Stantec

Alton Natural Gas Storage Project Decommissioning and Reclamation Plan

ALT-REG-REP-0001

alton
NATURAL GAS STORAGE L.P.
an AltaGas business

Alton Natural Gas Storage Project Decommissioning and Reclamation Plan

ALT-REG-REP-0001

Rev. 1

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Prepared for:

Alton Natural Gas Storage Project LP

Prepared by:

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Executive Summary

Alton Natural Gas Storage Limited Partnership (ANGS) proposes to decommission the partially constructed Alton Natural Gas Storage Project (the Project). As proposed, the Project would have consisted of engineered, underground salt caverns to safely store natural gas, a natural gas pipeline linking the caverns to the North American natural gas supply network, and facilities for the cavern construction phase, including water pipelines from the caverns to the Project's site on the tidal Shubenacadie River estuary.

Located in Colchester County, Nova Scotia (NS), the Project comprises two distinct sites connected by a linear pipeline corridor as well as a natural gas pipeline right-of-way (RoW) (Figure 1.1):

- A Cavern Site (proposed underground natural gas storage facility) near Alton, NS
- A River Site (site of water intake and discharge point in a diversion channel on the bank of the Shubenacadie River in Fort Ellis, NS)
- A Water and Brine Pipelines RoW that connects the Cavern Site and River Site
- A 10 km natural gas pipeline RoW which connects the Cavern Site to the Maritimes & Northeast Pipeline's natural gas transmission system

During the Project planning and construction process, AltaGas Ltd. (parent company of ANGS) divested its natural gas utilities in Canada in 2018, including the utility in Nova Scotia that the Project would support. This shift occurred as the Company's focus repositioned to natural gas processing and energy exports on the West Coast of North America and natural gas utilities in the United States. In addition to this repositioning, a financial review of the Project in 2020 determined that the Project would be economically challenging in the proposed configuration. Pending regulatory approval to proceed, decommissioning and reclamation activities of the Project are proposed to start in the spring of 2022 and are expected to be completed before the end of 2022.

ANGS is committed to decommissioning the Project in a manner that fulfills legal and regulatory requirements and reduces environmental and public safety risks. Decommissioning of the Project was assessed as an activity in the environmental assessment process for the Project (Jacques Whitford 2007) and does not represent a modification to the approved Project.

This document is a Decommissioning and Reclamation Plan intended to guide decommissioning planning and support ANGS in fulfilling regulatory requirements and environmental/social obligations associated with Project decommissioning and reclamation. Specifically, this Plan is intended to fulfill the requirement for a rehabilitation plan under Section 9 of Industrial Approval No. 2008-061384-03 and a decommissioning plan under Section 11 of Crown Land Lease No. 304528. With respect to the proposed natural gas pipeline, this Plan is intended to fulfill applicable requirements for an abandonment plan as stipulated in Section 14.1 of the environmental assessment approval conditions for the Alton Natural Gas Pipeline Project. This Plan also fulfills commitments made by ANGS regarding decommissioning planning in Section 2.1.3 of the Environmental Assessment Registration for the Alton Natural Gas Storage Project (Jacques Whitford 2007) and commitments made by ANGS regarding decommissioning planning in

Section 2.4 of the Environmental Assessment Registration for the Alton Natural Gas Pipeline Project (Stantec 2012).

This Decommissioning and Reclamation Plan describes the current infrastructure and existing natural environment at the River Site, along the Water and Brine Pipelines route, and the Cavern Site. Decommissioning and reclamation activities for these sites are proposed in consideration of legal and regulatory requirements (including applicable industry codes and standards), previous commitments made by ANGS, relevant experience on comparable decommissioning projects, and site-specific conditions. Where applicable, alternatives to the proposed decommissioning activities are noted.

The overall goal of Project decommissioning and reclamation is to reclaim to equivalent land capability, to allow the land to support various land uses similar, but not necessarily identical, to the uses that existed before the Project.

Our proposed approach would minimize ground and habitat disturbances and associated environmental effects (including erosion, sedimentation, noise and air emissions) associated with decommissioning and reclamation activities.

A successful decommissioning and reclamation program will achieve the following specific objectives:

- Comply with applicable legal and regulatory requirements
- Promote environmental stewardship across the full life cycle of the Project, including decommissioning and reclamation, minimizing environmental impacts of decommissioning activities
- Consider beneficial re-use of facilities, equipment and land
- Reduce public safety risk and potential long-term liabilities
- Provide a means to invite input from local communities and the Mi'kmaq of Nova Scotia on the decommissioning activities and objectives proposed

We propose to remove above-ground structures, leave buried components in the ground, and reclaim land to equivalent land capability. In-ground structures (e.g., piping) would be abandoned in place where allowed by regulatory and legal requirements and where they demonstrate no public health and safety risk. Abandoning in place is the generally accepted practice for buried on-lease and in RoW pipelines.

ANGS proposes to leave the constructed diversion channel in place. Since its construction in 2014, the diversion channel has naturally infilled and revegetated. The infilled channel causes no adverse effect on fish and fish habitat and does not preclude the river or shoreline from fulfilling similar ecological functions and uses that existed before the Project.

The natural infilling of the diversion channel has created salt marsh habitat. Salt marshes are extremely productive wetlands. More than 50% of salt marsh habitat in Nova Scotia has been lost, mostly as a result of diking to convert salt marsh to agricultural land (NSE 2019). The development of a salt marsh in the infilled channel is an asset for reclamation of the site due to the historical loss of much of Nova Scotia's salt marsh habitat.

The natural development of this salt marsh has the additional benefit in that it provides a highly valued habitat with no intrusive reclamation work required. Removal of the diversion channel would require substantial disturbance to habitats that could adversely affect fish and fish habitat and disrupt riparian vegetation and salt marsh habitat that has colonized the channel.

The “replacement dike” which was constructed by ANGS along the bank at the River Site is higher than the original dike, providing beneficial flood protection for the surrounding land. The dike will be subject to an inspection and any deficiencies remedied by ANGS prior to returning ownership of the portion of the land owned by ANGS to the Government of Nova Scotia along with the lands on which it is built.

ANGS is engaging or will engage applicable provincial and federal regulatory agencies, the Mi’kmaq of Nova Scotia, and other key stakeholders to communicate proposed plans and obtain feedback to help refine decommissioning and reclamation planning. This feedback will be incorporated into a final version of the Plan and reflected in an Environmental Protection Plan (EPP) to be developed to guide decommissioning and reclamation activities and follow-up measures.

Abbreviations

ANGS	Alton Natural Gas Storage Limited Partnership
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
EPP	Environmental Protection Plan
HDD	horizontal directional drilling
HDPE	high-density polyethylene
km/h	kilometres per hour
LOA	Letter of Authority
m^3	cubic metres
NS	Nova Scotia
NSDA	Nova Scotia Department of Agriculture
NRR	(Nova Scotia) Natural Resources and Renewables
NSECC	Nova Scotia Environment and Climate Change
NS ESA	Nova Scotia *Endangered Species Act*
NSPI	Nova Scotia Power Inc.
OHWM	ordinary high water mark
ppt	parts per thousand
RoW	right-of-way
SARA	*Species at Risk Act*
the Project	Alton Natural Gas Storage Project
UARB	Utility and Review Board

1.0 INTRODUCTION

Alton Natural Gas Storage Limited Partnership (ANGS) proposes to decommission the partially constructed Alton Natural Gas Storage Project (the Project). The Alton Natural Gas Storage Project was an underground natural gas storage facility being developed in Nova Scotia to support the Province's growing demand for dependable, clean, and affordable energy year-round. As proposed, the Alton Project would have consisted of engineered, underground salt caverns to safely store natural gas, a natural gas pipeline linking the caverns to the North American natural gas supply network, and facilities for the cavern construction phase, including water pipelines from the caverns to the Project's site on the tidal Shubenacadie River estuary.

