Antrim Gypsum Project

Environmental Assessment Registration Document
Antrim, Halifax County, Nova Scotia

CertainTeed Canada, Inc.

27 August 2024

→ **The Power of Commitment**

Status Code	Revision	Author	Reviewer		Approved for issue		
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→ **The Power of Commitment**

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Table index

Table index

Table index

Figure index

Figure index

Appendices

Acronyms

Common Acronym	Expanded Use
A	Applicable
AAQC	Ambient Air Quality Criteria
ACCDC	Atlantic Canada Conservation Data Centre
ACB	Air Contaminants Benchmarks
Access Road	Road off Lake Egmont Road to provide access for mine employee and maintenance suppliers
ACPF	Atlantic Coastal Plain Flora
AEMP	Aquatic Effects Management Plan
ANSMC	Association of Nova Scotia Mi'kmaq Chiefs
AO	Aesthetic Objectives
AMD	Acid Mine Drainage
AMO	Abandoned mine opening
ARD	Acid rock drainage
ARIA	Archaeological resource impact assessment
ASA	Aquatic Study Area
Ausenco	Ausenco Engineering Canada Inc.
BC	British Columbia
BTOR	Below top of riser
BV Labs	Bureau Veritas Laboratory
C	Continuous
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
CertainTeed	CertainTeed Canada Inc.
CLC	Community Liaison Committee
CMM	Confederacy of Mainland Mi'kmaq
CO	Carbon monoxide
CO_2	Carbon dioxide
COC	Chain of Custody
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPUE	Catch per unit effort
CRM Group	Cultural Resource Management Group
CWS	Canadian Wildlife Services
D	Dissolved
DEM	Digital Elevation Model
DFO	Department of Fisheries and Oceans Canada

Common Acronym	Expanded Use
EA	Environmental Assessment
EARD	Environmental Assessment Registration Document
ECCC	Environment and Climate Change Canada
eDNA	Environmental DNA
EMS	Environmental Management System
EMP	Environmental Management Plan
EOM	End of mine
EOSD	Earth Observation for Sustainable Developments of Forests
EQS	Environmental Quality Standards
ESC	Erosion and sediment control
FAA	Fisheries Act Authorization
FSC	Food, security, and ceremonial
CDWQ	Guideline for Canadian Drinking Water Quality
GHD	GHD Limited
GHG	Greenhouse Gas
GIS	Geographic Information System
GLC	Ground level concentrations
Griffin	Griffin Transportation Inc.
H	High
HADD	Harmful Alteration, Disruption, or Destruction
hCSM	Hydrogeologic Conceptual Site Model
HDPE	High-density polyethylene
HRM	Halifax Regional Municipality
HVAC	Heating, ventilation, and air conditioning
IA	Industrial Approval
IAA	Impact Assessment Act
iBoF	Inner Bay of Fundy
IR	Irreversible
kg	Kilogram
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
kVA	Kilovolt-amperes
L	Low
LAA	Local assessment area
LCA	Local catchment area
LT	Long-Term
M	Moderate
MAC	Maximum Allowable Concentrations
MAD	Mean Annual Discharge

Common Acronym	Expanded Use
MARI	Maritime Archaeological Resource Inventory
masl	Meters above sea level
MBCA	Migratory Birds Convention Act
mbgs	Meters below ground surface
McCallum/MEL	McCallum Environmental Ltd.
MEKS	Mi’kmaq Ecological Knowledge Study
Mercator	Mercator Geological Services
MGS	Membertou Geomatics Solutions
MK	Mi’kmaw Kina’matnewey
ML/ARD	Metal Leaching and Acid Rock Drainage
MMTS	Moose Mountain Technical Services
M&NP	Maritimes and Northeast Pipeline
Mt	Million tonnes
MT	Medium-Term
MTRI	Mersey Tobeatic Research Institute
N	Negligible
N/A	Not applicable
NAPS	National Air Pollution Surveillance Program
NO_x	Nitrous Oxides
NOAA	National Oceanic and Atmospheric Administration
NPRI	National Pollutant release Inventory
NRCAN	Natural Resources Canada
NS	Nova Scotia
NSAQS	Nova Scotia Air Quality Standards
NSDPW	Nova Scotia Department of Public Works
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
NSE	Nova Scotia Environment
NSECC	Nova Scotia Environment and Climate Change
NSESA	Nova Scotia Endangered Species Act
NSTDB	Nova Scotia Topographic Database
O	Once
ON	Ontario
Operations	Project phase including extraction, processing, and waste management
Overburden Stockpile	Overburden material stripped and stockpiled for Progressive Reclamation and Closure
P	Permanent
PA	Project Area
PC	Post Closure
PCR	Polymerase chain reaction

Common Acronym	Expanded Use
PET	Potential evapotranspiration
PM	Particulate matter
$PM_{2.5}$	Particulate matter less than or equal to 2.5 micrometres
PM_{10}	Particulate matter less than or equal to 10 micrometres
PR	Partially reversible
PSS	Pathway Specific Standards
PVC	Polyvinyl chloride
QA/QC	Quality Assessment/Quality Control
QC	Quebec
qPCR	Quantitative polymerase chain reaction
R	Regular
RAA	Regional assessment area
RE	Reversible
RGWD	Relative Groundwater Depth
ROI	Radius of Influence
ROM Stockpile	Run of Mine Stockpile
S	Sporadic
SAR	Species at Risk
SCC	Supreme Court of Canada
SEA	Significant Ecological Area
SML	Scotia Mine Limited
SO_2	Sulfur dioxide
SOCI	Species of conservation interest
SOP	Standard operating procedure
SPL	Sound pressure levels
SSD	Stopping sight distance
ST	Short-term
SWRT	Single well response test
TAC	Transportation Association of Canada
TC	Transport Canada
TDS	Total Dissolved Solids
TMF	Tailings Management Facility
TSP	Total suspended particles
TSS	Total suspended solids
T/y	Tonnes per year
UNSM	Union of Nova Scotia Mi’kmaq
US	United States (of America)
USEPA	United States Environmental Protection Agency

Common Acronym	Expanded Use
VC	Valued component
WBA	Water Balance Assessment
WC	Watercourse
WESP-AC	Wetland Ecosystem Services Protocol- Atlantic Canada
WL	Wetland
WSS	Wetland of Special Significance
YOY	Young of year

1. Introduction

CertainTeed Canada Inc. (CertainTeed), a subsidiary of Saint-Gobain Group, proposes to develop the Antrim Gypsum Project (the Project) located near Gays River, along Lake Egmont Road in Cooks Brook, Nova Scotia (NS). The Project consists of a conventional surface mining operation including an open pit, overburden stockpile, topsoil stockpiles, processing plant, and water management infrastructure. The average rate of production for gypsum and anhydrite is estimated to be 2.0 million tonnes per year (t/y), with an estimated marketable rate of production of 1.5 million t/y. The gypsum and anhydrite products will be transported via trucks to the Port of Sheet Harbour for shipment to manufacturing facilities in eastern North America, reducing maritime transportation Carbon Emission (Scope 3), reducing the need for CertainTeed to ship gypsum from overseas, to continue to meet the demand of their gypsum plants. Anhydrite will be available for agricultural purposes if there is a local market demand.

This Project aligns with CertainTeed's target to achieve Net-Zero Carbon by 2050. This Project along with other a number of different Scope 1 and 2 reduction projects, like the electrification of Montreal plant which will soon be North America's First Zero-Carbon wallboard plant, will assist with CertainTeed achieving the 2050 target.

CertainTeed has collected baseline environment data to support an environmental assessment (EA) for this Project since 2022 and has undertaken community and Mi'kmaq engagement. Based on the baseline studies and engagement, CertainTeed has evaluated multiple iterations of conceptual mine design to minimize the adverse effects of the project. CertainTeed has decided to proceed with the completion and submission of an EA Registration Document (EARD) to facilitate the Project's review as a Class I Undertaking in accordance with the *Environmental Assessment Regulations* made under the *Nova Scotia Environment Act*.

This EARD aims to showcase how the baseline data and effects assessment supported the development of the Project. The EA process was used as a planning tool to help shape the Project to reduce potential impact to the environment. The economic viability of the resource originally supported the open pit developed in one area; however, baseline studies identified 100 black ash (*Fraxinus nigra*), a species designated as Threatened under the *Nova Scotia Endangered Species Act*, which resulted in the open pit to go through several re-designs. Based on the sensitivities of the black ash, additional modelling was completed which resulted in multiple iterations of the Project water management infrastructure design. Other Project components have also been micro-sited to avoid watercourses, wetlands, species at risk (SAR) as well as identified registered archaeological sites.

As noted above, the Project has documented black ash across the study area of the EA (herein referred to as the Project Area (PA)), including a concentration of trees within the northwest corner, and several individual trees within the southern portion of the PA. One tree is located within the extents of the proposed open pit. This tree is proposed to be transplanted, in collaboration with the Mi'kmaq of Nova Scotia, in keeping with several other recent projects where transplantation of black ash has been allowed to support industrial and infrastructure development projects (Touquoy Gold Mine, Highway 104 and 107 upgrade projects). An initial site visit has been completed with the Mi'kmaq of Nova Scotia to review the location of the single black ash tree that is proposed for transplantation. The Mi'kmaq of Nova Scotia (representatives from Confederacy of Mainland Mi'kmaq (CMM) and Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO)) provided CertainTeed with positive feedback on the initial salvage plan. The detailed salvage plan will be developed during the permitting process, in conjunction with the Mi'kmaq of Nova Scotia and NSDNRR.

1.1 Scope of the Undertaking

The Project consists of a conventional open pit mining operation with an average rate of production for gypsum and anhydrite estimated to be 2.0 million t/y, with an estimated marketable rate of production of 1.5 million t/y. The gypsum mining operation includes an open pit, overburden stockpile which will contain approximately 5% waste rock (gypsum, siltstone, mudstone and a small amount of anhydrite), topsoil stockpiles, processing plant, water management infrastructure, and other ancillary supporting infrastructure. The mined material will be sized, screened, and conveyed based on the gypsum purity and stockpiled during processing, before transportation to the Port of Sheet Harbour for shipment. Pending release from the provincial EA process and obtaining all applicable permits, construction is expected to start in 2025, operation starting in 2027, and initiation of closure activities by 2050.

1.2 Proponent Information

The Proponent is CertainTeed, a subsidiary of Saint-Gobain Group, one of the world's largest and oldest building materials companies and manufacturer of innovative material solutions, represented in over 75 countries, – and based in Paris, France. CertainTeed has more than 60 manufacturing facilities throughout the United States (US) and Canada, including 22 gypsum facilities. The Nova Scotia Registry of Joint Stocks information for CertainTeed is included in Appendix A.

CertainTeed Canada Inc.

2424 Lakeshore Rd W, Mississauga, ON, L5J 1K4

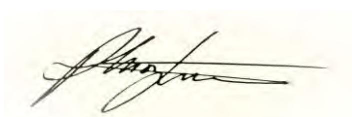
www.certainteed.ca/

Proponent Contact Information and Person with Signing Authority:

Roberto Margutti
Director, North America Mining Operations
roberto.margutti@saint-gobain.com

Table 1.2-1 provides the corporate contact information for the Project.

I, Roberto Margutti hereby accept responsibility for the content of this Environmental Assessment Registration Document.



August 27, 2024

Roberto Margutti, Director, NA Mining Operations Date
roberto.margutti@saint-gobain.com

Table 1.2-1 Antrim Gypsum Project Contacts

Position	Proponent
CEO – CertainTeed/Saint-Gobain Canada	**Julie Bonamy** Mississauga, Ontario Phone: +1 905 403-2786 Email: **Julie.bonamy@saint-gobain.com**
Director of North American Mining Operations	**Roberto Margutti** Las Vegas, NV, US Phone: +1 702 875-4111 ext 112 Mobile: +1 702 217-1601 Email: **roberto.margutti@saint-gobain.com**
Project Engineer – Antrim Gypsum Project	**Iain Smart** Lake Egmont, Nova Scotia Phone: +1 902-471-9022 Email: **iain.smart@saint-gobain.com**

1.2.1 Proponent Profile

Since 1904, CertainTeed has helped shape the building products industry in North America. CertainTeed designs, manufactures, and distributes materials and services for the construction and industrial markets. It's integrated solutions for the renovation of public and private buildings, light construction, and the decarbonization of construction and industry are developed through a continuous innovation process and provide sustainability and performance.

CertainTeed's mission is to transform the world into a better, more sustainable home through an ever-evolving range of ground-breaking building solutions. Saint Gobain-Group's commitment is guided by the purpose, "*Making the World a Better Home".*

CertainTeed is North America's leading brand of exterior and interior products, including roofing, siding, trim, insulation, gypsum, and ceilings. As such, gypsum is the commodity that interested CertainTeed in coming to NS, due to its world class gypsum deposits.

CertainTeed North American has more than 60 manufacturing facilities in the US and Canada, including 22 gypsum sites comprising of 15 wallboard plants and 7gypsum mines. CertainTeed North American employs over 6,400 people and is headquartered in Malvern, Pennsylvania, US. CertainTeed is represented in Canada as CertainTeed Canada Inc., based in Mississauga (ON), and operates 5 gypsum wallboard plants over 5 different Canadian provinces and has two active mines in British Columbia, the Windermere Mining Operation, and the Kootenay West Mine. The Windermere Mining Operation is the longest continuously running open pit mining operation in BC, and the Kootenay West Mine began commercial production in 2023.

1.3 Purpose of the Project and Need for the Undertaking

CertainTeed operates wallboard plant facilities on the East Coast, located in Toronto (ON), Montreal (QC) Buchanan (New York), and Palatka (Florida). To date, CertainTeed has relied on importation of gypsum resources from overseas (primarily Spain) to meet the demand of the wallboard plant facilities, which results in significant greenhouse gas (GHG) emissions from marine transportation, equating to approximately 120,000 tonne of carbon dioxide (CO_2) emitted on an annual basis. With the decommissioning of coal-fired power plants and the consequent reduced availability of desulphogypsum (synthetic gypsum) for wallboard manufacturing, the risk of shortage of supply of synthetic and natural gypsum is an actual concern for the gypsum industry in North America especially given the rate of new housing construction in Canada. CertainTeed, as a leading company in gypsum-based products, is looking to source natural gypsum to supply their manufacturing facilities to meet the domestic market demand for gypsum wallboard. NS serves as the only known major gypsum reserves and resources available to eastern North America. This Project provides opportunity for CertainTeed to secure a strategic source of natural gypsum to supply the Canadian and US gypsum building material market, in addition to reducing their global carbon footprint.

1.4 Benefits of the Project

This Project aligns with CertainTeed's target to achieve Net-Zero Carbon by 2050. The construction sector plays a significant role in global emissions, contributing up to 37% of CO_2 emissions (CertainTeed, 2024). The construction sector faces numerous challenges including the availability of resources, climate change, rapid urbanization, and population growth. All of these factors support the development of this Project by:

- Reducing the risk of shortage by providing a 23 year source of natural gypsum for supply in the construction and building material market in Eastern Canada and United States.
- Contributing approximately 35.8 million tonnes (Mt) to the global market to support the manufacturing of wallboard used in the application of residential and commercial (i.e. hospitals) purposes, helping to achieve lighter and more sustainable construction, due to the gypsum lower carbon impact compared to other building materials such as bricks and cement.
- Reducing carbon emissions associated with marine transport from Europe to the North American plants. The Project will reduce CertainTeed's Scope 3 emissions associated with marine transport by up to 75%. CertainTeed Canada is currently working on a number of different Scope 1 and 2 projects, like the electrification of the Montreal plant that will soon be North America's First Zero-Carbon wallboard plant.

This Project will make a strong contribution to the economy in the Halifax Regional Municipality (HRM) and NS. It will generate new employment in all Project phases (and related income and taxation benefits). Contracting and sub-contracting for required goods and services (i.e., equipment and supplies) and associated expenditures will provide business opportunities for qualified firms. Creation of new employment will benefit businesses through Project-related spending.

The plan of shipping material out of the Port of Sheet Harbour, currently underutilized, is an additional and tangible benefit of the Project, in respect to the economical valorisation and development of this rural area.

1.5 Regulatory Overview

The Project will require federal, provincial and municipal approvals for construction, operation and closure activities. The following section outlines the regulatory framework and the anticipated permitting requirements for the Project.

1.5.1 Regulatory Framework

The provincial *Environment Act* (1994-95, c. 1, s. 1.) requires any gypsum development in NS to undergo a Class 1 EA to receive an Environmental Approval for mining operations. The federal, provincial, and municipal regulatory framework required for the EA process, the permits required for the construction, operation, and closure phases of the Project, are outlined in Table 1.5-1 below. An Industrial Approval (IA) issued under the same *Act* must be obtained after receipt of EA approval, along with a Non-Mineral and Mineral Registration(s) issued under the provincial *Natural Resources Act* (2016, c. 3, s. 1. – "Act"). All associated work programs must be carried out in compliance with such legislation as well as with additional legislation such as the *Occupational Health and Safety Act*. (1996, c. 7, s. 1) and the Labour Standards Code of NS.

Table 1.5-1 Applicable Regulatory Framework

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Federal		
Fisheries Act	Authorization required for any direct or indirect disturbance of fish or fish habitat.	Fisheries and Oceans Canada (DFO)
Migratory Birds Convention Act – Migratory Birds Regulations	Project activities such as clearing and grubbing with the potential to interact with migratory birds.	Environment and Climate Change Canada (ECCC)
Species at Risk Act (SARA)	Physical disturbance or destruction of species at risk (SAR) and/or habitat.	DFO/ECCC
Canadian Environmental Protection Act (CEPA)	Pollution prevention measures to protect the environment and human health associated risks.	ECCC
Transportation of Dangerous Goods Act and Regulations	Transportation and use of dangerous goods associated with the Project.	Transport Canada (TC)
Canada Wildlife Act and Regulations	Project activities with the potential to adversely affect wildlife.	ECCC Canadian Wildlife Services (CWS)
Explosives Regulations	If blasting is required (not planned for the Project)	Natural Resources Canada (NRCan)
Provincial		
Environment Act – Environmental Assessment Regulations	EA required due to the construction, operation and decommissioning of a facility that extracts or processes metallic or non-metallic minerals.	Nova Scotia Department of Environment and Climate Change (NSECC)
Environment Act – Activities Designation Regulations	Industrial Approval (IA) is required for the construction, operation or reclamation of a surface mine using explosives and procuring mineral bearing ore. Water approval and/or notifications will be required for any water withdrawal and watercourse or wetland alterations.	NSECC

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Nova Scotia Endangered Species Act (NSESA) and Regulations	The act prohibits killing, injuring, disturbing, taking or interfering with endangered or threatened species and/or their habitat.	Nova Scotia Department of Natural Resources and Renewables (NSDNRR)
Mineral Resources Act and Regulations	The Project will require a non-mineral and mineral registrations, and will be required to provide a reclamation bond	NSDNRR
Crown Lands Act	Crown Lands lease is required for component of the Project occurring on Crown lands.	NSDNRR
Wildlife Act and Regulations	Prohibits the taking, hunting, killing, or possessing eagles, osprey, falcons, hawks, owls, and any other protected wildlife species.	NSDNRR
Nova Scotia Occupational Health and Safety Act (1996) and Regulations	Provides labour standards for which the Project will operate under.	Department of Labour, Skills and Immigration
Municipal		
National Building Code of Canada as administered through the municipal building permit process	Approval for construction and occupation of buildings.	Halifax Regional Municipality (HRM)
Municipal Planning Strategy and Land Use By-law for Musquodoboit Valley/Dutch Settlement	Resource extractive facilities are governed by the Planning Strategy and Land Use	HRM
Municipal Planning Strategy and Land Use By-law for the HRM	Industrial facilities and resource extraction are governed by the HRM Planning Strategy and Land Use By-Laws.	HRM

CertainTeed acknowledges that one black ash is proposed to be transplanted and that an Endangered Species Permit is required for this Project. This approach aligns with the precedent set on several other recent projects where transplantation of black ash has been allowed to support industrial and infrastructure development projects (Touquoy Gold Mine, Highway 104 and 107 upgrade projects). An initial site visit has been completed with the Mi’kmaq of Nova Scotia to review the location of the single black ash tree that is proposed for transplantation. The Mi’kmaq of Nova Scotia (representatives from CMM and KMKNO) provided the Proponent with positive feedback on the initial salvage plan. The detailed salvage plan will be developed during the permitting process, in conjunction with the Mi’kmaq of Nova Scotia and NSDNRR. A comprehensive monitoring program will be established to support Project development which will act as a research project relating to the required hydrologic regime required for the remaining black ash (all but one individual tree) that will be avoided by the Project.

It should be noted, the Recovery and Action Plan for black ash in NS (2015) provides statistics on population and distribution trends as well as information on species demographics in the province. The numbers presented in this report have been used as the benchmark for weighing the significance of recent observations yet are from the early 2000s and are in need of updating to incorporate knowledge gained over the last decade since the publishing of this report. It has been the experience of Strum Consulting and McCallum Environmental that identified populations, and specifically known seed bearing trees, have been steadily increasing as focussed survey efforts have yielded many new observations over the past several years. Strum/McCallum have already found one hundred trees within the PA, and at another site recently observed 20-30 seed bearing trees which triples the known individuals from the recovery strategy alone.

1.5.2 Scope of the Environmental Assessment

This EA was conducted in accordance with the NS *Environmental Assessment Regulations*, which are made under the NS *Environment Act.* Guidance from the NS *Environmental Assessment Regulations* was incorporated in developing the methodology used to execute the EA, and the identification and description of potential Project effects on the surrounding environment.

The scope of the assessment for the Project included selection of valued components (VCs), assessment of baseline conditions, engagement with the Mi'kmaq of Nova Scotia and other stakeholder groups, identification of interactions between the Project and VCs, effects prediction, assessment and mitigation, determination of effects significance, and quantification of residual effects following mitigation efforts.

In support of this scope, learnings and information were additionally derived from the following:

– Regulations, guiding documents, and policies applicable to the Project
– CertainTeed's experience with other gypsum projects in North America
– Engagement with the Mi'kmaq of Nova Scotia, stakeholders, and public consultation
– General acceptable local practices in EA
– Knowledge of biophysical and socioeconomic conditions

1.5.3 Environmental Assessment Requirements

A Class I EA is required under the *Environment Act* and *Environmental Assessment Regulations* (B.1(e)) where the Project is a mining facility that extracts or processes gypsum. This EARD was developed in accordance with the *Environmental Assessment Regulations* (s.9(1A)). Concordance with the EA requirements in the regulation are outlined in Table 1.5-2. Other provincial guidance documents that were consulted in preparation of this EARD include:

– A Proponent's Guide to Environmental Assessment (NSE, 2001)
– Guide to Preparing an EA Registration Document for Mining Developments in Nova Scotia (NSE, 2002)
– Guide to Considering Climate Change in Environmental Assessment in Nova Scotia (NSE, 2011)
– Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE, 2005)

Table 1.5-2 Concordance Table with the Environmental Assessment Regulations

Environmental Assessment Regulations Requirement	EARD Section Reference
The name of the proposed undertaking	Section 2.1
The location of the proposed undertaking	Section 2.2
The name, address and identification of the proponent	Section 1.2
A list of contact persons for the proposed undertaking and their contact information	Section 1.2
The name and signature of the Chief Executive Officer or a person with signing authority, if the proponent is a corporation	Section 1.2
Details of the nature and sensitivity of the area surrounding the proposed undertaking	section 6
The purpose and need for the proposed undertaking	Section 1.3
The proposed construction and operation schedules for the undertaking	Section 3.4
A description of the proposed undertaking	Section 3.1
Environmental baseline information	Section 6 – baseline section for each VC
A list of licences, certificates, permits, approvals and other forms of authorizations that will be required for the proposed undertaking	Section 1.5
All sources of public funding for the proposed undertaking	Section 2.4
All steps taken by the proponent to identify the concerns of the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	Section 4

Environmental Assessment Regulations Requirement	EARD Section Reference
A list of all concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	Section 4
All steps taken or proposed to be taken by the proponent to address concerns of the public and aboriginal people	Section 4 and Section 6

Despite gypsum being defined as a mineral under Section 16(1) of the Regulations, based on the proposed extraction process of gypsum for this Project (i.e. surface miners), and the gypsum mining process, i.e. screen, size and pile with no milling or processing to extract gypsum from ore, the Project is not anticipated to require a federal Impact Assessment as outlined in the IAA (IAA, 2019) - Regulations Designating Physical Activities, and therefore the Project is being submitted for consideration of a provincial Class I EA approval.

The NS Environment Act and Environmental Assessment Regulations regulate the format/scope of a provincial EA.

1.5.3.1 Environmental Assessment Study Team

CertainTeed has worked with a study team experienced in NS. GHD is the lead consultant supporting the EA. The EA Study Team is presented in Table 1.5-3.

Table 1.5-3 GHD EA Study Team

Position	GHD Limited
Environmental Assessment Lead	Callie Andrews, M.Sc. 120 Western Parkway, Bedford, NS T: (902) 499-0321 E: **Callie.Andrews@ghd.com**
Intermediate Environmental Scientist	Jessica Romo, MREM
Senior Impact Assessment Specialists	Nancy Griffiths, MCIP and Peter Oram, P.Geo
Water Resource Specialist	Chris Muirhead, P. Eng. (NS, ON)
Senior Hydrogeologist	Philip Sheffield, M.A.Sc, P.Eng. (BC, NS, ON)
Senior Fisheries Biologist	Amanda Smith, MSc.
Air Quality Specialist	Matthew Griffin, P.Eng (ON)
Noise and Vibration Practice Leader	Michael Masschaele, BES LEL

Other consultants who contributed supporting information for the preparation of the EARD are included in Table 1.5-4.

Table 1.5-4 Consultants Providing Supporting Information

Consultant	Contributing Role
McCallum Environmental Ltd. (Now Strum Consulting)	Valued Components: Wetlands, Fish and Fish Habitat, Terrestrial Environment Baseline data collection and reports: Flora and Fauna, Avian, Fish and Fish Habitat, Wetlands Wetland Compensation Plan Conceptual Fish Habitat Offsetting Plan
Mercator Geological Services Ltd.	Mineral Resource Evaluation
Terrane GeoScience Inc.	Geotechnical Investigation and Study
Ausenco Engineering Canada Inc.	Mine Development Plan Project Infrastructure Design
Moose Mountain Technical Services	Mine Planning and Design

Consultant	Contributing Role
Membertou Geomatics Solutions	Mi’kmaq Ecological Knowledge Study
Cultural Resource Management Group Limited	Archaeological Reconnaissance and Impact Assessment
Griffin Transportation Inc.	Traffic Impact Study (TIS)

1.5.4 Other Approvals

Following release of the Project from the EA process, several other permits and approvals are required for the Project to commence. A summary of key approvals and permits identified as required for the Project are included below.

Federal

– DFO Fisheries Act Authorization

Provincial

– Industrial Approval
– Water Withdrawal Permit
– Wetland Alteration Permit
– Watercourse Alteration Permit
– Crown Land Lease
– Non-Mineral and Mineral Lease(s)

1.5.5 Mi’kmaq of Nova Scotia

Engagement with the Mi’kmaq of Nova Scotia has been ongoing since the Project was initially proposed. CertainTeed has been in communication with three Mi’kmaq communities, including two in closest proximity to the Project, Sipekne'katik First Nation, Millbrook First Nation, Membertou First Nation, and the KMKNO. Results of these interactions have acted as guidance through the process of planning and designing the Project. Engagement with the Mi’kmaq of Nova Scotia is further detailed in Section 4.3.

2. Project Description

2.1 Project Name

The name of the undertaking is the Antrim Gypsum Project. The Project has been referred to as the Antrim Gypsum Project throughout the engagement period with the Mi’kmaq of Nova Scotia, community members and other members of the public, regulators and elected officials at all three municipal levels.

2.2 Project Location

The Project is located near Gays River, along Lake Egmont Road in the community of Cooks Brook, NS (Figure 2.2-1), approximately 50-kilometers (km) northeast of Halifax and 82 km northwest of Sheet Harbour. The Project can be accessed from Halifax via Provincial Highway 102 from Halifax to Milford Station (approximately 60 km), then via Highway 224 for approximately 15 km to Carroll’s Corner and Antrim – Lake Egmont area. For the EA, a PA was defined as the footprint of Project related infrastructure covering an area of approximately 602 hectares (ha). The PA is centered at coordinates NTS Map: 11E03: Latitude: 45° 00' 04.2" N, Longitude: 063° 19' 49.5" W or UTM Zone 20 NAD 83 (CSRS) 473958E 498313.

The Project will be located on a mixture of private lands (owned by CertainTeed) and Crown land. An application for a Crown Land Lease was submitted to the Crown on January 19th, 2024. Supplementary information including maps, and additional information was submitted on February 9th, 2024. Table 2.2-1 provides the premises identification numbers (PIDs) of both Crown and private land included in the PA and property ownership is shown on Figure 2.2-2.

Table 2.2-1 PA Property Ownership Summary

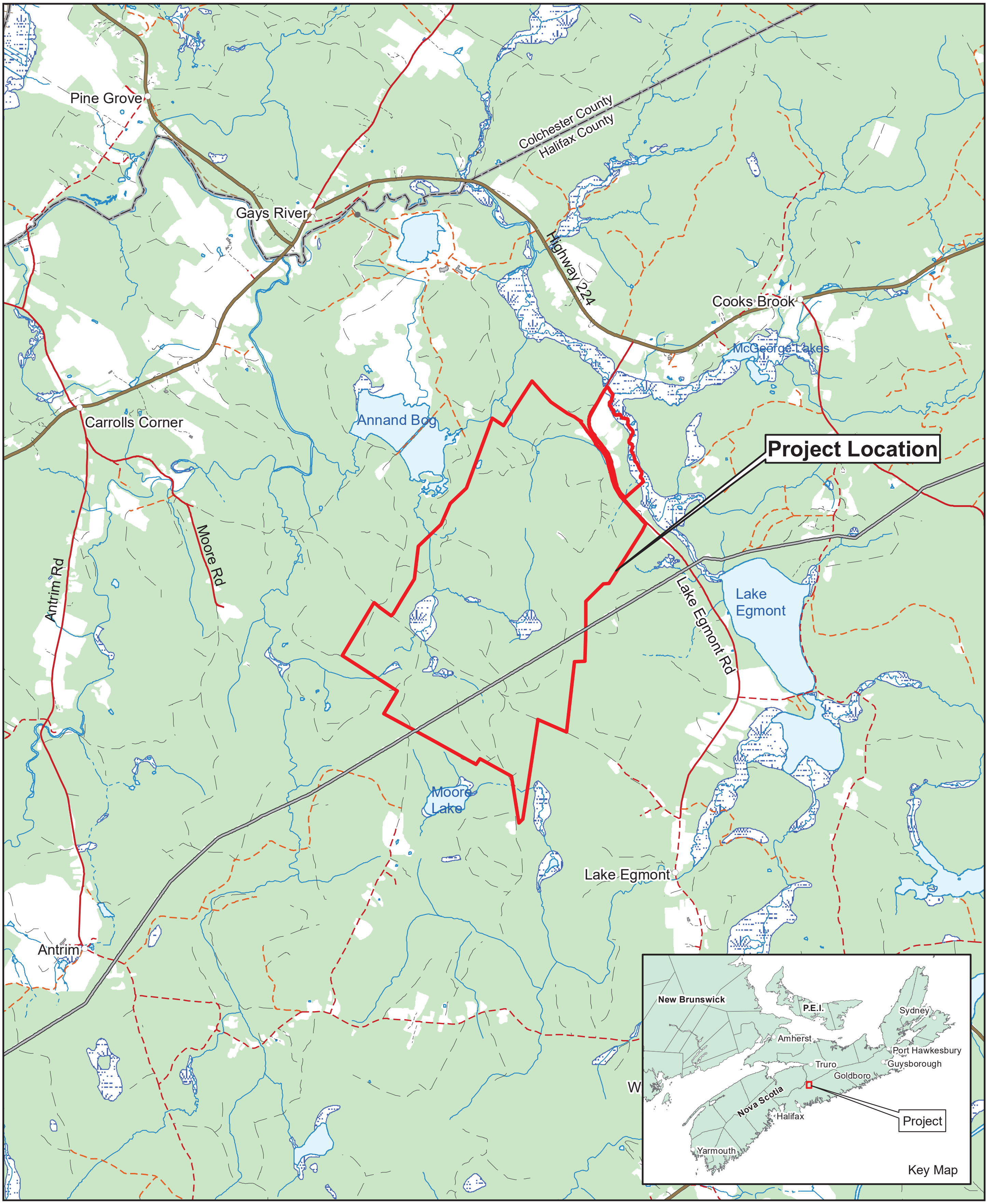
Landowner	PID
CertainTeed Canada, Inc.	40228009
	40228017
	41517319
	40767014
	41152893
Province of Nova Scotia	40228389
	40228371
	40212409
	40229676
	40959983
	40959975

Lake Egmont Road, a secondary paved road accessible from Old Guysborough Road runs between the PA. The main access to the PA is directly off Lake Egmont Road to the south. Access to supporting Project buildings (i.e., administration office, security, training house, guest house, etc.) and employee parking area, will be accessible via a driveway to the north of Lake Egmont Road. The Project is adjacent to the Maritimes & Northeast Pipeline (M&NP) natural gas pipeline, which passes through the southeastern portion of the PA.

The nearest residence is located approximately 960 m northeast of the open pit, approximately 730 m from the administration office building, and approximately 190 m from the northern boundary of the overburden stockpile. The number of residences located within 0.5 km, 1.0 km, 1.5 km, and 2.0 km of proposed Project infrastructure is provided in Table 2.2-2 below.

