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October 24, 2023

Attention: Rowland Howe, President
Atlas Salt Inc.
333 Duckworth Street
St. John's, NL A1C 1G9

SLR Project No.: 233.03447.0000

RE: Groundwater Modelling – Great Atlantic Salt

1.0 Introduction

This memorandum summarizes the work undertaken to-date on groundwater modelling conducted by SLR Consulting (Canada) Ltd. (SLR) for Atlas Salt Inc. (Atlas) in support of the Great Atlantic Salt feasibility study (FS). Atlas is proposing underground mining of a salt deposit overlain by up to several hundred metres of bedrock and unconsolidated overburden (the Project). Groundwater modelling of the Project will support advancement of the FS as well as the eventual permitting, construction, and operational phases of the project. The specific objectives of the groundwater modelling described herein were to provide preliminary estimates of:

- Phreatic surface, groundwater flow direction, and hydraulic gradient under baseline and operational conditions.
- Groundwater inflows to the boxcut and decline.
- Radius of influence of Project dewatering on the surrounding groundwater environment.

This analysis is considered the first of several modelling iterations that will occur during project advancement.

2.0 Disclaimer

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The analysis described herein is considered pre-feasibility (PFS) level due to the limited geological, geotechnical, and hydrogeological data currently available at the Project. Future refinements to the groundwater model may ultimately support a feasibility level design; however, the current model should be viewed as preliminary in nature. The opinions, estimates and conclusions described herein are based on:

1 Information available to SLR at the time of preparation of this report;

2 Assumptions, conditions, and qualifications as set forth in this report; and

3 Data, reports, and opinions supplied by Atlas and other third-party sources.

3.0 Background

Available hydrogeological data were reviewed to determine the appropriate complexity of the numerical groundwater modelling efforts. The two primary hydrogeological reports reviewed were the *Exploratory Well Drilling Program for the Town of St. Georges, NL* (Fracflow, 2003) and the *Factual Summary Report, Salt Drilling Program, Great Atlantic Salt Deposit, St. Georges, NL* (GEMTEC, 2023). The following information was reviewed to determine preliminary model layering, formation properties, and calibration datasets:

- Topographic information;
- Climate and surface water data;
- Local and/or regional hydrogeological characterization studies;
- Formation properties such as hydraulic conductivity and porosity;
- Geologic formation picks, geologic surfaces or any geological models, including any bedrock outcrop mapping;
- Drillhole data;
- Geotechnical information (e.g., rock quality data);
- Well locations and attributes including total depths, screened intervals and depth to water (DTW) or water level measurements; and
- Packer testing results.

Historically, there was drilling and hydrogeological testing associated with water supply sourcing at boreholes FR1 to FR3, FR-WW1 to FR-WW3, MR1, and RW1 to RW4. More recently, there has been drilling associated with halite deposits at boreholes CC1 to CC9 and D-1. Given their proximity, all of the CC series and D-1 borehole data were considered when forming the conceptual hydrogeological model of the Project.

3.1 Climate

The Project is located within the Southwestern Newfoundland Ecoregion, which is characterized by cool summers and snowy, cold winters (Heritage NL, 2002). Annual precipitation as recorded at the Stephenville A weather station is approximately 1,300 millimetres (mm), consisting of 995 mm of rain and 395 mm of snow (GEMTEC, 2023).

3.2 Physiography, Topography, and Drainage

The physiographic region of the Project is characterized by low-lying coastal plains bounded by upland regions, such as the Lewis Hills and Serpentine Range to the north, Long Range Mountains to the east, and the Anguille Mountains to the south (GEMTEC, 2023). The Project is located at an elevation of approximately 60 masl and topography slopes gradually northwest to the coast at Flat Bay. Uplands are present approximately 15 km southeast of the Project, where elevations reach up to 600 masl in the Long Range Mountains (GEMTEC, 2023). The most significant surface water features are the marine waters of Flat Bay to the northwest of the Project, and Flat Bay Brook approximately 200 m to the south. Several small ponds and ephemeral streams are also located in the Project area.

3.3 Local Geologic Context

Surficial geology in the Project area is primarily composed of till overburden, thinning in the topographic highs and thickening in the lows (SLR, 2023). Overburden soils average approximately 15 m in thickness and range from 4 to 35 m thick. Bedrock geology is primarily composed of halite deposits overlain by alternating beds of sandstone, conglomerate, and mudstone which can demonstrate individual bed thicknesses greater than 10 m. In the Project area, salt is primarily encountered between 183 to 394 mbgs. Bedrock units above the salt demonstrate evidence of fracture and a poor to fair rock mass quality (GEMTEC, 2023).