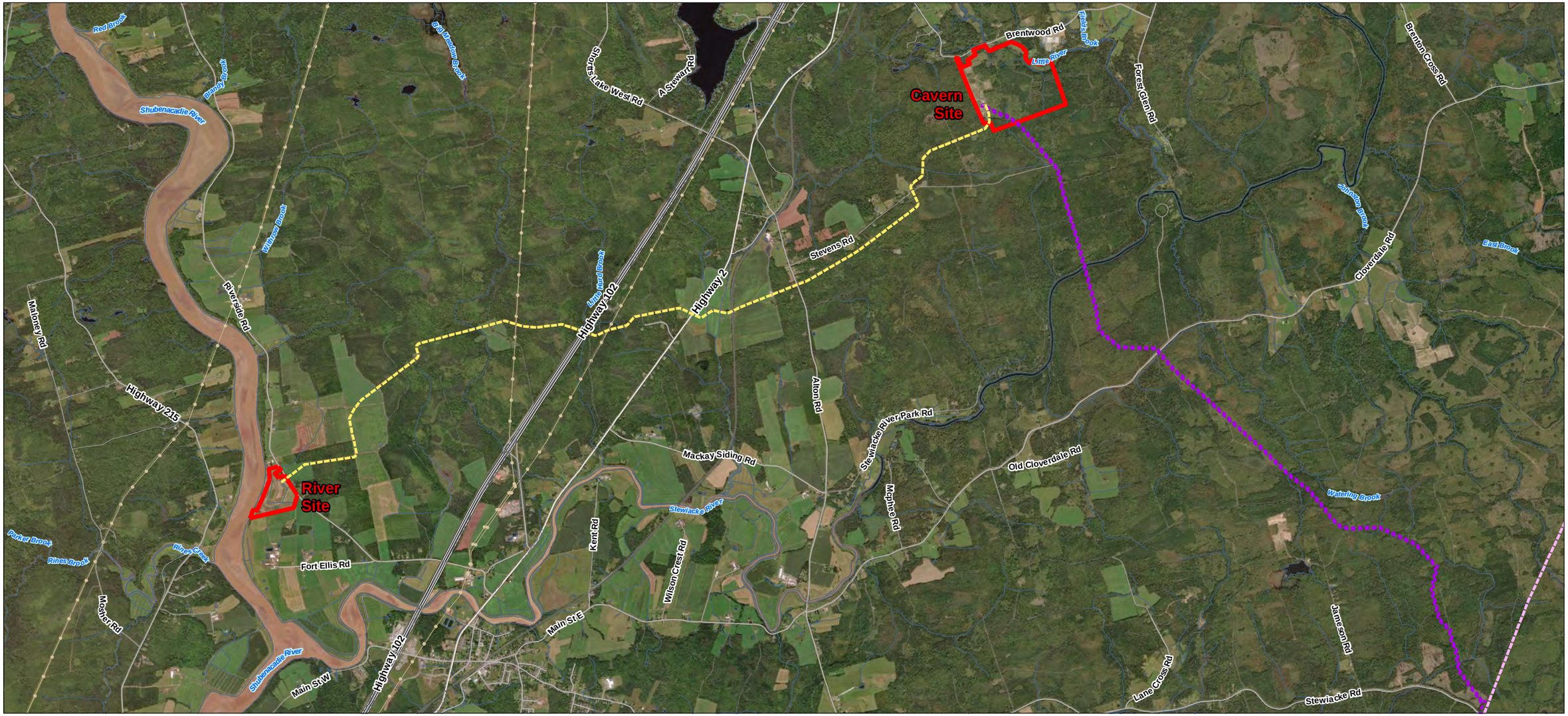
Located in Colchester County, Nova Scotia (NS), the Project comprises two distinct sites connected by a linear pipeline corridor as well as a natural gas pipeline right-of-way (RoW) (Figure 1.1):

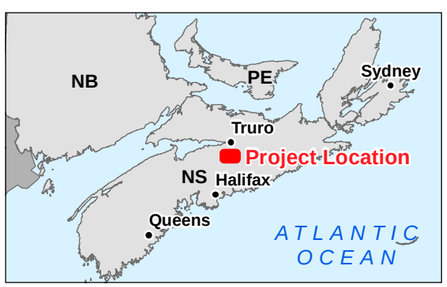
- A Cavern Site (proposed underground natural gas storage facility) near Alton, NS
- A River Site (site of water intake and discharge point in a diversion channel on the bank of the Shubenacadie River in Fort Ellis, NS)
- A Water and Brine Pipelines RoW that connects the Cavern Site and River Site
- A 10 km natural gas pipeline RoW which connects the Cavern Site to the Maritimes & Northeast Pipeline's (M&NP's) natural gas transmission system

The current design for the Project would have seen two storage caverns built to support natural gas consumers in Nova Scotia, where demand for natural gas continues to grow year over year. However, no water or brine ever flowed through the pipelines, no cavern was ever solution mined, and no brine was ever discharged to the environment. A proposed natural gas pipeline connecting the Cavern Site to the M&NP natural gas transmission system Halifax Lateral was assessed (Stantec 2012, 2013) and approved by the Minister of Environment. However, construction of the pipeline did not progress beyond the cutting of a survey centreline in 2019.

Decommissioning of the Project was assessed as an activity in the environmental assessment process for the Project (Jacques Whitford 2007) and does not represent a modification to the approved Project.

This document is a Decommissioning and Reclamation Plan intended to guide decommissioning planning and support ANGS in fulfilling regulatory requirements and environmental/social obligations associated with Project decommissioning and reclamation. Specifically, this Plan is intended to fulfill the requirement for a rehabilitation plan under Section 9 of Industrial Approval No. 2008-061384-03 and a decommissioning plan under Section 11 of Crown Land Lease No. 304528. With respect to the proposed natural gas pipeline, this Plan is intended to fulfill applicable requirements for an abandonment plan as stipulated in Section 14.1 of the environmental assessment approval conditions for the Alton Natural Gas Pipeline Project. This Plan also fulfills commitments made by ANGS regarding decommissioning planning in Section 2.1.3 of the Environmental Assessment Registration for the Alton Natural Gas Storage Project (Jacques Whitford 2007), and commitments made by ANGS regarding decommissioning planning in Section 2.4 of the Environmental Assessment Registration for the Alton Natural Gas Pipeline Project (Stantec 2012).





- Water and Brine Pipelines
- Proposed Natural Gas Pipeline
- Maritime and Northeast Gas Pipeline
- ANGS Property Boundary
- Highway
- Main Road
- Secondary Road
- Street
- Railroad
- Resource Road / Trail
- Transmission Line
- Watercourse

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1:50,000

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Stantec

Project Location
Colchester, NS

Prepared on 2021-09-02

Client/Project
121417145_001a
Alton Natural Gas Storage (ANGS) Limited Partnership

Figure No.
1.1

Title
Project Location

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Client
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User CommunityGovNS

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1.1 PROPONENT INFORMATION

ANGS is fully owned by AltaGas. Proponent information is provided below.