Table 2.2-2 Distances from Residences

Distance from Project Infrastructure (km)	**Approximate Number of Residences**
0.5	1
1.0	6
1.5	13
2.0	36



Paper Size ANSI A

0 500 1,000 1,500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

N

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CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

PROJECT LOCATION

Project No. 12601021
Revision No. -
Date July 22, 2024

FIGURE 2.2-1

N:\CA\Halifax\Projects\661\12601021\GIS\Maps\Deliverables\RPT006\12601021-RPT006-HX001-Fig 1 Site Location.mxd
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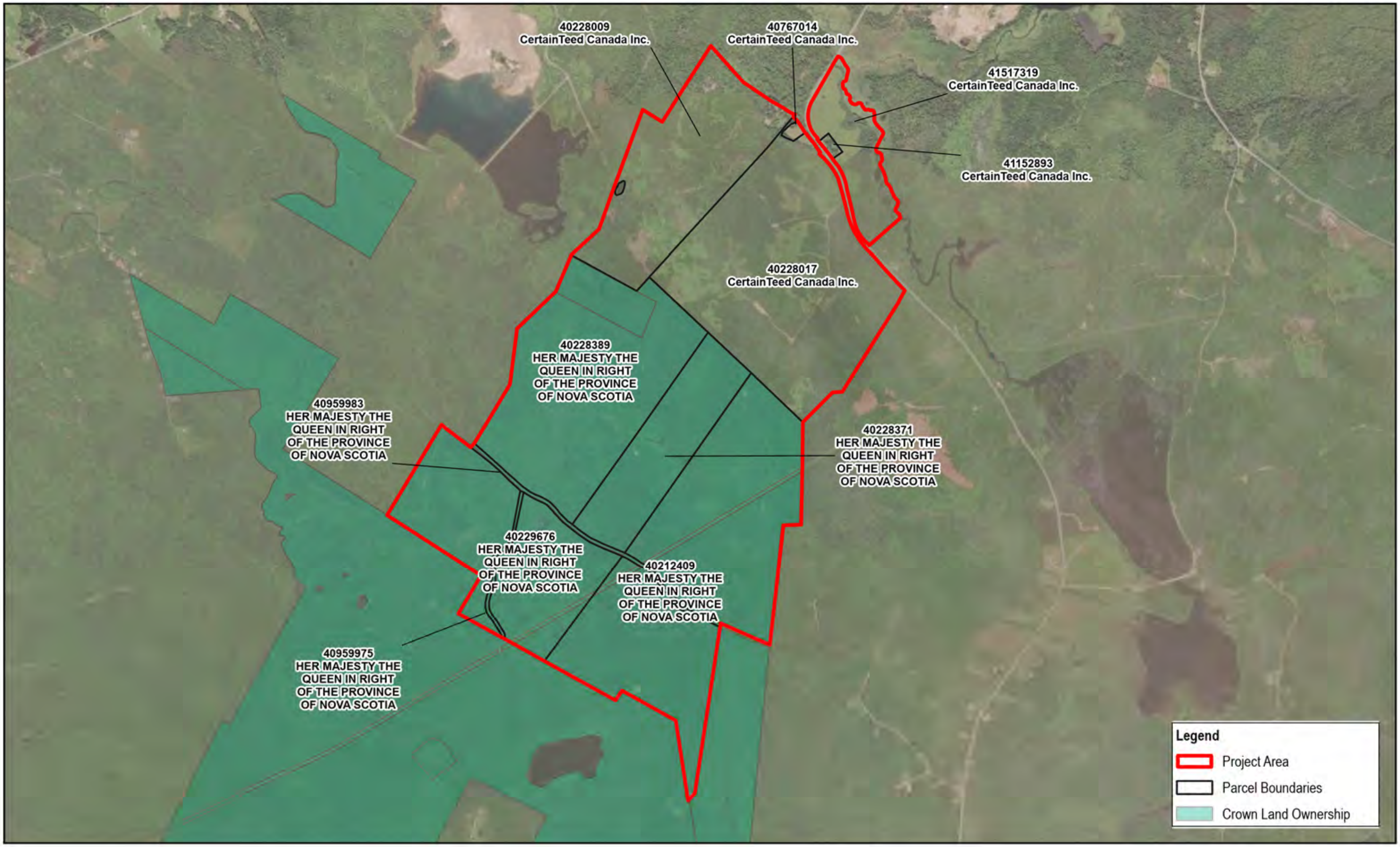
Created by: iwilson2



Paper Size ANSI A

0 300 600 900

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

Project No. **12601021**
Revision No. **-**
Date **14/08/2024**

PROPERTY OWNERSHIP

FIGURE 2.2-2

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Print date: 14 Aug 2024 - 11:36

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2.3 Exploration and Production History

The Gays River area of the Shubenacadie basin as well as the adjoining Musquodoboit basin were the subject of historical mineral exploration, primarily focused on base metals, but also included other industrial mineral resources such as gypsum, limestone, and silica sand (Ausenco Engineering Canada [Ausenco], 2024). Historical mineral exploration work in the area surrounding the PA has generally been related to the nearby Gays River and Getty zinc/lead deposits, Gold Bond East Milford gypsum mine, the undeveloped Dutch Settlement (originally owned by United States Gypsum) gypsum deposit, and the Murchyville (Knauf-owned) gypsum deposit (Ausenco, 2024).

Exploration programs directed toward defining the gypsum resource in the PA were carried out by the Gypsum Division of Lafarge North America Ltd. (Lafarge) and by CertainTeed. Lafarge programs completed from 1999 through 2002 initially defined the gypsum deposit characteristics and tonnage potential. In the early to mid-2000s, gypsum exploration consisting of percussion and core drilling programs were carried out by Lafarge between Antrim, the Scotia Mine Limited (SML) (previously owned by ScoZinc Ltd.) mine area to the north, and the Lake Egmont Road area to the east (Ausenco, 2024). This work identified and broadly defined the gypsum and anhydrite deposit currently being explored by CertainTeed. Continental Building Products LLC (Continental) acquired the Gypsum Division assets of Lafarge in 2013 and Saint-Gobain, CertainTeed's parent company, subsequently acquired Continental in early 2020. Due to these acquisitions, Lafarge technical data for the PA became available to CertainTeed for assessment in 2021.

In 2022, CertainTeed completed two core drilling programs for the Project. The program consisted of a six-hole, 352 m drill program on Exploration Licence 53450 and Exploration Licence 53344 held by CertainTeed to further delineate the gypsum deposit within the PA and to fulfill mineral exploration work obligations for these mineral claims (Cullen and Power, 2023; Cullen, 2023). The most recent program within the PA was a combined resource infill and geotechnical drilling program designed to further define the resource (Cullen, 2023).

CertainTeed carried out an in-house Mineral Resource estimation program for the Project based on compiled results of historical drilling and the 2022 drilling program (Cullen and Power, 2023). Deposit modelling and Mineral Resource estimation programs were carried out by Mercator Geological Services and the related digital block model forms the basis of the open pit design and development approach.

To date, there has been no gypsum or anhydrite production within the PA. The closest currently producing gypsum mine is operated by Gold Bond at East Milford, NS, approximately 7 km west of the PA.

2.4 Project Funding

No public or government funding is required for the execution of this undertaking. This Project will be funded by the CertainTeed's parent company, Saint-Gobain.

3. Project Scope

3.1 Description of the Undertaking

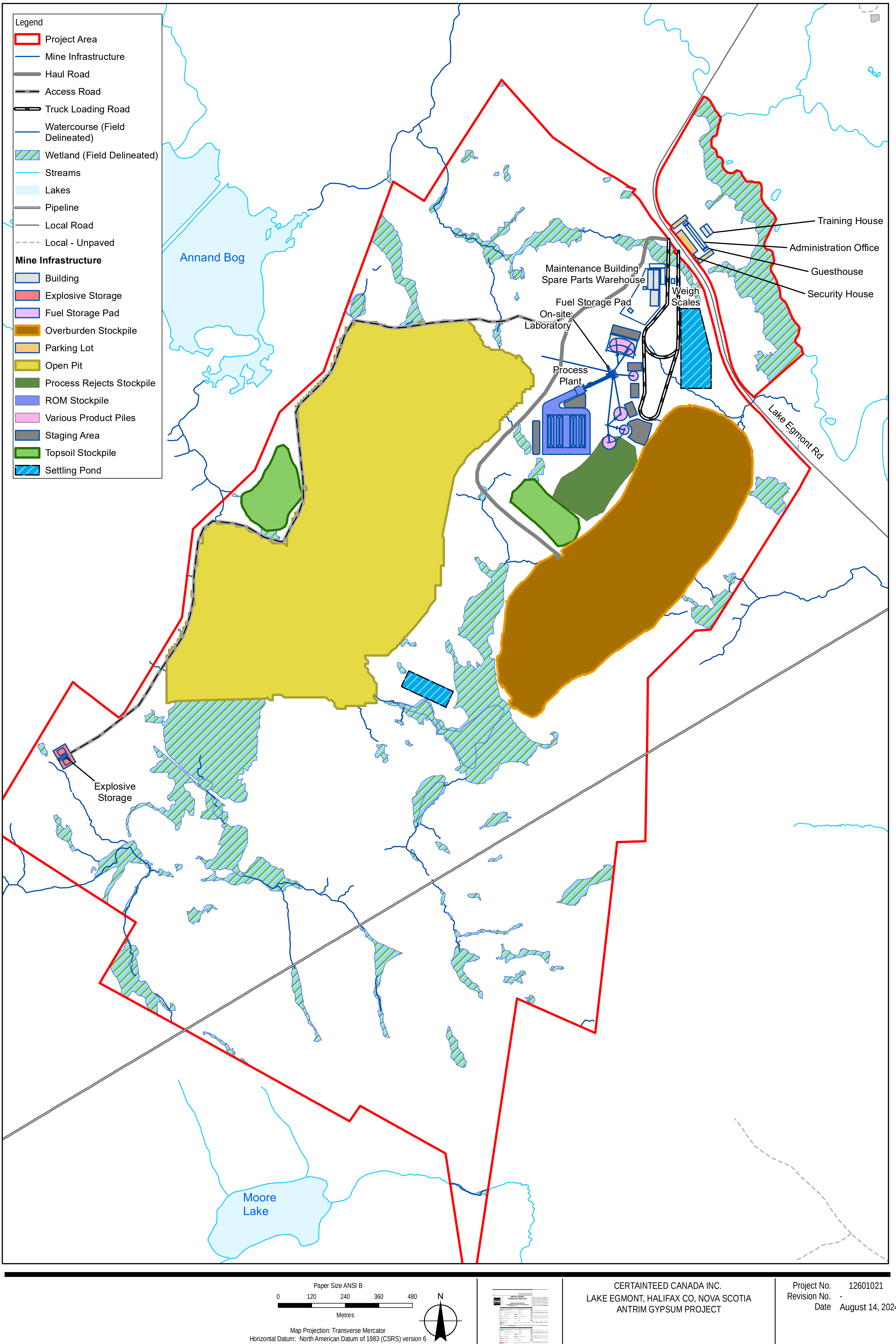
The Project consists of a conventional surface mining operation including an open pit, overburden and topsoil stockpiles, processing plant as well as water management infrastructure. Figure 3.1-1 presents the conceptual mine plan and Project layout. The Project will produce gypsum and anhydrite. Extraction will advance in two phases (Phase 1 and Phase 2) starting with Phase 1 mining from the north end, solely on private land, and Phase 2 mining advancing on to Crown land. The phased development will proceed with a series of seven pushbacks (Phase 1a,b and Phase 2a,b,c,d,e) as shown on Figure 3.1-2. The scope of the proposed Project encompasses activities associated with construction, operation, and closure activities, similar to other gypsum projects in the region.

The average production rate for gypsum and anhydrite is estimated to be 2.0 million t/y, with an estimated marketable rate of production of 1.5 million t/y. The proposed operating schedule is 7:00 AM to 5:30 PM five days a week, for

52 weeks/year. The extractable reserves in the Project are estimated to support operations for at least 23 years and will result in approximately 35.8 Mt of gypsum produced throughout the life of the Project. The product will be transported off-site in B-Train double trucks from 7:00 AM to 8:00 PM five days a week, to the Port of Sheet Harbour. The port currently can handle and load the product onto ships. If future upgrades are required to the Port to facilitate the Project or any other project, those upgrades are outside of the scope of this EARD and the Port will obtain the necessary permits and approvals.

Water management from surface run-off and pit dewatering will be collected and directed to one of two settling ponds (north settling pond and south settling pond). The north settling pond and perimeter ditching will be established in advance of the development to ensure adequate sedimentation control during site works and open pit development. In Phase 1 of operation, the north settling pond will collect surface water runoff from the overburden and topsoil stockpiles, runoff from processing area, and dewatering of the pit. The south settling pond will be constructed in advance of Phase 2 mine development, to support management of run-off and pit dewatering during this phase. Settling ponds will be constructed to ensure that the maximum total suspended solids (TSS) in the Project discharge are within operating limits outlined in the IA and other applicable permits. Other measures, such as siltation ponds, straw/hay/mulch and hydro-seeding may also be used, when deemed necessary, to minimize and control sedimentation.

The open pit will be progressively reclaimed as development advances to minimize the extent of the disturbed footprint and minimize the impact of the Project on identified environmentally sensitive areas. Waste rock, overburden, and process rejects will be used to backfill the mined-out area to original topographic elevations and contours during development as per the progressive reclamation approach. In general, during closure any buildings, culverts, and water management infrastructure (i.e., settling ponds) will be decommissioned and removed, returning the PA to a pre-mining state. Additional details on timelines for closure and reclamation activities will be developed as part of the IA and conditions of an EA approval, if granted.



Map Projection: Transverse Mercator
Horizontal Datum: North American Datum of 1983 (CSRS) version 6
Grid: NAD 1983 (CSRS) v6 UTM Zone 20N

CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

CONCEPTUAL MINE PLAN

Project No. 12601021
Revision No. -
Date August 14, 2024

FIGURE 3.1-1

N:\CA\Halifax\Projects\661\12601021\GIS\Maps\Deliverables\RPT006\12601021-RPT006-HX002-Fig 3.1-1 Conceptual Mine Plan.mxd
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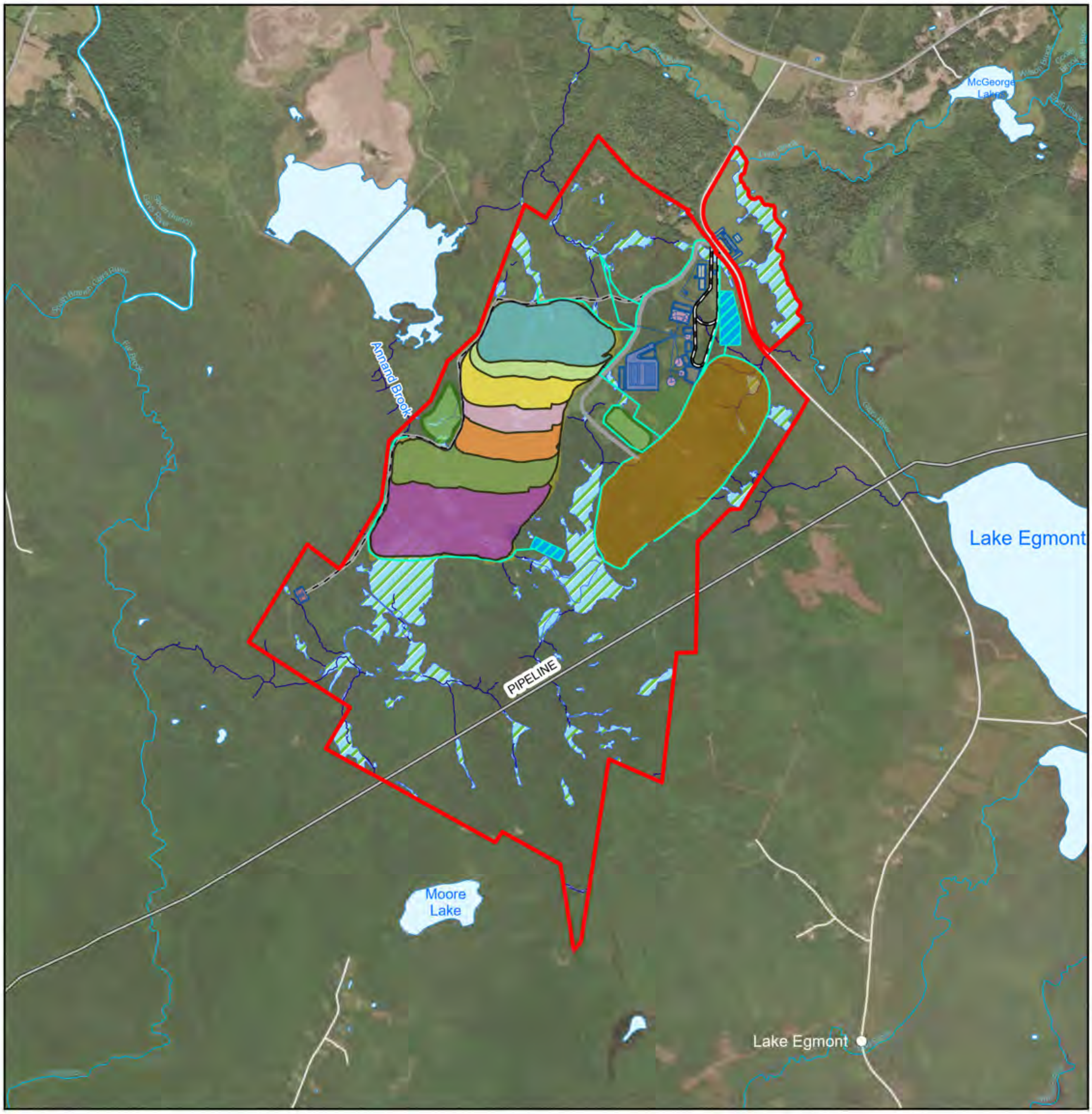

Legend

- Project Area
- Haul Road
- Truck Loading Road
- Access Road
- Mine Infrastructure
- Watercourse (Field Delineated)
- Wetland (Field Delineated)
- Coast; Lakes; Rivers; Reservoir; Rapids
- Streams
- Pipeline
- Trans Canada Highways
- Highways
- Arterial Roads
- Collector Roads
- Local Roads
- Pit Design - Phase 1a
- Pit Design - Phase 1b
- Pit Design - Phase 2a
- Pit Design - Phase 2b
- Pit Design - Phase 2c
- Pit Design - Phase 2d
- Pit Design - Phase 2e

Mine Infrastructure

- Building
- Explosive Storage
- Fuel Storage Pad
- Overburden Stockpile
- Parking Lot
- Open Pit
- Pond
- Process Rejects Stockpile
- ROM Stockpile
- Weigh Scale
- Various Product Piles
- Staging Area
- Topsoil Stockpile
- Settling Pond
- Water Management Infrastructure

Paper Size ANSI A

0 300 600 900

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 20N

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CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

CONCEPTUAL MINE PLAN
PROJECT PHASES

Project No. **12601021**
Revision No. **-**
Date **Aug 14, 2024**

FIGURE 3.1-2

N:\CA\Halifax\Projects\661\12601021\GIS\Maps\Deliverables\RPT006\12601021-RPT006-HX010-Fig 3.1-2 Conceptual Mine Plan Phases.aprx
Print date: 14 Aug 2024 - 16:17

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3.2 Project Components

The primary components associated with the Project are detailed in the following sections and shown on Figure 3.1-1.

– Open pit
– Overburden and waste rock stockpile
– Topsoil stockpile
– Product stockpiles
– Haulage Road Network
– Process Infrastructure
  - ROM stockpiles/staging area
  - Sizer building
  - Screening building
  - Board grade pile building
– Non process infrastructure/supporting buildings:
  - Maintenance building
  - Mine office and mine dry
  - Spare parts warehouse
  - Security house
  - Guest house
  - Training house
– Explosives Storage (if required)
– Water management infrastructure; and
– Power and electrical supply.

3.2.1 Open Pit

The open pit is planned to be advanced in a total of seven pushbacks (Phase 1a,b and Phase 2a,b,c,d,e), with mining advancing from north to south. The timeline for both Phase 1 and 2 are 6 and 16 years, respectively. Access to the open pit is maintained for each phase by internal ramps with two access ramps that will remain once life of mine is reached.

Corresponding material quantities, sizes, and elevations for the open pit by phase is listed in Table 3.2-1.

Table 3.2-1 Planned Open Pit Phase Depth and Estimated Material Quantities

Open Pit Phase	Estimated Material Quantity (mt)	Estimated Waste (mt)	Elevation of Pit Bottom (masl)	Pit Depth (m)	Years of gypsum production
1a	3.8	6.5	-20	60	4.0
1b	2.0	3.4	-20	75	1.5
2a	5.7	6.0	-25	78	2.8
2b	5.4	3.3	-30	78	2.8
2c	6.7	3.2	-31	78	3.0
2d	9.3	5.1	-25	70	4.0
2e	10.7	7.3	-1	41	4.5
Estimated Mine Life					22.6

3.2.2 Stockpile Areas

There will be several stockpiles across the PA to accommodate run of mine (ROM), overburden, and topsoil. Stockpiles of various product material (board grade, agricultural grade, cement and anhydrite), process rejects, and oversized material will also be located near the process plant.

3.2.2.1 Overburden Stockpile

All overburden material removed from Phase 1 of the open pit and other areas for construction will be placed in the overburden stockpile as shown on Figure 3.1-1. The overburden stockpile also contains waste rock, which comprises only 5% of the combined stockpile. Overburden material will consist of soil and till. Waste rock is classified as any rock that is extracted as part of the mining development which does not meet the quality specifications of any of the gypsum and anhydrite projects (a mix of muddy gypsum, siltstone, mudstone and a small amount of anhydrite). Overburden material from Phase 2 will be used to backfill Phase 1, and subsequent Phase 2 pushbacks.

Overburden stockpile will have a maximum capacity of 15.2 Mt. The conceptual overburden stockpile design is intended to have an overall slope of 3:1, which will be achieved with 10 m lifts at a 2.7:1 slope with a 3 m berm. The overburden stockpile also includes a 25 m wide ramp at a 10% grade. The maximum footprint is shown on Figure 3.1-1. The final elevation of the stockpile will be 85 masl. This conceptual design will be confirmed through geotechnical evaluation and detailed design at the permitting stage of the Project.

3.2.2.2 Topsoil Stockpiles

Topsoil and organics removed from the open pit and other development areas of the PA will be placed in two stockpiles, one located to the west of the open pit and a second located central to the PA as shown on Figure 3.1-1. Topsoil stockpiles are assumed to placed directly on top of existing topsoil and therefore do not to require topsoil removal. Topsoil stockpiles will have a maximum height of 24 m. The topsoil stockpiles will be constructed in lifts with 4:1 slopes. This conceptual design will be confirmed through geotechnical evaluation and detailed design at the permitting stage of the Project.

3.2.2.3 Run of Mine Stockpiles and Product Piles

ROM material from the open pit will be hauled to the process plant using off-highway haul trucks. At the ROM staging area, haul trucks will dump ROM material in one of four sheltered ROM stockpiles (A, B, C and D) each representing different percentage grades of gypsum. The ROM stockpiles will be approximately 20 m by 113 m in size. The stockpiles are positioned in rows and are classified by the purity percent gypsum. Haul trucks will offload material directly into the feed bin, or ROM stockpiles.

Material from the ROM stockpile will be fed through the processing system that will consist of sizing, screening, and blending equipment with intermediate and final product stockpiles.

Material is then directed to oversized material pile, or the board grade pile. The fines are transported from the screen to the ROM fine pile or the anhydrite pile. Material from the board grade and anhydrite piles can be transported out of the PA via the truck loading route for shipment as final products, and the fines can be used for pit infill or sent as process rejects. Through the processing, the material is sized, screened and conveyed based on the purity percent gypsum and overall size to one of the five material product stockpiles, to form three gypsum projects:

– Board grade
– Anhydrous/cement grade
– ROM A, B and C fines
– Agriculture grade
– Oversize pile

The location of the ROM staging area, piles, and product stockpiles are indicated on Figure 3.1-1.

3.2.3 Road Network

Roads within the PA will consist of haul roads and a truck loading road for the loading of gypsum to transportation to the Port of Sheet Harbour.

3.2.3.1 Haulage Road Network

The open pit, stockpiles, and process infrastructure in the PA will be accessed via a driveway extending south from Lake Egmont Road. The haul roads connect the open pit to the process plant and stockpiles, and will be primarily used for transportation of gypsum, waste rock, overburden, and topsoil from the open pit to the process plant and stockpiles. During Phase 2 of development, the haul roads will be extended to provide access to the southern extent of the open pit.

The Phase 1 haul road is approximately 1.5 km long and designed to accommodate dual running lanes and berm on the outside edge of the haul road. These haul roads are constructed to handle 90-tonne payload rigid frame haul trucks, allowing for double-lane travel and including an additional 2 m for light vehicle access where needed, with a maximum grade of 8%.

The conceptual mine plan also includes an allowance for light vehicle access roads around the stockpiles, western boundary of the pit, and to access the explosive storage area in Phase 2. The light vehicle access road will be unpaved, double-lane, with a maximum width of 5 m.

3.2.3.2 Truck Loading Road

The truck loading road is a one-way loop extending from the PA access to the process plant and will be used for filling and weighing of highway haul trucks with product for shipment. The truck loading road will be paved for a length of 31 m at both the entrance and exit of the route to minimize dust.

3.2.4 Process Plant

The process plant will be located on private land north of the PA entrance and east of the open pit as shown on Figure 3.1-1. The process plant will include the following primary components:

– ROM staging area
– Mineral sizer
– Triple-deck screen
– Conveyors
– Radial stackers
– ROM stockpile A/B
– ROM stockpile C/D
– Sizer building
– Screening building
– Board grade pile building

Ancillary components of the process plant will include the following:

– Laboratory
– Maintenance building
– Spare parts warehouse
– Fuel storage pad

The process plant is designed to treat four types of ROM products. Each product will be processed separately, utilizing shared equipment to segregate the material based on size and grade. This facility produces four products (board grade, agricultural grade, cement, and anhydrite). In addition to the process plant infrastructure, additional Project infrastructure and support buildings will be located to the north of Lake Egmont Road and include the following:

– Mine office
– Security house
– Guest house
– Training house
– Parking area (employee/service vehicles)

3.2.5 Explosives Storage

The primary extraction method will be by mechanical surface miners; however, there may be instances where the surface miners are unable to safely access or excavate the material and blasting may be required.

No explosives will be stored within the PA during Phase 1 of the Project. If required, explosives will be brought in by a licensed explosives supplier through a contract agreement. The explosives would be delivered to the PA on the same day as the scheduled blast. During Phase 2, if needed, a small portable explosives storage facility, with a capacity of 5,000 kilogram (kg), could be constructed in the southwest corner of the PA, on Crown Land, as shown on Figure 3.1-1.

The potential explosives storage area would abide by applicable regulations, including the provincial NS Blasting Regulations and the Canadian Federal Explosives Regulations, which outlines appropriate storage quantity, distance requirements, and construction parameters. All required permits and certifications will be met.

3.2.6 Fuel Storage

Two double walled fuel storage tanks with dispensing systems will be installed near the process plant. The tanks will store diesel for servicing onsite vehicles and stationary equipment. The tanks will have a capacity between 10,000 – 20,000 L.

3.2.7 Water Management Infrastructure

A conceptual water management plan was developed for each phase of mine development. Two settling ponds, north and south settling pond, will be required for this Project to manage water on site and settle TSS prior to discharging to the receiving environment. The ponds will be lined with a high-density polyethylene (HDPE) liner and designed to maintain the 5-year storm event and to control a 100-year storm event. The outlet structure of the ponds will be designed during the detailed design phase of the Project. Further treatment is not anticipated due to the nature of the geology associated with gypsum mining which is consistent with the requirements of other gypsum operators in the province (i.e. Gold Bond and Canadian Gypsum Corporation).

Figure 3.1-1 shows the conceptual mine plan, including the ditches, settling ponds, and proposed discharge points to the receiving environment. The discharge structures will be further defined during the detailed design stage of the process for the IA.

3.3 Project Activities

The Project involves three phases – construction, operation, and closure, as summarized in Table 3.3-1 and described in the following sections.

Table 3.3-1 Project Activities

Construction	
Clearing, grubbing, and grading	Vegetation clearing, grubbing, grading, overburden stripping and stockpiling
Road construction	Road surface clearing, grubbing, and grading; material placement
Water management	Preparation and construction of watercourse crossing structures, buffer establishment, and protection measures, installation of erosion and sediment control (ESC) measures, construction of ditching, settling ponds, and installation of pumps
Infrastructure installation and construction	Administration buildings, laboratory, maintenance building, warehouse, fuelling station, power distribution systems, process plant, etc.
Operation	
Extraction; Vermeer terrain level surface excavation machines (surface miners)	Primary extraction method will utilize Vermeer terrain level surface excavation machines (surface miners) with drilling / blasting only used, as required.
Processing	Sized, screened, and product stockpiled
Overburden and waste rock management	Storage and management of overburden, waste rock, and topsoil
Water management	Water sources, surface water management and water discharge
Power supply	Electrical systems and generation
Waste management	Sewage, non-hazardous domestic waste, hazardous waste
Road construction	Extension of haul road network to access Phase 2 of open pit
Surface infrastructure installation and construction	Explosives storage area (if required)
Closure	
Demolition	Removal of surface infrastructure, including administration buildings, spare parts warehouse, explosive storage area, laboratory, power distribution systems, etc.
Earthworks	Final sloping, grading, and placement of overburden and topsoil
Water management	Water management; refilling of open pit, removal of all water management infrastructure

3.3.1 Construction

The construction phase of the Project is anticipated to occur over a period of two years and will include site preparation activities including clearing, grubbing, and grading. This phase will include the construction of infrastructure required to initiate the operational phase of the Project. During construction, the footprint of Project infrastructure and Phase 1 of the open pit will be cleared, and any harvestable timber will be recovered.

CertainTeed will adhere to all regulatory restrictions and best practices for the construction period, including restricting any in-water works disturbance to the recommended timing window outlined by Fisheries and Oceans Canada (DFO) (DFO, 2019a) and following DFOs best practices measures to protect fish and fish habitat (DFO, 2023). When vegetation clearing cannot be avoided during the nesting bird period, a qualified professional will conduct nest searches or sweeps of any vegetation to be cleared within 48 prior to clearing activities. If active nests are identified, the professional will provide appropriate recommendations to maintain compliance with the *Migratory Birds Convention Act* (MBCA) and identify a protection area around the nest, if applicable. Clearing activities may proceed outside of this protection area and as per any additional recommendations identified by the qualified professional. CertainTeed will also adhere to any other Project specific limitations outlined in the IA and other permitting process, as well as appropriate SAR mitigation measures will be adhered to during all Project activities.

During the construction phase, the one black ash located within the extents of the open pit is proposed to be transplanted. This will be done in collaboration with the Mi'kmaq of Nova Scotia, in keeping with several other recent projects where transplantation of black ash has been allowed to support industrial and infrastructure development projects (Touquoy Gold Mine, Highway 104 and 107 upgrade projects). An initial site visit has been completed with the Mi'kmaq of Nova Scotia to review the location of the single black ash tree that is proposed for transplantation. The Mi'kmaq of Nova Scotia (representatives from CMM and KMKNO) provided CertainTeed with positive feedback on the initial salvage plan. The detailed salvage plan will be developed during the permitting process, in conjunction with the Mi'kmaq of Nova Scotia and NSDNRR.

Transplantation methods will be modelled on a successful Mi'kmaq black ash conservation strategy program established in New Brunswick. A seed transplantation program will provide a means of replacing this single tree to other wetlands in the PA and enhance overall recruitment of the black ash population by supplementing natural regeneration with transplants. The individual tree stump is also proposed to be transplanted to an adjacent wetland to allow for stump sprouts to regenerate and preserve this individual within the PA. Lastly, a harvest of this tree could also provide materials for local Mi'kmaw communities for traditional uses.

A comprehensive monitoring program will be established to support Project development which will act as a research project relating to the required hydrologic regime required for the remaining black ash (all but one individual tree) that will be avoided by the Project. The following sections provide an overview of activities that will occur during the construction phase of the Project.

3.3.1.1 Clearing, Grubbing, and Grading

Clearing, grubbing, and grading activities will occur at the start of the construction period in the footprint of Project infrastructure. Any harvestable timber will be recovered during clearing activities. During the initial Project development, waste rock from the open pit and from the process plant area, will be used for construction whenever possible. During construction activities and prior to the availability of waste rock from the open pit, material may be transported to the PA from permitted local quarry sites. Quarry sites near the PA will be preferential to limit hauling of material.

3.3.1.2 Road Construction

Approximately 1.49 km of haul road will be constructed from the Project entrance south of Lake Egmont Road, extending south to the pit, process plant, and stockpiles. Haul roads will be designed with dual-running width and will have berms on both sides of the road. Haul roads will be paved from the PA entrance for a distance of 31 m, and then unpaved. The truck loading road is a 1.49 km single laned one way roadway for highway haul trucks to reach product stockpiles, load, and be weighed, for transport offsite. Weigh scales will be positioned at both the entrance and exit of the loop to allow an appropriate flow of traffic.

Double lane unpaved light vehicle access roads assumed to be a maximum of 5 m wide will be constructed around the stockpiles and pit and extend down from the western boundary of the pit during the operation phase to provide access to the explosive storage area during Phase 2 of mining development.

Drainage ditches will be constructed parallel to all haul roads. At the intersection of drainage paths and roads, water will be conveyed beneath the road via a culvert crossing. Culverts will be installed with rip rap erosion protection at inlets and outlets and will require regular maintenance and monitoring to keep them sediment-free and free-flowing during rainfall events. Culverts will be designed in accordance with applicable legislation requirements, with a 0.5% minimum barrel slope and hydraulic capacity considering a 1-in-100 year storm flow (NSECC, 2015).

Haul roads, truck loading road, and light access vehicle roads will be constructed with waste rock from the open pit, whenever available. Construction rock will be sourced from permitted local quarries as required.

3.3.1.3 Water Management

Perimeter ditching and the north settling pond will be constructed in advance of the overburden and topsoil stockpiles. Perimeter ditching will be lined with rocks. The north settling pond will discharge into watercourse (WC) 12 which flows north into the Gays River. A supplemental flow pumping system will be installed in advance of Phase 1 mining activities to minimize the hydrological impacts to the northwestern portion of the PA, where identified sensitive black ash species are located. Refer to section 6.5 for additional details.

Erosion and sediment control (ESC) measures will be developed and implemented in construction and throughout the life of the Project in accordance with the ESC Plan completed as part of the IA process.

3.3.2 Operation

The operation phase of the Project is planned to occur in two phases (Phase 1 and Phase 2) and is estimated to support a 23-year life of mine. Operation of the Project will include the following activities:

– Mining
– Processing (sizing, screening and stockpiling of products)
– Overburden management
– Water management
– Fuel supply, storage and distribution
– Power and electrical; and
– Emissions and waste management

3.3.2.1 Mining

The open pit will be split into seven pushbacks which begin in the north end, initially restricting the disturbance to the Crown land portion of the PA. As the phases advance south, the hauling distance to the stockpiles and processing plant will gradually increase. A main haul road and ramp along the east side of the pit will connect to in-pit roads accessing active mining areas.

The nature of the deposit and the mining methods employed will not require the regular use of explosives. Vermeer terrain level surface excavation machines, commonly referred to as surface miners, will be used to mine the material. In instances where the surface miners are unable to safely access or excavate the materials, drilling /blasting will be used to achieve a suitable fragmentation size for the process plant. The use of surface miner allows CertainTeed to mine gypsum with reduced noise, dust, and vibration.