4.0 Model Construction and Calibration

SLR developed a conceptual groundwater model of the Project and surrounding area, including modelling domain (Figure 1 and Figure 2), hydrostratigraphy, recharge and discharge areas, groundwater flow paths, hydraulic connections between formations, and boundary conditions. Key characteristics include:

- Groundwater recharge is believed to occur in the highlands in the southeast of the model domain, with discharge occurring to the marine environment, Flat Bay Brook, and various ephemeral streams and topographic depressions in the Project area.
- Regional groundwater is conceptualized to flow from the south/southeast to the north/northwest.
- Estimated ranges of hydraulic conductivity were taken from a combination of historical and recent packer testing, with mudstone typically displaying lower conductivities than sandstone or conglomerate. The spread in hydraulic conductivities (described later) between lithologies and artesian conditions encountered at depth led to the hypothesis that lower permeability bedrock units potentially create confined aquifer conditions in the Project area.
- Conceptualized boundary conditions included major surface water features, recharge, and general head boundaries to simulate regional groundwater flow.

A numerical groundwater model for the model domain was developed using MODFLOW based on the conceptual model. Development of the numerical groundwater model consisted of the following steps:

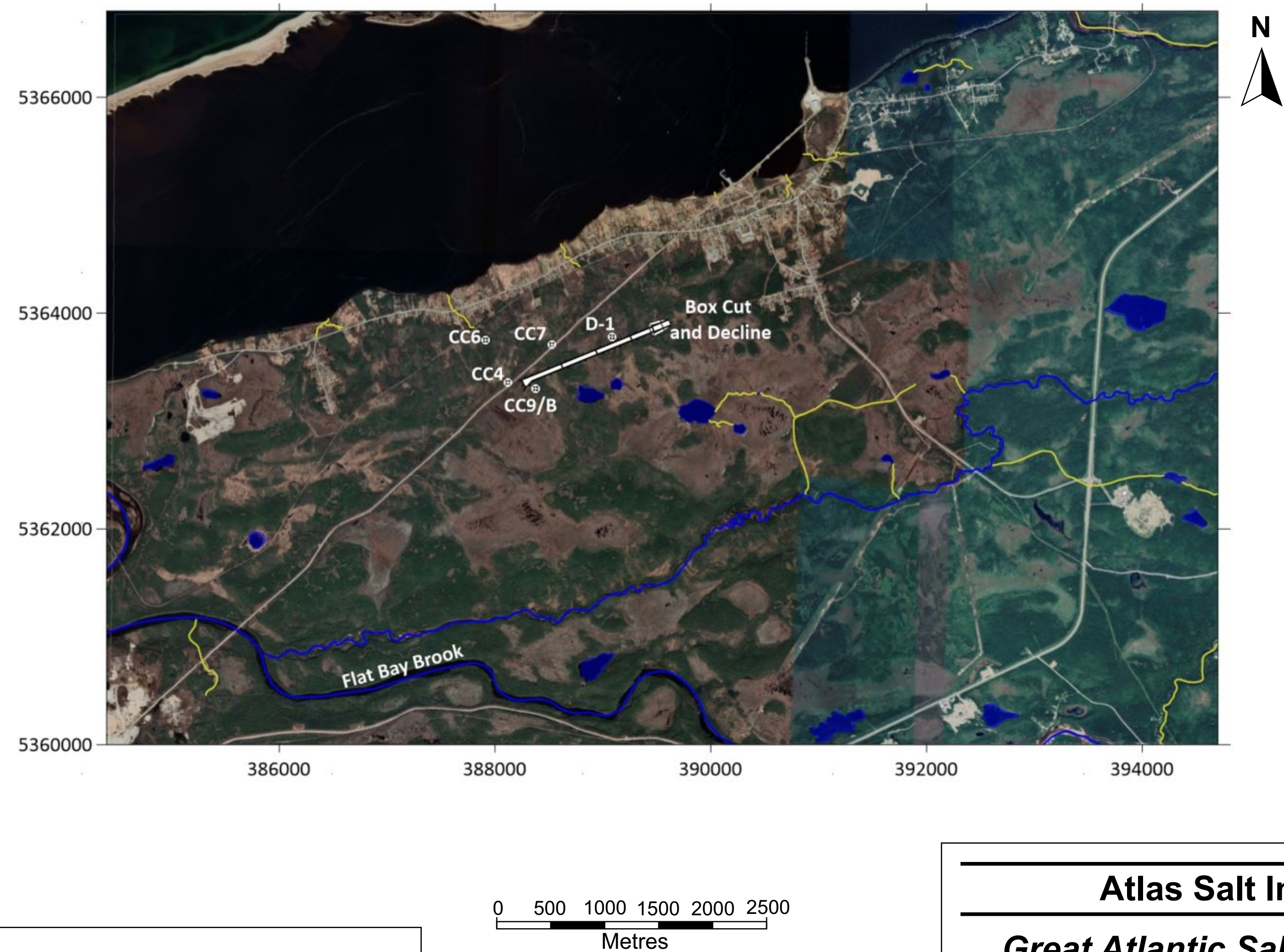
- Build and import surfaces of the hydrostratigraphic model layers.
- Assign boundary conditions based on the conceptual model framework.
- Assign hydrogeological properties to each model cell based on available information.