Name of Proponent:	Alton Natural Gas Storage Limited Partnership (ANGS)
Proponent Project Contact:	Project Manager Email: AltonProject@AltaGas.ca

Questions or comments on the Project can be directed to AltonProject@AltaGas.ca.

1.2 BACKGROUND

The Alton Natural Gas Storage Project was designed and partially constructed as a hydrocarbon storage facility to store natural gas underground in salt caverns for distribution and sale to market. Natural gas was proposed to be stored in engineered caverns during periods of low demand and supplied during periods of high demand. Bulk storage of hydrocarbons in underground salt caverns is a method that has been used in North America and elsewhere. As Nova Scotia relies on importing natural gas, the Project was intended to improve Nova Scotia's access to natural gas, reduce volatility in natural gas prices, and provide an opportunity for more stable transportation and storage.

As proposed, the Project was designed to create natural gas storage caverns in an underground salt formation. To create caverns, water would be pumped from the tidal Shubenacadie River to the Cavern Site approximately 12 km away where it would be sent down drilled wells to a depth of about one kilometre. Using a process called "solution mining" or "brining", water would wash away the salt deposit, creating a large cavern at each wellsite. During the brining process, the water and dissolved salt (i.e., brine) would be pumped to the surface, then piped to the River Site for release into the tidal Shubenacadie River estuary under closely monitored conditions. Caverns created in the salt formation would be used to safely store natural gas. A natural gas pipeline would link the caverns to the North American natural gas supply network. Figure 1.2 provides a schematic of the overall Project.

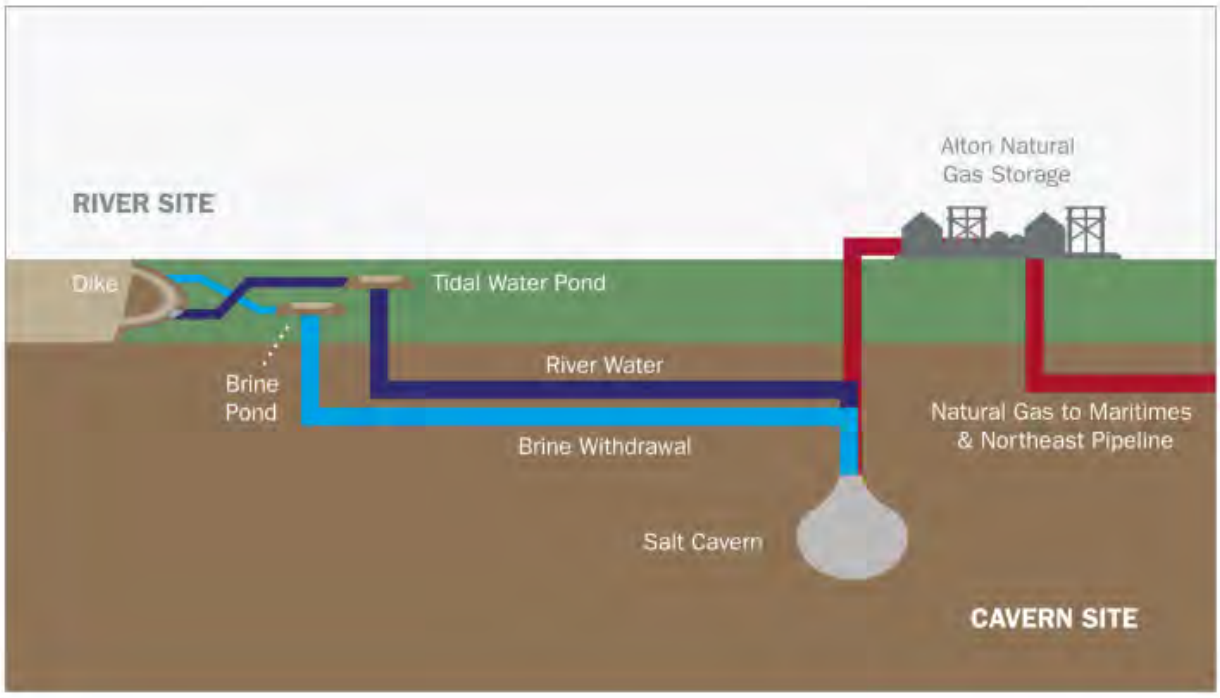


Figure 1.2 Project overview schematic

Following an environmental assessment process and receipt of applicable approvals (Section 3.1), installation of Project infrastructure began in 2014 with the construction of water and brine management facilities including water and brine pipelines linking the Cavern Site to the tidal Shubenacadie River estuary. A diversion channel was constructed adjacent to the Shubenacadie River to promote mixing of brackish river water and brine discharge under closely monitored conditions. The brining operation was never initiated, no brine was ever produced from the cavern site and no brine was ever discharged to the tidal Shubenacadie River estuary. The channel was also constructed to create an intake for river water with fish protection engineered measures, to provide water supply to the Cavern Site.

Three wells were drilled at the Cavern Site. However brining operations did not begin and therefore cavern development did not occur. The natural gas pipeline was also not constructed. The Project was partially constructed but did not proceed to commissioning or operations. Between 2015 and 2019, ANGS undertook several focused studies to provide additional information on the tidal Shubenacadie River and estuary and to help refine Project design.

1.3 REASONS FOR DECOMMISSIONING

Natural gas storage is important for the Maritimes and New England market. The Alton Natural Gas Storage Project was intended to supply storage within this market. While planning and construction for Alton took place, AltaGas divested its natural gas utilities in Canada in 2018 including the utility in Nova Scotia that Alton would support. This shift occurred as the Company's focus repositioned to natural gas processing and energy exports on the West Coast of North America and natural gas utilities in the United States. In addition to this repositioning, a financial review of the Project in 2020 determined that the Project would be economically challenging in the proposed configuration. Subsequently, a decision was made to decommission the Alton Project.

1.4 GUIDING PRINCIPLES AND OBJECTIVES

ANGS is committed to decommissioning the Project in a manner that fulfills legal and regulatory requirements and reduces environmental and public safety risks. The overall goal of Project decommissioning and reclamation is to reclaim equivalent land capability, to allow the land to support various land uses similar, but not necessarily identical, to the uses that existed before the Project.

The development of the Decommissioning and Reclamation Plan is guided by the following:

- Regulatory requirements in existing Project approvals, licences and authorizations
- Legal obligations in lease and easement agreements with the Province of Nova Scotia and private landowners
- Commitments made by ANGS in environmental assessment and permitting applications, including environmental management plans developed for the Project
- Applicable industry codes and standards
- Precedents set by other comparable projects that have been decommissioned in Nova Scotia
- Site-specific conditions as noted through visual observations and review of baseline and follow-up monitoring data
- Feedback obtained through Indigenous and stakeholder engagement

Specific objectives for decommissioning and reclamation are to:

- Comply with applicable legal and regulatory requirements
- Promote environmental stewardship across the full life cycle of the Project, including decommissioning and reclamation, minimizing environmental impacts of decommissioning activities
- Consider beneficial re-use of facilities, equipment and land
- Reduce public safety risk and potential long-term liabilities
- Provide a means to invite input from local communities and the Mi'kmaq of Nova Scotia on the decommissioning activities and objectives proposed

2.0 SCOPE AND APPROACH

2.1 SCOPE

This Decommissioning and Reclamation Plan encompasses all existing Project facilities and infrastructure associated with the River Site, Water and Brine Pipelines, and Cavern Site as provided in Table 2.1 as well as associated regulatory approvals for these facilities. Except for clearing a survey centreline, the proposed natural gas pipeline was never constructed to connect the Cavern Site to the Maritimes & Northeast Pipeline's natural gas transmission system Halifax Lateral. Therefore no physical decommissioning is required for this Project component.