Mining will involve clearing mining areas of trees and recovering any harvestable timber. Topsoil will be removed and stockpiled for future reclamation activities. Overburden material from Phase 1 will be hauled to the overburden stockpile located to the east of the PA. Phase 2 overburden will be used to backfill mined sections of the pit. Once overburden stripping is completed to clean off the top of the gypsum, the surface will be levelled to allow the mining machines to cut horizontal strips of gypsum which will be then transported to the processing plant.

Horizontal cuts continue until the designed pit bottom is reached for each phase. As Phase 1b is mined out, overburden, waste rock, and process rejects will then be backfilled into the north end of the open pit. As mining advances south, backfilling will also continue, at an offset distance, behind active mining areas such that safe access and appropriate working space for mining operation can be maintained. Further, backfilling Phase 1a (Figure 3.1-2) aids in minimizing the potential impacts to the environmentally sensitive northwestern portion of the PA.

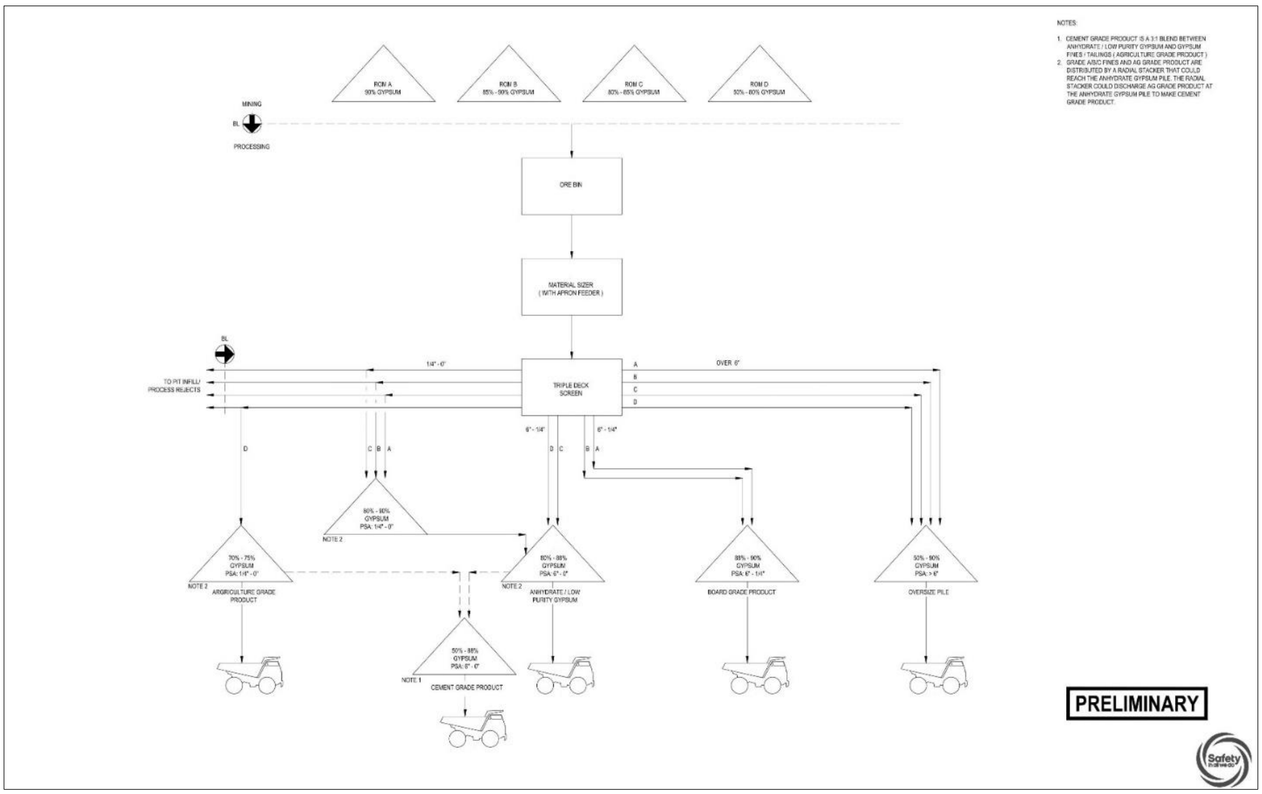
3.3.2.2 Processing

The process plant will be designed to manage four types of ROM semi-products, with gypsum purity ranging between 50% and 90%. Each semi-product will be blended or processed separately, utilizing shared equipment to segregate the material based on size and grade. This facility produces 3 products: board grade for wallboard manufacturing, anhydrite/cement for cement manufacturing, and agriculture grade materials for soil conditioning and natural fertilizer.

Figure 3.3-1 shows the process plant flowsheet that has been selected for the Project based on the mineralized material sizing requirements. The unit operation selected for this process plant is standard technology widely used in mineral processing. The process plant includes the following components:

- ROM stockpiles/staging area
- Mineral sizer
- Triple-deck screen
- Conveyors, and
- Radial stackers.

Figure 3.3-1 Process Plant Flow



The Project has four sheltered ROM stockpiles (A, B, C and D) approximately 20 m x 113 m in size. The stockpiles are positioned in rows and are classified by gypsum purity percent. Haul trucks offload the material directly into the piles, or feed bin for processing.

The material will be sized, screened, and conveyed based on the gypsum purity percent and overall size as outlined in Section 3.2.2.

3.3.2.3 Waste Material Management

Low purity gypsum and waste rock removed from the pit, excluding rock used for construction of haul roads and other Project infrastructure, will be placed in the combined overburden / waste rock stockpile. The waste rock comprises 5% of the combined stockpile. Overburden and topsoil removed from the development area of Project infrastructure and the open pit will be placed in designated stockpiles as shown on Figure 3.1-1.

Once Phase 1a has been completed, overburden and waste rock will begin to be backfilled into the mined-out pit as part of the progressive reclamation approach.

3.3.2.4 Water Management

Two settling ponds are required for this Project. The north settling pond and perimeter ditching will be installed in advance of operation, during the construction phase. The conceptual water management plan for the operation phase includes the construction of the south settling pond in advance of Phase 2, to manage run-off and pit dewatering. The settling pond will be sized to store run-off generated by the 5-year storm event and has accounted for the dewatering and designed to control discharge from a 1-in-100-year 24-hour storm event. The settling ponds will be lined with an HDPE liner. All contact water will be collected and treated for TSS prior to discharging into watercourse 12 (WC12) and WC39 (watercourse located near the western boundary of the PA).

During Phase 1 of the Project, water from the PA will be directed northwest towards the north settling pond located north of the overburden stockpile. Runoff from the overburden stockpile will be collected via perimeter ditches and will drain via gravity to the north settling pond. Water from the process plant and ROM pad areas will drain via overland flow and surface water ditches to the north settling pond. Water collected from the open pit will be pumped to the north settling pond, to ensure the water management infrastructure does not pose a conflict with operational activities near the process plant.

Water pumped to the north settling pond, will be discharged northeast of the PA via an outlet and discharge channel, which connects to the Gays River. Water management for Phase 1 will include a supplemental flow pumping system to minimize the hydrological impacts to the environmentally sensitive northwestern portion of the PA associated with the black ash.

During Phase 2, water from the PA will be directed either to the north or south settling pond. The process plant and ROM area as well as the northern portions of the overburden stockpile will be directed via gravity to the north settling pond while the southern portion of the overburden stockpile will be directed to the south settling pond. The northern portion of the open pit is assumed to be backfilled to existing conditions, and therefore all water from the pit will be pumped around the southern extent of the open pit to a watercourse that flows to the western boundary of the PA.

3.3.2.5 Fuel Supply, Storage and Distribution

A fuel storage and dispensing system with estimated 20,000 – 40,000 L capacity will be installed in advance of operation and will be located adjacent to the maintenance building/spare parts warehouse, near the process plant. Double walled tanks will store diesel fuel for the purpose of servicing onsite vehicles and stationary equipment. Diesel will be delivered in tanker trucks from a fuel supply company who are licensed and familiar with distributing petroleum products. Fuel storage tanks will be constructed and registered as required, based on applicable NSECC Petroleum Management Regulations under the *Environment Act*, and NS Standards for Construction and Installation for Petroleum Storage Tank Systems (NSECC, 2021a). Fuel supply, storage and distribution will be required through all Project phases.

Environmental Emergency Response and Spill Contingency Plan will be developed for the Project, and will include information on incident prevention, response procedures, and response training in the event of an accidental release. To minimize the possibility of an uncontrolled release, transfer of the fuel from the delivery truck to the double-walled tanks will be supervised by a delivery person to ensure constant observations and immediate response in the event an accidental release occurs.

3.3.2.6 Power and Electrical

The power supply to the PA will be provided by Nova Scotia Power Inc. Power distribution for the Project will be via 4.16 kilovolt (kV) overhead power line using utility poles, and the process plant will be powered from the nearest high voltage powerline. Loads up to 300 Kilovolt-amperes (kVA) will be fed by pole mounted transformers and those greater than 300 kVA will be fed by pad mounted transformers.

The process plant will include an electrical room (E-Room), that acts as a Project power substation. The E-Room will be prefabricated, preassembled, pre-tested modular units complete with HVAC system These will be sized to allow adequate working space around the switchgear and other equipment for operation and maintenance. The E-Rooms will be located as close as practical to the electrical loads to optimize conductor sizes and minimize cable lengths. All electrical installations will meet applicable codes, permits and regulations.

3.3.2.7 Waste Management

Waste management will be required through construction, operation, and closure phases.

Sewage from the process facility buildings, administration buildings, and guest house will flow by gravity drain via buried piping to septic tanks, equipped with septic fields. The lines will be buried below the frost line to prevent from receiving and/or uncontrolled release, and the septic tanks will be pumped out by a licensed and experienced contractor, as required.

Non-hazardous waste, including paper, cardboard, and domestic waste (food and food packaging) will be collected and disposed of offsite at an approved external facility, by a licensed contractor, in accordance with applicable provincial and municipal regulations. Wherever practicable, recyclable wastes will be segregated, stored, and shipped to appropriate external waste recycling facilities by an accredited contractor.

Hazardous wastes, such as used oil, oily filters, lubricants, and antifreeze, will be collected by a qualified hazardous waste contractor and taken offsite for recycling or disposal, as required, as per applicable legislation.

3.3.3 Closure

The closure phase of the Project will consist of two components, active closure and passive closure. During active closure, Project infrastructure will be removed with the exception of the water management infrastructure, which will be removed once the PA is stabilized and it is safe to do so. Buildings will be demolished and/or taken apart prior to moving offsite. Compacted surfaces including the ROM staging area, and haulage road network roads will be re-contoured, capped with topsoil, and re-vegetated. Any culverts installed as part of Project activities will be removed and decommissioned. Earthworks, recontouring and grading will take place to return the PA to a pre-mining state to match natural elevations.

The mined out area of the open pit will be progressively reclaimed/backfilled throughout the operation phase of the Project, to existing topographic elevations and contours with overburden material, waste rock and process rejects. Any final backfill lifts that will be placed above the original surface elevation will be re-sloped for water drainage and long-term slope stability. Overburden and topsoil stockpiles will be used to reclaim disturbed areas of the PA. Remaining areas will be covered with topsoil, and the surface will be ripped or scarified, sloped, re-contoured to a stable angle to match local topography and hydroseeded with a native seed mix to return the areas to a natural and stable state. Any exposed pit walls cut in hard rock will not be reclaimed, however, will be designed to ensure long-term slope stability through a series of benches and berms typical of an open-pit mining operation. Slopes of the pit lake at closure will be designed to 5:1 in specific areas to allow of safe egress.

During passive closure, the remaining open portion of the pit will naturally fill with water and monitoring activities will continue. Pit filling is expected to occur in 14 years via, groundwater inflow and rainfall that enters the open pit. Water from two contributing watercourses flowing southwest, will be allowed to drain into the open pit to aid in filling of the pit. A portion of water from the pit will be pumped to a watercourse flowing to the west of the pit to maintain flow through that system. During pit filling, drainage to the north settling pond will be unaltered. Supplemental flows to the northwestern portion of the PA will continue to draw from this pond with overflow being discharged to the receiving environment, northeast of the PA.

All pumps used to assist in water management will be removed and water located to the north and west of the open pit will continue to flow overland or through established surface water ditch network. The north settling pond will be decommissioned during this Project phase, and water will be directed northeast of the PA via an outlet and discharge channel. The pumping system present along the southern boundary of the pit will be decommissioned and water from these watercourses will flow into the pit lake before discharging towards a watercourse to the western boundary of the PA.

Groundwater and surface water monitoring programs will continue until such a time that the data demonstrates that monitoring is no longer required and specified monitoring requirements, as part of the permit(s) for the Project were fulfilled.

Engagement with appropriate stakeholders and rightsholders will be completed to support closure planning, and to determine post-mining land use objectives and necessary investigations required to achieve and monitor those objectives.

3.4 Project Schedule

The Project schedule is based on the following milestones following EA approval as shown in Table 3.4-1. The schedule is subject to change based on schedule of detailed design and additional permitting requirements.

Table 3.4-1 Estimated Project Planning Schedule

Project Phase	Estimated Duration
Post-EA approval permitting	1 year
Construction	2 years
Operation	23 years
Closure – Active	2 years
Closure - Pit-Filling	14 years

3.5 Environmental Management System

CertainTeed will develop and implement an Environmental Management System (EMS) framework that outlines an appropriate approach to manage and minimize environmental risk to the environment from activities employed during the Project.

The EMS will include the following key elements:

– Environmental management plans
– Environmental monitoring programs
– Project orientation and training program for all Project personnel and applicable contractors
– Permits and authorizations, including plans and procedures to ensure compliance
– Environmental emergency response and contingency planning

The management plans and monitoring programs will consider detailed engineering design and environmental planning. These will be developed based on industry standards and best practices available at the time of development. CertainTeed will also apply knowledge and experience gained from environmental management at their pre-existing gypsum mining operations for the development of the Environmental Management approach for this Project. An ongoing review and adjustment of the system's elements will take place to ensure effectiveness.

Examples of plans that will be developed for this Project include, but are not limited to, the following:

– Environmental Protection Plan
– ESC Plan
– Fugitive Dust Management Plan
– Surface Water and Groundwater Management and Monitoring Plans
– Wildlife Monitoring and Management Plan
– Black Ash Management Plan
– Environmental Emergency Response and Spill Contingency Plan

– Reclamation and Closure Plan

3.6 Design Considerations

The following section outlines the considerations of alternatives and design considerations that informed the design of the Project.

3.6.1 Consideration of Alternatives

3.6.1.1 Alternative Site

The province of NS serves as the only known major gypsum reserves available to eastern North America. Resource exploration and extraction has occurred in the Musquodoboit Valley/Dutch Settlement Area for many years and has included a variety of materials, including aggregate, limestone, gypsum, gold, and zinc. CertainTeed investigated other potential resources in Newfoundland and NS, from Cape Breton to the PA, without success, due to lower quality and quantities of the resources, and overall non-economical and non-sustainable options. Purchasing gypsum from other local producers was also considered but is not an option due to third parties limited supply capacity and/or limited reserves to supply internal needs and external customers.

The construction market requires wallboard for renovation and new commercial and residential construction. CertainTeed, as one of the building material leaders in Canada, has a demand to produce gypsum wallboard and is facing a shortage/supply risk based on limited domestic sources. This Project provides opportunity for CertainTeed to secure a strategic source of gypsum to supply the Canadian and US gypsum plants. This Project will replace the need to ship gypsum from Europe to the Eastern North American plant facilities, which ultimately reduces GHG emissions and supports CertainTeed's sustainability commitment to decarbonize construction and emit less carbon throughout the entirety of a building's lifecycle.

3.6.1.2 Alternative Access Road and Haulage Road Network

Access to the PA originally existed as two driveways to the PA to the south of Lake Egmont Road. One access allowed for access of mine employees to access the process plant and supporting infrastructure, while the second entrance was designed for highway haul trucks loading and transporting materials to the existing port facility for shipment.

Based on the identification of the environmentally sensitive species, black ash, in the northwestern portion of the PA and establishing a protective buffer around the species, one access road was removed. Further, a visibility assessment was done to ensure the access point off Lake Egmont Road was suitable for the proposed development and ensured the safety of the public and Project personnel. The findings of the assessment identified a suitable zone in which the access point could be located. Based on this assessment, the access point was refined.

The haulage road network was re-designed to allow for safe and efficient movement around the PA for all mine employees, Project personnel, contractors, and highway haul truck drivers, and to work within the confines of the identified single access point for the Project.

3.6.2 Mitigation by Design

Throughout the EA process, the layout of the conceptual mine plan and design of major Project components have undergone several design changes based on findings of the baseline studies and identified environmental constraints. Changes made to Project components and conceptual mine plan design are described in the following sections.

3.6.2.1 Open Pit

The location and geometry of the open pit is generally constrained by geology and economic conditions. Based on resource drilling, the location of the open pit was initially located in the northwestern portion of the PA on private land based on the gypsum resource being identified as high grade with a lower strip ratio, which makes it an economically viable area to mine. Through the completion of baseline studies to support the EA, a total of 100 black ash, a species designated as Threatened under the *Nova Scotia Endangered Species Act*, were identified within the northwestern area of the PA. An exclusion buffer was defined based on the Black Ash Recovery Plan Addendum (Government of NS and NSDNRR, 2015), and the placement of the open pit was relocated south to avoid 99 of the 100 black ash.

The open pit will be developed in seven pushbacks, which begin in the north end. The open pit will be progressively backfilled and reclaimed, as mining operations advance south, to minimize the hydrological change to the habitat that supports the black ash. See the Surface Water Resources and Terrestrial Habitat sections for additional detail.

3.6.2.2 Stockpiles

Stockpiles required as part of this Project include topsoil, overburden (which includes waste rock), process rejects and product stockpiles. Efforts were made during the design of the Project to place most Project infrastructure on private land, as to minimize disturbance to the Crown land.

The location and footprint of the overburden stockpile was altered and optimized several times to avoid environmental constraints, including wetlands and Species at Risk (SAR) which included Blue Felt Lichen (*Degelia plumbea*) and Frosted Glass Whiskers (*Sclerophora peronella*). Based on feedback received from the public during the Public Open House, the overburden stockpile was also adjusted to leave a larger forested buffer between the Project infrastructure on the Project boundary.

3.6.2.3 Haulage Road Network and Site Access

The alignment of haul roads (two haul roads that connect the open pit to the process plant and stockpile) and truck loading road (route for filling and weighing trucks for shipment), were optimized to avoid environmental constraints, including wetlands, watercourses, and SAR species. Where watercourses could not be avoided, crossings will be designed to reduce the area of disturbance to watercourse shoreline, wherever practicable.

Griffin Transportation Inc. (Griffin) was retained to complete a visibility assessment to identify a suitable location for a new driveway to the south of Lake Egmont Road. The assessment aimed to ensure the access location met Transportation Association of Canada’s (TAC) minimum requirements, and that all mine personnel, contractors, and members of the public accessing the PA and utilizing Lake Egmont Road can do so safely. The findings from the visibility review identified a suitable zone on the south side Lake Egmont Road and the location of the proposed access was adjusted to be within the proposed zone.

3.6.2.4 Process Plant

The location of the process plant was optimized to avoid environmental constraints, such as wetlands and SAR. The location was also selected to minimize hauling distances between the open pit, stockpiles, and PA access.

Administration buildings, guest house facilities, and security office were placed on the north side of Lake Egmont Road as to allow the process plant facilities and associated infrastructure (i.e. product stockpiles) to be in closer proximity to reduce truck hauling distance.

3.6.2.5 Water Management

The location of settling ponds and water management infrastructure was optimized to avoid environmental constraints, including wetlands, watercourse crossings, and SAR, primarily black ash, and was designed to minimize overall disturbance within the PA throughout the life of the Project.

Two settling ponds, north and south settling ponds, are planned for the Project. The north settling pond will be located on private land and will be developed in advance of Phase 1 during construction. The south settling pond will be constructed in advance of Phase 2 mine development, to support management of run-off and open pit dewatering during this phase. The overall water management approach is phased based on mine development (Phase 1 and Phase 2) and aims to minimize disturbance to the crown land during Phase 1 of mine development. The settling ponds will be sized to store run-off generated by the 1 in 100-year 24-hour storm event and will consider climate change impacts. Appropriate emergency response and contingency measures will be put in place to avoid uncontrolled release to the environment.

To minimize impacts to the habitats that support the black ash communities, the Project includes supplemental pumping of water to those areas to maintain the hydrological function.

The location of settling ponds and water management infrastructure was optimized to avoid environmental constraints, including wetlands, watercourse crossings, and SAR, primarily black ash, and was designed to minimize overall disturbance within the PA throughout the life of the Project.

A supplemental flow pumping system is included in the water management approach for the Project and is integral to aid in minimizing hydrological changes to the black ash species. Based on topography of the PA and the 10 m elevation difference between the southern extent of the pit and watercourses located to the south of the settling pond, multiple pumps will be required to pump the water around the pit.

The path of water management infrastructure from the pit to the north settling pond will be further refined to determine a route that does not interfere with mining operations as it is proposed to cross the ROM stockpiles, staging area and process plant area.

4. Consultation and Engagement

The EA process is a planning tool, and requires input from stakeholders, Rightsholders, regulators, and members of the public to make refinements to minimize potential adverse effects of the Project. Feedback and comments received through the engagement process were used to aid in Project design and planning.

CertainTeed acknowledges the importance and value of effective engagement and envisions a long and mutually beneficial engagement program. GHD has worked closely with CertainTeed in identifying key stakeholders (public and regulators) and Rightsholders (Mi’kmaq of Nova Scotia) and developing an effective consultation and engagement approach for this Project. In addition to the consultation and engagement that has been completed to support the EARD, CertainTeed will continue to engage with those groups and key regulatory agencies to maintain ongoing communication regarding Project activities and progress should an EA Approval be granted.

Details of the ongoing engagement are outlined in this section, and includes a Project website (HTTPS://WWW.CERTAINTEED.CA/ANTRIM-GYPSUM-PROJECT) established in April 2024 that allows for sharing Project updates and offers a direct line of communication between the public to CertainTeed staff through the comment submission function. CertainTeed has also committed to establishing a Community Liaison Committee (CLC) for the Project and has had preliminary discussions with interested community members regarding their involvement, pending release from the EA process. CertainTeed is committed to ongoing dialogue with stakeholders, Rightsholders and community members throughout the life of the Project.

4.1 Regulatory Engagement

4.1.1 Engagement Approach

The NSECC EA Branch was consulted throughout the Project design and completion of the EARD. A Project introduction and Project update presentations were held with the EA Branch in May and November 2023. A One Window Meeting was also held on April 4, 2024, with approximately 30 attendees participating both virtually and in person. The One Window presentation included attendees from provincial and federal departments involved in the permitting of mines in NS. The biophysical assessment methods and preliminary findings were shared with NSDNRR for review and comment. CertainTeed also informed representatives from the Office of L’nu Affairs regarding Mi’kmaq engagement activities being undertaken for the Project.

4.2 Stakeholder and Public Engagement

4.2.1 Engagement Approach

Information packages were provided to Members of the Legislative Assembly (MLA) for the area where the Project is located (Musquodoboit Valley/Dutch Settlement), neighbouring district (Hants East) as well as the Member of Parliament for Central Nova, as their federal district encompasses the PA.

The stakeholder and public consultation program included two public open houses held on May 28th and July 10th, 2024 at the Carrolls Corner Community Centre, located approximately 8 kms from the PA. Advertisement of the open houses included posting information notices at local businesses, the Project Website, and to community social media groups. A mailout campaign was introduced for the second open house, with notices being delivered via Canada Post to every residence within a 5 km radius of the PA. The mailout was introduced as a direct response to feedback received from the first public session.

The two public sessions allowed for stakeholders and community members to learn more about the Project, ask questions, and provide feedback and concerns to CertainTeed and their consultants. Poster boards and printouts were available at both public sessions for attendees to review, detailing the below topics:

- Proponent Information
- Project Description
- Proposed Project Area and Infrastructure
- The EA Permitting Process
- Air, Noise, and Light
- Traffic
- Groundwater
- Surface Water
- Wetlands
- Fish and Fish Habitat
- Terrestrial Environment
- Mi'kmaq of Nova Scotia, Cultural and Heritage Resources
- Operations and Employment
- Reclamation Activities

A total of 80 and 91 people attended the open houses, respectively. Participants included local officials, community members, and business owners. Questions, comments, concerns, and feedback received during the public sessions was documented and can be found in the Consultation and Engagement Report (Appendix B).

4.2.2 Key Issues Raised and Proponent Responses

Comments received during engagement activities for the Project are summarized in Table 4.2-1 and were considered in the Project design and planning. The main topics raised by attendees during the open houses were:

- Employment opportunities and economic benefits
- Truck traffic and safety between the PA and the Port of Sheet Harbour
- Potential impacts to local domestic groundwater wells (water level changes and water chemistry)
- Impacts to air quality and noise resulting from operational activities
- Operational hours and frequency of potential blasting events

A summary of key comments received during consultation and engagement activities, and responses from CertainTeed are provided in Table 4.2-1.

Table 4.2-1 Summary Key Issues Raised During Engagement Activities for the Project

Key Issue/Concern	Summary of Proponent Response	Primary EARD References
Employment opportunities and economic benefits of the Project	CertainTeed is committed to maximizing local recruitment and employment, local labour market training, procurement and service opportunities throughout all Project phases. Employment opportunities for the Project will be shared through the Project website.	6.9 Socioeconomic Conditions
Request to be informed on Project updates and activities	Pending EA approval, the CLC will be formed prior to the commencement of construction. CertainTeed is committed to maintaining a CLC for the life of the Project, as required. Ongoing engagement with stakeholders, community members, and regulatory agencies will include sharing of information via the Project website, and other avenues (i.e., community social media groups, posting of information in high-traffic businesses, and mail campaigns), as required.	4. Consultation and Engagement
Volume of highway haul trucks as it relates to safety of community members and the condition of local roads to support volume of trucks.	Transportation of material for shipment between the PA and Port of Sheet Harbour will be conducted by an independent trucking company. CertainTeed will ensure the safety standards and training requirements for all highway truck contractors hired to support hauling of material between the PA and Port of Sheet Harbour. A clear line of communication for traffic complaints to be recorded and addressed.	5.10 Socioeconomic Conditions
Elevated dust in proximity to and downwind of the Project	Results of the air emissions estimate modelling completed for the Project (Appendix C) indicated that all compounds will be below the air quality criteria at the identified sensitive receptors (residences) in proximity to the PA. Dust control measures for all Project phases will be detailed in a Fugitive Dust Management Plan, to be developed and submitted prior to construction. CertainTeed will apply water to the haulage road network as a form of dust suppressant. Further, the truck loading route is assumed to be paved for a length of 31 m at both the entrance and exit of the route to mitigate dust near the PA access off Lake Egmont Road. Air quality monitoring will be conducted as required by NSECC and results will be compared to baseline air quality conditions and the Maximum Permissible Ground Level	6.1 Air Quality and Light

Key Issue/Concern	Summary of Proponent Response	Primary EARD References
	Concentrations (GLC) listed in Schedule A of the NS *Air Quality Regulation*s, or other appropriate criteria as defined in the IA.	
Increased noise levels from Project operational activities	Results of the noise impact assessment modelling completed for the Project (Appendix D) indicated that predicted noise levels results from Project operational activities will be within guideline limits as specified by the NSECC Guidelines for Environmental Noise Measurement and Assessment at all identified worst case sensitive receptors in proximity to the PA. Noise monitoring will be conducted as required by NSECC and results will be compared to baseline levels and applicable guidelines. The Project infrastructure layout and overall design has gone through multiple iterations to minimize Project related noise concerns. The truck loading road were designed to minimize the need to reverse and use back up beepers, to minimize potential nuisance to nearby sensitive receptors. The overburden stockpile and other Project infrastructure were micro=-sited to allow for a vegetative buffer between Project infrastructure and sensitive receptors, where possible. Further, the primary extraction method for the Project is surface miners. Drilling/blasting will only be used as required, which aims to minimize Project related noise. Based on concerns around noise, the operational hours for the Project are from 7:00 am to 5:30 pm to reduce noise levels during the nighttime hours.	6.2 Noise
Potential impacts to domestic wells groundwater levels	Prior to construction, CertainTeed will conduct a domestic groundwater well survey as directed by NSECC through the approval process. Local residents outside of a defined area for conducting the groundwater well surveys, may be included on a case-by-case basis as determined CertainTeed, based on the resident's proximity to the PA and request to participate in the survey. If community members have concerns regarding groundwater wells, CertainTeed encourages the resident to submit a comment via the established complaints process and/or Project website. Based on groundwater modelling completed, the Project is not anticipated to impact domestic wells outside of the PA. CertainTeed will established a long-term monitoring network of groundwater monitoring wells outside of the Project	6.4 Groundwater Resources

Key Issue/Concern	Summary of Proponent Response	Primary EARD References
	infrastructure footprint that will be monitored throughout the life of the Project. Baseline groundwater monitoring will be used to compare future groundwater quality and elevation data to in order to monitor the influence of Project activities on groundwater.	
Maintaining access to crown lands for the purpose of recreational activities (i.e., hunting, foraging, fishing, and use of offroad vehicles)	CertainTeed has committed to maintaining access to the Crown lands within the PA for the purpose of recreational use at a safe distance from Project infrastructure and/or activities. CertainTeed will restrict access only where it is unsafe for land users to access, and access will be gradually restored in the area of the Project infrastructure as the area is reclaimed during closure.	6.9 Socioeconomic Conditions
Location of the overburden stockpile in proximity to residences on Lake Egmont Road.	Previous mine plan layouts included the overburden stockpile closer to the northern PA boundary. Based on feedback received during the open house from local homeowners on Lake Egmont Road and refinement of the overburden capacity through the Project design, the overburden footprint was refined to allow for a wider vegetative buffer between the stockpile and the PA boundary, which allowed for a larger offset between Project infrastructure and the nearest residence.	3.6.2.2 Stockpiles
Frequency of blasting events	Blasting is not planned for this Project. Blasting will be used only to safely access or excavate the material.	3.3 Project Activities

4.3 Mi’kmaq of Nova Scotia Engagement

4.3.1 Engagement Approach

Developing longstanding relationships between CertainTeed and the Mi’kmaq of Nova Scotia throughout the life of the Project is important to CertainTeed. In 2022, CertainTeed developed a plan to effectively engage with the Mi’kmaq of Nova Scotia. The intent of the plan was to build a relationship with the Mi’kmaq of Nova Scotia in a meaningful and respectful way. CertainTeed also respected the ways in which certain Bands have expressed their methods for engagement on projects. Where there was mutual agreement between a Band or organization to move the discussions with CertainTeed to a formalized process, CertainTeed has proceeded through this process.

4.3.2 Key Issues Raised and Proponent Responses

CertainTeed has carefully considered input on Project design provided through engagement by the Mi’kmaq of Nova Scotia and used this in the overall planning and design of the Project, as noted throughout this document. Table 4.3-1 below provides a summary of the issues and concern received during engagement with the Mi’kmaq of Nova Scotia. To respect the terms of engagement with the Mi’kmaq of Nova Scotia the summary below does not ascribe items to any particular Band or organization.

Table 4.3-1 Summary of Key Issues Raised During Mi'kmaq Engagement

Key Issue/Concern	Summary of Proponent Response	Primary EARD References
Request for ongoing engagement relating to Project activities	CertainTeed is dedicated to continuous engagement and involvement of the Mi'kmaq throughout the Project's lifecycle. This commitment entails open communication, sharing of information, holding in-person meetings, as required, and addressing emerging issues as the Project progresses.	4.0 Consultation and Engagement
Questions about Mi'kmaq employment and benefits	CertainTeed is committed to maximizing local recruitment and employment and will prioritize hiring local community members and Indigenous peoples, where possible. Communication with the Sipekne'katik First Nation and the KMKNO Benefits Officer on these topics have been ongoing and will be maintained through the life of the Project.	6.10 Mi'kmaq of Nova Scotia
Concerns relating to the presence and quantity of black ash within the PA	CertainTeed provided details relating to thorough baseline SAR assessments which resulted in the identification of 100 black ash located within the boundaries of the individuals in the northwest sector of the PA. Through diligent infrastructure micro-siting activities, including re-designing the pit footprint, 99 of the trees will remain undisturbed by Project activities. One black ash is located within the footprint of the open pit. CertainTeed has had preliminary discussions with Mi'kmaq of Nova Scotia communities and organizations regarding the black ash tree located with the proposed development footprint. CertainTeed is committed to continued engagement with the Mi'kmaq of Nova Scotia on the black ash, and maintaining safe access to the area in which the black ash are located for educational purposes, and other traditional purposes as determined through consultation with the Mi'kmaq of Nova Scotia. Further, a Black Ash Management Plan will be established for this Project.	6.8 Terrestrial Environment
Concerns relating to light impacts on night ecology	Operational hours of the Project will be from 7:00 am to 5:30 pm, Monday to Friday. By restricting operations to daytime hours, the lighting requirement outside operations will be only what is needed for safety and security purposes. Project lighting will be installed to minimize light trespass beyond the PA boundary, where possible, and Lighting will be installed as to minimize light trespass beyond the PA where possible. Further, the Project has been designed to allow for a vegetative buffer between Project infrastructure and residential receptors, wherever possible.	6.1 Air Quality and Light
Concerns relating to hydrologic impacts to wetlands.	CertainTeed has completed quantitative modelling to predict the extent of potential impacts to both surface water and groundwater elevations. The mine plan design and location of Project infrastructure has been micro-sited to avoid wetlands and watercourses within the PA, wherever possible. Water management infrastructure will be installed to minimize the hydrological changes to the wetlands throughout the PA during all phases of the Project. Wetland monitoring locations will be established prior to construction and will be monitored throughout the life of the Project, as directed by NSECC through the IA process.	6.4 Surface Water Resources 6.5 Groundwater Resources 6.6 Wetlands
Request for Mi'kmaq involvement during environmental monitoring programs	CertainTeed is committed to including Mi'kmaq of Nova Scotia communities in the monitoring of black ash within the PA. In addition, there will be opportunities for Mi'kmaq involvement in other environmental monitoring programs throughout the life of the Project as defined through the IA process.	5 Consultation and Engagement 6.10 Mi'kmaq of Nova Scotia

4.4 Ongoing Consultation and Engagement

4.4.1 Future Engagement – Stakeholder and Public

Ongoing stakeholder engagement will be maintained and will include the following:

– Establishing an open line of communication between members of the public and CertainTeed.
– Maintaining Project website to share Project updates and information, and allow for as a means of accepting comments through the comment submission function.
– Establishing of a CLC for the Project prior to operations.

