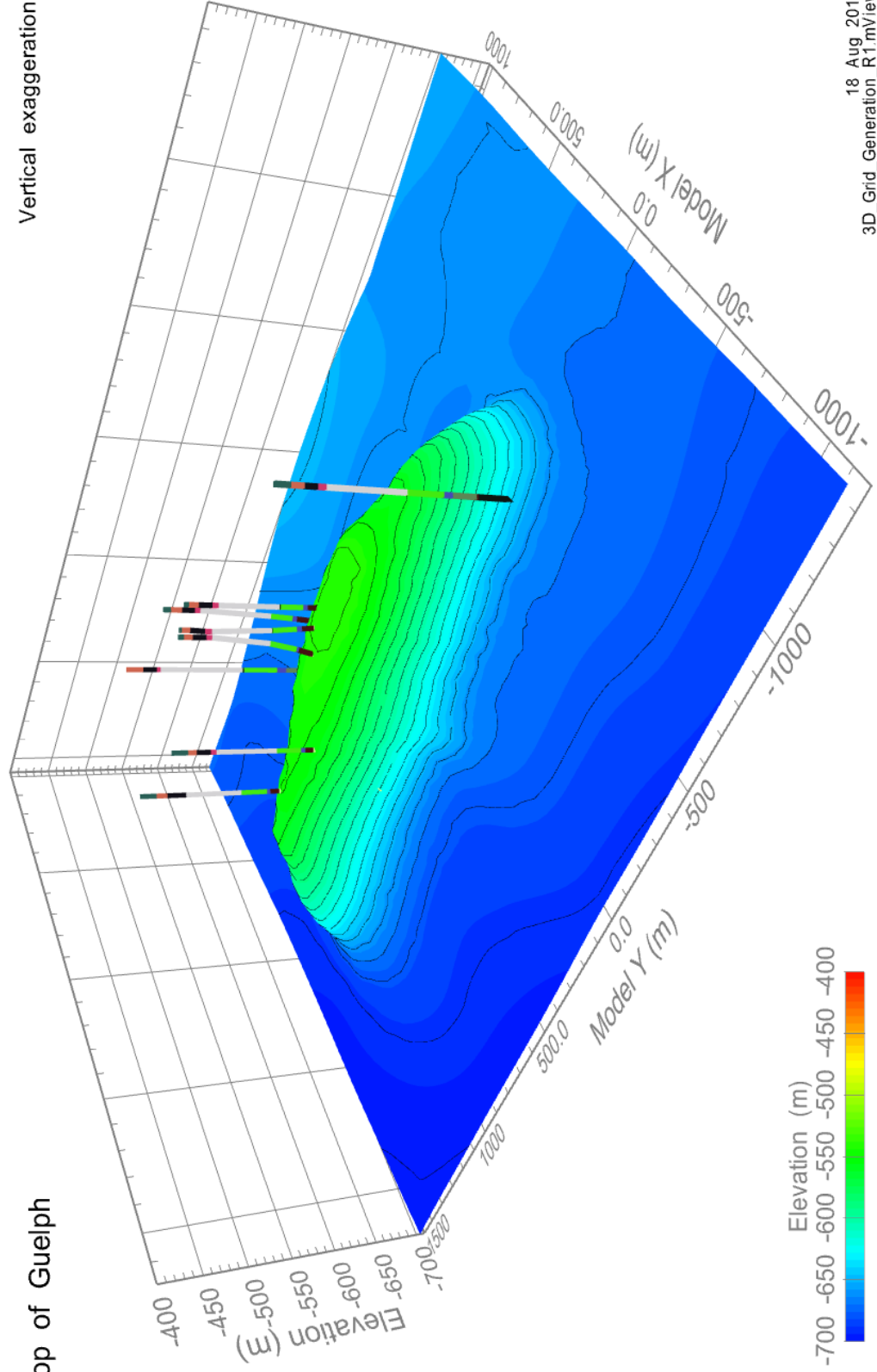
- An engineering analysis of the Sarnia Airport Pool was completed by Geofirma Engineering Limited
- The model assesses the potential for pressure and gas propagation in the caprock, and the geomechanical response to pressure changes in the reservoir
- The Sarnia Airport Pool was modelled to 18.1 kPa/m (0.80 psi/ft)
- The models concluded that the increased operating pressure is below 80% of the fracture gradient as specified in the CSA code