Brining operations were never conducted for the Project. Therefore, although the water and brine pipelines, brine tanks and brine storage pond have been constructed and now require decommissioning, these facilities were never operated. Similarly, while wells have been drilled and applicable infrastructure installed to create storage caverns, brining operations did not occur. Therefore, underground hydrocarbon storage caverns were never developed.

Where Project components were not constructed, physical decommissioning is not required. However, since these components were part of the approved Project, ANGS remains obligated to close out applicable regulatory authorizations associated with these Project components.

Table 2.1 Key Project Facilities and Infrastructure to be Decommissioned

Site	Facilities and Infrastructure
River Site	• Diversion channel • Intake (including gabion wall) and brine outfall facilities • Pumphouse • Electrical building (Motor Control Centre) • Freshwater storage pond • Brine storage pond • Piping, valves and metering equipment • Roads • Powerlines
Water and Brine Pipelines	• Pipelines • RoW easement • Air release/vacuum valve chambers • Groundwater monitoring wells
Cavern Site	• Building with water injection pumps and control equipment • Water tanks • Brine tank • Nitrogen generation facility • Above and below-grade piping • Valving site equipment • Wells

2.2 APPROACH

ANGS is committed to decommissioning the Project in a manner that fulfills legal and regulatory requirements and reduces environmental and public safety risks.

As noted in Section 1.4, the development of this Plan was guided by regulatory requirements and guidelines, landowner obligations, applicable environmental commitments made by ANGS, examples of comparable decommissioning and reclamation projects, site-specific conditions, and historical Indigenous and stakeholder input on the Project. Applicable regulatory and legal requirements, codes and standards are described in Section 3. Site-specific conditions are described in Sections 4.1, 5.1 and 6.1. Feedback obtained during stakeholder and Indigenous engagement is summarized in Section 7. Appendix A contains information on relevant experience from other decommissioning projects as well as other current knowledge that may be relevant to decommissioning planning for this Project.

The overall proposed approach for decommissioning the Alton Natural Gas Project is to remove above-ground structures, leave buried components in the ground, and reclaim land to equivalent land capability. In-ground structures (e.g., piping, valves) would be abandoned in place where allowed by regulatory and legal requirements and where they demonstrate no public health and safety risk. This approach would minimize ground and habitat disturbances and associated environmental effects (including erosion, sedimentation, noise and air emissions) associated with decommissioning and reclamation activities.

Likewise, ANGS proposes to leave the constructed diversion channel in place. As it exists, the diversion channel has naturally infilled and revegetated and there is no adverse effect on fish and fish habitat. And while this approach would represent a change in the shoreline and diked structure along the Shubenacadie River that existed before Project construction, naturalization of the diversion channel is already occurring and these changes do not preclude the river or shoreline from fulfilling similar ecological functions and uses that existed before the Project. Salt marshes are extremely productive wetlands. More than 50% of salt marsh habitat in Nova Scotia has been lost, mostly as a result of diking to convert salt marsh to agricultural land (NSE 2019). The development of a salt marsh in the brine discharge channel is an asset for reclamation of the site due to the historical loss of much of Nova Scotia's salt marsh habitat. The natural development of this salt marsh has the additional benefit in that it provides a highly valued habitat with no intrusive reclamation work required. Removal of the diversion channel would require substantial in-water work that could adversely affect fish and fish habitat and disrupt herbaceous vegetation and salt marsh habitat that has colonized the channel.

Specific decommissioning and reclamation plans for the River Site, Water and Brine Pipelines, and Cavern Site are described in Sections 4, 5 and 6 of this Plan.

3.0 REGULATORY REQUIREMENTS, CODES AND STANDARDS

3.1 EXISTING REGULATORY APPROVALS, AUTHORIZATIONS AND AGREEMENTS

The Project has secured numerous approvals, authorizations and agreements to permit activities conducted to date. As shown in Table 3.1, many of these approvals contain stipulations for Project decommissioning and reclamation or otherwise have relevant implications for planning decommissioning activities.

Table 3.1 Summary of Project Approvals and Authorizations and Implications for Decommissioning and Reclamation

Approval/Authorization	Regulatory Authority	Scope/Context	Status	Decommissioning and Reclamation Implications
General				
Environment Act – Environmental Assessment Approval with Terms and Conditions	Nova Scotia Environment and Climate Change (NSECC)	The Alton Natural Gas Storage Project was registered as an undertaking under the *Environment Act*. Approval was received with conditions.	Valid – Approval received December 18, 2007	No specific approval conditions for decommissioning, however, conditions related to construction activity will be considered, as appropriate. Section 1.4 of the Approval Conditions requires ANGS to implement all mitigation and commitments in the Registration Document, unless otherwise approved by NSECC. This includes ANGS' commitments pertaining to decommissioning as presented in Section 2.1.3 of the Registration Document for the Alton Natural Gas Storage Project (the facilities).
River Site (Channel, Dike, Brining Facilities)				
Industrial – Oil and Gas- Brine Storage Pond Approval No. 2008-061384-03	NSECC	Industrial Approval issued under Part V of the *Environment Act* to operate the Brine Storage Pond and associated works. The Industrial Approval was appealed and set aside to allow 120 days of additional consultation by the Nova Scotia government.	Set-aside pending further Crown consultation – Approval No.:2008-061384-A03 Effective: January 2016 Amended: April 8, 2019 Expiry: January 20, 2026	Section 9 requires ANGS to provide a rehabilitation plan acceptable to NSECC at least 60 days before abandoning the site.
Letter of Authority (LOA) – Construction of Manmade Channel and Installation of Water Intake and Brine Storage Structures, Fort Ellis, (Shubenacadie River), Colchester County LOA#3045428	Nova Scotia Lands and Forestry (now part of Nova Scotia Natural Resources and Renewables [NRR])	LOA provides authority pursuant to the *Crown Lands Act* and *Beaches Act* to place infill on submerged Crown lands below the ordinary high water mark (OHWM) in the Shubenacadie River	Expired – LOA issued on January 27, 2016; expired once lease was issued to Alton Gas (Lease No. 304528)	N/A
Crown Land Lease No. 304528	NRR	Lease grants use of certain parcels of Crown land for the development, construction, use and maintenance of a "channel", where the channel represents the structures, pipelines, facilities and channel adjacent to the Shubenacadie River involved in brining facilities for the Project (PID 20218871 on Figure 4.1).	Valid – Signed April 5, 2016; Lease has a term of 20 years starting from the date upon which water from the Shubenacadie River begins to flow through the channel unless terminated	Section 11 of the Lease Agreement contains provisions for the removal of equipment and structures and requires ANGS to submit a decommissioning plan. The decommissioning plan must include the following: • Any studies, analysis and reports required in compliance with environmental laws • An analysis of the technical, economic and environmental considerations associated with: – Removal of the channel and any equipment and structures – Abandonment in place of the channel and any equipment and structures • A recommendation as to whether the channel and any equipment and structures should be removed or abandoned in place, in each such case together with all recommended remedial and mitigating measures • A description of the work techniques and methods that would be used to remove the channel and any equipment and structures • A schedule for completion of any removal of the channel and any equipment and structures that is recommended. The Lessee (ANGS) must remove the structures of the Channel and any other equipment and structures or other personal property brought on the Property immediately on the expiration or termination of the Lease unless otherwise notified by the Lessor (Province of NS).
Crown Land Lease Agreement (2019) (Dikelands)	NS Department of Agriculture (NSDA)	Agreement which grants license (with standards and conditions) to enter on Crown land and existing dike for purpose of reconstructing the existing dike and constructing the replacement dike. Issued in accordance with the *Agricultural Marshland Conservation Act.*	Valid – Agreement signed February 26, 2019; expires on December 1, 2021. Supersedes 2016 Agreement which expired December 1, 2016.	Agreement does not contain any stipulations specific to decommissioning, although Schedule E presents standard for hydroseeding which may be used to inform reclamation at the River Site.