4.4.2 Future Engagement and Consultation - Mi'kmaq of Nova Scotia

Ongoing Mi'kmaq community and organization engagement is important to CertainTeed and to the success of the Project. To date no consultation has occurred but CertainTeed remain open to future agreements relative to consultation and mutual benefits agreements should they be requested. CertainTeed has entered into an engagement agreement with one Mi'kmaq Band and offering PA visits with several Mi'kmaq organization to provide information to assist in the development of possible management programs and other opportunities associated with black ash and environmental monitoring programs. The Mi'kmaq Ecological Knowledge Study (MEKS) completed by Membertou Geomatics Solutions (MGS) provided information relative to past and present use of the PA, which will be used by CertainTeed to inform engagement programs with the Mi'kmaq of Nova Scotia. The Office of L'Nu Affairs has a role through the EARD review process and may provide feedback that may offer suggestions for future engagement or consultation programs with the Mi'kmaq of Nova Scotia.

5. Environmental Effects Approach and Methods

5.1 Approach and Guiding Principles

The approach and methods for this EARD are based on requirements of the NS *Environment Act* and *Environmental Assessment Regulations*, particularly for a Class I Undertaking, as well as direction from the Guide to Preparing an EA Registration Document for Mining Developments in NS, A Proponent's Guide to Environmental Assessment and the Proponent's Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia.

5.1.1 Planning Tool

An EA is a planning tool used to develop projects in manner to avoid or mitigate possible adverse environmental and socioeconomic effects, and to maximize potential benefits. CertainTeed used the EA process early in the design of the Project identify issues, review of alternatives and modifications to Project design to meet regulatory requirements, minimize disturbance to the environment including limiting the hydrological changes to the area supporting the black ash, and address stakeholder concerns and expectations.

5.1.2 Precautionary Approach

CertainTeed has applied a conservative (i.e., worst case scenario) approach to effects assessment through the following:

– Detail the existing environment to establish baseline conditions and identify potential Project-environment interactions

- Results of modelling and other analyses to provide conservative science-based effects predictions
- Mitigation measures to avoid, minimize, or compensate for Project effects on the environment and communities
- Contingency plans to address worst-case scenario Project-related accidents and malfunctions
- Follow-up and monitoring programs to facilitate effects management and verify Project-related effects predictions
- Description of other projects in the area to identify possible intersections and potential effects

5.2 Scope of the Environmental Assessment

The Project is an open pit gypsum mine, consisting of construction, operation, and closure phases. The Project is planned to commence construction in 2025, pending regulatory approvals. Detailed studies evaluating the trucking from the PA to the Port of Sheet Harbour are excluded from the scope of the EA based on discussions with NSECC during the initial EA scoping meeting. The effects of increased traffic on the community are assessed as part of the Socioeconomic Conditions section (Section 6.9). EA methods are described below.

5.2.1 Overview of Methods

The methodology used to conduct this EA and describe the potential effects of the Project was developed to meet the requirements of the NS Environmental Assessment Regulations made under the NS *Environment Act*. It incorporates information and learnings derived from:

- Proposed Project components and activities
- Applicable municipal, provincial and federal regulations
- Applicable policies, guidance documents, and guidelines
- Environmental and socioeconomic regulatory interests
- Knowledge of the biophysical and socioeconomic environments
- Engagement with the Mi'kmaq of Nova Scotia, stakeholders, and public consultation for this Project
- Experience with other gypsum mining projects in Canada
- Other legislative and regulatory requirements that apply to the Project

The following sections describe the general methodology used to conduct this effects assessment. This overview includes valued components (VC) selection, Project boundaries, determination of significance, baseline conditions, results of engagement, Project interactions, effects prediction, mitigation measures, identification and characterization of residual effects, monitoring, and follow-up. The detailed methodology for each VC is described in the appropriate sub-sections of Section 6.

5.2.2 Valued Components Selection

The selection of VCs for this EARD was based on the consideration of the following:

- Technical aspects of the Project, including the nature and extent of Project activities
- Applicable federal, provincial, and municipal legislation, including species of conservation interest (SOCI) and SAR
- Regulatory guidance and DFO, ECCC, TC, and NSDNRR
- Concerns raised by stakeholders and the public
- Concerns raised by the Mi'kmaq of Nova Scotia
- Traditional ecological knowledge obtained through a MEKS and Mi'kmaq engagement
- Known physical, biophysical, and socioeconomic conditions and characteristics
- A review of publicly available information including EAs of similar projects

Table 5.2-1 identifies the VCs based on these considerations and provides rationale for their selection.

Table 5.2-1 Rationale for Selection of VCs

VC	Rationale for Inclusion
Air and Light	Dust will be emitted and light generated from mining activities, stockpiles, processing, and vehicle/machinery traffic on unpaved roadways throughout the construction and operation phases of the Project. GHG emissions will result from vehicle use during construction and operation.
Noise	Project related noise result from construction, operation and closure activities. Changes to ambient noise have the potential to adversely affect fauna and birds by influencing patterns of important life activities.
Geology, Soil, and Sediment	Project activities may result in sediment laden runoff from Project infrastructure and mobilization of fine particles. Soil and sediment contamination may increase exposure for human health and ecological receptors. Soil erosion from Project activities may increase the potential for siltation of watercourses from surface water runoff.
Groundwater Resources	Changes to aquifers may limit groundwater or surface water recharge. Groundwater drawdown may adversely affect surface water quantity in adjacent watercourses and/or wetlands. Groundwater recharge is important for potable well users.
Surface Water Resources	The Project will result in changes to hydrology of streams and wetlands. Sediment and contaminants may be conveyed through stormwater runoff into water systems (i.e., rivers, lakes, oceans) and groundwater through recharge.
Wetlands	Wetlands may be affected by development or changes to groundwater and surface water.
Fish and Fish Habitat	Fish habitat, including surface water and wetlands, may be affected by development or by changes to groundwater and surface water.
Terrestrial Environment	The terrestrial environment may be affected, either directly or indirectly, by Project activities.
Socioeconomic Conditions	The Project has the potential to provide benefits from direct, indirect and/or induced employment and procurement as well as tax revenue.
Mi'kmaq of Nova Scotia	The Project could result in conflicts with traditional land use.
Cultural and Heritage Resources	The Project may interact with cultural and heritage resources.

5.2.3 Project Boundaries

Boundaries established to define the scope or limits of the analyses of potential effects and encompass both the areas (spatial) and the times (temporal) in which it is reasonable to assume that effects from a project will interact with a VC. Boundaries may also be established that include possible political, social, and economic constraints (administrative boundaries) and limitations (technical) when trying to predict or measure changes to a VC. Some or all assessment boundaries may vary between VCs based on the EA Study Team expertise and experience with regulatory feedback from other projects.

Temporal Boundaries

The temporal boundaries represent the duration over which Project activities interact with each VC. These include phases of a project (e.g., construction, operation, closure), and duration of specific project activities. Generally, temporal boundaries encompass all Project activities but may vary depending on the VC being considered.

Spatial Boundaries

Spatial boundaries represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs. Establishing suitable spatial boundaries facilitates consideration of all important potential effects. The following spatial boundaries will be used for this EARD and described in detail in each VC.

– **PA:** The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. The PA includes a mix of private and crown lands, and includes the following parcels: PID 40228009, 40228017, 41517319, 40767014, 41152893, 40228389, 40228371, 40212409, 40229676, 40959983, and 40959975.
– **Local Assessment Area (LAA):** The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs; however, the size of the LAA can vary depending on the VC being considered, and the biological and physical variables present.
– **Regional Assessment Area (RAA):** The RAA encompasses all Project and VC interactions including diffuse or longer-range effects such as those from Project activities on GHG emissions and socio-economic environments. The RAA may vary in size depending on the VC being considered, and the biological and physical variables present. The author of each EARD chapter is responsible for defining the RAA related to their VC. In some cases, the RAA may not be required.

Temporal Boundaries

The temporal boundaries are related to the duration of each phase of the Project. The duration of each phase is provided in the table below.

Table 5.2-2 Project Timeline

Project Phase	Duration
Construction	2 years
Operations	23 years
Closure – Active	2 years
Closure – Passive (pit filling)	14 years

Administrative Boundaries

The administrative boundaries represent the regulatory, public policy, and/or economic limitations placed on the execution of the Project. An example of a potential administrative boundary would be if an available dataset does not have the same spatial boundaries as the selected VC. This could cause potential constraints to the assessment of effects.

Technical Boundaries

The technical boundaries represent the limits of the EA Study Team's ability to assess a VC. The limitations to measure, assess, and/or monitor the effects of the Project on VCs may be theoretical or physical. These technical boundaries may create gaps in knowledge and understanding related to key conclusions, therefore, limiting the EA Study Team's ability to predict potential effects of the Project on a VC. An example of a technical boundary is the difficulty associated with sampling certain reclusive species, resulting in a data gap for a VC. Technical limitations can also be associated with modelling and the possible margin of error in the generated data.

5.2.4 Standards or Thresholds for Characterizing and Determining Significance of Effects

Criteria or established thresholds for determining the significance of predicted effects from Project activities may be based on regulations, standards, resource management objectives, scientific literature, and/or ecological processes. These criteria or thresholds were developed through the following:

– Applicable regulatory documents, environmental standards, guidelines, and/or objectives
– Consultation with appropriate regulatory agencies
– Information obtained in stakeholder consultation

– Available information on the status and characteristics of each VC
– Information regarding the outcomes from monitoring of previous projects

The resulting criteria are used to establish a threshold beyond which a predicted effect would be considered significant. Significance criteria were defined quantitatively where possible, and qualitatively with supporting justifications where no standards exist. Significance criteria are defined in each VC in Section 6. Some or all threshold criteria may vary between VCs based on the EA Study Team's expertise and experience with regulatory feedback from other projects.

5.2.5 Baseline Conditions

Baseline conditions are presented for each VC to characterize the existing environment, to establish an understanding of the receiving environment, and to provide sufficient context to enable an understanding of how the Project may affect existing conditions. Inclusion of existing conditions is limited to that which is necessary to assess the effects of the Project and support the development of mitigation measures, monitoring, and follow-up programs. Existing conditions consider the effects of past and current projects occurring within and outside of the PA.

5.2.6 Project Interactions and Potential Effects

Interactions between Project activities, and the VCs outlined in this EARD may either be direct or indirect. Direct interactions between the Project and VCs can logically be expected to be based on a good understanding of Project activities and existing conditions and characteristics. Indirect interactions typically require an active pathway between Project activities and the VCs they are affecting.

To determine the potential direct and indirect interactions between Project activities and VCs, the EA Study Team conducted the following:

1. Reviewed the anticipated components and activities required to construct, operate, and close the Project
2. Selected those VCs that may have the potential to be directly or indirectly affected by Project activities through potential interactions

Table 5.2-3 presents the anticipated Project components and activities and interactions with the VCs.

Table 5.2-3 Interactions Table

	Valued Components										
	Air and Light	Noise	Geology, Soil, and Sediment	Groundwater Resources	Surface Water Resources	Wetlands	Fish and Fish Habitat	Terrestrial Environment	Socioeconomic Conditions	Mi' kmaq of Nova Scotia	Cultural and Heritage Resources
Construction											
Clearing, grubbing, and grading	x	x	x	x	x	x	x	x	x	x	x
Topsoil, overburden and waste rock management	x	x	x	x	x	x	x	x	x	x	x
Surface infrastructure installation and construction	x	x	x	x	x	x	x	x	x	x	x
Haul road construction	x	x	x	x	x	x	x	x	x	x	x
Collection ditch and settling pond construction	x	x	x	x	x	x	x	x	x	x	x
General waste management	x	x	x	x	x	-	-	x	x	-	-

	Valued Components										
Operations											
Gypsum management (extraction, loading, hauling, screening)	x	x	x	x	x	x	x	x	x	x	x
Topsoil, overburden and waste rock management	x	x	x	x	x	x	x	x	x	x	x
Water management	x	x	x	x	x	x	x	x	x	x	x
Haul road construction and maintenance	x	x	x	x	x	x	x	x	x	x	x
Petroleum products management	x	x	x	x	x	x	x	x	x	x	-
Maintenance and repairs	x	x	x	x	x	-	-	-	x	x	-
General waste management	x	x	x	x	x	-	-	x	x	x	-
Closure											
Demolition	x	x	x	-	-	-	-	x	x	x	-
Earthworks	x	x	x	x	x	x	x	x	x	x	-
Water management	-	x	x	x	x	x	x	x	x	x	-
General waste management	x	x	x	x	x	-	-	x	x	-	-

Potential Project-related effects are changes to the physical, biophysical, and/or socioeconomic environment resulting from Project activities. Interactions between VCs and Project activities described above form the basis of the effects assessment. Once interactions were identified, changes to VCs as a result of the Project can be determined by evaluating predicted changes from existing conditions. The degree of scientific uncertainty related to the data and methods used to determine the potential effects is also documented.

5.2.7 Mitigation Measures

A variety of regulations, guidelines, and mitigation measures are typically available to avoid, reduce, or compensate for adverse effects of Project activities. These range from standard industry best management practices for construction and operation, policies and practices communicated through training programs, management plans, and/or engineering controls incorporated into the final Project design.

5.2.8 Monitoring and Follow-up

Monitoring programs will be implemented to ensure regulatory compliance, details on the specific monitoring required for each VC are based on the potential effects identified. Monitoring data will be used to verify the accuracy of predicted effects and determine the degree to which mitigation measures were successful in eliminating, reducing, or controlling those effects. The follow-up programs, will be carried out in conjunction with the proposed monitoring and will be used to determine if additional work or mitigation is required to address any adverse effect, should it be experienced. The frequency of the proposed monitoring programs/plans discussed in this EA document will be re-evaluated throughout the life of the Project based on recommendations by qualified professionals and in consultation with NSECC.

5.2.9 Residual Effects and the Determination of Significance

Residual effects are effects to VCs that are predicted to remain even after the implementation of mitigation measures. The process by which they are identified is as follows:

1. Determine the potential interactions between VCs and Project activities and the effects those interactions will have.

2. Assess effect of each mitigation strategy applied to the interactions.
3. Characterize the extent and nature of the remaining residual effects after mitigation measures were applied.

To identify if residual effects are significant or not, consideration of the magnitude, geographical extent, duration, frequency, and reversibility is required. Where possible, criteria will be described quantitatively. When residual effects cannot be characterized quantitatively, they will be characterized qualitatively.

Table 5.2-4 ***Characterization Criteria for Residual Environmental Effects***

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N)** – Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of documented/measured natural variation and below a threshold value **Low (L)** – Differing from the average value for the existing environment/baseline conditions, outside the range of documented/measured natural variation, and less than or equal to appropriate guideline or threshold value **Moderate (M)** – Differing from the existing environment/ baseline conditions and documented/measured natural variation, and marginally exceeding a guideline or threshold value **High (H)** – Differing from the existing environment/ baseline conditions and documented/measured natural variation, and exceeding a guideline or threshold value
Geographic Extent	The geographic area over or throughout which the effects are likely to be measurable	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA **RAA** – Occurs beyond the PA and LAA and within the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (N/A)** — seasonal aspects are unlikely to affect VC's (i.e., fisheries productivity). **Applicable (A)** — seasonal aspects may affect VC's (i.e., fisheries productivity).
Duration	The time period over which the effects are likely to last	**Short-Term (ST)** – effects are limited to occur from as little as one day to 12 months **Medium-Term (MT)** – effects can occur beyond 12 months and up to seven years **Long-Term (LT)** – effects extend beyond seven years **Permanent (P)** – valued component unlikely to recover to baseline conditions Different timeframe definitions may be provided in each VC section depending on specific VC effects.
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O)** – effects occur once **Sporadic (S)** – effects occur at irregular intervals throughout the Project **Regular (R)** – effects occur at regular intervals throughout the Project **Continuous (C)** – effects occur continuously throughout the Project
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the	**Reversible (RE)** – VCs will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible (PR)** — mitigation cannot guarantee a return to baseline conditions

	environmental attribute or feature)	**Irreversible (IR)** – effects to VCs are permanent and will not recover to baseline conditions

The significance of the residual effects is determined based on the assigned standards or thresholds assigned to each VC. Rationale for the threshold determination and the residual effects characterization will be provided in each VC section to provide the reader with an understanding of how the EA Study Team determined the conclusions presented in the residual table for each VC.

6. Environmental Effects Assessment

The following sections present the environmental effects assessment for the selected VC associated with this Project using the methods outlined above.

6.1 Air Quality and Light

6.1.1 Rationale for Valued Component Selection

Air quality is influenced by total suspended particles (TSP), including dust, dirt, smoke, and liquid droplets directly emitted into the air by sources such as heavy equipment and motorized vehicles, construction activity, fires, and natural wind. Air quality is provincially regulated by the *NS Air Quality Regulations*, under the *Environment Act*, which aims to protect the health of workers. Increased TSP, and changes to air quality may affect wildlife due to inhalation and/or ingestion. Air quality was selected as a VC, as the Project has the potential to result in changes to air quality through dust and particulate mobilization, vehicle and equipment emissions which has the possibility of causing effects to human and ecological health.

Light level limits are not directly regulated through provincial or federal regulations. Changes to ambient light levels (i.e., increases or changes to occurrence/timing) have the potential to adversely affect the general population and sensitive residential receptors, as it can be viewed as a nuisance. Changes to ambient light levels also have the potential to adversely affect fauna and birds. Light was selected as a VC, as the Project has the potential to result in changes to light conditions through vehicle and equipment operating within the PA, and introduction of artificial lighting for the safety and security of onsite activities which may adversely affect fauna and general public and human receptors.

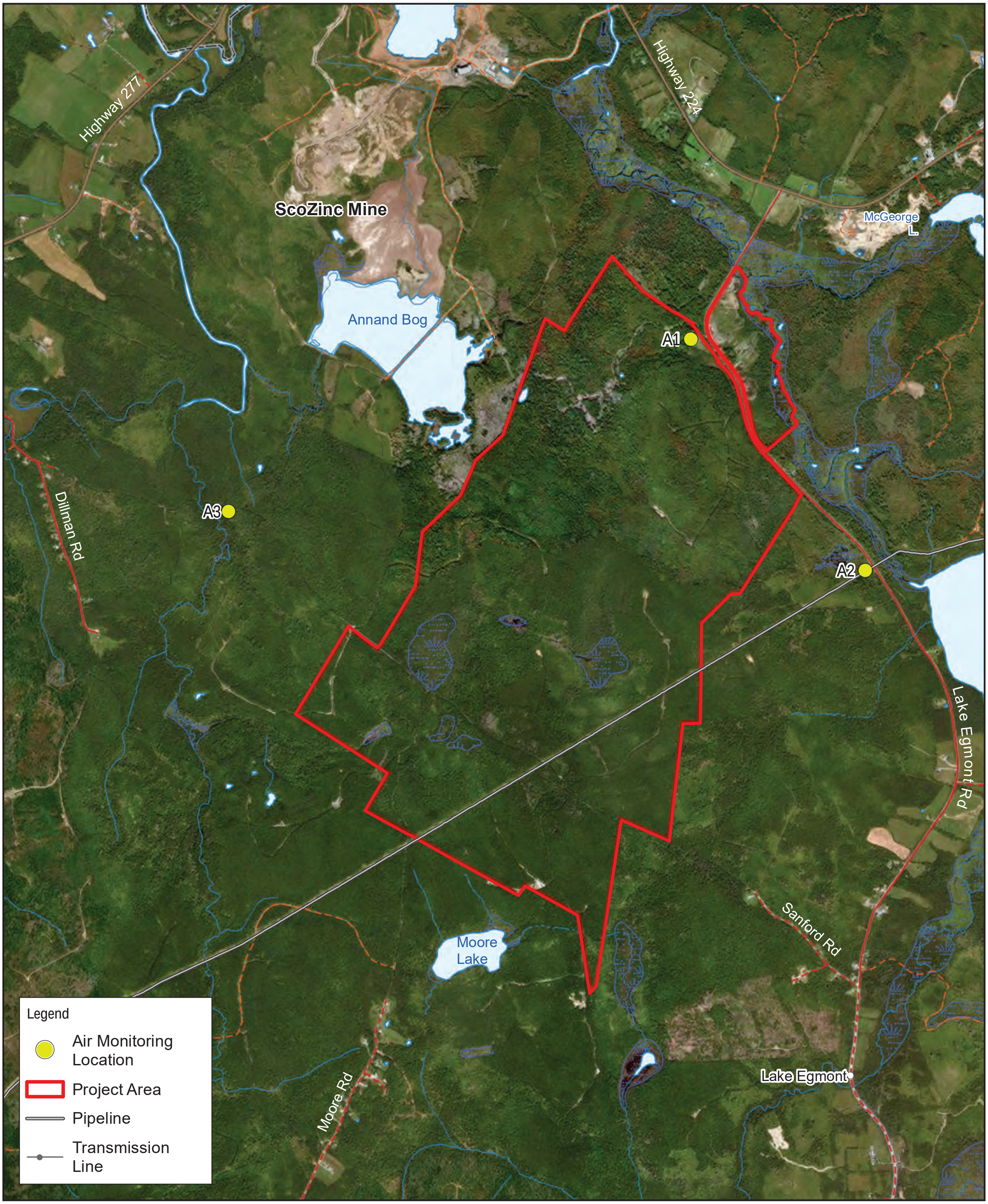
6.1.2 Baseline Program Methodology

6.1.2.1 Air Quality Baseline Program Methodology

Baseline air quality (TSP) monitoring was conducted from October 2 through October 7, 2023, at three locations described in Table 6.1-1, and depicted in Figure 6.1-1. Sampling was completed using Tisch® High Volume (Hi-Vol) samplers in accordance with the United States Environmental Protection Agency (USEPA) Compendium Method IO-2.1 (USEPA, 1999). Filters were placed within the Hi-Vol samplers, where they were left for 24 hours to collect TSP from the surrounding environment. Once the sampling round was complete, a new filter was placed on the Hi-Vol sampler, and monitoring resumed for another 24 hours. This process was repeated for a total of four 24-hour sampling periods per location.

Table 6.1-1 Baseline Air Monitoring Locations

Monitoring Location ID and Coordinates (UTM NAD 20)	Location	Description	Wind Direction Relative to Project
A1 (474642, 4984647)	Near proposed PA entrance	Small clearing adjacent to existing northern access road to Project, immediately south of Lake Egmont Road.	Downwind
A2 (475656, 4983303)	M&NP clearing, northeast of PA	50 metres west of intersection of the M&NP right of way and Lake Egmont Road	Downwind
A3 (471956, 4983647)	MacWilliams Road, west of PA	Intersection of MacWilliams Road and tributary of South Branch Gays River, equidistant between Dillman Road and Annand Bog	Upwind



1 cm = 300 m

0 300 600 900

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

N

CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

BASELINE AIR MONITORING

Project No. 12601021
Revision No. -
Date 07/22/2024

FIGURE 6.1-1

N:\CA\Halifax\Projects\661\12601021\GIS\Maps\Deliverables\RPT006\12601021-RPT006-HX005-Fig 6.1-1 Baseline Air Monitoring.mxd
Print date: 22 Jul 2024 - 09:29

Attribution: GEONOVA, GHD, Source: Esri, Maxar, Earthstar Geographics, IGN, and the GIS User Community. Created by: iwilson2

6.1.2.2 Qualitative Light Assessment Methodology

A review of sensitive receptors in the vicinity of the PA was completed to qualitatively assess potential impact of light from the Project on the surrounding community. The nearest residence was identified at approximately 960 m northeast of the open pit, 730 m east of the administration office building, and approximately 190 m from the northern boundary of the overburden stockpile. Based on the conceptual mine plan, a vegetative buffer approximately 100 m in width will be established between the overburden stockpile and the nearest residential receptor. Given the location of the Project infrastructure, topography of the PA, and establishment of a vegetative buffer between the PA and surrounding receptors a qualitative review was considered sufficient for the purpose of the Project.

6.1.3 Baseline Conditions

6.1.3.1 Baseline Ambient Air Quality

Results of the baseline air quality monitoring program are summarized in Table 6.1-2, below and provided in the Air Emissions Assessment report (Appendix C).

Table 6.1-2 Baseline Air Quality TSP Results

Date	A1	A2	A3
October 2-3, 2023	12 μg/m3	13 μg/m3	12 μg/m3
October 3-4, 2023	13 μg/m3	--	8 μg/m3
October 4-5, 2023	12 μg/m3	13 μg/m3	12 μg/m3
October 5-6, 2023	9 μg/m3	12 μg/m3	13 μg/m3
October 6-7, 2023	--	9 μg/m3	--
-- No data collected			

No data was collected at monitoring location A2 during the monitoring period of October 3 – 4th, 2024. Upon arrival at monitoring location A2 on October 4, 2023, it was determined that the Hi-Vol sampler was off, and data had not been collecting for the previous 24-hours. Monitoring was conducted for an additional 24-hours at this location to compensate for the data gap to ensure that monitoring data was collected for four 24-hour sampling periods per location.

All TSP concentrations recorded during the baseline program were beneath the maximum permissible ground level concentration of 120 μg/m^3 outlined in Schedule A of the NS *Air Quality Regulations* (NSECC, 2020). TSP concentrations ranged from 8 to 13 μg/m^3, with concentrations of 13 μg/m^3 observed at all three monitoring locations.

6.1.3.2 Regional Ambient Air Quality

The National Pollutant Release Inventory (NPRI) is Canada's legislated and publicly accessible inventory of pollutant releases to air, water, and land. The NPRI is managed by ECCC and currently tracks over 200 substances and groups of substances. By the authority of the *Canadian Environmental Protection Act* (CEPA), owners or operators of facilities that meet NPRI reporting requirements published in the Canada Gazette, Part 1 are required to report to the NPRI.

The nearest NPRI reporting stations to the Project are the Milford Mine Site (Gold Bond Canada, Milford Station), Elmsdale Asphalt Plant (Martells Contracting Ltd., Elmsdale), and the Shaw Brick Plant (Shaw Ltd., Lantz), all located within 12 km of the Project. These projects have been documented to release particulate matter (PM) less than or equal to 10 micrometers (PM10), carbon monoxide, manganese, PM2.5, sulphur dioxide, and nitrogen oxides into the atmosphere (ECCC, 2024a).

GHGs have been studied by ECCC, with the publication of *Greenhouse Gas Sources and Sinks in Canada: Executive Summary 2024* (ECCC, 2024b) detailing provincial and national GHG emissions according to the released quantities of Mt CO_2 eq (million tonnes of carbon dioxide equivalent). NS is reported to have released 15 Mt CO_2 eq in 2022, a 35% decrease from 2005 baseline conditions of 23 Mt CO_2 eq (ECCC, 2024b).

The National Air Pollution Surveillance Program (NAPS) provides long-term air quality data across Canada, assessing ambient outdoor air quality at monitoring stations in populated regions (ECCC, 2023). There are seven NAPS stations in NS, with the closest to the PA being Halifax (Station ID 30113) and Lake Major (Station ID 30120). These two stations provide local NO_2, SO_2, and PM2.5 concentration data, however it should be noted that the Halifax station is located within a dense urban centre with presumably elevated GHG emissions, and the Lake Major station concentration data is also likely skewed by the proximity to the nearby urban core. As a result, air quality is likely better at the PA in comparison to the nearest NAPS stations. The Project is located in the NS Central Air Zone (NSECC, 2021b).

The Project is situated in a mixed use rural agricultural area, where farming activities, quarry and mining operations, and vehicle traffic may contribute to local baseline emission levels.

6.1.3.3 Climate and Meteorological Information

Several meteorological stations were reviewed to obtain data for air emission estimates and dispersion modelling. Halifax Stanfield International Airport (Station ID 8202251), approximately 17 km southwest of the PA, was selected as the most appropriate surface dataset for this assessment as it was the closest station to the Project which records cloud cover, a necessary component in calculating plume dispersal. Five years (2018-2022) of unprocessed hourly meteorological data was obtained from the Halifax Stanfield International Airport station.

Upper air data (radiosonde, Yarmouth) was sourced from National Oceanic and Atmospheric Administration (NOAA). The historical meteorological data, upper air data, coupled with the Earth Observation for Sustainable Developments of Forests (EOSD) land use characteristics was processed using AERMET version 19191. The hourly data generated included many factors which affect the dispersion of air compounds including wind speed, wind direction, temperature, ceiling height, and atmospheric stability.

The dominant wind direction at the Halifax Stanfield International Airport meteorological station is westerly. A wind rose generated from hourly wind recordings at the Halifax Stanfield International Airport station is presented on Figure 6.1-2.

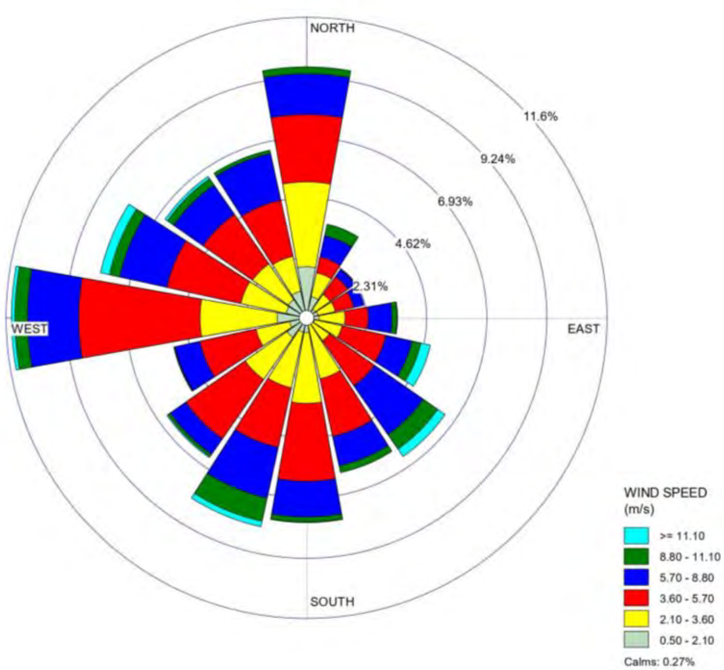


Figure 6.1-2 Wind Rose - Halifax Stanfield International Airport (Station ID 8202251)

Existing ambient light levels are not monitored in the PA or surrounding areas; however, the levels are expected to be typical of a rural environment with low levels of ambient illuminance.

Artificial lighting in the surrounding community is expected to be consistent with that of sparsely populated rural communities with light sources from residences and vehicles on Lake Egmont Road. The nearest permanent residential receptors to the Project are houses along Lake Egmont Road, approximately 960 m northeast of the open pit, 730 m east from the administration office building, and approximately 190 m from the northern boundary of the overburden stockpile.

6.1.4 Effects Assessment Methodology

6.1.4.1 Boundaries

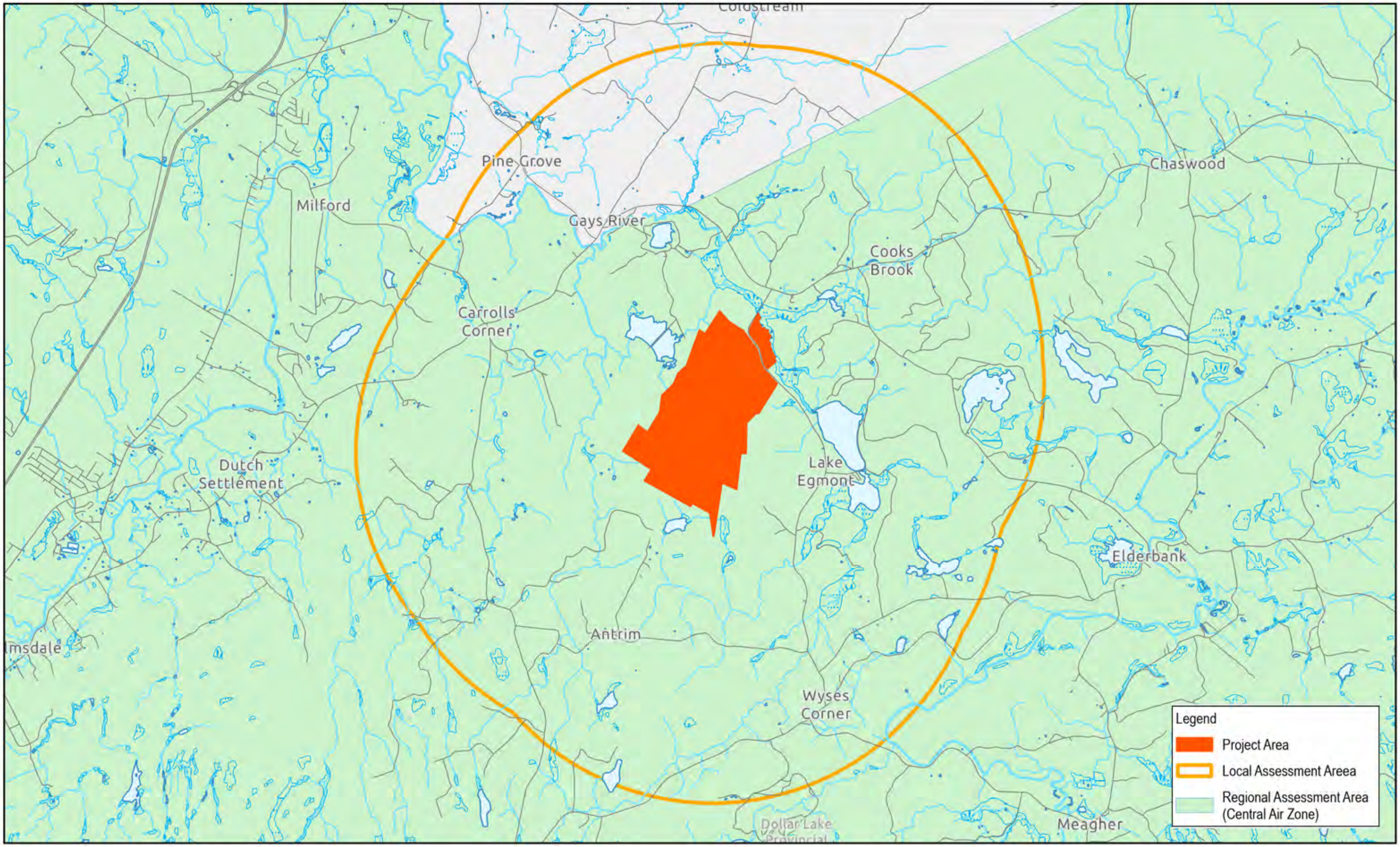
The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

Spatial Boundaries

The spatial boundaries used for the assessment of effects of air quality and ambient light are defined below:

– The PA encompasses the footprint of Project related infrastructure and includes the area in which Project activities are likely to cause direct and indirect effects to VCs.
– The LAA encompasses includes adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. The LAA for air quality encompasses an area of 5 km from the PA in all directions to capture predicted air quality impacts on worst-case sensitive receptors identified in the air emissions modelling report.
– The RAA encompasses the Central NS Air Zone (NSECC, 2021b), which is defined as an area with common meteorology, topography, and other factors that have the potential to influence ambient air quality.