- Calibrate the groundwater model with site-specific hydrogeological data where available. Static water levels were used for steady-state calibration as it is understood there is no pumping test or long-term water level monitoring data near the Project area to be used for transient calibration. Model calibration was evaluated using the magnitude and spatial distribution of head residuals.

4.1 Model Domain

The model domain is presented on Figure 1 and Figure 2 and has an area of approximately 70 km^2, centered around the Project area. The model grid is coarser around the limits of the domain to finer in the vicinity of the proposed boxcut and decline. The grid is composed of approximately 70,000 cells in each of the 24 model layers for a total of approximately 1,680,000 cells. The boundaries of the model were constrained vertically by ground surface topography and extend to a maximum depth of approximately 400 m below ground surface.

The goal of the model domain selection was to capture a large enough area to accurately reproduce the regional hydrogeology while constraining the model domain sufficiently so that detailed predictions could be made for local impacts to groundwater. The outline of the groundwater flow model domain was made sufficiently large such that undue numerical 'boundary effects' from Project dewatering would be avoided. The model domain was defined by natural hydrologic and hydrogeologic boundaries, including watershed boundaries (assumed to be coincident with groundwater flow divides) or surface water features (also assumed to be coincident with groundwater flow divides).



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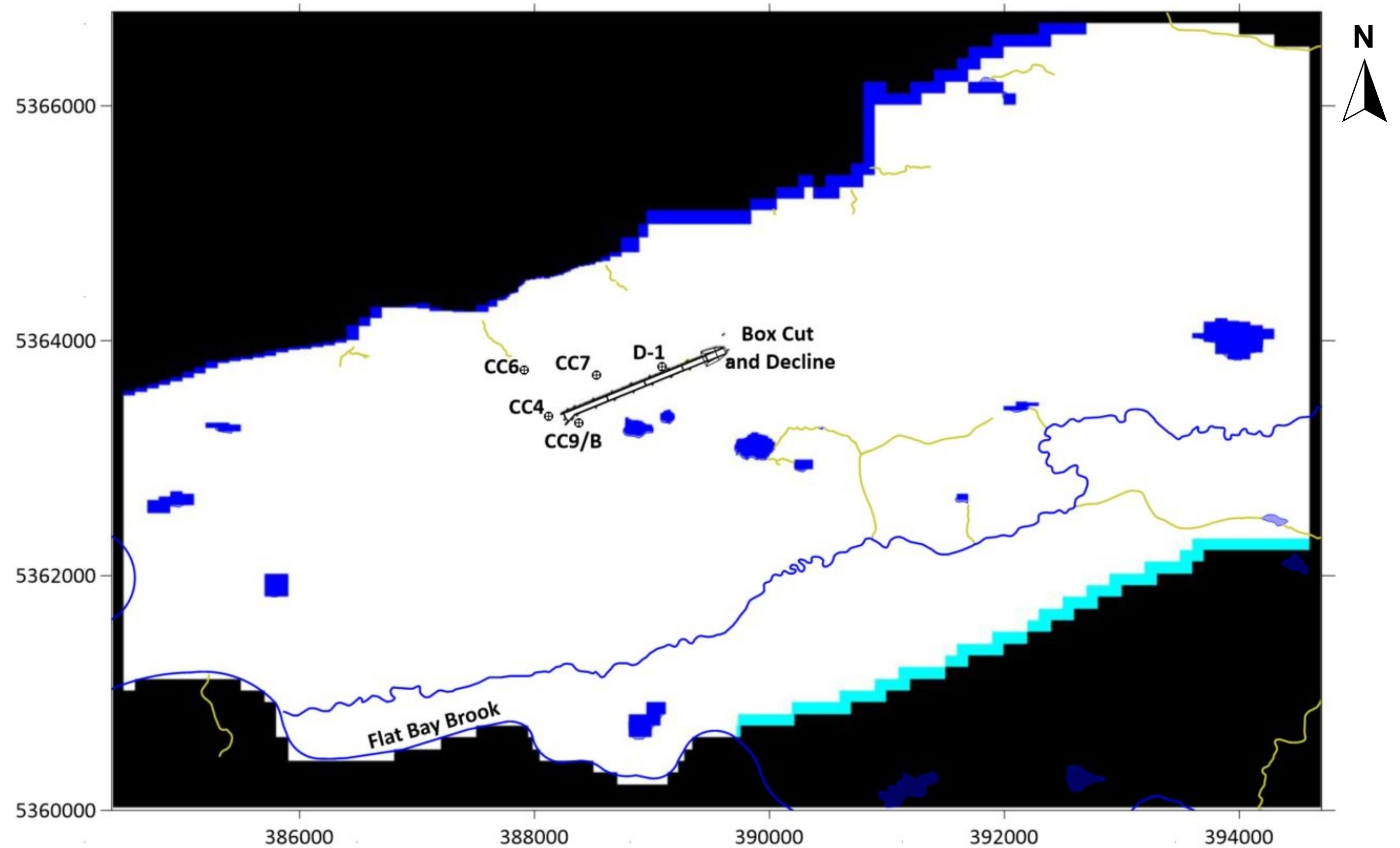
Newfoundland and Labrador, Canada

Model Domain and Drill Hole Locations

Figure 1

Source: SLR, 2023.



Legend:

- *Streams, Rivers and Waterbodies*
- *Drainage*
- *General Head Boundary*
- *No-Flow*

0 500 1000 1500 2000 2500

Metres

Source: SLR, 2023.

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Active Cells and Surface Water Features

Figure 2

4.2 Hydrostratigraphy