Table 3.1 Summary of Project Approvals and Authorizations and Implications for Decommissioning and Reclamation

Approval/Authorization	Regulatory Authority	Scope/Context	Status	Decommissioning and Reclamation Implications
Water and Brine Lines				
Approval to Construct – Pipeline on Various Watercourses Approval No. 2014-089061	NSECC	Approval to construct water pipelines	Expired – Approval received June 6, 2014; expired December 31, 2014	N/A
Easement agreements with private landowners	-	Easement agreements were negotiated with landowners along the water and brine pipelines RoW prior to pipeline installation. A general form of easement was used for all landowners except Northern Timber Nova Scotia Corporation which required specific provisions for decommissioning and reclamation.	Valid	The general form of easement allows ANGS to elect to leave the water pipelines in the ground, although if ANGS elects to remove the pipelines, it must restore the surface of the easement area to the same conditions as prior to the installation. The form of easement with Northern Timber Nova Scotia Corporation requires ANGS to remove the pipelines and remediate the lands in the event of Project abandonment.
Cavern Site				
Underground Hydrocarbons Storage Act – Underground Hydrocarbons Storage Regulations – Approval to Construct M08974	UARB	On March 11, 2019, the UARB issued an Approval to Construct (M08974) in response to an application by ANGS for extension to a previous approval (M04172) that expired on September 1, 2018. The underground hydrocarbons storage facility has not been constructed, therefore the applicability of this approval to Project decommissioning is uncertain and requires further discussion with the UARB.	Valid – Approval to Construct M08974 Expiry: September 1, 2023	Proposed works must be carried out in accordance with all applicable federal, provincial and municipal laws including the *Underground Hydrocarbons Storage Act*, the Underground Hydrocarbons Storage Regulations, and the Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002. The Project (including any proposed changes) must maintain compliance with applicable environmental approvals. The applicability of this approval to Project decommissioning will be determined in consultation with the UARB.
Underground Hydrocarbons Storage Area Licence UHSLIC-07-11-15#1	NRR	Pursuant to the *Underground Hydrocarbons Storage Act,* a Licence gives the holder the exclusive right to conduct activities required to evaluate the potential of a geological formation for the development of a storage reservoir	No longer valid – Issued November 15, 2007; term of licence was 1 year and could be renewed up to 4 times for further periods of 1 year. This licence was superseded by the issuance of the lease (see below).	s. 6(1) The Licensee shall reclaim the Lands in a manner satisfactory to the Licensor. (2) Details respecting reclamation are addressed in the Code of Practice [*Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002*] (see Paragraph 3.3 of the licence). s. 19 Cessation of work or suspension or termination of this Licence for any reason shall not relieve the Licensee from any ongoing obligations imposed by the terms of this Licence.
Hydrocarbon Storage Area Lease (Alton #1)	NRR	Pursuant to the *Underground Hydrocarbons Storage Act,* a Lease gives the holder the exclusive right to develop and utilize the storage area for the injection, storage or withdrawal of hydrocarbons in a storage reservoir.	Valid – Lease is granted for an initial term of 20 years from the effective date (June 2, 2009) of the lease	s. 23 Should this Lease be cancelled or suspended, the Lessee is not relieved of any responsibility for the proper abandonment of the storage reservoir and restoration of the storage area as provided in the Act [*Underground Hydrocarbons Storage Act*] and Regulations [*Underground Hydrocarbons Storage Regulations]*.[1] s. 25 The Lessee may, at any time during the term of this Lease, in accordance with Section 21 of the Act, apply to surrender this Lease.
Natural Gas Pipeline				
Environment Act – Environmental Assessment Approval with Terms and Conditions	Nova Scotia Environment and Climate Change (NSECC)	The Alton Natural Gas Pipeline was registered as an undertaking under the *Environment Act*. Approval was received with conditions.	Valid – Approval received May 21, 2013	Section 14.1 of the Approval Conditions stipulate: The Approval Holder must provide NSE with a finalized abandonment plan, for review and approval, six months prior to the permanent shut down of the Undertaking. The Undertaking is the Alton Natural Gas Pipeline Project. Other than the cutting of a centreline within the proposed RoW, the Undertaking was not constructed. There is therefore no Undertaking to shut down or abandon other than a RoW.

[1] Section 31(1) of the *Underground Hydrocarbons Storage Regulations* indicate: "The suspension, cancellation or surrender of a licence or lease does not relieve the licensee or lessee of responsibility for the proper abandonment of the storage reservoir and restoration of the storage area.

Decommissioning of the Alton Natural Gas Storage Project was assessed in the EA Registration (Jacques Whitford 2007) and approved as a Project activity by NSECC. Proposed decommissioning and reclamation activities do not represent a modification to the approved Project. Section 2.1.3 of the EA Registration (Jacques Whitford 2007) outlines decommissioning commitments made by ANGS for the Project as follows:

> *Should decommissioning be required, options include leaving pipeline structures in place, or removing them. If abandonment of the structures is chosen, it will be undertaken in accordance with the regulatory requirements applicable at the time of such activities. In the event the structures are dismantled/decommissioned, an abandonment plan and, if required, a site restoration plan, will be developed in consultation with the appropriate regulatory authorities.*
>
> *At a minimum, an abandonment plan would include a schedule for equipment decommissioning and disassembly. The plan would indicate the approximate time required to remove and dispose all abandoned installations, structures, and buildings for which onsite reuse is not possible, and to reinstate the site to a quality necessary for subsequent industrial land use. Abandonment of the caverns themselves is covered in CSA Z341 and the requirements of this standard must, by Nova Scotia statute, be followed.*
>
> *Decommissioning planning will be developed in consideration of environmental goals for the area. Activities that support such planning may include a review of baseline and follow up monitoring data; thorough record keeping; adherence to applicable standards and guidelines during Project operations; documentation of potential influencing factors; and development of a rehabilitation plan.*
>
> *Disposal of waste will be conducted in accordance with [NSECC] waste management regulations and guidelines. Removal of buildings or structures is expected to have similar effects and considerations as construction and will be conducted in accordance with regulatory requirements applicable at the time of removal.*

3.2 ADDITIONAL RELEVANT LEGISLATION FOR PROJECT DECOMMISSIONING AND RECLAMATION

In addition to complying with existing regulatory approvals and authorizations associated with the Project, decommissioning and reclamation activities must adhere to applicable legislative requirements. Table 3.2 provides an overview of key provincial and federal legislation that may have implications for decommissioning and reclamation planning. Additional requirements may be identified during detailed planning and implementation of decommissioning activities.