Based on the air emissions assessment modelling for this Project indicating that all compounds are below the most stringent air quality criteria at all locations at the PA boundary, the LAA was deemed sufficient for evaluation of air effects. An RAA was defined for the air quality VC; however, no effects outside of the LAA are anticipated for this Project. Spatial boundaries defined for the air quality and light effects assessment are presented on Figure 6.1-3.



Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

GHD

CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

AIR QUALITY AND LIGHT EFFECTS ASSESSMENT BOUNDARIES

Project No. **12601021**
Revision No. **-**
Date **22/07/2024**

FIGURE 6.1-3

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Attribution: GHD, GeoNOVA, NR Canada Light Gray Reference: Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, NRCan, Parks Canada
Light Gray Base: Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, NRCan, Parks Canada. Created by: rwilson2

Temporal Boundaries

The temporal boundaries used for the assessment of effects on the ambient air quality and light of the Project includes the construction, operation and closure phases.

Administrative Boundaries

No technical boundaries were identified for the effects assessment of air quality and light.

Technical Boundaries

Impacts to air quality resulting from the Project were assessed according to the assessment criteria listed in Table 6.1-3, below. Maximum permissible ground level concentrations provided in the NS Air Quality Standards (NSAQS) were applied in this assessment. Additional contaminant concentration limits from the Ontario Ministry of the Environment, Conservation and Parks Air Contaminants Benchmarks (ACB) list as well as Ontario's Ambient Air Quality Criteria (AAQC) were applied in the absence of NS criteria (i.e., PM10 and PM2.5). The most conservative standard was used for each contaminant in this assessment.

NSECC released the *GHG Emissions Regulations* in 2009, under Section 112 of the *Environment Act*, establishing GHG emission caps on the electricity sector (NSECC, 2013). These regulations apply to any facility located in NS that emits greater than 10 kt of CO_2 equivalent GHGs in a calendar year. The facility may be required to report to the NPRI, an inventory of pollutant releases to air, water, and land. There exists no province-wide standard for GHG emissions.

Light level limits are not directly regulated through the provincial or federal regulatory regime.

There may be other requirements for monitoring of the atmospheric environment through provincial approvals to be obtained prior to the start of the Project, specifically defined through the IA.

Table 6.1-3 Air Quality Assessment Criteria

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration	
		µg/m^3	Guideline
TSP	24 hours	100	NSAQS
	Annual	60	NSAQS
$PM_{2.5}$	24 hours	15	NSAQS
	Annual	5	NSAQS
PM_{10}	24 hours	45	AAQC
	Annual	15	NSAQS
Nitrogen Dioxide	1 hour	200	NSAQS
	24 hours	25	NSAQS
	Annual	10	NSAQS
Sulphur Dioxide	1 hour	100	ACB
	24 hours	40	NSAQS
	Annual	10	ACB
µg/m^3 – micrograms per meter cubed			

6.1.4.2 Air Dispersion Modelling

Dispersion modelling was performed using the US EPA multi source dispersion model AERMOD, following methodology as described in the Air Assessment Guidance Document (NSECC, 2021c). Halifax Stanfield International Airport (Station ID 8202251), approximately 17 km southwest of the PA, was selected as the most appropriate surface dataset for this assessment as it is the closest station to the Project which records cloud cover, required for air dispersion modelling.

Upper air data (radiosonde, Yarmouth) was sourced from NOAA. The historical meteorological data, upper air data, and Earth Observation for Sustainable Developments of Forests (EOSD) land use characteristics were processed using the AERMET version 19191 meteorological data processing tool. The hourly data generated included many factors which affect the dispersion of air compounds including wind speed, wind direction, temperature, ceiling height, and atmospheric stability.

Source input parameters for dispersion modelling included haul roads, waste rock haul routes, phased pit operations, and process operations during peak production years (i.e. years 6 and 7 of the operation phase), when air emissions are predicted to be at their maximum. Dispersion modelling also considered road surface, which includes the consideration that the truck loading route is assumed to be paved for a length of 31 m at both the entrance and exit of the route. Contaminants assessed included TSP, PM_{10}, $PM_{2.5}$, NO_x, and SO_2, with NO_x and SO_2 primarily being sourced from vehicle tailpipe exhaust emissions. Where CO was not assessed, it was assumed that compliance with guidelines for gaseous compounds NO_x, and SO_2 was also reflective of compliance with CO.

Further detail on the methodology applied in the air emissions estimates and dispersion modelling completed for the Project is provided in the Air Emissions Assessment report in Appendix C.

6.1.4.3 Thresholds for Determination of Significance

The characterization criteria applied in the air quality and light effects assessment are detailed in Table 6.1-4 and 6.1-5 respectively, below.

Table 6.1-4 Characterization Criteria for Air Quality Effects

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	N – background air contaminant concentrations met at the PA boundary L – air contaminant concentrations exceed background levels beyond the PA boundary but comply with guidelines M – air quality contaminant concentrations exceed guidelines beyond the PA boundary but comply with guidelines at residences H – air quality contaminant concentrations exceed guidelines at residences
Geographic Extent	PA – direct and indirect effects from Project activities are restricted to the PA LAA – indirect effects from Project activities are restricted to the local assessment area RAA – effects from Project activities extend beyond the PAA and LAA to affect a more diffuse and longer-range geographic area
Timing	N/A – seasonal aspects are unlikely to affect air quality A – seasonal aspects may affect air quality
Duration	ST – effects are limited to occur from as little as 1 day to 12 months MT – effects can occur beyond 12 months and up to 3 years LT – effects extend beyond 3 years P – air quality unlikely to return to baseline conditions
Frequency	O – effects occur once S – effects occur at irregular intervals throughout the Project R – effects occur at regular intervals throughout the Project C – effects occur continuously throughout the Project
Reversibility	RE – air quality will return to baseline conditions before or after Project activities have been completed. PR – mitigation cannot guarantee a return to baseline conditions IR – effects to air quality are permanent and will not recover to baseline conditions

A significant adverse effect from the Project with respect to air quality is defined as:

– An exceedance of the NS Air Quality Standards at a residential or commercial location outside of the PA boundary resulting from Project activity.

Table 6.1-5 Characterization Criteria for Light Effects (Qualitative)

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – no change in light levels PA boundary **L** – changes in light levels observed beyond the PA but not observed at residential receptors. **M** –changes in light levels observed beyond the PA but not anticipated to be an annoyance at residential receptors **H** – changes in light levels observed beyond the PA resulting in an annoyance at residential receptors
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA. **LAA** – indirect effects from Project activities are restricted to the local assessment area **RAA** – effects from Project activities extend beyond the PA and LAA to affect a more diffuse and longer-range geographic area
Timing	**N/A** — seasonal aspects are unlikely to affect light **A** — seasonal aspects may affect light
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months **MT** – effects can occur beyond 12 months and up to 3 years **LT** – effects extend beyond 3 years **P** – light unlikely to return to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – light will return to baseline conditions before or after Project activities have been completed. **PR** - mitigation cannot guarantee a return to baseline conditions **IR** – effects are permanent and will not recover to baseline conditions

Light trespass and the increases or changes to occurrence/timing of light may be observed as an annoyance or nuisance to wildlife and human receptors and may cause adverse effects such as disrupting sleeping patterns, or cause glare issues from direct view of a light source. The adverse effects of light trespass from exterior lighting are influenced by various factors, including:

– Light trespass is more likely to be perceived as obtrusive and a nuisance if the lighting installation is located above the observer. Installations of artificial lighting for safety and security purposes are usually directed towards the ground and an observer could therefore have a direct view of the luminaire.
– The surrounding topography and Project infrastructure, including hills, vegetation, and buildings, generally have a positive effect by creating a buffer between an observer and a light source.
– Pre-existing lighting in the area: light from a particular source is seen as less obtrusive if it is in, or perceived in, an area where lighting levels are already high (e.g., along roads and near heavily populated areas).
– Zoning of an area: a rural residential area is seen as more sensitive compared to commercial areas where higher light levels exist and are typically seen as more acceptable.
– Time of use: light will be seen as being more obtrusive during nighttime. This is generally considered to be between 11:00 pm and 7:00 am.

A significant adverse effect from the Project with respect to light is defined as:

– Continuous nighttime light levels deemed as an annoyance or causing a disturbance as reported by nearby residential receptors

6.1.5 Project Interactions and Potential Effects

Project activities have the potential to result in changes to air quality (dust and particulates) and exhaust type emissions with potential climate effects, as well as ambient light levels. Dust, exhaust type emissions, and changes to light levels will occur during the construction, operation, and closure phases of the Project.

Table 6.1-6 Project Activities and Air and Light Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Topsoil, overburden, and waste rock management Surface infrastructure installation and construction Haul road construction Collection ditch and settling pond construction General waste management
Operation	Gypsum management (extraction, loading, hauling, screening) Topsoil, overburden, and waste rock management Water management Haul road construction and maintenance Petroleum products management Maintenance and repairs General waste management
Closure	Demolition Earthworks General waste management

6.1.5.1 Air Emissions

Fugitive dust, particulate matter that becomes airborne and typically composed of local minerals from dried soils, may be generated by disturbance of exposed soils, vehicle traffic, heavy machinery, and other construction and/or operational activities. Fugitive dust poses a risk to respiratory systems of both humans and wildlife, as the particles are small enough to be inhaled (ECCC, 2017). Beyond respiratory concerns, significant amounts of dust may reduce vision, deposit on vegetation which is consumed by wildlife, and impact water chemistry and/or turbidity through deposition in waterbodies.

The haul roads within the PA are assumed to be unpaved and will be subject to watering to ensure moisture level of five times the ambient soil is maintained, to decrease fugitive dust. The truck loading road will also be paved for a length of 31 m at both the entrance and exit of the route, to minimize potential for dust to influence air quality in high traffic areas near the PA entrance. Assuming appropriate mitigation to minimize dust generation and transport, effects on air quality resultant of fugitive dust are anticipated to be low during all phases of the Project. Predicted concentrations and dispersion of all modelled air contaminants are described in detail in the Air Emissions Assessment report provided in Appendix C.

The results of predictive emission modelling of NO_x, SO_2, and PM2.5 concentrations during the maximum emission period (years 6 and 7 of operation) demonstrated that all compounds are below the most stringent air quality criteria, as defined in Section 6.1.4.1.4 (NS Air Quality Regulations and proposed Air Quality Standards for NS) (Appendix C). Further, the results of the modelling during the years 6 and 7 of operation are lower than those reported in 2021 at the closest NAPS air quality monitoring station (Lake Major, Station ID 30120) (NSECC, 2021b). While air pollutant concentrations will marginally increase above baseline, the effects on air quality resultant of air pollutant emissions and fugitive dust from Project activities are anticipated to be low during all phases of the Project.

6.1.5.2 Light Trespass

It is unlikely that surrounding residences will experience significant adverse effects due to light trespass from the PA. This is primarily due to the limitation of operational hours to daylight hours (7:00 AM to 5:30 PM) and operating schedule of Monday to Friday, in addition to the established vegetative buffer and natural topographic and landscape features which are predicted to act as a buffer to light between nearby residential receptors and Project related light sources (i.e. infrastructure, mobile equipment). Light present outside of the daylight hours is expected to be only what is necessary for security and safety.

Reflected light is used by animals to collect a wide range of information within their environment. At night, many nocturnal animals use moonlight and starlight to forage for food and detect predators. Objects in the night sky may be used as aids to navigation for migrating birds. Patterns of light and darkness are also used to regulate circadian cycles; to control the behavior of diurnal, nocturnal, and crepuscular animals; to determine day length; and as a directional cue for navigation (Gaston et al., 2012). Decreasing the duration of lighting may help to minimize alleviate impacts on nocturnal and crepuscular animals, since peak lighting demand periods often coincide with the peak activities of these species (Gaston et al., 2012). Further discussion of impacts to terrestrial and avifauna is provided in Section 6.8.

6.1.6 Mitigation

Air quality and light mitigation measures planned for the Project are detailed in Table 6.1-7 below.

Table 6.1-7 Air Quality and Light Mitigation Measures

Project Phase	Mitigation Measure
Construction	Limit disturbed areas to the extent practical.
	Clearing associated with road construction will be limited, where possible, to the width required for the road embankments and drainage areas.
	Dust control measures for all Project phases will be detailed in a Fugitive Dust Management Plan, to be submitted prior to construction.
	Lights will be placed as far from residential receptors as practical; lighting will be aimed inward to prevent light trespass beyond the PA.
Construction, Operation, Closure	Surfaces of stockpiles (i.e. organic material, till, overburden, etc.) will be stabilized via vegetating or covering exposed surfaces if there are extended periods of time between use.
	During dry periods, watering as a form of dust suppressant will be applied to the haulage road network as needed to mitigate dust emissions. Watering may be repeated several times a day if required, depending on the conditions. Water used for dust suppression will be sourced from Project the settling pond (with suitable water chemistry) and not sourced from natural waterbodies.
	Drop heights will be reduced to be as close to the pile as possible, during dumping and/or movement of waste rock, topsoil, and overburden to limit dust generation.
	Equipment, vehicles, and haul trucks will be maintained in good working order. To reduce emissions, idling times and cold starts will be limited, where practicable.
	Project vehicles will be required to comply with established speed limits to limit fugitive dust generation from vehicle travel on unpaved roads. Speed limits will be set in accordance with provincial regulations and industry standards.
	Mitigation measures outlined in the ESC Plan and the Fugitive Dust Management Plan will be adhered to and maintained throughout the Project.
	Equipment and vehicles will be restricted to defined work areas and the haulage road network.
	No unnecessary lighting will be used.
	Lighting will be angled / directed towards the work area and shielded where possible to minimize light trespass.

Project Phase	Mitigation Measure
	Motion sensing lighting will be installed in lower traffic areas, wherever practicable, to reduce unnecessary lighting
	Light spectrums that have less effect on wildlife will be used, wherever practicable.
	Floodlights and asymmetric beams will be used where possible.
Closure	Disturbed areas will be graded and/or scarified, covered with topsoil and overburden, where required, and seeded with native seed mix representative of natural conditions to promote natural plan colonization.

6.1.7 Monitoring and Follow-up

The NPRI is a federally administrated program that collects data on annual emissions of substances released to air, water and land, as well as transfers of substances for disposal or recycling. NPRI reporting is a requirement of subsection 46(1) of the CEPA. CertainTeed is aware of the legislation and will comply with reporting requirements, as applicable.

Based on the results of the Air Emissions Assessment (Appendix C), air quality monitoring is not required; however, air quality monitoring will occur over the life of the Project, as required by NSECC, with results compared to baseline air quality conditions and the Maximum Permissible GLCs listed in Schedule A of the NS *Air Quality Regulation*s (NSECC, 2020), or other appropriate criteria as defined in the IA. If complaints are received concerning dust and air quality, CertainTeed will review frequency of dust suppression watering and Fugitive Dust Management Plan. Air monitoring stations can be set up at anytime throughout the life of the Project, as required, to compare conditions to baseline levels and applicable guidelines.

If complaints are received concerning light trespass, a monitoring program will be developed in consultation with NSECC that will aim to reduce light-levels in non-active work areas, and redirect lighting in active work areas within the parameters of worker safety. Light monitoring may be undertaken as a condition of an IA, if required.

6.1.8 Residual Effects and Significance

The predicted residual environmental effects of the Project on air quality are assessed to be adverse, but not significant. However, after appropriate mitigation measures have been implemented, the overall residual effect of the Project on air quality are assessed as not likely to have significant adverse effects.

The predicted residual environmental effects of the Project on light are also assessed to be adverse, but not significant. With the application of appropriate mitigation measures, the overall residual effect of the Project on light is assessed as not likely to have a significant adverse effect.

A significant adverse effect on air quality was defined in Section 6.4.4.3 as:

– A Project-related exceedance of the NS Air Quality Standards at a residential or commercial location outside of the PA resulting from Project activity.

A significant adverse effect to light conditions was defined in Section 6.4.4.3 as:

– Continuous nighttime light levels deemed as an annoyance or causing a disturbance as reported by nearby residential receptors

GHG emissions was not carried through the effects assessment for this Project, as Project will be connected to the provincial power grid and emissions from truck traffic and heavy machinery are not predicted to contribute as a significant source of GHG emitted within the study boundaries of this EA, or the province of Nova Scotia as a whole.

Residual environmental effects of the Project on air quality and light are summarized in Table 6.1-8 and Table 6.1-9, respectively.

Table 6.1-8 Residual Effect on Air Quality

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – clearing, grading, and grubbing, haul road construction, water management	Dust suppression, regular equipment maintenance, stockpile stabilization	A	L Predicted air contaminant for certain parameters exceed background concentrations however comply with guidelines.	LAA	A	MT The construction phase is 2 years.	C	RE	Increased ambient air pollutant concentrations and dust generation	Not significant
Operations – mining, processing, overburden and waste rock management, water management, waste management	Dust suppression, regular equipment maintenance, stockpile stabilization	A	L Predicted air contaminant for certain parameters exceed background concentrations however comply with guidelines.	LAA	A	LT The operation phase is 23 years	C	RE	Increased ambient air pollutant concentrations and dust generation	Not significant
Closure – demolition and earthworks	Dust suppression, regular equipment maintenance, stockpile stabilization	A	L Predicted air contaminant concentrations comply with the most conservative concentration guidelines	LAA	A	MT The closure phase is 2 years.	C	RE	Increased ambient air pollutant concentrations and dust generation	Not significant
Construction, operations, and closure – vehicle emissions	Regular equipment maintenance, reduction of vehicle idling when possible	A	L Based on the scale of the Project, its anticipated that there will be negligible GHG emissions on a provincial level.	RAA	A	LT Occurring during all phases of the Project.	C	IR	GHG emissions	Not significant
Legend (refer to Table 6.1-4 for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area		Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility RE – Reversible IR – Irreversible PR – Partially Reversible			

Table 6.1-9 Residual Effects on Ambient Light

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, operations, and closure – vehicle headlights and lighting installations	Operating hours are from 7:00 am to 5:30 pm – limiting the sources of light. Minimize lighting required for safety activities at night, face lighting downwards, place lighting as far away from sensitive receptors as possible.	A	M Based on the hours of operation there are anticipated to be minimal light impacts.	LAA	A	LT Potential for increased light emissions through all phases of the Project	C	RE	Increased ambient light	Not significant

Legend (refer to Table 6.1-4 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	RE – Reversible IR – Irreversible PR – Partially Reversible

6.2 Noise

6.2.1 Rationale for Valued Component Selection

Noise is defined as any unwanted sound which may be hazardous to health, interfere with speech and verbal communications or is otherwise disturbing, irritating, or annoying. Noise is provincially regulated via the *NS Workplace Health and Safety Regulations* and the NSECC Guidelines for Environmental Noise Measurement and Assessment (NSECC, 2023a). Changes to noise levels (i.e. increases or changes to occurrence/timing) have the potential to cause a disturbance or nuisance to nearby residential receptors and the general public, as well as impact migration and behavioural patterns causing an adverse affect to wildlife.

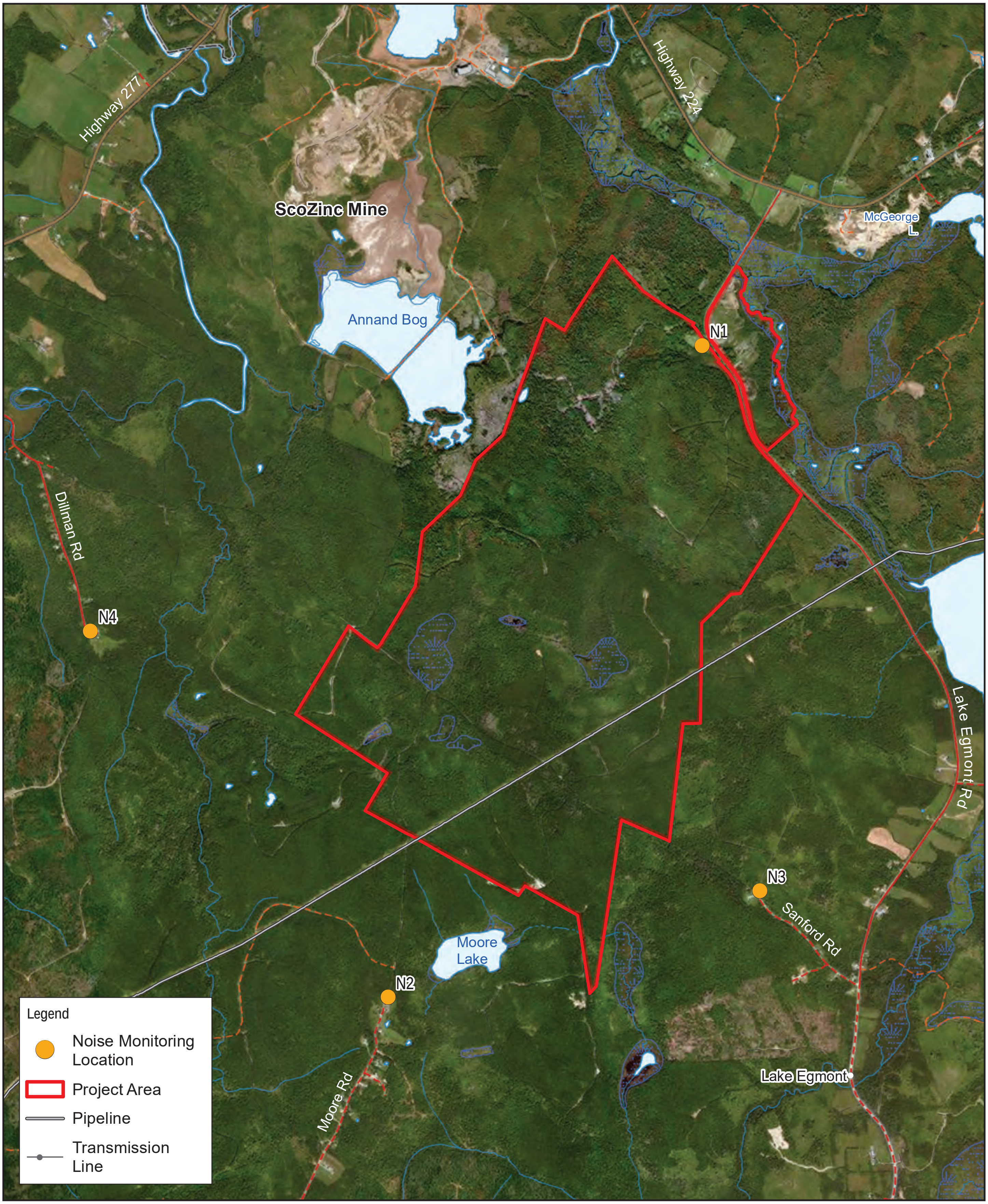
Noise was selected as a VC as the Project will generate noise through all Project phases, through the operation of heavy equipment and vehicle traffic. Operational noise resulting from Project activities will be restricted to operational hours of 7:00 am to 5:30 pm, Monday to Friday, and noise sources will be generally consistent throughout the operational hours.

6.2.2 Baseline Program Methodology

Baseline noise monitoring was conducted at four locations, from October 2 to 6, 2023. Table 6.2-1 provides a description of the noise monitoring locations. Monitoring locations are depicted on Figure 6.2-1.

Table 6.2-1 Baseline Noise Monitoring Locations

Monitoring Location ID and Coordinates (UTM NAD 20)	Location	Description
M1 (474707, 4984610)	Lake Egmont, NS	Small clearing adjacent to existing northern access road to Project, immediately south of Lake Egmont Road.
M2 (472884, 4980823)	Moore Lake, NS	Small, cleared area off Moore Road, located south of the PA, before road extends south to an unpaved / unmaintained trail. Trail leads to the southern extent of the PA
M3 (475042, 4981442)	Sanford Road, NS	Small clearing near end of Sanford Road before the road surface changes to gravel, southeast of the PA
M4 (471155, 4982951)	Dillman Road, NS	Small clearing near the end of Dillman Road, west of the PA.



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Grid: NAD 1983 CSRS UTM Zone 20N

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LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

BASELINE NOISE MONITORING

Project No. 12601021
Revision No. -
Date 07/22/2024

FIGURE 6.2-1

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The baseline noise monitoring was conducted in accordance with ISO 1996-2:2007 (“Acoustics –Description, measurement and assessment of environmental noise – Part 2L Determination of environmental noise levels”). Ambient sound levels were measured using Type 1 Sound Pressure Level Meters. Measurements were taken continuously for one 24-hour period at each monitoring location. Calibration checks were undertaken throughout the monitoring survey to ensure the noise meter was functioning correctly.

The noise meter was programmed to record continuous 1-minute sound level measurements taken with the detector in slow response using the A-weighting (dBA scale) and reported as average equivalent continuous level (Leq) dBA readings at each of the four monitoring locations. The sound level meters were equipped with an outdoor casing and foam covering to protect the microphone from adverse weather conditions and reduce sound disturbances caused by physical contact and wind disturbances. Baseline monitoring methodologies are further described in Appendix D.

6.2.3 Baseline Conditions

6.2.3.1 Baseline Ambient Noise Levels

Average baseline noise levels for each evaluation period (day/evening/night) during the baseline noise monitoring program is summarized in Table 6.2-2, below and provided in the Noise Impact Assessment Report, provided as Appendix D.

Noise is measured as sound pressure levels (SPL) in decibels (dB). This measurement scale is “A" weighted to approximate the way the human ear hears. Noise measurements presented in Table 6.2-2 are therefore represented as dBA units. In general, an increase in noise levels from 1 to 3 dBA will not be noticeable, 3 to 5 dBA will be noticeable by most people, 5 to 7 dBA will be easily heard and an increase of 7 to 10 dBA will be considered by most to be twice as loud (USEPA, 1974). The decibel scale is logarithmic, therefore doubling the number of noise sources will increase noise levels by 3 dBA. A tenfold increase in the number of noise sources will add 10 dBA to the noise level.

Table 6.2-2 Baseline Noise Monitoring Summary Table

Monitoring Location ID	Measured Noise Levels (dBA)		
	Day (7am-7pm) 12-hour L_{Aeq}	Evening (7pm-11pm) 4-hour L_{Aeq}	Night (11pm-7am) 8-hour L_{Aeq}
M1	43	33	36
M2	40	40	36
M3	40	33	35
M4	44	36	33

The results from this sampling program were obtained as a time averaged sound level (Leq); a single number value that expresses the time varying sound level for the specified period (in this case, one hour) as though it were a constant sound level with the same total sound energy as the time varying level. The data collected was filtered via historical climate data from nearby climate stations to identify periods of inclement weather and remove the noise levels during these periods. Average baseline noise levels ranged from 33 dBA to 44 dBA at all monitoring locations. Average sound level values for each time interval were reported below the maximum permissible sound levels of the NSECC guidelines for Environmental Noise Measurement and Assessment (NSECC, 2023a).

The lowest sound levels were reported south of the PA, at location M3 (Sanford Road), located southeast of the PA. The highest noise levels recorded during daytime (07:00 – 19:00) were measured at location M4 (Dillman Road), located west of the PA and the highest noise levels recorded during evening (19:00 – 23:00) and nighttime (23:00 – 07:00) were measured at M2 (Moore Lake), located south of the PA.

The major contributor to baseline noise levels recorded during the daytime and evening monitoring period were related to vehicle traffic, where the natural environment and occasional noise emissions from vehicle traffic were the contributing sources during the nighttime.

A complete summary of the results and the sound level measurements compared to applicable criteria are presented in Appendix D.

6.2.4 Effects Assessment Methodology

6.2.4.1 Boundaries

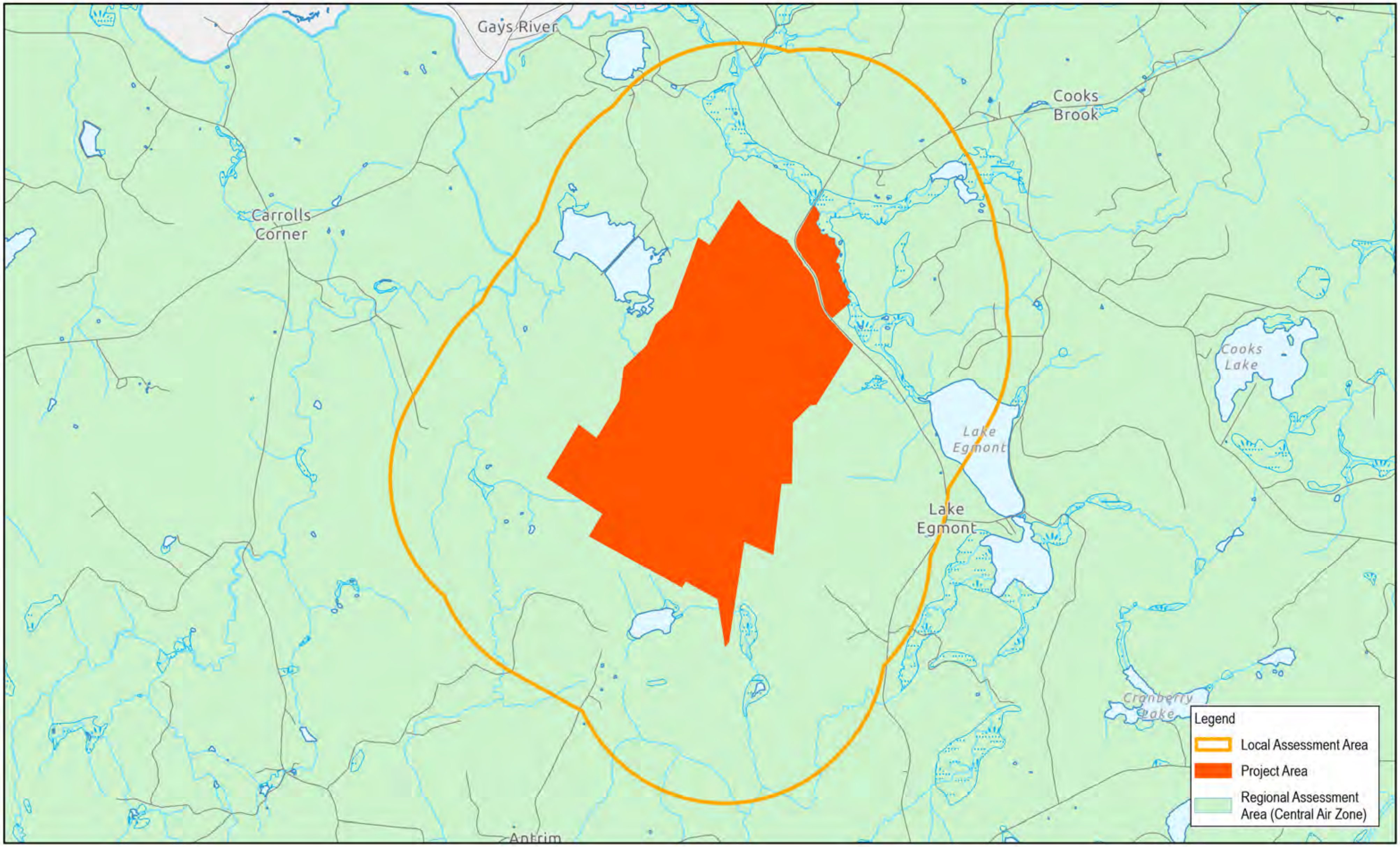
Spatial Boundaries

The spatial boundaries used for the assessment of effects of noise are defined below:

– The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs.

– The LAA includes adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. The LAA encompasses a 1.5 km radius from the PA to capture predicted noise impacts on worst-case sensitive receptors.

Based on the noise impact assessment modelling results for this Project indicating compliance with applicable guidelines at the PA boundary, the LAA was deemed sufficient for evaluation of noise effects, and an RAA was not defined for the noise VC. Spatial boundaries defined for the noise effects assessment are presented in Figure 6.2-2.



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Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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NOISE EFFECTS ASSESSMENT BOUNDARIES

Project No. **12601021**
Revision No. **-**
Date **22/07/2024**

FIGURE 6.2-2

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Light Gray Base: Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, METI/NASA, USGS, NRCan, Parks Canada. Created by: iwilson2

Temporal Boundaries

The temporal boundaries used for the assessment of effects of noise are the construction, operation, and closure phases of the Project.

Technical Boundaries

No technical boundaries were identified for the effects assessment of noise.

Administrative Boundaries

The NSECC guidelines for Environmental Noise Measurement and Assessment (NSECC, 2023a) require noise levels to be met at locations where people normally live, work, or take part in recreation. The PA was classified as a rural acoustic environment, as per the NSECC guidelines (NSECC, 2023a).

Noise impacts from the Project were assessed for the worst-case operations on the sensitive receptors located nearest to the PA for Phase 1 and Phase 2 of mining development. The relevant criteria and critical parameters are presented in Table 6.2-3 below.

Table 6.2-3 Noise Level Limits

Guideline	Location	Time Period	Noise Limit
NSECC Guidelines for Environmental Noise Measurement and Assessment (2023)	Receptor based	Day, 7:00 AM and 7:00 PM	Leq ≤ 53 dBA
		Evening, 7:00 PM and 11:00 PM	Leq ≤ 48 dBA
		Night*, 11:00 PM and 7:00 AM	Leq ≤ 40 dBA
*Nighttime hours include all day Sunday and statutory holidays			

6.2.4.2 Acoustical Modelling

A noise impact assessment was undertaken to evaluate the potential noise impacts from the Project generated during worst-case operation on the sensitive receptors located nearest to the PA, based on operational hours from 7:00 AM to 5:30 PM.

Datakustik's CadnaA Acoustical Modelling Software (CadnaA) is the industry standard for environmental noise modelling in Canada. CadnaA version 2023 was used to model the potential impacts of the significant noise sources. CadnaA calculates sound level emissions based on the ISO 9613-2 standard "Acoustics – Attenuation of Sound During Propagation Outdoors", which accounts for attenuation effects due to geometric divergence, atmospheric attenuation, barriers/berms, ground absorption, and directivity. Topography for the PA and surrounding environment was obtained from GHD's GIS department, and input in the 3-D acoustical model (5 m resolution for elevations).