# Sarnia Airport Pool Modelling Report



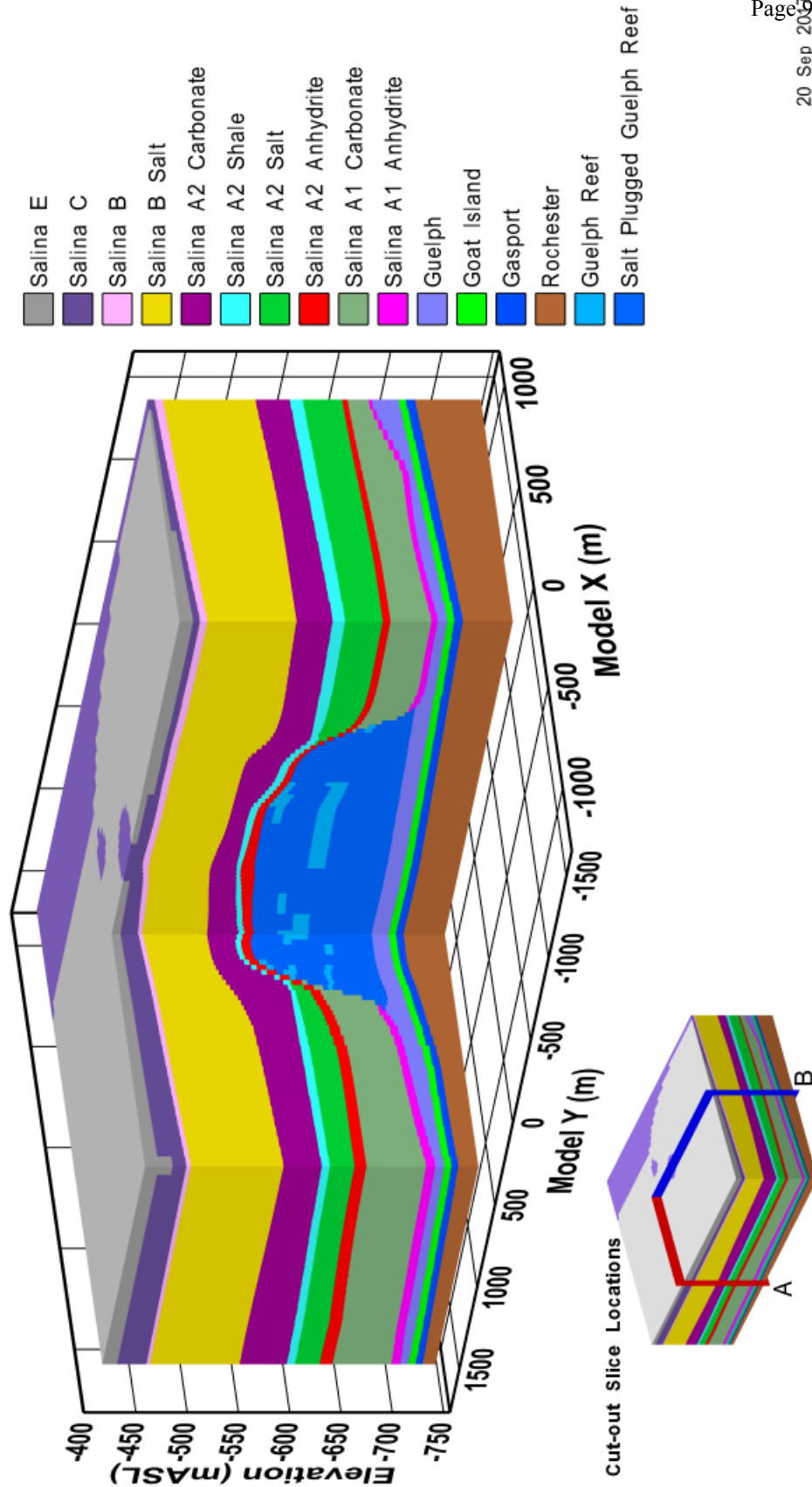
Top of Guelph

Vertical exaggeration 3:1





# Sarnia Airport Pool Modelling Report



# “What If” Analysis of Hazards and Operability Issues (Hazop)

- A “What If” analysis identifies hazards, hazardous situations, and specific incidents that could arise and discusses the likelihood, consequences and mitigation of scenarios that are identified
- The sessions records and risk rankings indicate “acceptable risk” with respect to the Sarnia Airport Pool
- The sessions did not indicate further mitigation or actions