Table 3.2 Key Legislation Relevant to Project Decommissioning and Reclamation

Legislation/Regulation	Regulatory Authority	Relevance to Decommissioning and Reclamation Requirements
Provincial		
Environment Act and associated regulations	NSECC	Approvals issued for the Project under Part IV and Part V of the *Environment Act* are addressed in Table 3.1. If decommissioning and reclamation activities will require alteration to wetlands or watercourses, a Division I Water Approval will be required in accordance with the Activities Designation Regulations under the Act.
Agricultural Marshland Conservation Act	NSDA	The conservation of tidal agricultural marshland (dikelands) and limitations of non-agricultural development on dikelands is managed under the Act. As indicated in Table 3.1, the Crown land lease agreement at the River Site (dikelands) is issued in accordance with the Act.
Endangered Species Act (NS ESA)	NRR	This Act provides legal protection for provincially-listed species and their habitat. Decommissioning and reclamation activities must be planned to avoid contravention of the Act.
Federal		
Fisheries Act	Fisheries and Oceans Canada (DFO)/Environment and Climate Change Canada (ECCC)	The *Fisheries Act* prohibits the harmful alteration, disruption or destruction of fish habitat and activities (other than fishing) that cause the death of fish without authorization under the Act. Decommissioning and reclamation activities must be planned to avoid contravention of the Act including the deposit of deleterious substances in water frequented by fish or may enter any such water.
Migratory Birds Convention Act, 1994	ECCC	This Act prohibits harm to any migratory bird, its nest, eggs and/or young. Decommissioning and reclamation activities must be planned to avoid contravention of the Act.
Canadian Navigable Waters Act	Transport Canada	This Act protects against interference with navigation on waterways. Reclamation activities related to the diversion channel would most likely be considered “minor works” under the Act and not require an application for approval as long as activities comply with legal requirements under the Act.
Species at Risk Act (SARA)	ECCC/DFO/Parks Canada Agency	SARA provides legal protection for listed species and their habitat. Decommissioning and reclamation activities must be planned to avoid contravention of the Act.

3.3 RELEVANT CODES, STANDARDS, AND GUIDELINES FOR PROJECT DECOMMISSIONING AND RECLAMATION

In addition to the legislated requirements for decommissioning, there are several codes, standards and guidelines to be considered for Project decommissioning and reclamation. A description of relevant codes and standards is provided in Table 3.3.

Table 3.3 Relevant Codes and Standards

Regulation/Code/Standard	Regulatory Authority	Relevance to Decommissioning and Reclamation Requirements
Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002	Utility and Review Board (UARB)	Given that the caverns were never developed or otherwise used to store hydrocarbons, the applicability of the Code of Practice remains uncertain and requires discussion with the UARB and NRR. Below is a summary of key provisions in the Code pertaining to decommissioning and reclamation. Section 3.12 in the Code references CSA Z341 with respect to cavern storage wells and addresses closure and abandonment with the stated objectives as stated below: • Isolate the storage reservoir from other subsurface formations • Have records of the size and the extent of the cavern system for future developments at the site • Ensure the wellbore is permanently isolated • Return the surface site to near original condition. The operator is required to cut off the production and surface casing at least one meter below ground level and cap the surface casing with a welded steel plate and also return the area of surface facilities to a condition acceptable to the Administrator or the Board. Section 3.12.6 in the Code describes monitoring and measuring requirements specific to cavern storage and associated product and brine. These requirements are not applicable to the Project as the cavern was never developed and there was no product or brine involved. Sections 3.12.17 and 3.12.8 in the Code outline record keeping and reporting requirements. Section 3.13.7 requires that records be kept of any well plugging, abandonment and site restoration work. Following storage facility abandonment, records must be retained by the operator in a location in Nova Scotia for a period of not less than 5 years. Section 3.12.9 in the Code requires that a public safety plan be developed and implemented for the closure of a storage facility. These requirements may not be applicable to the Project as the storage facility (cavern) was never developed. Section 3.13.20 in the Code describes the required submission of information for closure and abandonment for approval by the UARB which include: • Cavern abandonment/decommissioning program and design • Site restoration program • Public safety • Confirmation from NSECC of site rehabilitation completion • Consent of surface owner for site abandonment Confirmation of completion of restoration must be submitted to the UARB after the restoration of the surface of any abandoned well or storage facility. Confirmation must include evidence of restoration in compliance with any terms and conditions provided in the approval to abandon the well or storage facility.

Table 3.3 Relevant Codes and Standards

Regulation/Code/Standard	Regulatory Authority	Relevance to Decommissioning and Reclamation Requirements
CSA Z341-18 Storage of Hydrocarbons in Underground Formations (CSA 2018)		This CSA standard sets out the minimum requirements for the design, construction, operation, maintenance, abandonment, and safety of hydrocarbon storage in underground reservoir formations and associated equipment. The equipment considered includes storage wellhead and Christmas tree assemblies; wells and subsurface equipment; and safety equipment, including monitoring, control, and emergency shutdown systems. The applicability of this CSA standard requires discussion with the UARB and NRR. Condition 13 of the CSA standard describes the requirements for abandonment of storage wells. The applicability of these requirements is currently unknown and requires further evaluation and discussion with the UARB and NRR.
Nova Scotia Environment and Labour (2007) Fact Sheet: Environmental Monitoring Well Decommissioning	NSECC	Fact sheet provides information on typical monitoring well decommissioning methods that are suitable for use by industry during or following environmental site work and is intended to be used as guidance for consultants to prepare plans and for staff of NSECC to evaluate decommissioning proposals.

4.0 RIVER SITE

4.1 SITE DESCRIPTION

The River Site is the site of the river water intake and brine discharge point for cavern development and is located on the eastern bank of the tidal section of the Shubenacadie River, approximately 2.3 km downstream of the confluence of the Stewiacke River. The River Site is surrounded by agricultural and residential land uses (Figure 4.1). A historical dike system (referred to herein as “existing dike” to differentiate it from the “replacement dike” constructed by ANGS) exists along the bank of the Shubenacadie River.

4.1.1 Site Infrastructure

Key site components at the River Site include in-water infrastructure associated with a constructed diversion channel and replacement dike, including river water intake and brine outflow components, and facilities constructed on ANGS property land behind the dike to control the movement of water from the river to the Cavern Site and the brine from the Cavern Site for ultimate discharge to the river (Figure 4.1, Photo 1).