Operations were conservatively assessed after a pit depth of 10 m was reached to account for the minimum depth of overburden removal required for mining. Despite only representing a small portion of the pit, the minimum depth was used to provide a worst-case assessment of noise impacts since line-of-sight exposure to sensitive receptors would be maximized at this depth.

The acoustic modelling has been completed using the current infrastructure for the Project and estimates of truck traffic on the haul roads. The noise analysis results presented herein include all sensitive receptors (i.e., human receptors – seasonal and permanent dwellings) locations.

6.2.4.3 Threshold for Determination of Significance

The characterization criteria applied in the noise effects assessment are detailed in Table 6.2-4 below.

Table 6.2-4 Characterization Criteria for Noise Effects

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – background noise levels are met at the PA **L** – noise levels exceed background levels beyond the PA but comply with guidelines **M** – noise levels exceed guidelines beyond the PA but comply with guidelines at the nearest sensitive receptors (residences) **H** – noise levels exceed guidelines at residences
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – indirect effects from Project activities are restricted to the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect noise **A** – seasonal aspects may affect noise
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months **MT** – effects can occur beyond 12 months and up to 3 years **LT** – effects extend beyond 3 years **P** – noise unlikely to return to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R**– effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – noise will return to baseline conditions before or after Project activities have been completed. **PR** – mitigation cannot guarantee a return to baseline conditions **IR** – effects to noise are permanent and will not recover to baseline conditions

A significant adverse effect from the Project with respect to noise is defined as:

– Repeated or sustained noise levels being emitted from Project activities that exceed NSECC Guidelines for Environmental Noise Measurement and Assessment (2023a) at the nearest sensitive receptors (i.e., human receptors – seasonal and permanent dwellings).

6.2.5 Project Interactions and Potential Effects

Potential Project interactions with noise are presented in Table 6.2-5, below.

Table 6.2-5 Project Activities and Noise Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Topsoil, overburden, and waste rock management Surface infrastructure installation and construction Haul road construction Collection ditch and settling pond construction Water management General waste management
Operations	Gypsum management (extraction, loading, hauling, screening) Topsoil, overburden, and waste rock management Water management Haul road construction and maintenance Petroleum products management

Project Phase	Relevant Project Activity
	Maintenance and repairs Water management General waste management
Closure	Demolition Earthworks Water management General waste management

The model concluded that predicted noise levels resulting from Project activities during Phase 1 and Phase 2 of Project activities will be within guidelines limits specified by the NSECC Guidelines for Environmental Noise Measurement and Assessment (2023a) at all identified worst-case sensitive receptors.

The nearest residential receptor is located approximately 190 from the overburden stockpile and 960 m from the open pit. Due to the distance of the nearest receptor to the open pit, and the operational hours between 7:00 AM and 5:30 PM, the model identified that the Project will be compliance with the applicable noise guidelines at the nearest identified sensitive receptors.

Project activities have the potential to generate noise through use of heavy equipment and truck traffic during all Project phases. Given the rural setting of the Project, noise levels in the vicinity of the Project are expected to be typical of a rural environment and therefore Project related noise may cause short periods of elevated noise that could be identified as a nuisance or disturbance to nearby receptors; however, potential for nuisance or disturbance resulting from noise levels will be confined to the daytime operational hours. The Project will not be active during nighttime hours, or on weekends.

Surface miners will be used for the Project, and drilling/blasting will be used on an as needed basis. Blasting has the potential to create air vibration, commonly referred to as air blasts, pressure waves that travel through the air. Blasting is also often viewed as a disturbance to community members and sensitive receptors in close proximity to the PA. Blasting was excluded from the modelling as it is not planned for the Project and will only be used as required. Any potential blasts will be designed by a blasting contractor to meet the required noise and vibration limits. Blast sound and vibration levels can be controlled by adjusting various parameters such as hole spacing, explosive charge weight, and time delay between rows. Weather conditions, such as the presence of temperature inversions (low ceiling, clouds) and strong winds blowing towards populated areas can magnify the levels of air pressures, thus air vibrations are predominately influenced by the weather conditions at the time of the blast, and therefore weather conditions will be monitored before any blasting event is scheduled or undertaken for this Project.

The Noise Impact Assessment report is provided in Appendix D.

6.2.6 Mitigation

Mitigation measures planned for the Project to ensure applicable noise guidelines are met are detailed in Table 6.2-6.

Table 6.2-6 Noise Mitigation Measures

Project Phase	Mitigation Measure
Construction	Haulage road network and layout of Project infrastructure will be designed to reduce haul distances, where practicable.
	Haulage road network will be designed to limit use of back up beepers of haul trucks and highway trucks, where possible.
	Trees and other vegetation will be left in place and/or vegetative bugger will be established to minimize nuisance noise near the PA boundary.
	Project has been designed to provide the greatest setback to nearby sensitive receptors, where possible.
	Project infrastructure will be designed to minimize noise emissions, where possible.

Project Phase	Mitigation Measure
Construction, Operation and Closure	Conduct Project orientations for all contractors, mine employees and other applicable Project personnel about behavioral practices, and proper operation of equipment to limit unnecessary noise, where possible.
	Limit unnecessary shouting, slamming of doors, or use of loud stereos/radios
	Drop heights will be reduced to be as close to the pile as possible, during dumping and/or movement of waste rock, topsoil, and overburden to limit dust generation.
	Equipment, vehicles, and haul trucks will be maintained in good working order. To reduce emissions, idling times and cold starts will be limited, where practicable.
Construction, Operations, and Closure	If blasting is conducted, a technical blast design will be prepared by a qualified blasting contractor. Blasts will be designed to meet the prescribed ground vibration and air concussion limits are achieved. A monitoring plan will be implemented to record vibration and overpressure for each blast
	Equipment and vehicles will be restricted to defined work areas and the established haulage road network

6.2.7 Monitoring and Follow-up

Follow-up monitoring is intended to verify the accuracy of predictions made through modelling, to assess the implementation and effectiveness of mitigation, and to manage adaptively, as required. Based on the results presented in the Noise Impact Assessment (Appendix D), noise monitoring is not required; however, compliance monitoring will be conducted, where required by permitting or regulations.

Noise monitoring locations can be set up any time throughout the duration of the Project should complaints be received related to Project noise. Results of noise monitoring will be compared to baseline levels and applicable guidelines. Should an unexpected deterioration of the environment be observed as part of monitoring, intervention mechanisms such as additional noise mitigation measures may be put in place to address it.

6.2.8 Residual Effects and Significance

Residual effects of the Project on noise levels are anticipated to be adverse, but not significant. After appropriate mitigation measures have been implemented, the overall residual effect of the Project on noise is assessed as not likely to have a significant adverse effect, as summarized in Table 6.2-7.

A significant adverse effect on the noise VC was defined in Section 6.4.4.3 as:

– Noise levels resulting from Project activities that exceed the NSECC Guidelines for Environmental Noise Measurement and Assessment (2023a) beyond the PA at fixed sensitive receptors (i.e., human receptors – seasonal and permanent dwellings).

Table 6.2-7 Residual Effects of Nosie

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction –clearing, grading, and grubbing, haul road construction, water management	Construction activities limited to daytime hours on weekdays Equipment and vehicle maintenance	A	L Noise levels exceed background levels beyond the PA but comply with applicable guidelines	LAA	N/A	MT Construction will occur over approximately 2 years.	C	RE Noise will return to baseline conditions before or after Project activities have been completed.	Increased ambient noise	Not significant
Operations – mining, processing, overburden and waste rock management, water management, waste management	Operation limited to daytime hours on weekdays Surface miners primary method of extraction Equipment and vehicle maintenance Establish / maintain vegetative buffer	A	L Noise levels exceed background levels beyond the PA but comply with applicable guidelines	LAA	N/A	LT Occurring during operation (23 year)	C	RE Noise will return to baseline conditions before or after Project activities have been completed.	Increased ambient noise	Not significant
Construction, operation, and closure – truck traffic and operation of heavy equipment	Operation limited to daytime hours on weekdays Equipment and vehicle maintenance	A	L Noise levels exceed background levels beyond the PA but comply with applicable guidelines	LAA	N/A	LT Occurring during operation (23 year)	C	RE Noise will return to baseline conditions before or after Project activities have been completed.	Increased ambient noise	Not significant
Closure – demolition and earthworks	Equipment and vehicle maintenance	A	L Noise levels exceed background levels beyond the PA but comply with applicable guidelines	LAA	N/A	MT Occur during closure (2 years)	C	RE Noise levels will return to baseline conditions before or after Project activities have been completed.	Increased ambient noise	Not significant

Legend (refer to Table 6.2-4- for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	RE – Reversible IR – Irreversible PR – Partially Reversible

6.3 Geology, Soil, and Sediment

6.3.1 Rationale for Valued Component Selection

Geology, soil, and sediment are selected as a VC due to the potential for sediment laden runoff from Project infrastructure to be transported to nearby watercourses and wetlands, and for fine sediment particles to mobilize into the air. Soil and sediment quality may facilitate exposure of birds, fauna, and fish to contaminants through ingestion, and may decrease the water quality of local waterbodies in the event of a sediment release. Sediment releases, whether aquatic or in the air, additionally have the potential to be visibly identified by stakeholders, including the general public.

6.3.2 Baseline Program Methodology

A series of drilling programs were carried out within the PA by a variety of companies since 1952 (Ausenco, 2024). Drilling programs were primarily conducted to explore potential lead, zinc, barium, and gypsum deposits. CertainTeed has conducted a variety of drilling programs since 2022, which focused on deposit delineation and hydrogeologic exploration. Table 6.3-1 provides an overview of known drilling programs which have occurred since 1952.

Table 6.3-1 Historic Drilling Programs Summary

Years	No. Holes	Company
1952	2	Gays River Lead and Zinc Mines
1967	1	Magnet Cove Barium
1972 to 1975	21	Getty Mines
1973	1	Riocanex
1973 to 1975	48	Imperial Oil Ltd.
1982	1	Province of Nova Scotia
1989	1	Westminer Canada Ltd.
1991	33	National Gypsum Ltd.
1997	3	Can Nova Goldfields
2001 to 2002	39	Lafarge
2007	9	Can Nova
2022	6	CertainTeed
2023	12	CertainTeed
2024	16	CertainTeed

During drilling programs conducted by both Lafarge and CertainTeed, logs of drilled core were collected which detailed the characteristics of the soil, overburden, and bedrock, including general composition, depths to features, and moisture content. These descripting factors contributed to a thorough understanding of baseline geology, soil, and sediment conditions.

All drilling for CertainTeed between 2022 and 2024 was carried out by Logan Drilling Group of Stewiacke, NS. The 2022 and 2023 drilling programs were conducted in support of geologic modelling, with documentation of geologic features such as contacts and inclusions occurring prior to geochemical analysis of crushed core samples at the Minerals Engineering Centre (MEC) at Dalhousie University. Core collected in 2022 was 63.5 mm diameter, and 61.1 mm diameter in 2023. The 2024 drilling program was conducted primarily to investigate the hydrogeologic conditions within the PA, installing 50 mm diameter PVC groundwater wells topped with protective steel casings in nests of 2 to 3 wells of increasing depths at each location. Mercator and Terrane Geoscience Inc. oversaw the 2022 and 2023 exploration drilling programs, while GHD provided oversight for the 2024 hydrogeology drilling program. A summary of CertainTeed drilling programs conducted from 2022-2024 are presented in Table 6.3-2, with Figure 6.3-1 depicting locations, below.

Table 6.3-2 Borehole Locations and Depths

Year	Borehole ID	Borehole Location (NAD 1983 UTM 20N)		Depth (mbgs[1])
		Easting	Northing	
2022	22-ANT-01	473055	4982300	39.7
2022	22-ANT-02	472949	4982775	32.5
2022	22-ANT-03	472576	4982521	53.4
2022	22-ANT-04	473747	4982801	39.6
2022	22-ANT-05	473771	4983225	46.1
2022	22-ANT-06	473322	4983376	33.8
2023	ANT-2023-07	474223	4984573	30
2023	ANT-2023-08	474149	4984163	41
2023	ANT-2023-09	474480	4983604	61
2023	ANT-2023-10	475028	4983554	36
2023	ANT-2023-11	474860	4983951	58
2023	ANT-2023-12	474512	4984156	62
2023	ANT-2023-GT-01	473585	4983850	62
2023	ANT-2023-GT-02	473749	4984289	39
2023	ANT-2023-GT-03	474096	4984864	29
2023	ANT-2023-GT-04	474149	4983776	51
2023	ANT-2023-GT-05	474661	4983180	57
2023	ANT-2023-GT-06	474579	4984712	42
2024	MW-1A	473454	4983993	10.02
2024	MW-1B	473454	4983993	32.4
2024	MW-1C	473454	4983993	50.3
2024	MW-2A	473750	4984286	15.6
2024	MW-2B	473750	4984286	21.6
2024	MW-3A	474239	4984317	23.77
2024	MW-3B	474239	4984317	29.4
2024	MW-4A	474191	4983752	6.6
2024	MW-4B	474191	4983752	18.3
2024	MW-5A	474693	4983995	9.1
2024	MW-5B	474693	4983995	40.8
2024	MW-6A	475159	4983835	27.4
2024	MW-6B	475159	4983835	38.1
2024	MW-7A	475093	4983480	7.04
2024	MW-7B	475093	4983480	30.2

Year	Borehole ID	Borehole Location (NAD 1983 UTM 20N)		Depth (mbgs[1])
		Easting	Northing	
2024	MW-7C	475093	4983480	48.86
[1] mbgs – metres below ground surface				

6.3.3 Baseline Conditions

6.3.3.1 Regional Geology

The Antrim gypsum and anhydrite deposit is hosted by a Lower Carboniferous sedimentary succession, which is further contained within a regionally extensive depositional basin termed the 'Maritimes Basin. This basin is estimated to be 12 km thick and encompasses a large portion of both onshore and offshore Eastern Canada, stretching from southwestern New Brunswick (NB) to the continental margin located at the eastern Grand Banks of Newfoundland (Gibling et al, 2008).

The deposit is part of the Windsor Group, represented in multiple sub-basins across the Province of NS. The basic sequence of depositional cycles present is broadly similar throughout the Windsor Group, but differences between geographic areas have important implications with respect to thickness of the Windsor Group evaporites, as well as the amount of erosion and hydration that now characterize those sequences.

Geological information pertaining to the Windsor Group referred to in this report directly reflects nomenclature and interpretations on the Nova Scotia Department of Mines and Energy Map 82-4 of the Shubenacadie and Musquodoboit basins (Giles and Boehner, 1982). Descriptions of glacial deposits and their spatial extents that are referenced in this report reflect regional interpretations and nomenclature presented by Stea et al. (1992).

Windsor Group evaporites occur in NS in five cycles. The lowermost cycle (Major Cycle 1) contains the most extensive thickness of evaporite in the province and is represented in central NS by carbonates of the Macumber and Gays River Formations plus thickly bedded evaporites of the Carrolls Corner Formation. Carrolls Corner Formation and Gays River Formation strata underlie the PA above metamorphosed and folded Cambro-Ordovician sequences. Siliciclastic units of the Meaghers Grant Formation locally occur along the southern edge of the Musquodoboit Basin and are in part laterally equivalent to the Carrolls Corner Formation.

Deposits of Cretaceous Age sediments associated with karsted and collapsed evaporite units are locally present throughout the Musquodoboit and adjacent Shubenacadie Basins and were explored to varying degrees for clay and silica sand potential.

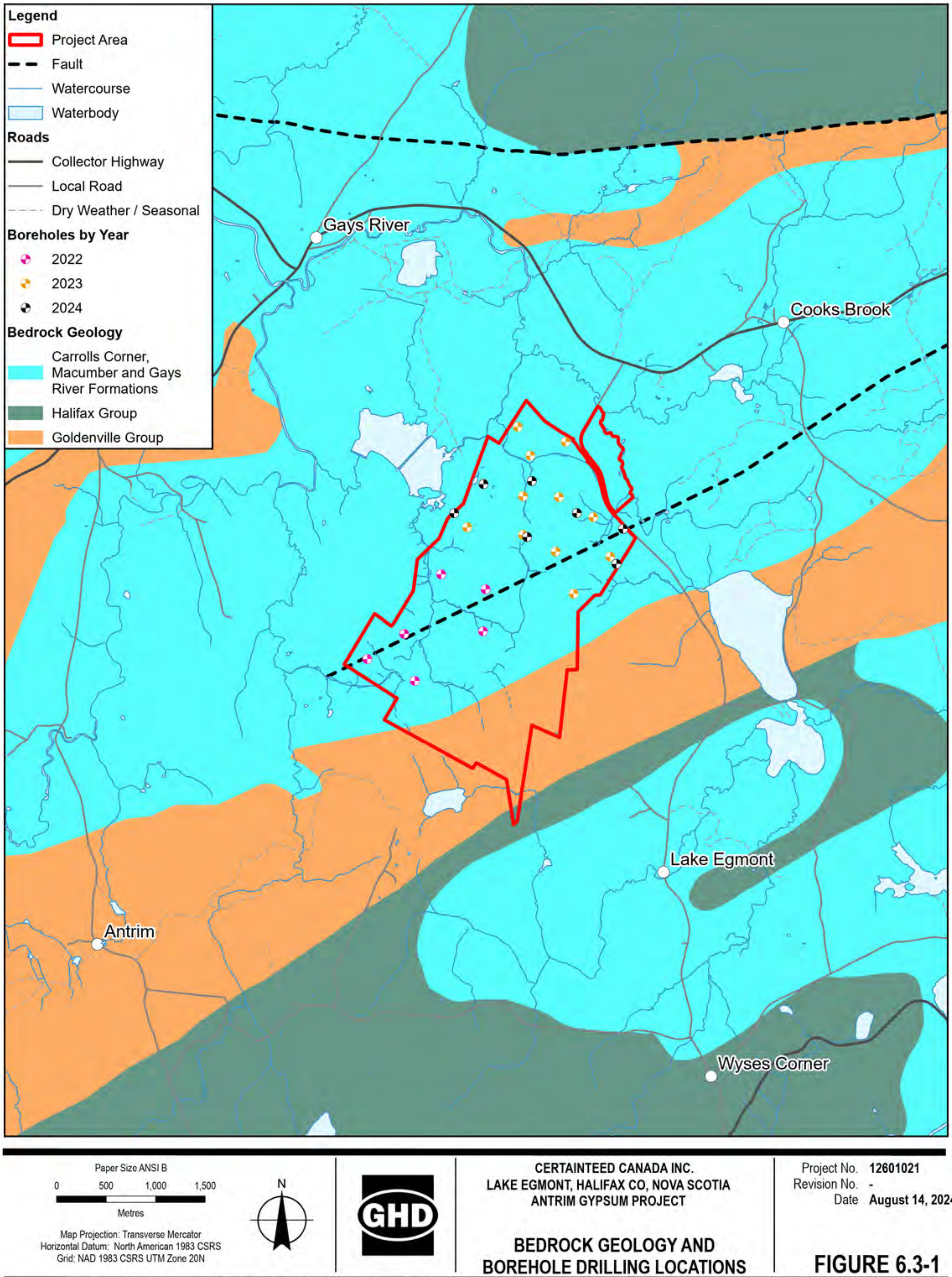
The Musquodoboit Basin that hosts the PA contains numerous other gypsum occurrences and deposits due to the wide lateral extent of Major Cycle 1 and Major Cycle 2 units. The Murchyville gypsum deposit is the largest of these that is publicly reported and occurs on the south margin of the basin between the Carrolls Corner Formation and the Meaghers Grant Formation.

6.3.3.2 Local Geology

The PA is entirely located within the Cooks Brook Syncline (Giles and Boehner, 1982), and is primarily comprised of the Carrolls Corner Formation, which is underlain by the Gays River Formation and Meguma Supergroup basement sequences. The Carrolls Corner Formation hosts the gypsum and anhydrite deposits of interest and is composed of a thick succession of anhydrite and lesser gypsum, with relatively minor amounts of interbedded dolostone and mudstone. Near the surface of the Formation, karst is present in the form of collapse zones and sinkholes. Karst features range in age, with some predating the local glacial till deposits. Karst-fill sediment is common and is characterized by grey, unconsolidated to semi-lithified clay, mud, breccia and sand. The Gays River Formation, formed prior to the deposition of the Carrolls Corner Formation, is comprised of dolomitized carbonates facies which were found to contain algal, coral and bryozoan bafflestones, skeletal packstones and wackestones. The Meguma Supergroup basement sequence is present in the southernmost portion of the PA, and is divided into two groups, the Goldenville Group, and the Halifax Group. The Goldenville Group forms the lower part of the Meguma Supergroup and consists of meta-greywacke and meta-siltstone. The Halifax Group forms the upper part of the Meguma Supergroup and is comprised of thinly bedded slates and sandy siltstone.

The Cooks Brook Syncline dominates the structural geology of the area, trending northeast with the hinge traversing through the centre of the PA. Parallel to the syncline, the steeply dipping Chaswood Fault similarly trends in a northeast direction approximately 1 km to the south of the syncline, however the specific location of this fault is poorly defined. The bedrock area surrounding this fault may show deeper than average depths of gypsum development due to enhanced hydration associated with fault corridor fracturing and water flow.

Lithology recorded during the 2022 and 2024 drilling programs conducted within the Carrolls Corner and Gays River Formations confirm a dominant bedrock type of anhydrite, followed by gypsum. Lesser amounts of limestone, dolostone, and fine-grained sedimentary rocks were additionally occasionally reported, with the sedimentary deposits potentially attributed to karst-fill features. Anhydrite and gypsum were frequently reported to be intermixed, with varying degrees of competence. Drilling was not conducted within the Goldenville or Halifax Groups. Drilling program results were found to be closely aligned with publicly available reports and provincial mapping. The local bedrock geology and the locations of drilling conducted by CertainTeed in 2022-2024 are provided in Figure 6.3-1, below.



Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

GHD

CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

BEDROCK GEOLOGY AND BOREHOLE DRILLING LOCATIONS

Project No. 12601021
Revision No. -
Date August 14, 2024

FIGURE 6.3-1

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Print date: 14 Aug 2024 - 11:54

Attribution: GeoNova, GHD, DP ME 43, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological Map of the Province of Nova Scotia, Scale 1:500 000, Compiled by J. D. Keppie, 2000. Created by: rwilson2

6.3.3.3 Surficial Geology

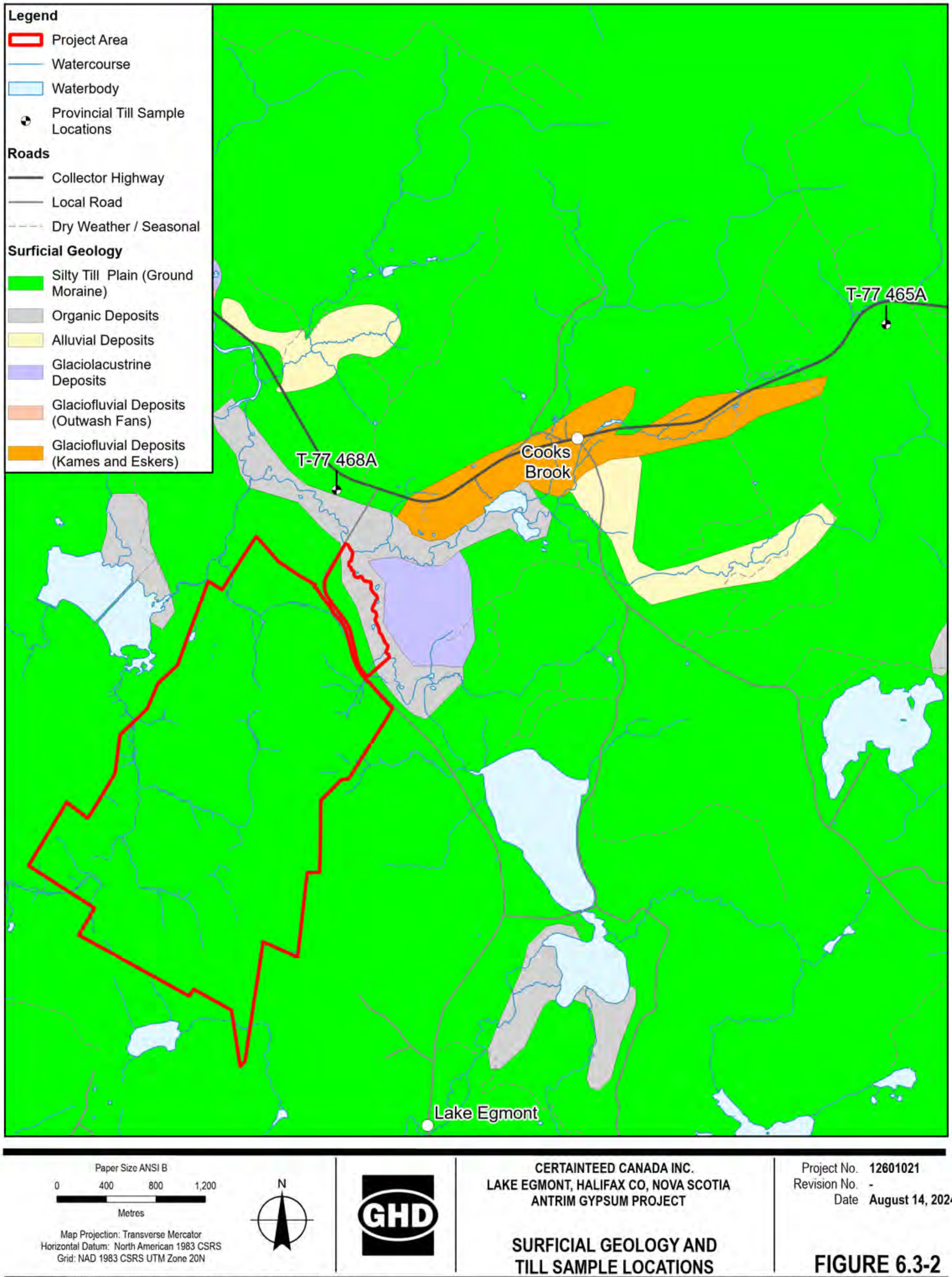
Thick and continuous glacial till (Hants Till of Stea et al, 1992) occurs across the PA and few bedrock exposures are currently known within PA limits. The till section is composite in nature and was deposited during the mid to late Wisconsin glacial episode, ending approximately 11,000 years ago. It has a silty matrix and variable exotic clast content. Drumlin features within the overburden section are characterized by an abundance of far travelled (>30 km) cobbles and boulders. Drilling results and field exposures on the PA show that overburden thickness ranges from less than 5 m to 50 m or more. LiDAR imagery of the area shows that northwest trending drumlinoid features characterize areas of thickest till accumulation. Provincial surficial geology mapping describes the local till as being a silty till plain sourced from ground moraine deposits, with till material being sourced from glacial melt (Hants Till of Stea et al, 1992). The local surficial geology and the locations of till sampling are provided in Figure 6.3-2, below.

Between 1982 and 1985, the Mineral Resources Branch of NSDNRR conducted widescale till sampling and mapping over northern mainland NS with the intent of creating a georeferenced dataset of provincial till geochemistry (NSDNRR, 2006). Samples were collected at depths of 1 to 2 meters, and characterized by their sediment grain size, parent bedrock, and geochemical compositions. Of this dataset, sample numbers T-77 465A and T-77 468A, share the same bedrock and surficial geology features as the Project, and are geographically close to the PA. Geochemical analytical results for these samples, as provided by NSDNRR, are summarized in Table 6.3-3, below. Geochemical concentrations are measured in parts per million (ppm).

Table 6.3-3 Baseline Provincial Till Sampling Summary

Sample ID	T-77 468A	T-77 465A
Coordinates (UTM NAD 20)	474780.34, 4985278	479222.02, 4986615.1
Distance to PA (m)	440	4 650
Sample Depth (m)	2	2
Arsenic (ppm)	7.2	10.4
Barium (ppm)	0	0
Cadmium (ppm)	0.1	0.1
Calcium (ppm)	108	106
Cobalt (ppm)	17.6	18.2
Copper (ppm)	37.4	41.4
Iron (ppm)	5.28	5.34
Lead (ppm)	26	26
Magnesium (ppm)	8180	7420
Manganese (ppm)	1580	1140
Mercury (ppm)	0.11	0.24
Molybdenum (ppm)	0.65	0.55
Nickel (ppm)	50.8	43.2
Silver (ppm)	0.1	0.1
Tin (ppm)	1	1
Tungsten (ppm)	50	40
Uranium (ppm)	0.2	0.2
Zinc (ppm)	240	200

Till geochemistry may be influenced by local bedrock but is typically predominantly sourced by parent material being removed and transported during glacial periods.



Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

GHD

CERTAINTEED CANADA INC.
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

SURFICIAL GEOLOGY AND TILL SAMPLE LOCATIONS

Project No. **12601021**
Revision No. **-**
Date **August 14, 2024**

FIGURE 6.3-2

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Print date: 14 Aug 2024 - 11:59

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6.3.3.4 Topography

The topography of the area is defined by historic glacial activity and the presence of karstic evaporitic bedrock. Gentle rolling hills were formed during the Wisconsonian Glaciation, ending approximately 11,000 years ago, with smaller landforms such as sinkholes formed via the dissolution of bedrock. Elevation is variable across the Project, with wetlands and watercourses situated in some areas of low relief. Generally, the elevation ranges from approximately 85 masl to 20 masl, with the lowest elevations located adjacent to the Gays River.

6.3.3.5 Soils and Sediments

Provincial soil mapping indicates that the Project is located within the 'Wolfville' soil unit (Agriculture and Agri-Food Canada, 1972). Wolfville soil is classified primarily as soil type ST5 (NSDNRR, 2007), which is described as being a fine to medium textured soil dominated by silt, clay, and sandy loams. Drainage is variable dependant on slope and subsoil permeability but is generally considered moderately to well drained (NSDNRR, 2011). Soil is highly acidic at the surface, with decreasing acidity at depth. The Wolfville soil unit is typically found in areas of undulating till and drumlin plains, which is reflected in the surficial geology at the Project. Field data from the 2023 and 2024 drilling programs document overburden comprised primarily of red-brown sandy loams, silts and clays, which aligns with the provincial soil mapping data.

6.3.3.6 Metal Leaching and Acid Rock Drainage

Metal Leaching and Acid Rock Drainage (ML/ARD) occurs when naturally occurring sulphide minerals in rock and overburden are exposed to oxygen and water, resulting in sulphide mineral oxidation. This reaction produces iron-oxides, sulphide minerals, and sulphuric acid which are released into contact water. The acidic runoff can mobilize metals including iron, arsenic, manganese, and copper from the surrounding bedrock, releasing them into the environment as well.

ML/ARD is also commonly known as Acid Mine Drainage (AMD), as the reaction frequently occurs at mine sites through the exposure of sulphide bearing minerals via mining activities. As described in Section 6.3.3.2, sulphide-bearing Meguma Supergroup sequences are present at the local geology scale. Drilling programs conducted within the Carrolls Corner and Gays River Formations did not come in to contact with the basement Meguma bedrock. Open pit development is limited to the Carrolls Corner and Gays River Formations, which are composed of gypsum and anhydrite and therefore are not ML/ARD generating. ML/ARD is not considered to be at risk of occurring at the Project.

6.3.4 Effects Assessment Methodology

6.3.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

Spatial Boundaries

The spatial boundary used for the assessment of effects to geology, soil, and sediment are defined below:

- The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs.
- The LAA encompasses the Annand Brook catchment as well as portions of the Gays River catchment. This is reflective of Surface Water Resources spatial boundaries discussed in Section 6.5, as watercourses are a receiving environment for sediment.
- The RAA corresponds to the extent of the groundwater flow model domain. This is reflective of the Groundwater Resources spatial boundaries discussed in Section 6.4, as the groundwater flow model domain encompasses all Project and groundwater VC interactions, and groundwater chemistry is influenced by bedrock geochemistry.

As the Project has the potential to cause direct and indirect impacts to geology, soil, and sediment outside of the PA, the LAA is considered the most appropriate spatial boundary for this assessment.

Temporal Boundaries

The temporal boundaries used for the assessment of effects of the Project includes the construction, operations, and closure phases.

Technical Boundaries

No technical boundaries were identified for the effects assessment of geology, soil, and sediment.

Administrative Boundaries

There are no regulatory conditions regarding geology. Should ARD monitoring be undertaken in the future, monitoring and sampling procedures will follow the criteria outlined in the *Sulphide Bearing Material Disposal Regulations.*

6.3.4.2 Thresholds for Determination of Significance

Table 6.3-4 provides the quantitative measure or definition of qualitative categories for magnitude, duration, and frequency, specific to geology, soils, and sediments. Geographic extent, timing, and reversibility are consistent with the other VCs.

Table 6.3-4 Characterization Criteria for Environmental Effects

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N –** minimal sediment and erosion potential associated with Project activities within the PA. **L –** potential for sediment and erosion within a small, isolated area of the PA **M –** potential for sediment and erosion within the PA and the potential to enter a sensitive habitat (i.e. wetland or watercourse) **H -** potential for sediment and erosion within the PA with effects at the LAA
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – direct and indirect effects from Project activities are restricted to the LAA **RAA** – direct and indirect effects from Project activities are restricted to the RAA
Timing	**N/A** – seasonal aspects are unlikely to affect geology, soils, or sediments. **A** – seasonal aspects may affect geology, soils, or sediments
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months **MT** – effects can occur beyond 12 months and up to 3 years **LT** – effects extend beyond 3 years **P** – valued component unlikely to recover to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – Soils, and sediments will recover to baseline conditions before or after Project activities have been completed **PR** – mitigation cannot guarantee a return to baseline conditions **IR** – effects to soils, and sediments are permanent and will not recover to baseline conditions

A significant adverse effect to geology, soil, and sediment is defined as:

– A Project-related effect of high magnitude, potential for regional geographic extent and for medium to long term duration, occurring at any frequency, and is partially reversible to irreversible.

6.3.5 Project Interactions and Potential Effects

Potential Project interactions with geology, soil, and sediment are presented in Table 6.3-5, below.

Table 6.3-5 Project Activities and Geology, Soils, and Sediments Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Topsoil, overburden, and waste rock management Surface infrastructure installation and construction Haul road construction Collection ditch and settling pond construction General waste management
Operations	Gypsum management (extraction, loading, hauling, screening) Topsoil, overburden, and waste rock management Water management Haul road construction and maintenance Petroleum products management Maintenance and repairs General waste management
Closure and Reclamation	Demolition Earthworks Water treatment General waste management

Disturbances to geology, soils, and sediment as caused by Project activities have the potential to cause adverse effects through all Project phases. Removal and relocation of overburden and natural material is anticipated to occur to varied degrees across the Project, including but not limited to the open pit, processing area, stockpiles, and haul roads. Sediment mobilization may occur through either fine particle release into the air, or collection via water movement such as sheet runoff. Airborne sediment particles may reduce visibility to personnel and wildlife, introduce fine metals and sediment particulates into the air, and distribute to nearby habitats where either vegetation is coated, or sediment enters waterbodies. During rain events, loose sediment may interact with runoff, where the water with elevated turbidity is then transported to waterbodies or wetlands. Sediment releases during the closure and reclamation phases may occur as a result of recontouring slopes and pit rehabilitation.