- The reports included:
  - Reservoir History and Geology
  - Existing and abandoned wells within 1 kilometre of the base of gas
  - Subsurface operations within 5 kilometres of the base of gas
  - Wells penetrating the storage zone
- The reports did not identify any areas of concerns

# Current Status

- Notifying surrounding landowners by letter
- Initiated consultation with the First Nations
- Provide MNRF with information necessary to review project

# Next Steps

- Submit drilling applications for the proposed wells to the MNRF
- File Ontario Energy Board application in the beginning of November 2017
- MNRF will be notified when application is submitted
- Request MNRF to intervene and participate in the process
- OEB wants MNRF's view of the project as part of the MNRF's final submission

## Executive Summary

**Title:** Assessment of Neighbouring Activities  
Delta Pressuring Project 2018 – The Sarnia Airport Pool  
**Authors:** Union Gas Ltd. (on behalf of Sarnia Airport Storage Pool LP)

The “Assessment of Neighbouring Activities” report has been completed to comply with the requirements of Clause 7.2 of Standard CSA Z341.1-14 – Storage of Hydrocarbons in Underground Formations – Reservoir Storage (“CSA Z341.1-14”) in support of an increase in the delta pressure in the Sarnia Airport Pool.

Sarnia Airport Storage Pool LP (SASP) proposes to increase pressure in the Sarnia Airport Pool. The Sarnia Airport Pool is protected by a Designated Storage Area (DSA) which was approved by Ontario Energy Board in 2008. The DSA is comprised of approximately 321 hectares. SASP is confident that the DSA adequately protects the Sarnia Airport Pool. In addition, the Oil, Gas and Salt Resources Act provides protection for the reservoir with a 1.6 km buffer zone surrounding each DSA.

The report reviews the geology, the existing and abandoned wells within 1 kilometre of the storage zone, subsurface operations within 5 kilometres of the storage zone, and wells penetrating the storage zone.

Well drilling records from the Oil, Gas and Salt Resources Library (OGSRL) indicate that five wells have been drilled within 1 km of the base of gas of the Sarnia Airport Pool. SASP has conducted a review of these wells and is satisfied that they have not had any “impact on the integrity of the storage facility” as required by CSA Z341.1-14 Clause 7.2(a).

A review of records from the OGSRL for subsurface activities within 5 kilometres of the Sarnia Airport Pool indicates that there are no subsurface operations, including oil and natural gas production, natural gas storage, or brine operations. Since there are no operations within a 5 kilometre radius of the Sarnia Airport Pool, SASP is satisfied that there is no “impact on the integrity of the storage zone” as required by the CSA Z341.1-14 Clause 7.2(b).

Seven wells penetrate the Sarnia Airport storage zone. Six of the wells are associated with storage operations and one of the wells is abandoned. The integrity of each well that penetrates the storage zone, including casing, cement, and abandonment records was reviewed. SASP is satisfied that the wells penetrating the Sarnia Airport Pool meet the requirements of CSA Z341.1-14.

In conclusion, the Sarnia Airport Pool has been safely operated as a natural gas storage pool for the past nine years and is protected by an approved DSA. The technical information reviewed, indicates that there is minimal risk regarding the potential migration of natural gas between any known existing or abandoned wells within 1 km, and existing operations within 5 km, of the Sarnia Airport Pool. All active wells that penetrate the storage zone within the Sarnia Airport Pool are utilized as part of storage operations.

All the active wells are operated, and maintained in accordance with CSA Z341.1-14 Storage of Hydrocarbons in Underground Formations and in accordance with the Oil, Gas and Salt Resources Act, its regulations and Provincial Operating Standards. SASP is satisfied that the new operating pressure will not compromise the integrity of the Sarnia Airport Pool or any associated facilities.