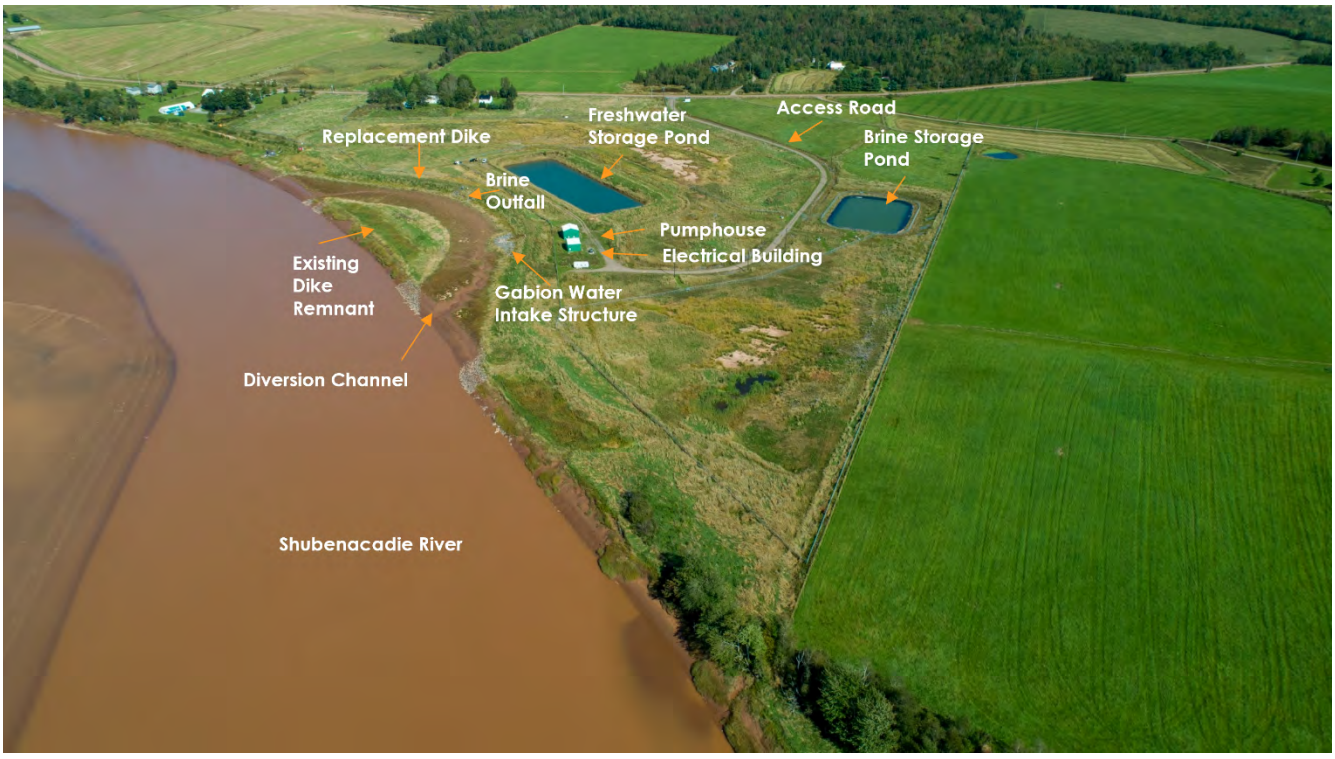
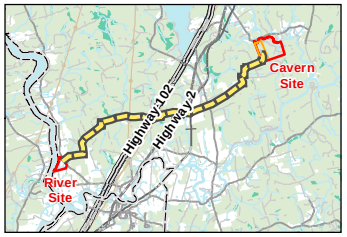


Photo 1 Aerial view of the River Site (2021)



- Buried Piping
- Access Road
- Building
- Gabion Intake Structure
- Pond
- Water and Brine Pipelines
- ANGS Property Boundary
- Other Property Boundary
- Secondary Road
- Resource Road / Trail
- Watercourse

N

0 60 120 metres
(At original document size of 8.5x11)
1:5,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Client
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

Project Location
Riverside Rd
Colchester, NS

Prepared on 2021-09-02

Client/Project
Alton Natural Gas Storage (ANGS) Limited Partnership

121417145_002

Figure No.
4.1

Title
River Site Plan

V:\1214\active\121417145\03_data\gis_cad\gis\mapping\mxd\report\121417145_002_RiverSite.mxd Revised: 2021-09-02 By: mblackwood

The River Site is accessed through a locked gate from Riverside Road. A chain-link fence lines the perimeter of the ANGS property from the road to the dike. Within the fenced area, an unpaved road winds from the gatehouse at the site entry point, past the brine storage pond, to the pumphouse and electrical building. The site has electrical power provided by Nova Scotia Power Inc. (NSPI) via an onsite transformer and distribution line. There is no water or sewer service on site.

Channel and Dike

In 2014, a diversion channel was constructed adjacent to the Shubenacadie River to provide an area for water intake and brine discharge that was outside the main river channel. One of the reasons for pursuing this approach was to avoid the main passage of fish and to leave the river mainly undisturbed to its active users, including fish harvesters. The channel was constructed by excavating the dry area behind the existing dike, with coffer dams placed at the new entrance/exit of the channel to allow for dry installation of the water intake and brine outfall. The slopes on both sides of the channel were reinforced with structural fill and riprap. The cofferdams were then removed to allow the channel to fill naturally with the tidal water of the Shubenacadie River once below-grade piping work for the brine outfall was completed.

During construction, the existing dike was breached in 2016 to create the inlet/outlet of the diversion channel. As required by Crown land lease agreements and approvals (Table 3.1), the interior wall of the channel was connected to the farther reaches of the dike on the site, creating a new section of dike continuous with the existing dike landscape. The “replacement dike” was inspected by the Nova Scotia Department of Agriculture in 2019. Since its construction, the channel has filled naturally with sediments and has become colonized with vegetation representative of salt marsh habitat (e.g., cordgrass) (Section 4.1.2). The intake and outfall infrastructure at the channel never entered operation and the accumulated sediment has not been removed. A site visit during August 2021 confirmed the replacement dike appears to be performing as designed and no obvious signs of distress or deterioration were observed at the time of the site visit. However, side slopes were consistently overgrown with vegetation and restricted detailed observations of the areas.

Intake Structure (Gabion Wall)

A water intake structure, designed to prevent fish entrainment or impingement, is located within the channel (Photo 2). The intake pipe, located within a gabion wall (retaining wall made of stones contained in a wire mesh) is located at the base elevation of the channel, and connects through the dike to pumps in the basement of the pumphouse. There is also a set of overflow high-density polyethylene (HDPE) pipes that run from the gabion structure through the dike, underground, to and from the freshwater storage pond. These pipes were intended to allow for passive movement of water to relieve/drain high water levels from both locations and to feed intake pumps for short time periods if river levels were insufficient to supply water during operations. This structure never entered operation.

Photo 2 Gabion wall intake structure in the diversion channel (2021) with the pumphouse (left) and electrical building (right) visible in the background

Brine Outfall

The brine outfall was also constructed within the channel, on the same side of the channel as the intake (see Photo 3 and Figure 4.1). It consists of a forked HDPE perforated pipe (teed into two sections) to provide dispersion of brine effluent through the cross section of the bottom of the channel, promoting mixing with the natural flow of water in the channel. Rock placement over the outfall pipes was intended to act as a barrier to large fish from swimming too closely to higher concentrations of brine, prior to effluent assimilation with the receiving water concentrations. A second set of HDPE pipes was also installed to feed compressed air into the channel to provide a secondary means of fish diversion (e.g., bubble curtains). The brine outfall never entered operation.

Photo 3 Brine outfall structure in diversion channel with two salinity monitors (2021)

Buildings

There are two buildings at the River Site: the pumphouse and the electrical building. The pumphouse is a steel frame building on a concrete foundation with a basement extending two levels below grade. Large intake water pumps were installed in the basement to move the water through the water pipeline to the Cavern Site. The pumphouse also houses a sediment filter (pretreatment before the Cavern Site), and compressed air system (for supply to the outfall). Mechanical piping within the building includes control valves, isolation valves, and instruments required for the control of the intake and discharge systems.