6.3.6 Mitigation

Project mitigation measures protective of geology, soil, and sediment are detailed in Table 6.3-6 below.

Table 6.3-6 Geology, Soil, and Sediment Mitigation Measures

Project Phase	Mitigation Measure
Construction	Minimize disturbed areas to the extent practical.
	Clearing associated with road construction will be limited, where possible, to the width required for the road embankments and drainage areas.
	Erosion and sediment control measures will be established and detailed in an ESC Plan, completed, and submitted as part of the Industrial Approval application.
	Disturbed areas will be monitored to ensure erosion and sediment control measures are maintained / effective and to identify if additional mitigation is required.
	Road and site grading will be directed away from wetlands and watercourses, where possible.

Project Phase	Mitigation Measure
	Overburden and topsoil material will be separated and stockpiled separately during clearing and stripping activities. Material cleared will be stockpiled separately for use during progressive reclamation and closure activities
	Topsoil and overburden stockpiles will be developed with appropriate buffers (30 m) to wetlands and watercourses where possible. Ditching around stockpiles will collect run-off material for treatment of TSS prior to discharge to the receiving environment
	Sediment control fences will be installed, as required, in areas (e.g., slopes and embankments) where organic material and till have the potential for erosion and siltation to occur. Sediment control fences will be inspected and maintained until the disturbed areas have stabilized and revegetation has occurred.
	Dust control measures will be established and detailed in a Fugitive Dust Management Plan, to be submitted prior to construction commencement.
Operations	Surfaces of stockpiles (i.e. organic, overburden, etc.) will be stabilized via vegetating or covering exposed surfaces if there are extended periods of time between use.
	Settling ponds will be constructed and used to allow TSS in surface water runoff and water pumped from the open pit to settle prior to discharge to the natural environment.
	Settling ponds will be constructed with a mechanism to stop discharge if TSS exceeds acceptable water quality parameters. All surface water discharges from settling ponds to the natural environment will be monitored as per requirements outlined in the Industrial Approval, to ensure water quality conforms to applicable regulations and guidelines.
	Precipitation runoff from stockpiles, open pit, and disturbed areas for Project activities will be collected and directed to associated water management infrastructure.
	Water management infrastructure will be designed to reduce erosion and sedimentation and will be inspected regularly to ensure it is maintained and functioning adequately.
	Mitigation measures outlined in the ESC Plan and the Fugitive Dust Management Plan will be adhered to and maintained.
Closure and Reclamation	Disturbed areas will be graded and/or scarified, covered with organic material and till, where required, and seeded with native seed mix representative of natural conditions to promote natural plant colonization and succession.
	Volume of organic material and till required for rehabilitation will be tracked to ensure sufficient material is available for reclamation.

6.3.7 Monitoring and Follow-up

Prior to construction commencing, CertainTeed will conduct soil sampling within the PA to verify local soil chemistry. The effectiveness of erosion and sediment control measures will be monitored as described in the ESC Plan, to be developed and submitted as part of the IA application. The Surface Water Monitoring Plan will include mitigation measures for unplanned releases to sediment to waterbodies. Monitoring of surface water is further discussed in Section 6.5.7. Similarly, a Fugitive Dust Management Plan will detail the monitoring and management of airborne particulates, including sediments released by Project activities. Air quality is further discussed in Section 6.1. Results of monitoring programs will be provided in the Industrial Approval Annual Report, submitted to NSECC.

6.3.8 Residual Effects and Significance

Residual effects of the Project on geology, soil and sediment are anticipated to be adverse, but not significant. After appropriate mitigation measures have been implemented, the overall residual effect of the Project on noise is assessed as not likely to have a significant adverse effect, as summarized in Table 6.3-7.

A significant adverse effect on the noise VC was defined in Section 6.4.4.3 as:

– A Project-related effect of high magnitude, potential for regional geographic extent and for medium to long term duration, occurring at any frequency, and is partially reversible to irreversible.

Residual effects resulting from sediment releases via waterbodies are further addressed in the Surface Water Resources VC (Section 6.5).

Table 6.3-7 Residual Effects of Geology, Soils, and Sediments

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, Operation, and Closure – Discharge of sediment laden runoff to watercourses and wetlands	Erosion and sediment controls Water management infrastructure Progressive reclamation of stockpiles	A	M	LAA	N/A	LT Potential for sediment laden runoff during all phases of the Project	S With the implementation of proper mitigations, the effects occur at irregular intervals throughout the Project.	PR	Watercourse siltation	Not significant
Construction, Operation, and Closure – Airborne mobilization of fine sediments	Erosion and sediment controls Fugitive dust management	A	M	LAA	N/A	LT Potential for air mobilization during all phases of the Project	S With the implementation of proper mitigations, the effects occur at irregular intervals throughout the Project.	PR	Decreased air quality and visibility	Not significant
Legend (refer to Table for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area		Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic RE – Regular C – Continuous	Reversibility RE – Reversible IR – Irreversible PR – Partially Reversible			

6.4 Groundwater Resources

6.4.1 Rationale for Valued Component Selection

Groundwater resources was selected as a VC for its significance to ecological, and socioeconomic systems. Groundwater resources provide ecological value by supporting surface water flows and wetlands providing habitat for aquatic and terrestrial species that rely on accessible water sources for their survival. Socially and economically, groundwater resources can provide a source of water, potable or otherwise, to municipal, agricultural, industrial, and recreation sectors, among others. Groundwater quantity and/or quality may be changed due to the activities associated with Project construction, operation, and closure. Groundwater quality is provincially and federally regulated via many legislative avenues within the NS *Environment Act* and several of its regulations. The regulations are protective of ecological receptors, as well as the health of the general public.

During various Project activities, there is a potential for direct adverse effects to groundwater quantity. Project activities such as dewatering the open pit, have the potential to drawdown (lower) the groundwater table adversely impacting the quantity of groundwater available for use (e.g., potable consumption). There is also a potential for impacts to groundwater quantity to indirectly impact other VCs including surface water, wetlands, fish and fish habitat, terrestrial, and Indigenous Peoples. Where impacts to groundwater may affect other VCs, the impacts to those VCs are discussed in the section of the impacted VC (i.e., groundwater impacts are incorporated into the surface water assessment as discussed in Section 6.5 (Surface Water Resources)).

6.4.2 Baseline Program Methodology

To assess baseline groundwater quantity and quality conditions, GHD developed an understanding of the regional and Project-specific hydrologic, geologic, and hydrogeologic conditions through the review and compilation of publicly available and information through Project-specific hydrogeologic investigations. Project-specific investigations included monitoring well installation, groundwater elevation monitoring, hydraulic conductivity testing, and groundwater quality sampling. The review and compilation of regional and Project-specific data forms the basis for developing a hydrogeologic Conceptual Site Model (hCSM) to describe the key components of the hydrogeologic system with respect to groundwater quantity under baseline conditions. At the time of hCSM and subsequent groundwater flow model development, three monitoring wells (Ausenco, 2024) were available within the PA in addition to regional groundwater elevation data outside the PA. While the available groundwater elevation monitoring data can provide inform the typical range in depth to groundwater in the region, the installation of additional monitoring wells and subsequent groundwater elevation monitoring events will be required to calibrate a groundwater flow model to baseline conditions within the PA. To address this limitation, GHD developed the 3D numerical groundwater flow model for the specific purpose of providing a conservate estimate of potential impacts due to Project development. Rather than focusing model calibration on reflecting groundwater elevations at three monitoring wells which are insufficient to develop a model calibration, emphasis was placed on assigning model property values such that the model would tend to overpredict potential Project impacts on groundwater quantity and a conceptual calibration was completed to confirm that the model reproduced the typical range in depth to groundwater in the region. The development of the model to provide a basis to conservatively estimate potential Project impacts as described in Appendix E.1.

6.4.2.1 Review and Compilation of Regional and Project-Specific Hydrologic, Geologic, and Hydrogeologic Data

GHD reviewed historical and recent data to develop an understanding of the regional and Project-specific hydrologic, geologic, and hydrogeologic conditions. Reviewed publicly available data included:

- Surficial soil and geologic mapping developed for NS
- Drillhole records available through the NS Drillhole and Drill Core Database (NSDNRR, 2024)
- Regional recharge and baseflow mapping

– Reports on regional groundwater quantity
– Climatic data

In addition to the above-mentioned sources, GHD reviewed the NS Well Logs Database (NSECC, nd) to identify water supply wells and private wells located within or in the vicinity of the PA. The NS Well Logs Database also provided information on geologic conditions, groundwater elevations, and well yields.

6.4.2.2 Project Specific Hydrogeologic Investigation

Project-specific hydrogeological investigations were conducted by Ausenco (2024) and through the Phase 1 Hydrogeologic Investigation (Appendix E.2) to collect detailed geologic and hydrogeologic information within the PA. Ausenco (2024) described the installation and hydraulic testing of three monitoring well locations, TGI-GT-02, TGI-GT-04, and TGI-GT-05, which were installed in 2023. Two rounds of groundwater elevation monitoring were completed at, TGI-GT-02, TGI-GT-04, and TGI-GT-05. Additional monitoring well locations were selected by GHD in 2024 to provide spatial coverage over the PA and to focus on collecting detailed geologic and hydrogeologic information near the proposed Project infrastructure. Monitoring well locations are constrained by property access agreements, Crown land use permits, and offsets from environmentally sensitive areas. Additional monitoring wells are planned for the Crown land component of the PA. CertainTeed is currently awaiting approval for the installation of the additional wells.

For the 2024 drilling and monitoring well installations Logan Drilling Inc. used a rubber track mounted CME 55 rig. Drilling and monitoring well installation was overseen by GHD field staff. The seven drilling locations are presented on Figure 6.4-1, and installation details of the 16 monitoring wells installed to date for long-term monitoring (including TGI-GT-02 and TGI-GT-04 which are renamed to MW2A and MW4A, respectively) are listed in Table 6.4-1. Figure 6.4-1 also presents monitoring well locations proposed to be installed during Phase 2 hydrogeologic investigations. TGI-GT-05 is not included for long-term monitoring as the monitoring well will be decommissioned for the construction of Project infrastructure. A total of sixteen monitoring wells, excluding TGI-GT-05, were installed within individual boreholes at each drilling location. Between two and three monitoring wells were installed at each location. Monitoring wells labelled ‘A’ and ‘B’ were installed to approximately 6.6 to 69 mbgs and 18 to 41 mbgs, respectively, and wells labelled ‘C’ were installed to depths ranging from 48 to 50 mbgs. The detailed methodology for monitoring well installation, development, hydraulic conductivity testing, monitoring, and sampling is presented the Phase 1 Hydrogeological Investigation Technical Memorandum in Appendix E.2. The methodology for hydraulic conductivity testing, groundwater elevation monitoring and sampling is briefly summarized in the sections that follow.

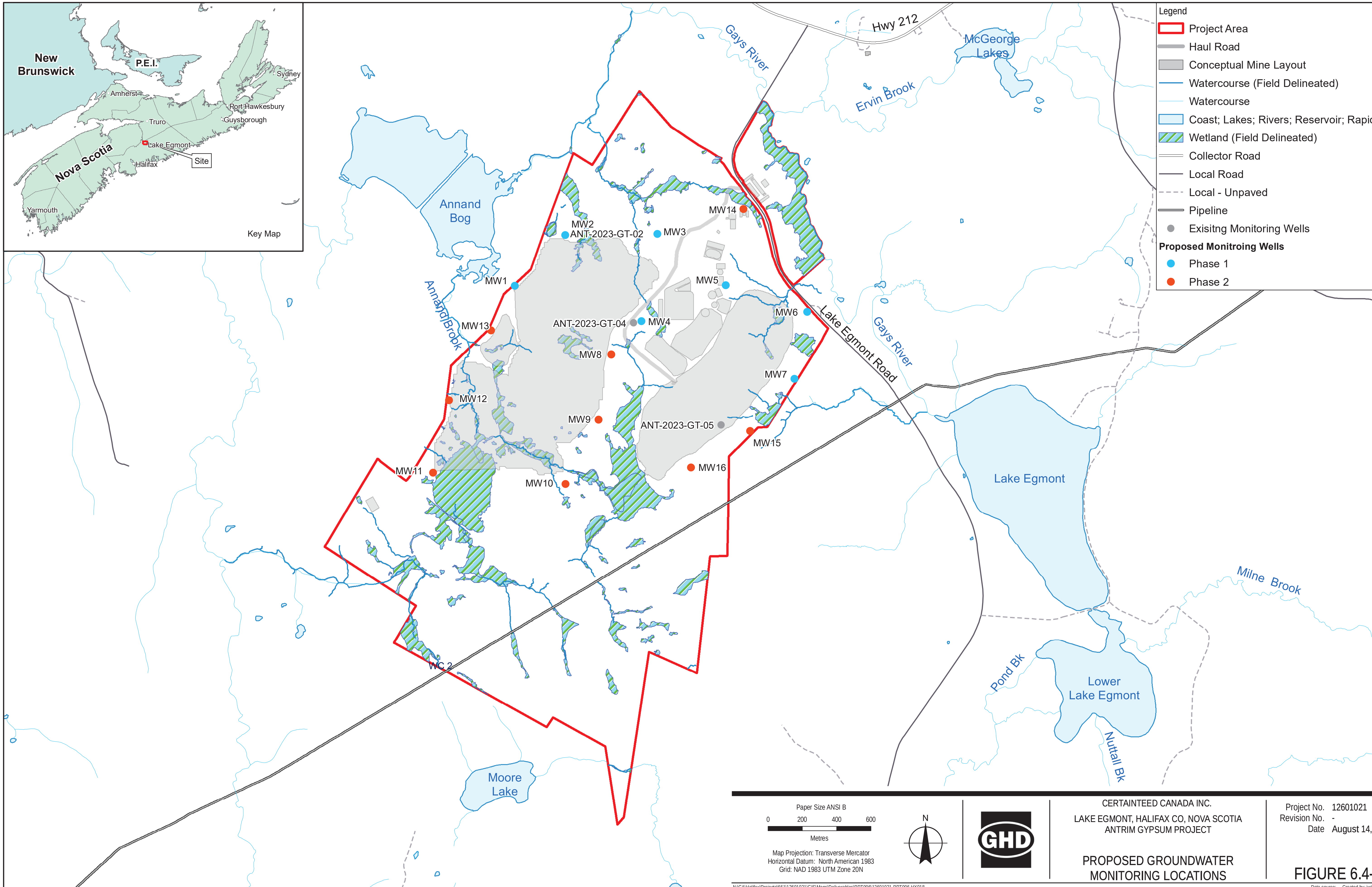


FIGURE 6.4-1 PROPOSED GROUNDWATER MONITORING LOCATIONS

Table 6.4-1 Monitoring Well Locations and Depths

Monitoring Well ID	Approximate Well Location (NAD 1983 UTM 20N)		Recorded Drilled Depth (mbgs[1])	Screened Interval (mbgs)	Reference Elevation[2] (masl[3])	Installation Date
	Northing (m)	Easting (m)				
MW-1A	4983993.1	473454.6	10.02	6.0 – 9.1	-	May 23, 2024
MW-1B	4983993.1	473454.6	32.4	29.0 – 32.0	-	May 22, 2024
MW-1C	4983993.1	473454.6	50.3	45.7 – 48.8	-	May 21, 2024
MW-2A[4]	4984288.9	473749.2	69.0	11.5 – 14.5	-	August 17, 2023
MW-2B	4984288.9	473749.2	21.6	18.3 – 21.3	-	May 9, 2024
MW-3A	4984295.5	474287.7	23.77	20.7 – 23.8	-	May 6, 2024
MW-3B	4984295.5	474287.7	29.4	25.6 – 28.7	-	May 2, 2024
MW-4A[5]	4983752.0	474191.0	6.60	3.55 – 6.60	-	August 30, 2023
MW-4B	4983785.0	474194.8	18.3	12.2 – 15.2	-	April 17, 2024
MW-5A	4983996.4	474687.3	9.1	7.60 – 9.14	-	April 12, 2024
MW-5B	4983996.4	474687.3	40.8	37.8 – 40.8	-	April 12, 2024
MW-6A	4983840.2	475163.3	27.4	22.4 – 26.9	-	April 26, 2024
MW-6B	4983840.2	475163.3	38.1	30.5 – 33.5	-	April 26, 2024
MW-7A	4983448.9	475088.7	7.040	3.99 – 7.04	-	April 24, 2024
MW-7B	4983448.9	475088.7	30.2	25.9 – 29.0	-	April 24, 2024
MW-7C	4983448.9	475088.7	48.86	44.5 – 47.5	-	April 24, 2024

Notes
[1] mbgs – meters below ground surface
[2] Monitoring wells will be surveyed in 2024
[3] masl – meters above sea-level
[4] MW-2A – preexisting well formerly named TGI-GT-02
[5] MW4-A – preexisting well formerly named TGI-GT-04

6.4.2.2.1 Hydraulic Conductivity Testing Methodology

Prior to the installation of the monitoring wells, GHD completed packer tests, in the bedrock core holes drilled for monitoring wells MW-1C, MW-5B, and MW-7C between April 9 and May 17, 2024. Additionally, packer testing was also completed Terrane Geoscience Inc. (Terrane) on boreholes TGI-PFS-GT-01, TGI-PFS-GT-05, and TGI-PFS-GT-06 as documents by Ausenco (2024). The purpose of the packer tests was to estimate hydraulic conductivities of the bedrock underlying the PA.

To characterize hydraulic conductivity at installed monitoring well locations, GHD completed single wells response testing (SWRT) on June 5, 2024, and June 6, 2024 at 11 monitoring wells installed in the overburden and bedrock. The majority of the tests were completed using solid PVC slugs, Solinst™ water level meters, and Solinst™ Levelogger data loggers. The remaining SWRT were "bail down" tests. Barometric pressure was simultaneously recorded using a Solinst™ Barologger datalogger. The purpose of the SWRTs was to estimate hydraulic conductivities of the overburden and bedrock underlying the PA.

GHD analyzed the results of the recovery tests using the AQTESOLV© (v. 4.01) software. GHD used monitoring well/borehole specific data along with time-displacement data collected during the SWRT with the Bouwer-Rice (1976) solution for unconfined and confined aquifers to estimate hydraulic conductivity values for each test.

Single well response tests were also completed at monitoring wells TGI-GT-02 (MW-2A), TGI-GT-04 (MW-4A), and TGI-GT-05 (Ausenco, 2024).

6.4.2.2.2 Groundwater Elevation Monitoring Methodology

Groundwater static water levels are measured relative to surveyed referenced points (top of PVC casing) with an electric water level probe. All monitoring wells also have transducers (Leveloggers) installed to automatically record hourly water levels.

The Leveloggers are removed from the monitoring well and data is downloaded in the field. Data is also retrieved from a Barologger, which is used to compensate the transducer.

6.4.2.2.3 Groundwater Elevation Monitoring Methodology

GHD collected a total of 18 groundwater samples (including 2 field duplicates) from 16 monitoring wells in the PA on May 29, May 30, and June 6, 2024.

Prior to collecting the groundwater samples, the static water levels were measured in each monitoring well and each monitoring well was purged of a minimum of three well volumes, or until dry. The water level in each of the monitoring wells was allowed to recover to its approximate static water level prior to collecting the groundwater samples.

Sample bottles were prepared and provided by Bureau Veritas Laboratories (BV Labs), Bedford, NS. Field staff collected samples directly from each monitoring well with a dedicated bailer. Samples for dissolved metals analysis were filtered in the field with a 0.45 µm filter and syringe, or inline filter and polyethylene Waterra® tubing.

Collected groundwater samples were stored on ice until submitted to BV Labs for analysis. Chain-of-custody documents remained with the samples until the analyses was completed and certified results were provided by the laboratory.

6.4.2.3 Methodology for hCSM Development

The hCSM forms the working basis for understanding the hydrogeologic conditions at the Project. The CSM includes:

- The extent, geometry, and composition of the hydrostratigraphic units
- Groundwater flow characteristics of each hydrostratigraphic unit
- Groundwater flow interactions between the units
- Groundwater/surface water interactions

The hCSM facilitates selecting model domain limits for the numerical groundwater flow model, as well as hydrostratigraphic unit representation and boundary conditions taking into consideration the observed Project-specific and regional hydrogeologic conditions. The hCSM then forms the basis for constructing the numerical groundwater flow model. GHD developed the hCSM for the project through the review and compilation of hydrologic, geologic and hydrogeologic data collected through the review of publicly available information, and the Project-specific hydrogeologic investigation.

6.4.2.4 Methodology for Developed of 3D Numerical Groundwater Flow Model

To develop the 3D numerical groundwater flow model, GHD selected a simulation program based on the following:

- The ability of the program to represent key components of the hCSM.
- The demonstration that the program correctly represents the hydrogeologic processes being considered.
- The proven acceptance of the program by regulatory agencies and the scientific/engineering community.
- The ability of the program to represent the proposed Project design.
- The ability of the program to provide a reasonable numerical solution in consideration of the complexity of the hydrogeologic conditions at in the PA and their interaction with the proposed Project infrastructure.

GHD developed a 3D numerical groundwater flow model to represent the hydrogeologic conditions observed at and surrounding the PA based on available hydrologic, geologic and hydrogeologic data and the hCSM. GHD conceptually calibrated the groundwater flow model to approximate baseline Project conditions by reflecting the range of observed groundwater elevations. To address the limitation of the available data within the PA, emphasis was placed on selecting model parameter values for the specific purpose of providing a conservative estimate of potential groundwater quantity impacts. GHD applied groundwater flow model to estimate potential groundwater quantity impacts including the potential change in the groundwater table (drawdown) resulting from the open pit dewatering and the potential change in baseflow to surface water features.

6.4.3 Baseline Conditions

This section provides a summary of the existing or baseline conditions for groundwater resources (i.e., groundwater quantity and quality) based on a review of publicly available regional and Project-specific hydrologic, geologic, and hydrogeologic information and Project-specific hydrogeologic investigations. A summary of the hCSM and development of the 3D numerical groundwater flow model to assess potential impacts is also provided. Detailed drilling, monitoring well installation details groundwater levels and groundwater quality monitoring results from the 2024 hydrogeologic investigations is presented in the Phase 1 Hydrogeological Investigation Technical Memorandum provided in Appendix E.2. The Hydrogeological Modelling Report (Appendix E.1) provides a detailed description of the 3D numerical groundwater flow model development, calibration, and application to predict potential impacts of Project development

6.4.3.1 Summary of Hydrologic, and Hydrogeologic Conditions

GHD reviewed the regional and site-specific hydrologic, geologic, and hydrogeologic conditions at the Project. This analysis forms the basis for developing a hCSM that characterizes key groundwater flow conditions, including groundwater sinks (i.e., conditions that remove groundwater from the groundwater flow system) and groundwater sources (i.e., conditions that introduce/recharge groundwater into the groundwater flow system) at/near the Project. Understanding these groundwater flow conditions allows for the development of a groundwater flow model that can be applied to make predictions of groundwater flow, and groundwater/surface water interactions. An overview of the regional and Project-specific hydrologic, geologic, hydrogeologic conditions are summarized below. Geologic conditions are described in Section 6.3.3.

6.4.3.1.1 Hydrologic Conditions

The hydrologic conditions are affected by regional climate, physiography, topography, and surface water features. The climatic conditions and surface water features are described in Section 6.5.3. Topography is described in Section 6.3.3. In general, the physiographic province condition the Project is characterized by undulating topography from lowland plains to rolling hills; rarely exceeding 90 masl. The central basin is drained by several large rivers that are affected by the tidal movements of the Bay of Fundy, with the exception of the Musquodoboit River which flows south to the Atlantic Ocean. A few lakes dot the landscape but not nearly as abundantly as the Atlantic Interior or Southern Uplands.

6.4.3.1.2 Hydrogeologic Conditions

The hydrogeologic and groundwater flow conditions in and surrounding the PA are informed by the review of publicly available information and through hydrogeologic investigations conducted in the PA, including the review and compilation of measured groundwater elevations and hydraulic conductivity testing data.

Regionally, the gently rolling topography of the Gays River watershed is the driving force behind groundwater flow. Groundwater recharge generally occurs on hills at higher elevations and discharges to surface water features in low lying areas. The highest hills in the southwest and northeast corners of the Gays River watershed likely act as significant recharge areas. Westminer Canada Limited Seabright Operations estimated that the topographic gradients vary between 0.015 to 0.15 and likely generate flow paths from recharge to discharge locations that are km long and potentially hundreds of m deep (WCLSO, 1992).

Groundwater elevation data within the PA consisted of two rounds of groundwater elevation monitoring at TGI-GT-02, TGI-GT-04, and TGI-GT-05, prior to the Phase 1 Hydrogeologic Investigation. The first round of groundwater elevations were collected from August 16 through September 2, 2023, and the second round was completed on March 25, 2024. TGI-GT-02 is screened across the overburden/bedrock contact in sandy silt and gypsum while TGI-GT-04, and TGI-GT-05 are screened in the overburden in silt and silt/clay. Based on the available data, groundwater elevation in the overburden ranges from 25.4 to 43.76 masl (1.33 to 14.57 m below top of riser [BTOR]) and groundwater elevation in the upper bedrock ranges from 25.8 to 29.2 masl (5.84 to 9.24 m BTOR).

At the date of this report, groundwater elevation monitoring is ongoing at monitoring wells installed in 2024; however, the wells have not been surveyed. Therefore, groundwater elevations cannot be accurately calculated at 2024 monitoring well locations. Measured depth to water at 2024 monitoring well locations are presented in Table 6.4-2.

Table 6.4-2 2024 Groundwater Elevation Data

Well ID	Date	Depth to Groundwater (mbtor[3])
MW-1A	May 29, 2024	0.997
MW-1B	May 29, 2024	21.620
MW-1C	May 29, 2024	30.785
MW-2A	May 29, 2024	9.216
MW-2B	May 29, 2024	9.115
MW-3A	May 29, 2024	12.600
MW-3B	May 29, 2024	28.145
MW-4A	May 29, 2024	4.919
MW-4B	May 29, 2024	14.865
MW-5A	May 29, 2024	8.200
MW-5B	May 29, 2024	24.745
MW-6A	May 29, 2024	6.814
MW-6B	May 29, 2024	6.229
MW-7A	May 29, 2024	1.320
MW-7B	May 29, 2024	28.475
MW-7C	May 29, 2024	42.7

Depth to water ranged from 0.997 mbtor at MW-1A to 30.785 mbtor at MW-1C. The depth to groundwater data presented in Table 6.4-2 is suitable for and confirms that the depth to groundwater considered for hCSM and groundwater model development is within the range of that observed in the PA. Groundwater elevations relative to sea level for the monitoring wells will be determined following the well survey.

Table 6.4-2 shows that there is a strong downward groundwater gradient observed at monitoring well nests 1, 3, 4, 5, and 7. However, a small downward to small upward gradient is observed monitoring well nests 2 and 6. Ongoing groundwater elevation monitoring using pressure transducers will be completed to confirm whether the observed vertical gradients are due to slow recovery following well development and sampling or are representative of baseline groundwater flow conditions.

While the existing data is suitable for confirming the range of depth to groundwater within the PA, additional groundwater elevation monitoring is required to further refine the understanding of hydrogeologic conditions within the PA and to support the IA application and development of a detailed groundwater monitoring and contingency plan.

To support the current assessment of hydrogeologic conditions in the area surrounding the PA, GHD compiled groundwater elevation data collected between 2007 and 2022 at monitoring wells on the SML property (GHD, 2023). The SML monitoring wells are applicable to the PA because several wells on the SML property are installed in close proximity to the PA near SML's tailings management facility (TMF) within the same overburden deposit which overlies the PA. SML monitoring wells located farther from the PA provide regional context for groundwater elevations overserved with the PA.

Groundwater elevations at the SML monitoring wells were affected by pit dewatering activities between 2007 and 2009. Based on the long-term groundwater elevation monitoring data, groundwater elevations stabilized in 2012; therefore, to define average hydrogeologic conditions for the area, average annual water levels were calculated for 25 SML monitoring well locations from 2012 to 2022. Where a single groundwater elevation observation demonstrated a significant departure from the typical range in water elevations observed at a given location that observation was excluded from the average. Due to difference in measurement frequency at groundwater monitoring well locations, average annual groundwater elevations were calculated as the average groundwater elevation measurements collected during the wet season (January – June) and dry season (July – December) for each year, and an overall annual average was calculated for each well using the set of yearly annual averages. Table 6.4-3 presents estimated average annual groundwater elevations for SML monitoring wells.

Table 6.4-3 SML Monitoring Wells Average Annual Groundwater Elevations (2012-2022)

Well ID	Average Annual Groundwater Elevation (masl)
GA-04	13.92
GA-07	14.13
GA-09	13.63
GA-10	13.71
GA-11	14.54
GA-12	14.32
GA-13	14.72
GA-14	13.68
GA-18	15.17
GA-22	14.36
GA-32	16.29
GR-P1	18.62
GR-P2	19.97
GR-P6	13.92
MW-41	12.73
MW-43	12.79

Observed groundwater elevations at SML monitoring wells were also examined to estimate seasonal variations in groundwater elevations near the PA. On average, seasonal variations in groundwater elevations are typically on the order of one to two metres.

6.4.3.1.2.1 Hydrostratigraphic Units and Hydraulic Properties

For the specific purpose of hydrogeological modeling, hydrostratigraphic units were developed to group/simplify the geologic units described in Section 2.3 into hydrostratigraphic units of similar geologic characteristics and hydrogeologic properties. Hydraulic conductivity of the till overburden, fractured bedrock, and Carrolls Corner Formation were estimated using single well response tests and packer tests completed in PA boreholes and monitoring wells. A summary of SWRT results completed as part of the Phase 1 Hydrogeologic Investigation is presented in Table 6.4-4. The hydrostratigraphic units at and near the PA are summarized below, including a discuss of the hydraulic conductivity testing results from the Phase 1 Hydrogeologic Investigation for the applicable hydrostratigraphic units.

Table 6.4-4 SWRT Estimated Hydraulic Conductivity Values

Monitoring Well ID	Stratigraphy	Test Type	Analytical Solution	Estimated Hydraulic Conductivity (m/s)	Geometric Mean Hydraulic Conductivity (m/s)
MW2B	Anhydrite, rock	Falling Head	Bouwer-Rice, 1976	1.65×10^{-4}	$1.83 \text{ X } 10^{-4}$
		Rising Head	Bouwer-Rice, 1976	2.03×10^{-4}	
MW3A	Sand and Silt, Anhydrite, rock with internal fractures	Falling Head	Bouwer-Rice, 1976	1.97×10^{-6}	$1.93 \text{ X } 10^{-6}$
		Rising Head	Bouwer-Rice, 1976	1.90×10^{-6}	
MW3B	Anhydrite, rock	Falling Head	Bouwer-Rice, 1976	2.24×10^{-4}	$1.71 \text{ X } 10^{-4}$
		Rising Head	Bouwer-Rice, 1976	1.31×10^{-4}	
MW4A	Sandy Silt	Falling head	Bouwer-Rice, 1976	1.15×10^{-8}	1.15×10^{-8}
MW4B	Conglomerate, Gypsum,	Rising Head	Bouwer-Rice, 1976	1.43×10^{-8}	1.43×10^{-8}
MW6A	Sand, silty sand, sandy silt	Falling Head	Bouwer-Rice, 1976	4.91×10^{-6}	$4.81 \text{ X } 10^{-6}$
		Rising Head	Bouwer-Rice, 1976	4.72×10^{-6}	
MW6B	Gypsum, Anhydrite	Falling Head	Bouwer-Rice, 1976	8.79×10^{-4}	$6.86 \text{ X } 10^{-4}$
		Rising Head	Bouwer-Rice, 1976	5.35×10^{-4}	
MW7A	Sand, Sandy Silt/Clay	Falling Head	Bouwer-Rice, 1976	4.78×10^{-7}	$4.06 \text{ X } 10^{-7}$
		Rising Head	Bouwer-Rice, 1976	3.45×10^{-7}	

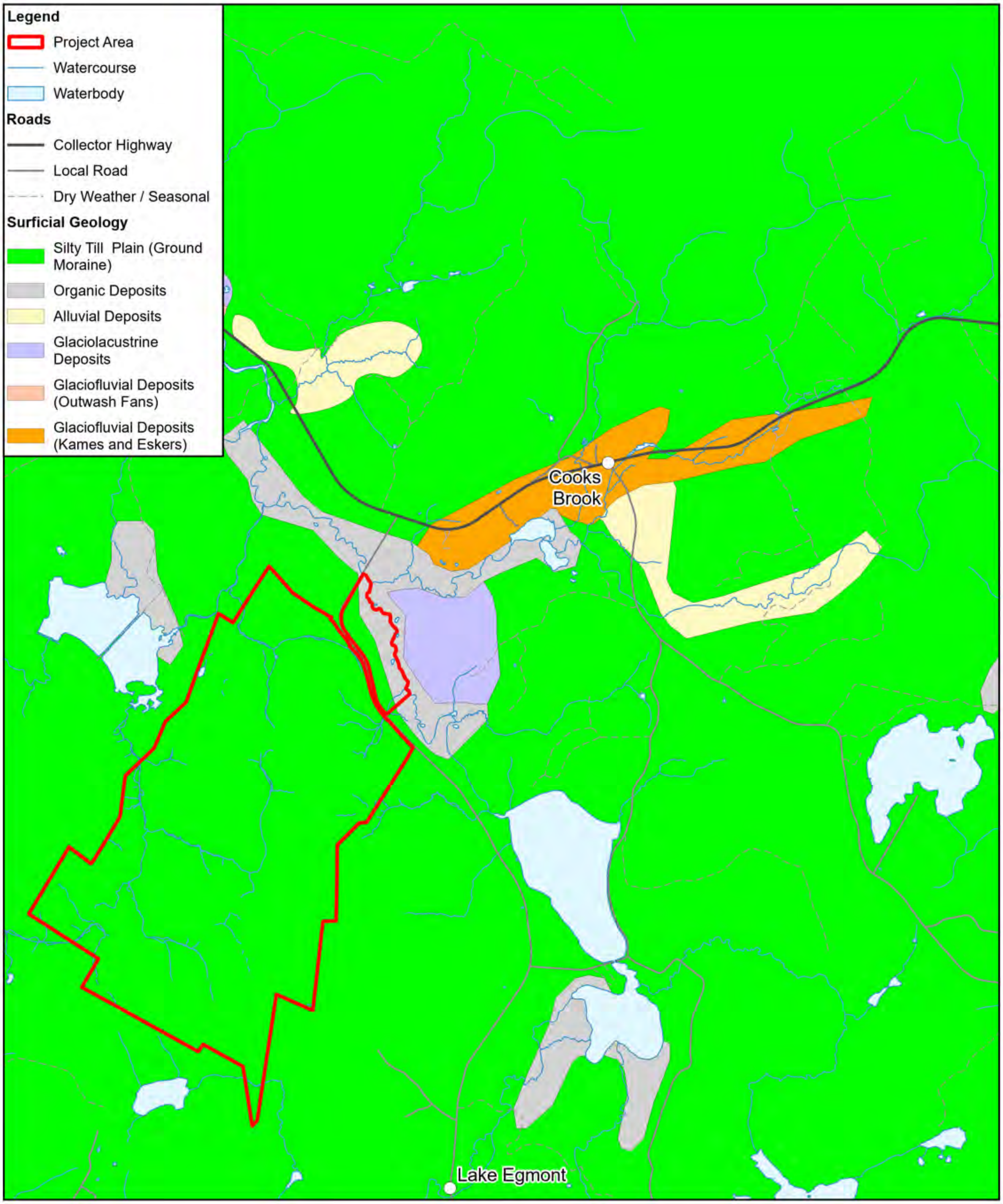
Till Overburden

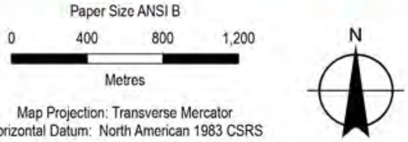
Hydraulic conductivity testing using single well response tests (i.e., slug tests) was completed by Ausenco (2024) in the monitoring wells installed in TGI-GT-02, TGI-GT-04, and TGI-GT-05. TGI-GT-04, and TGI-GT-05 are screened within the till overburden within sandy silt and silt and clay respectively. Hydraulic conductivity for the overburden at TGI-GT-04, and TGI-GT-05 was estimated by Ausenco (2024) to be 5.3×10^{-7} m/s and 8.2×10^{-8} m/s respectively, which is consistent with the hydraulic conductivity testing results completed within the till on the SML property to the north which ranged from 7.3×10^{-5} m/s to 1×10^{-10} m/s (WCLSO, 1992).