Based on drilling logs, the overburden is generally continuous and averages 15 m thick. Given that the model layers are approximately 10 m thick, this average was rounded up to 20 m for the purposes of modelling. The overburden soils have been described as till consisting of silty sand to clayey silt with local interbeds of sand and gravel (GEMTEC, 2023). Below the overburden, sequences of sandstone, conglomerate, and mudstone overlay a continuous halite unit. Given the sparse distribution of drillhole data and relative thinness of the bedrock layers, interpolation between drillhole intervals is not geologically defensible. Instead, a conceptualized hydrostratigraphy was compiled, using the composited overall thicknesses of the bedrock lithologies in nearby drillholes as a guide (Table 1). Model layers were further discretized (approximately 10 m thick) within the hydrostratigraphic layers to help render the decline accurately.

Table 1: Conceptualized Project Hydrostratigraphy

Hydrostratigraphic Layer	Formation	Average Thickness (m)*
1	Overburden	20
2	Sandstone	20
3	Mudstone	20
4	Conglomerate	60
5	Mudstone	30
6	Sandstone	50
7	Mudstone	40
TOTAL	**NA**	**240**

*Thickness varies considerably across the Project area

4.3 Hydraulic Conductivity

As presented previously, model layers have been defined based on hydrogeological properties into overburden, sandstone, conglomerate, and mudstone. The salt contact was assigned as a no flow boundary condition. Historical sieve analysis and pumping tests outside of the Project area reported hydraulic conductivity values for the overburden till between 10^{-3} to $7E^{-5}$ m/s (GEMTEC, 2023). However, in the same report, overburden permeability was described as generally low to moderate, which does not agree with the reported values. Artesian conditions in the bedrock located below the overburden in the Project area may suggest low till permeabilities. As such, the overburden conductivity was allowed a lower range than historical testing values if it aided in the calibration. Regardless, there were no overburden conductivity values available near the Project area, which is one of the areas of uncertainty encountered during the modelling. Given that the overburden only makes up a small percentage of the overall geology intercepted by the decline, changes to the hydraulic conductivity of that unit only make small differences in the overall underground inflow.