## Executive Summary

**Title:** “What If” Analysis of Hazards and Operability Issues  
Deliverability Project 2018 – Sarnia Airport Pool  
**Author:** Gordon Cowan, P.Eng., UGM Engineering Ltd.

UGM Engineering Ltd. was contracted to prepare a “What If” Analysis for the Sarnia Airport Pool with regards to the 2018 Delta Pressuring Project. It describes the “What if” session of hazard assessment that took place over a one day period held on Thursday, June 1, 2017.

The sessions were attended by the “What if” Leader and eight technical experts. The preparation for the sessions, selection of the project scope systems, subsystems, session conduction, and reporting function for the “What if” analysis was performed by U G M Engineering Ltd., using PHA Pro 8.0 software for recording, organizing and reporting functions. Mr. Gordon W. Cowan, P.Eng., of U G M Engineering Ltd. (UGM), was team leader.

Risk ranking was performed in sessions for each “What if”. A total of 126 “What if” entries concerning the Sarnia Airport Pool were generated from the scope of the CSA Z341.1-14, and examined in the session. As part of the evaluation a 5x5 risk matrix was used to express the risk. Risk is a qualitative expression made up of the session group’s assignment of values for likelihood and severity (Risk = Likelihood x Severity). Likelihood refers to the “What if” being examined, and how often the “What if” might occur. For Consequences, the group considered the worst case scenario, the worst consequence of the entire listing of consequences outlined, for Severity assignment. Therefore, only one combination of Likelihood and Severity is provided per What if, which is composed of the highest Likelihood and Severity that arises from the subject “What if”. All “What ifs” were ranked. The sessions team could enter new “What ifs” in addition to the pre-entered “What ifs,” at any point in session time.

While the operability, storage and drilling aspects of the project were of primary concern; safety, environmental, public impact, and personnel protection issues were also addressed. For all the systems examined, the group as a whole determined whether the system/question/topic had been covered in adequate depth.

After consideration, it was concluded that the session was a complete study of the Sarnia Airport Pool Delta Pressuring Project within the scope of the CSA Z341.1-14 regulation. It was agreed that the session had examined safety, operability and technical integrity in a responsible and diligent manner.

In conclusion, the “What if” sessions records and risk rankings, coupled with consideration of the Sarnia Airport Pool Delta Pressuring Project development location, indicate “Acceptable Risk.”





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October 6, 2017

Doc. ID.: UG-TR-17-01

## EXECUTIVE SUMMARY

**Title:** Delta Pressuring Study: Sarnia Airport Pool Modelling Report  
**Document ID:** UG-TR-17-01  
**Authors:** Robert Walsh, P.Eng., Nicolas Sgro, Othman Nasir, P.Eng.

Geofirma was contracted to prepare engineering and modelling studies assessing the feasibility of increasing the maximum storage pressure in the Sarnia Airport underground natural gas storage reservoir. This required an assessment of the potential for pressure and gas propagation in the caprock, and the geomechanical response to pressure change in the storage reservoir and connected secondary storage zones. To solve this problem in an efficient manner, models developed in the codes TOUGH2 and FLAC3D were combined in series. Two-phase flow models were developed in TOUGH2 and calibrated with observed pool pressure data. The mechanical response of the caprock to delta pressuring was modelled using FLAC3D, allowing assessment of the induced stresses in formations surrounding the reservoir. Under current maximum operating pressure (0.70 psi/ft), the maximum fracture gradient is estimated to be 62.6%. Increasing the maximum delta pressure to 0.76 psi/ft increases the maximum fracture gradient to 68.9%. Model scenarios were run to assess the potential for shear failure due to increased delta pressuring, and this was determined to be a very unlikely failure mode. To assess the impact of some key, but uncertain, model parameters, a number of other sensitivity cases with alternate parameter sets were assessed. These sensitivity cases included reducing the A2 Anhydrite caprock threshold pressure and increasing the compressibility of the storage reservoir. The model results showed that a pressure increase to a maximum delta pressure of 0.76 psi/ft (or even 0.80 psi/ft) would be feasible, and would not exceed 80% of the fracture gradient, in compliance with CSA Z341.1-14.