MW-4A, MW-6A, and MW-7A, installed during the Phase 1 Hydrogeologic Investigation are screened within the till overburden. As presented in Table 6.4-4, the estimated hydraulic conductivity values at these wells ranges from 4.8×10^{-6} to 1.2×10^{-8} m/s, which corroborates the hydraulic conductivity testing results from Ausenco (2024) and falls within the range presented by WCLSO (1992) for the adjacent SML property.

Sand and Gravel Overburden

As shown on Figure 6.4-2, glaciolacustrine, glaciofluvial, alluvial and organic deposits have also been identified along surface water bodies in low-lying areas; however, these units are generally located beyond project infrastructure. In particular, a large sand deposit was identified on the SML property that impacts groundwater elevation north of the PA as described by WCLSO (1992). Hydraulic conductivity testing was conducted on the glaciofluvial sand and gravel units encountered on the SML property and in general, the estimated hydraulic conductivity for the sands and gravels ranged from 2×10^{-4} m/s to 9×10^{-8} m/s.





Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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Project No. **12601021**
Revision No. **-**
Date **August 14, 2024**

SURFICIAL GEOLOGY

FIGURE 6.4-2

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Print date: 14 Aug 2024 - 11:58

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: iwilson2

Weathered Fractured Bedrock

TGI-GT-02 is screened at the base of the overburden across both a layer of sandy silt overburden and into the underlying gypsum. Hydraulic conductivity at TGI-GT-02 was estimated to be $1.9x10^{-4}$ m/s, which is over an order of magnitude higher than the range of hydraulic conductivity testing results from $1x10^{-5}$ m/s to $1x10^{-11}$ m/s for the gypsum at the SML property (WCLSO , 1992), and also above the range of hydraulic conductivity testing results for monitoring wells completed entirely within the till overburden.

The high hydraulic conductivity testing result at TGI-GT-02 suggests that there is potentially a layer of weathered fractured bedrock at the overburden/bedrock interface which is of higher hydraulic conductivity than the overlying overburden and the underlying competent bedrock. Therefore, the upper portion of bedrock is assigned is assumed to be a unique hydrostratigraphic unit consistent the hydraulic conductivity test results at TGI-GT-02 and the general trend that weathering is observed in the upper portion of the bedrock.

MW-2B, MW-3A, MW-3B, MW-4B, and MW-6B, installed during the Phase 1 Hydrogeologic Investigation are screened across the bedrock/overburden contact or have screens in contact with the upper 5 metres of bedrock. Estimated hydraulic conductivity values at these monitoring wells ranges from $6.9x10^{-4}$ to $1.43x10^{-8}$ m/s. In general, these monitoring wells confirm previous hydraulic conductivity testing results across the bedrock/overburden contact and within the upper 5 metres of bedrock. MW-2B, MW-3B, and MW-6B had higher hydraulic conductivity estimates on the order of 10^{-4} m/s while MW-3A and MW-4B had lower hydraulic conductivity values of $1.9x10^{-6}$ and $1.4x10^{-8}$ m/s, respectively, indicating that while higher hydraulic conductivity areas are present within the weathered fractured upper bedrock, those areas are likely discontinuous. Further hydraulic conductivity testing during Phase 2 Hydrogeologic investigations will further assess the presences of higher hydraulic conductivity areas within the weathered fractured upper bedrock.

Carrolls Corner Formation

A total of seven packer tests were complete in the bedrock were completed by Terrane Geoscience Inc. in boreholes TGI-PFS-GT-01, TGI-PFS-GT-05, and TGI-PFS-GT-06. The packer tests were performed at various depth intervals to estimate a potential range of hydraulic conductivity values within the dolomite, gypsum, karst fill, and anhydrite of the Carrolls Corner Formation. Hydraulic conductivity of the bedrock was estimated to be between $1.3x10^{-7}$ m/s and $4.1x10^{-10}$ m/s, with a geometric mean of $3.7x10^{-9}$ m/s.

Additional packer testing completed as part of the Phase 1 Hydrogeologic Investigation is presented in Table 6.4-5. Hydraulic conductivities calculated for the Carrols Corner Fomation ranged from < 4.21E-06 meters per second (m/s) to 4.62E-05 m/s. Therefore, the total range in hydraulic conductivity testing results for the Carrolls Corner Formation from packer testing is from 4.62E-05 m/s.

Table 6.4-5 Summary of Packer Test Results

Monitoring Well ID	Test Interval (mbgs)	Lithology	Hydraulic Conductivity (m/s)
MW-1C	46.9 – 48.5 (154 – 159 ft BGS)	Anhydrite	7.54E-06
MW-1C	43.9 – 45.4 (144 – 149 ft BGS)	Anhydrite	<7.58E-06
MW-5B	37.8 – 41.2 (124 – 135 ft BGS)	Conglomerate	4.62E-05
MW-7C	45.5 – 47.6 (149 – 156 ft BGS)	Anhydrite	7.85E-06
MW-7C	41.0 – 43.1 (134 – 141 ft BGS)	Anhydrite	5.17E-06
MW-7C	31.8 – 33.9 (104 –111 ft BGS)	Anhydrite	<4.21E-06

Monitoring Well ID	Test Interval (mbgs)	Lithology	Hydraulic Conductivity (m/s)
MW-7C	25.7 – 27.8 (84 – 91 ft BGS)	Gypsum	5.18E-06

Gays River Formation

No hydraulic conductivity testing was conducted in the Gays River Formation with the PA; however, hydraulic conductivity ranges are available from testing completed on the SML property to the north. Based on the hydraulic conductivity testing information presented by WLSCO (1992), the range in hydraulic conductivity values for the carbonates of the Gays River Formation is from approximately $1.6x10^{-4}$ m/s to $2.8x10^{-7-}$m/s.

Goldenville Group

No hydraulic conductivity testing was conducted in the Goldenville Group within the PA in 2023 or 2024 specific to this Project; however, hydraulic conductivity ranges are available from testing completed by WLSCO (1992) estimates that the range of hydraulic conductivity values for the quartzites and slates of the Goldenville Group is approximately from $2.2\ x10^{-7}$ m/s to $6.4x10^{-9}$ m/s. Extensive hydraulic conductivity testing has been completed within the quartzites and slates of the Goldenville Group for other projects (GHD, 2022) which confirms that range of hydraulic conductivity values presented by WLSCO (1992) and demonstrates that, in general, the hydraulic conductivity of the Goldenville Group decreases with depth.

6.4.3.1.2.2 Groundwater Sinks

A groundwater sink is any feature that removes groundwater from the flow system. Within the PA, the primary groundwater sinks correspond to groundwater discharge to surface water features. Groundwater discharge to surface water features is discussed in more detail in the following section.

Evapotranspiration

Evapotranspiration removes groundwater from the shallow groundwater flow system through transpiration by plants whose roots extend into the water table (i.e., phreatophytes) when groundwater is near ground surface. The rate of groundwater removal by evapotranspiration (which is the volume of water removed from the groundwater flow system per unit surface area of water table per day and near the Site has units of m^3/day) decreases with depth to groundwater as soils provide insulating conditions and plant root volumes diminish. That is to say that the maximum evapotranspiration rate occurs when the water table equals or exceeds the ground surface elevation. The evapotranspiration is zero when the water table is below the root zone. This depth is referred to as the extinction depth (EXD). Between ground surface and EXD the volumetric rate of water loss due to evapotranspiration varies linearly. The maximum potential evapotranspiration rates vary seasonally, and the average annual potential evapotranspiration rate is approximately 529.4 mm/yr with an annual range from approximately 476 mm/yr to 609 mm/yr across the 50-year historical climate dataset. Therefore, the groundwater loss due to evapotranspiration will vary seasonally, and based on the depth to the groundwater table, up to a maximum potential evapotranspiration rate of approximately 476 mm/yr to 609 mm/yr.

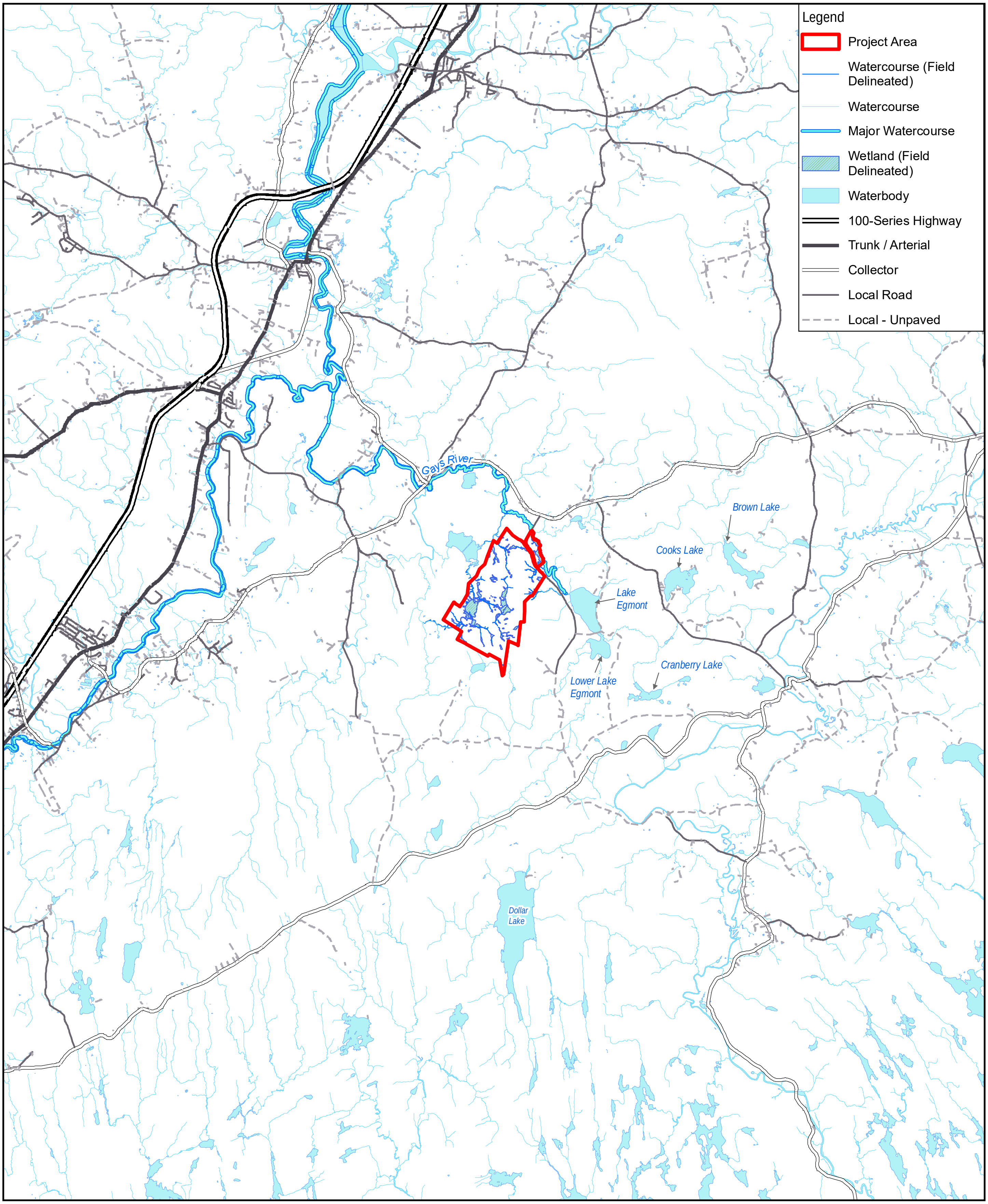
Discharge to Surface Water Features

Groundwater flow typically follows topographic relief, flowing towards surface water features in low lying areas. As presented on Figure 6.4-3, there are several surface water features located in the PA, including small streams and major features including the Gays River, SML's TMF, and Lake Egmont.

A set of surface water subcatchment areas were mapped for the Project and surrounding area to assess surface water flow under baseline conditions and potential changes that could result from the Project. The subcatchment areas are presented on Figure 6.4-4.

Discharge to Open Pit

The Project will involve excavation of an open pit, which will extend below the groundwater table. The open pit will act as a groundwater sink, receiving groundwater discharge. Under Post Closure (PC) conditions, the open pit will be partially backfilled and allowed to fill with water, creating a lake.



Paper Size ANSI A

0 1 2 3

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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Revision No. -
Date August 14, 2024

SURFACE WATER FEATURES

FIGURE 6.4-3

N:\CA\Halifax\Projects\661\12601021\GIS\Maps\Deliverables\RPT006\12601021-RPT006-HX026-Fig 6.4-3 Surface Water Features.mxd
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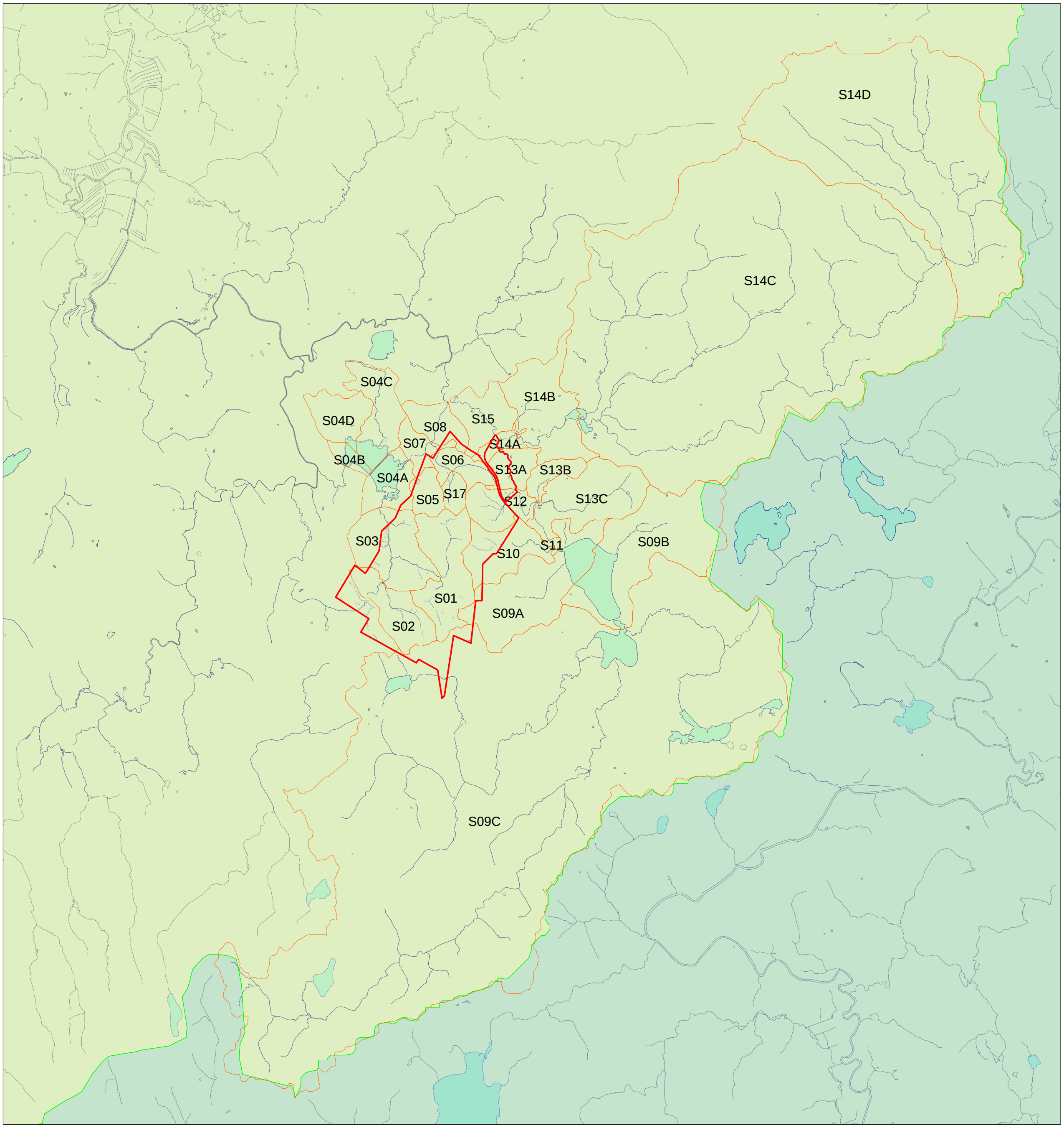

LEGEND

- SURFACE WATER FEATURES
- MAJOR RIVERS
- PROJECT AREA (PA)
- SURFACE WATER BODY
- S09C PROJECT SUBCATCHMENT AREAS

PRIMARY WATERSHEDS

- MUSQUODOBOIT
- SHUBENACADIE/STEWIACKE

0 1000 2000 3000m

N

GHD

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ANTRIM GYPSUM PROJECT

PRIMARY WATERSHEDS AND SUBCATCHMENT AREAS

Project No. **12601021**
Date **August 2024**

FIGURE 6.4-4

6.4.3.1.2.3 Groundwater Sources

A groundwater source is any feature that contributes groundwater to the groundwater flow system. At the PA, the primary groundwater source is from groundwater recharge through precipitation infiltration. In some areas it is expected that groundwater will receive recharge from surface water bodies; however, surface water bodies overall are expected to receive net discharge from the groundwater flow system.

Net Precipitation Through Precipitation Infiltration

As described in Section 6.5.3, the average annual precipitation in the area is 1459.2 mm per year. Precipitation falling onto the PA and surrounding area recharges the groundwater flow system through infiltration into the surficial soils. The amount of precipitation reaching the groundwater table (i.e., net recharge equal to precipitation infiltration minus actual evapotranspiration) is typically considered to range from approximately 10 to 40 percent of the average annual precipitation (Arnold et al., 2000; and Rushton and Ward, 1979). Based on the total annual precipitation of 1459.2 mm, the expected infiltration rate is 145.9 mm to 583.7 mm.

Baseflow often is used to estimate recharge rates, with the caveats that: 1) baseflow probably represents some amount less than that which recharges the aquifer; and 2) baseflow is best applied to provide a reasonable estimate of recharge occurring over long time periods (1 year or more) (Risser et al., 2005). To estimate recharge from baseflow, typically the total baseflow is divided by the area of the watershed.

Using a similar method, the NSDNRR estimated recharge for primary watersheds across NS (Kennedy et al., 2010). The average annual recharge rate calculated for the primary watershed within which the PA is located was estimated to be 180-220 mm per year. This range corresponds to approximately 13-16% of total annual precipitation.

Recharge from Surface Water Features

In general, surface water bodies are expected to be a net groundwater sink, although there will be some losing reaches (i.e., sections where surface water recharges groundwater) along some surface water features. Surface water features will recharge groundwater in areas where groundwater levels fall below adjacent surface water elevations.

6.4.3.1.3 Groundwater Quality Results

GHD collected a total of 18 groundwater samples (including 2 field duplicates) from 16 monitoring wells in the PA on May 29, May 30, and June 6, 2024.

Analytical results were compared to the Guideline for Canadian Drinking Water Quality (CDWQ) Maximum Allowable Concentrations (MAC) and Aesthetic Objectives (AO), the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for potable groundwater, and the NSE Pathway Specific Standards (PSS) for Groundwater discharging to surface water (0-10m from a freshwater body). A detailed comparison of groundwater quality samples to the forementioned criteria is presented in the Phase 1 Hydrogeologic Investigation Memorandum (Appendix E.2). All parameters were within the applicable limits with the exception of those shown in Table 6.4-6.

Table 6.4-6 May 29 – June 6, 2024 Groundwater Exceedances - Metals and General Chemistry

Well ID	NSE PSS	NSE Tier 1	CDWQ MAC
MW-1A	Aluminium (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MWDUPA (Duplicate of MW1-A)	Iron (D) Manganese (D) Selenium (D) Zinc (D) Sulphate (D	Iron (D) Manganese (D) Strontium (D)	Iron (D) (AO and MAC) Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-1B	Aluminium (D) Zinc (D)	Manganese (D)	Manganese (D) (AO)
MW-1C	Manganese (D) Selenium (D) Zinc (D)	Iron (D) Manganese (D) Strontium (D)	Iron (D) (AO and MAC) Manganese (D) (AO and MAC) Sulphate (D) (AO)

Well ID	NSE PSS	NSE Tier 1	CDWQ MAC
	Sulphate (D)		Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-2A	Aluminium (D) Manganese (D) Zinc (D)	Manganese (D)	Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-2B	Aluminium (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MW-3A	Iron (D) Zinc (D) Sulphate (D)	Iron (D) Manganese (D)	Iron (D) (AO and MAC) Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-3B	Cadmium (D) Cobalt (D) Manganese (D) Selenium (D) Zinc (D) Sulphate (D)	Cobalt (D) Manganese (D) Strontium (D)	Cobalt (D) (MAC) Manganese (D) (AO and MAC) Sodium (D) (AO) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-4A	Manganese (D) Sulphate (D)	Manganese (D)	Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-4B	Cadmium (D) Cobalt (D) Copper (D) Manganese (D) Zinc (D) Sulphate (D)	Cobalt (D) Manganese (D) Strontium (D)	Cobalt (D) (MAC) Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-5A	Aluminium (D) Selenium (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MW-DUPB (Duplicate of MW-5A)	Aluminium (D) Selenium (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MW-5B	Aluminium (D) Manganese (D) Selenium (D) Zinc (D) Sulphate (D)	Manganese (D) Strontium (D)	Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-6A	Aluminium (D) Copper (D) Zinc (D) Sulphate (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MW-6B	Aluminium (D) Iron (D) Zinc (D) Sulphate (D)	Iron (D) Manganese (D)	Iron (D) (AO and MAC) Manganese (D) (AO and MAC) Colour (AO) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)

Well ID	NSE PSS	NSE Tier 1	CDWQ MAC
MW-7A	Aluminium (D) Manganese (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
MW-7B	Aluminium (D) Boron (D) Cobalt (D) Manganese (D) Selenium (D) Zinc (D) Sulphate (D	Manganese (D) Strontium (D)	Manganese (D) (AO and MAC) Sulphate (D) (AO) Total Dissolved Solids (calculated) (AO) Turbidity (AO)
MW-7C	Manganese (D)	Manganese (D)	Manganese (D) (AO and MAC) Turbidity (AO)
Notes: (D): Dissolved NSE PSS: Nova Scotia Environment Pathway Specific Standards for groundwater discharge to surface water (0-10m from freshwater body) NSE Tier 1: Nova Scotia Environment Tier 1 Environmental Quality Standards (EQS) for potable groundwater CDWQ: Guidelines for Canadian Drinking Water Quality MAC: Maximum Allowable Concentrations AO: Aesthetic Objectives			

The results of the groundwater monitoring program indicate exceedances of applicable criteria for the following metals: aluminium, boron, cadmium, cobalt, copper, iron, manganese, selenium, sodium, strontium, and zinc. The results also indicated exceedances of applicable criteria for the following general chemistry parameters: color, sulphate, turbidity, and Total Dissolved Solids (TDS). Overall, each monitoring well applicable criteria for at least one or more constituent in groundwater.

All data collected from the groundwater monitoring well network is considered baseline as no current mining activity has occurred. The parameters with identified exceedances are considered naturally occurring in groundwater in the vicinity of the Project.

6.4.3.2 Hydrogeologic CSM

Understanding the hydrologic, geologic, and hydrogeologic conditions forms the basis for developing a conceptual understanding of the groundwater flow system. This conceptual understanding is the hCSM and it facilitates the assessment of potential impacts to groundwater resources that could result from development of the Project. Based on the available regional and Project-specific information, the hydrogeologic characteristics are summarized as follows:

– Based on available borehole records, and regional and Project-specific reports, the bedrock geologic conditions within the PA consist of the highly jointed quartzite of the Goldenville Formation overlain by the carbonates of the Gays River and Macumber Formations and the evaporites of the Carrolls Corner. The bedrock formations are generally overlain by a silty compact glacial till; however, significant glaciofluvial sand and gravel deposits were identified in some areas along the Gays River. In general, the major hydrostratigraphic units at near the PA consist of the following:
  - Till overburden
  - Sand and gravel overburden
  - Weathered fractured bedrock
  - Carrolls Corner Formation
  - Gays River Formation
  - Goldenville Group
– Groundwater flow directions are interpreted to follow the rolling topography, from highland to lowland areas.
– The groundwater flow system receives recharge from precipitation infiltration.

– Surface water features are a net groundwater sink; however, changes to the groundwater flow system resulting from excavation of the mine pit may result in an increase of recharge from surface water features to groundwater, as groundwater levels near surface water features are reduced.
– Groundwater is removed through evapotranspiration.
– Throughout Project development, the proposed open pit will act as a groundwater sink.

6.4.3.3 3D Numerical Groundwater Flow Model Development

GHD developed a 3D numerical groundwater flow model to provide an approximation of Project conditions for the specific purpose of providing a conservative estimate of potential Project impacts. This section briefly describes the development of 3D groundwater flow model. Additional details of the development of the 3D groundwater flow model are provided in Appendix E.1.

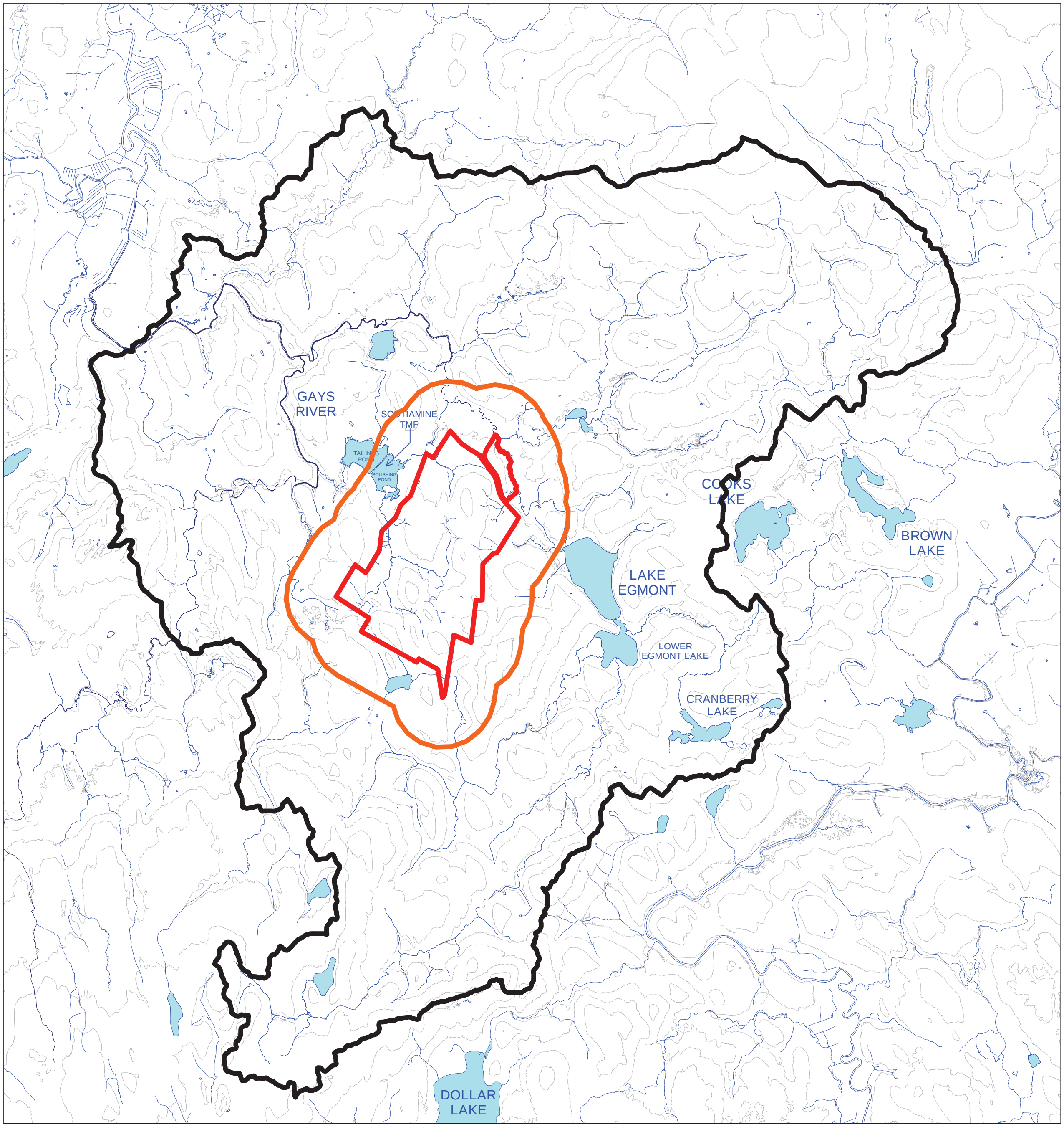
GHD selected MODFLOW-NWT (Niswonger, 2011) to simulate groundwater flow for this modelling study due to its ability to efficiently solve complex groundwater flow simulations characterized by drying and rewetting of model cells such as that encountered in the simulation of dewatering scenarios, including the proposed dewatering of the open pits during Project construction and operations. MODFLOW-NWT has been extensively verified and is readily accepted by many regulatory agencies throughout North America and Europe. MODFLOW-NWT can represent the hydrogeologic components of the CSM for the Project.

The model domain developed for this modelling study is presented on Figure 6.4-5. As presented on Figure 6.4-5, the model domain extends to a maximum of approximately 14.7 km in the north-south direction and a maximum of 13 km in the east-west direction. The model domain is oriented with its axes aligned north-south and east-west.

No-flow boundary conditions are applied along the edges of the model domain. The no-flow boundary along the eastern and southern edges of the model corresponds roughly with the boundary of the Shubenacadie/Stewiacke watershed, and the western and no-flow boundaries along the western and northern edges correspond to the boundaries of surface water catchment.

Vertically, the model domain extends from ground surface to elevations of approximately -352 to -527, where a no-flow boundary is inferred within the Meguma Group bedrock as the hydraulic conductivity of the Meguma Group typically decreases with depth and vertical groundwater flow is assumed negligible. Recharge and evapotranspiration boundary conditions are applied at the top of the model domain.

The hydraulic conductivity zones were assigned in the model to represent each of the major hydrogeologic units identified in the hydrogeologic conceptual site model. Two hydraulic conductivity zones were assigned in model layer 1, one zone to represent the till overburden and a second zone to represent the area of the SML property where surficial sands were identified. Hydraulic conductivity zones were assigned for each of the bedrock units identified in the 3D geologic model, representing the evaporites, carbonates, and crystalline bedrock of the Carrolls Corner, Gays River, and Halifax/Goldenville Formations, respectively. The hydraulic conductivity value for each unit was adjusted during model calibration within reasonable bounds based on the results of the hydraulic conductivity testing conducted within each hydrogeologic unit, as well as values available in published literature consistent with the geological materials that make up each unit.



LEGEND

- SURFACE WATER FEATURES
- MAJOR RIVERS
- GROUND SURFACE ELEVATION CONTOURS (20 m CONTOUR INTERVAL)
- SURFACE WATER BODY
- ACTIVE MODEL DOMAIN
- LOCAL ASSESSMENT AREA (LAA)
- PROJECT AREA (PA)

0 1000 2000 3000m

N

GHD

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ANTRIM GYPSUM PROJECT

GROUNDWATER FLOW MODEL DOMAIN

Project No. 12601021
Date August 2024

FIGURE 6.4-5

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Data Source

6.4.4 Effects Assessment Methodology

6.4.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

Spatial Boundaries

The spatial boundaries used for the assessment of effects of noise are defined below:

- The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs
- The LAA encompasses an 800 m buffer surrounding the PA or extends to the groundwater flow model domain. The LAA was selected consistent with 800 m buffer for blasting.
- The RAA corresponds to the groundwater flow model domain. The groundwater flow model domain corresponds to physically based boundaries of the groundwater flow system surrounding the PA where practical and was selected to provide sufficient separation between Project infrastructure and model domain boundaries as to not unduly bias predicted impacts. Therefore, RAA encompasses all Project and groundwater VC interactions.

As the Project has the potential to cause direct and indirect effects on groundwater quantity and quality outside of the PA, the LAA is considered the most appropriate spatial boundary for this assessment because groundwater impacts contained within the LAA will not impact residential well locations. Spatial boundaries defined for the groundwater effects assessment are presented in Figure 6.4-6.