Historical drillhole bedrock packer testing in the Project area reported conductivities of 10^{-6} m/s for coarse conglomerate, 10^{-7} for sandstone, 10^{-8} for till/pug, and $7E^{-7}$ to $8E^{-7}$ for fine to medium grain sand (Fracflow, 2003). Additional packer testing conducted in 2022 reported conductivities of 10^{-7} to 10^{-8} m/s for conglomerate, 10^{-6} m/s for sandstone, and 10^{-8} m/s for half sandstone/half mudstone. Most recently, packer testing conducted in 2023 reported conductivities of 10^{-7} to 10^{-8} m/s for conglomerate, 10^{-7} m/s for sandstone, and 10^{-8} m/s for mudstone. Tests conducted in 2023 were impacted by leakage and as a result, conductivity values may be lower, especially values for low conductivity units such as the mudstone. These values were used to constrain the conductivity ranges that were used in the model during the calibration phase.

4.4 Recharge and Boundary Conditions

A uniform recharge rate of 10^{-5} m/day (determined during calibration) was applied across the model domain to reflect the continuous overburden layer. As shown on Figure 2, the marine environment and Flat Bay Brook are located in the model domain and represented as constant head boundaries. Flat Bay Brook was assumed to be shallow and was assigned as constant head boundaries (values based on topography) only occurring in the topmost layers of the model domain. Ephemeral streams and small ponds were assigned drain and constant head boundary conditions, respectively. The highlands in the southeast of the model domain were assigned general head boundaries (values based on topography) to represent groundwater flow from those recharge zones.

4.5 Calibration

Model calibration was conducted using a combined manual/automated (PEST) iterative approach under steady-state conditions. This involved a process where a flow simulation was carried out, the resulting groundwater levels were compared to field measured values, and the model input parameters (i.e., conductivity, recharge, general head boundaries) were adjusted to achieve better agreement with observed conditions and the overall interpreted groundwater flow directions.

Drilling at D-1 encountered groundwater at approximately 4.1 mbgs, which was the only calibration target available in the Project area. Regional groundwater levels were reported between 1 to 30 mbgs in GEMTEC (2023) but artesian conditions have also been observed in a number of deeper drillholes. Given the lack of a robust water level dataset in the Project area and to be conservative, the water table was assumed to be at or within several metres of ground surface for calibration. Calibration was also focused on achieving artesian pressures at depth.

Calibration statistics are not provided given the lack of calibration data available. Modeled heads were generally within a couple of metres of target values in the boxcut/decline area. The values of the hydrogeologic parameters that were determined from the calibration process are presented in Table 2. The hydraulic conductivity values for the various hydrostratigraphic units generated by the model are within the ranges expected for the materials based on measured and literature values. Recharge was allowed to vary between 0.1 and 10% of precipitation and a calibrated value of approximately 1% was determined to be optimal.

Table 2: Calibrated Hydraulic Conductivities

Formation	Calibrated K (m/s)
Overburden	4.6E-08
Sandstone	1.0E-07
Mudstone	1.4E-08
Conglomerate	3.5E-08

5.0 Model Applications

The calibrated groundwater flow model was used to simulate groundwater levels and flow under baseline conditions. The baseline model results were then used to compare to model predictions during operation phases of the Project.

5.1 Baseline Conditions

The calibrated groundwater flow model was used to estimate the water table elevation and groundwater flow under baseline conditions (Figure 3). Regionally, groundwater is predicted to flow north towards Flat Bay.

Figure 3: Baseline Water Table Elevations (MASL)

5.2 Operational Conditions

The groundwater flow model was subsequently modified from the baseline model to simulate the effects of the Project during operation on groundwater levels and flow. Drainage nodes representing mined-out volumes were placed in the model based on the boxcut/decline wire frame provided by Atlas Salt on May 15, 2023 (boxcut surf decline plant 230509.dwg). As part of these simulations, the model was used to predict groundwater inflows to the boxcut/decline. Model output included groundwater elevations, interpreted groundwater flow directions, and estimation of seepage rates into the boxcut/decline. The model was run under steady-state conditions during the maximum boxcut/decline development footprint. The modelling scope of work did not include the calculation of flows during the closure and post-closure stages, nor during early mine years, when groundwater released from storage could result in larger inflows than the steady-state values presented in this report.

Predicted long-term inflows to the fully built-out boxcut/decline were simulated to be approximately 500 m^3/day. The entire flow is contributed by the decline as the boxcut is fully dewatered in the steady-state solution. To further discretize the flows, the inflow for each lithology was divided by the length of decline (both sides combined; total decline length of approximately 1500 m) exposed to each lithology for a flow per metre per lithology. Groundwater inflow per metre for the sandstone, conglomerate, and mudstone were 0.6, 0.4, and 0.3 m^3/day/m, respectively. Figure 4 and Figure 5 show the projected drawdown under steady-state operational conditions, in plan and cross-section view, respectively. Drawdown of 1 m extended approximately 1.7 km from the boxcut/decline area. A maximum drawdown of approximately 100 m was observed in the Project area, located above the intersection of the decline with the salt. It is important to note that because the model was run in steady-state, the drawdown is more conservative than what would be observed over a shorter mining timeframe. However, as mentioned previously, the inflows may be less conservative because of the steady-state nature of the simulation.

Legend:

- *Streams, Rivers and Waterbodies*
- *Drainage*
- *General Head Boundary*
- *Drawdown Cone (m)*

0 500 1000 1500 2000 2500
Metres

Source: SLR, 2023.

Figure 4

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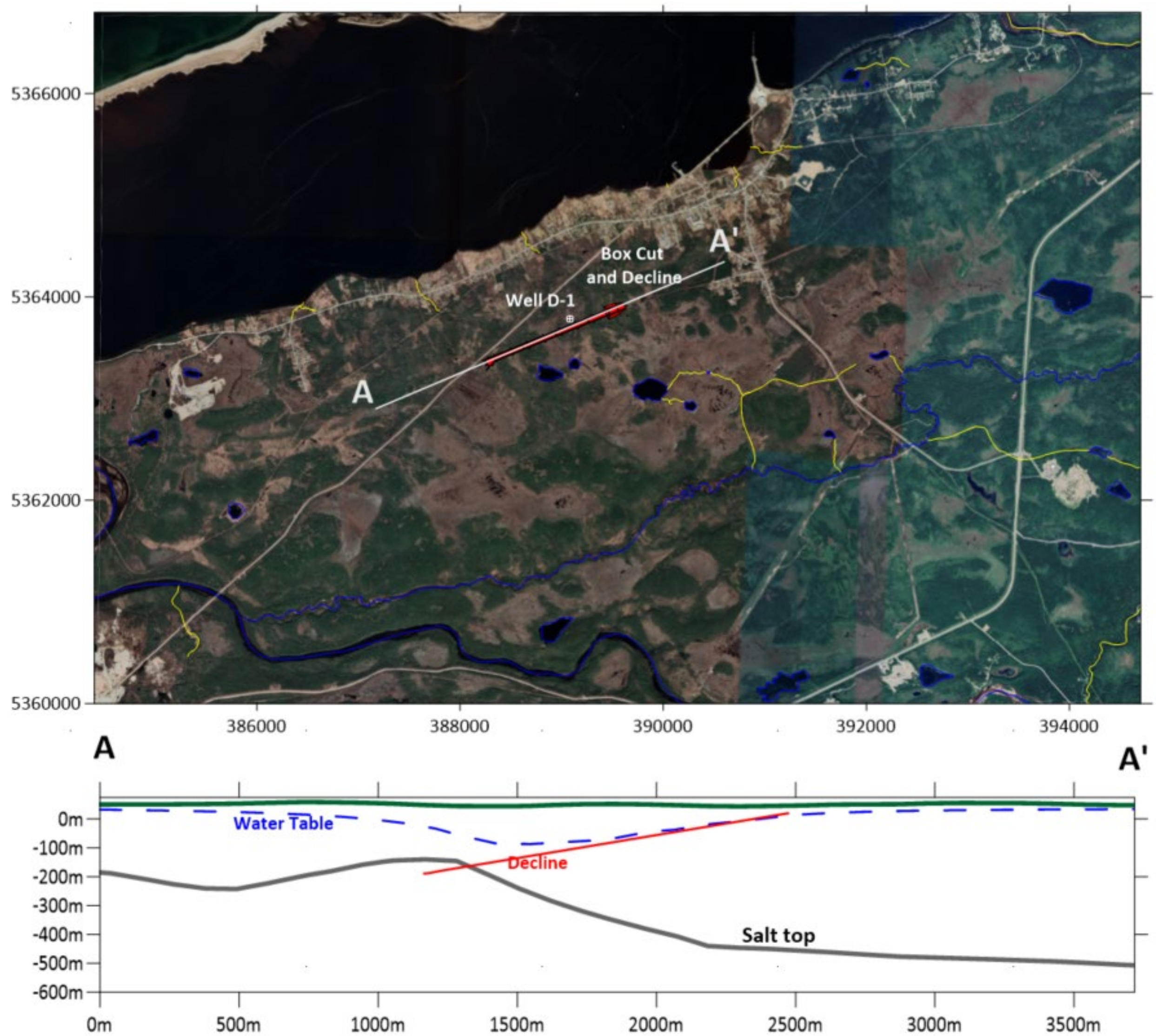
Operational Water Table Drawdown Plan View

Figure 5: Operational Water Table Drawdown – Cross-Section View



5.3 Sensitivity Analyses

A sensitivity analysis was performed to evaluate the impact of model parameters on predicted heads and flows. Sensitivity analysis was run on the parameters with the greatest levels of uncertainty (hydraulic conductivity and recharge) to determine the impact of the data gaps on risk. Predicted inflows were most sensitive to changes in hydraulic conductivity of the sandstone unit. Varying the hydraulic conductivity of the sandstone unit one order of magnitude up and down resulted in an inflow range of 250 to 2,300 m^3/day. The sensitivity analysis demonstrates that the baseline hydraulic conductivity values were quite low, as decreasing them further did not have a significant impact to inflows relative to increasing them. As a result, the possible distribution of flows reported from the sensitivity analysis skews to the high side, meaning that potential inflow numbers could be higher than the baseline value.

5.4 Prediction Confidence

The approach used in model simulations completed for this Project was to incorporate defendable assumptions for predicting effects that may result from the Project. This report presents the assumptions made in developing these predictions and considers uncertainty of input parameters via a sensitivity analysis. The groundwater flow modelling was conducted using a model calibrated to water levels to establish baseline conditions, although the calibration dataset was not robust given the lack of available data. The predictions made in this analysis are considered sufficient for PFS-level work; however, confidence remains limited until additional/new data may further refine the model construction and calibration.

Formation surfaces outside of the mine project area were projected based on the available drillhole data, which were informed with data near the underground workings but significantly less so near the edges of the model domain. Consequently, the model should not be relied upon to make detailed predictions outside of the Project area. The quantity, coverage, and seasonality of field-obtained hydrogeological property values were limited. Accordingly, only steady-state calibration of the model was attempted. Formation properties used in the model were determined from a limited amount of field data and, in some cases, publicly available literature.

6.0 Future Work and Recommendations

SLR recommends the following actions to increase confidence in the groundwater modelling results:

1 Collection of static groundwater levels measurements during drilling. Many boreholes do not have a recorded depth to groundwater.

2 Installation of wells for continuous or long-term monitoring of groundwater levels.

3 In-situ testing of overburden conductivities. To date, all of the conductivity testing on overburden materials has been laboratory based, which can give different results than field testing.

4 More packer testing of various lithologies (2-3 additional tests per lithology). To date, most lithologies have only 2-3 packer tests, with the older testing straddling large intervals and multiples lithologies, and the newer testing being impacted by a leaky packer setup. Given the limited amount of testing and issues associated with the testing, additional packer testing of the bedrock intervals would help refine inflow predictions. Depending on drillhole condition, legacy drillholes could be re-entered for additional testing.

5 Transient modelling of the Project which would help determine peak inflow values for early mining years and the extent of drawdown during the intermediate mine years. Currently, the inflow values are only presented for a steady-state Project scenario (infinite length). Whereas a steady-state analysis of full mine build-out may provide for conservative estimate of operational inflows, under certain scenarios, release of water from storage during early mining could result in temporary inflows greater than those reported herein.

6 Modelling of saltwater intrusion. Given the shape and extent of the drawdown cone, saltwater may be induced to flow towards the Project area during mining. Currently, the scope of work does not include saltwater intrusion modelling and density-dependent groundwater flow.

7.0 Closure

SLR would like to thank Atlas for the opportunity to work on this Project. Should you have any questions, please do not hesitate to contact us at any time.

Yours sincerely,

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