The electrical building is a single-story, steel frame building on a cement slab and houses electrical panels, Programmable Logic Controller (PLC) panels and a Motor Control Centre (MCC) to be used in the automated operation of the intake and discharge systems. These buildings never entered operation.

Ponds

A freshwater storage pond, which is a constructed impoundment lined with clay, was intended to store water drawn from the Shubenacadie River for use on an as-needed basis. Water from the storage pond was to be directed to the intake reservoir for the pumps leading to the Cavern Site. The impoundment for the storage pond was excavated below natural grade and berms were constructed of native and structural fill to match the top of the dike to allow natural flow to the outlet as needed when water level was at its peak. Water was never withdrawn from the Shubenacadie River as planned. Instead, the freshwater storage pond is currently filled with rainwater.

A brine storage pond, intended to hold saturated brine transported from the Cavern Site via a brine pipeline, was constructed as an impoundment, partially excavated and finished with a polyethylene liner to prevent brine seepage into the ground. However, since brining operations were never conducted, the brine storage pond has never stored brine and is filled with rainwater. The brine pond has a chain-link fence surrounding it.

Buried Infrastructure and Other Equipment

Buried HDPE lines cross through the River Site at various locations. The pumphouse cavern supply line leaves the building subsurface and meets the brine line adjacent the freshwater pond, where they both travel in parallel through the Water and Brine Pipelines RoW to the Cavern Site (12 km away). The brine pipeline enters the River Site from the Cavern Site near the freshwater storage pond but is directed under the access road to the brine pond for storage. A second brine line is located at the outlet of the pond, travelling under the road and between the pumphouse and freshwater storage pond on the path to the brine outfall at the channel. Other buried lines include the passive fill lines between the gabion intake structure and the freshwater storage pond, as well as the compressed air lines running underground from the pumphouse to the channel.

There are also buried isolation valves and instruments at the River Site, connected to the HDPE lines. The brine line entering the brine storage pond has a manual isolation valve with the stem and wheel above ground, visible from the access road. Near this, there is a dry manhole with a flow meter. A similar configuration exists at the outlet of the brine storage pond with a buried motor-operated control valve that has control systems above ground, and a second dry manhole with a flow meter.

Within the diversion channel there are salinity monitoring instruments with HDPE housings and related wiring and electrical equipment, visible at the edge of the channel above ground.

4.1.2 Environmental Setting

The River Site comprises a portion of the tidal section of the Shubenacadie River and dike system, and behind the dike, lands owned by ANGS.

Shubenacadie River

The Shubenacadie River is a tidal bore river that fluctuates widely in salinity, temperature, water elevation, suspended sediment, and river bottom configuration over very short temporal periods (less than one hour). The river meander length is approximately 50 km from its source at Grand Lake to its mouth at Maitland on Cobequid Bay. The river system receives freshwater from a relatively large watershed area (2,600 km^2) that includes the Stewiacke River, a tributary to the Shubenacadie River, the confluence of which is located approximately 22 km upriver of the mouth of the Shubenacadie River. Due to the extreme tidal forcing (>10 m large tidal range) from Cobequid Bay, the lower 30 km of the river is tidal and therefore estuarine in nature.

Striped bass research led by Dalhousie University on the tidal Shubenacadie River since 2008 has provided valuable insight into the physical and biological characteristics of the river, including the estuary at the River Site (Duston et al. 2018). The duration of the flood tide is about 1.5 hours at the River Site, with the estuary at the River Site expanding from approximately 50 m to 240 m in channel width and from 1.5 m to 5 m in depth between low and high tides. Saltwater intrusion can vary greatly during a tidal cycle, with salinities measured at the River Site ranging from 0 parts per thousand (ppt) to 16 ppt over a single cycle (Duston et al. 2018). Tidal exchange at the River Site is approximately 4×10^6 cubic metres (m^3) at the River Site (MARTEC 2007). On the ebb tide, current velocity in the main channel at the River Site location has been measured to peak at around 5.8 kilometres per hour (km/h) decreasing to 1.8 km/h at low tide (Duston et al. 2018).

The turbulence associated with the passage of the tidal bore in the Shubenacadie River estuary plays an important role in the transport of sediment within the estuarine system and Cobequid Bay. Suspended sediment is continuously being reworked from bottom sediments and eroded from exposed banks to form the extensive shoals, varying temporally and spatially, within the river and salt marshes throughout Cobequid Bay. Water quality sampling in the estuary has shown high total suspended solid (TSS) concentrations of 300 mg/L during ebbing tides and 1,300 mg/L during flooding tides (Jacques Whitford 2007).

This significant transportation of sediment over the years since the opening of the diversion channel at the River Site in 2016, with no consistent flow through the constructed diversion channel over the range of tides and no brine discharge occurring since construction, has resulted in sediment infilling of the riprap and armour rock protection lining the slopes and bottom of the diversion channel (Photos 4 and 5).

In the spring of 2020, a conical-shaped depression in the sediment, approximately 1 to 1.5 m in diameter at surface and approximately 2 to 2.5 m deep was identified in the center of the diversion channel, near the location of the brine discharge pipe (which was never operated). An investigation at the time suggested the depression was likely caused by a combination of surface flow, subsurface flow and tidal flow water movements. Further investigation of the presence and extent of any subsurface zones of saturation or voids that could exist has not been conducted since this would require excavation and would be disruptive to the site.

Photo 4 Diversion channel looking downstream in 2016 (top) and 2021 (bottom)

Photo 5 Diversion channel looking upstream in 2019 (top) and 2021 (bottom)

As shown in Photos 4 and 5, since its construction and subsequent opening to the river, the diversion channel has filled with sediment, and salt marsh vegetation has become established. This vegetation consists of a continuous carpet dominated by white sea-blite (*Suaeda maritima*), an annual plant which is tolerant of saline soils and flooding. Other species, including the grasses *Sporobolus alterniflorus* (saltmarsh cordgrass) and *Puccinellia maritima* (seaside alkaligrass) have also become established on the tidal mud flats. It is expected that the white sea-blite will be largely replaced by smooth cordgrass over the next decade. Remnants of a smaller drainage channel to the Shubenacadie River in 2021 on the upstream and downstream sections of the diversion channel are visible to the left in Photos 4 and 5, respectively, which is likely attributed to river water levels during the large spring tides.

It is anticipated that over the next several years the ongoing growth of vegetation will entrap more sediment and TSS from the estuary water, gradually reducing the drainage channel even further. Photo 6 is a simulated visualization of the natural reclamation of the diversion channel in approximately five years from now, after the decommissioning of ANGS assets at the River Site. This is based on the observed growth and progression of salt marsh vegetation over the past three years and visualization assessment methodology using site photos captured with a camera and drone in 2021. These photos were used to construct a three-dimensional (3D) model and visualization image out to 2026. Over time as the abundance of the perennial saltmarsh cordgrass increases, this species will eventually replace annual seablite on the mud flat forming a small salt marsh. The appearance of the new salt marsh will change over time with the relatively open annual seablite foliage cover replaced by a dense sward of saltmarsh cordgrass. The dense root system of the saltmarsh cordgrass will stabilize the mud which will result in the channels in the salt marsh becoming narrower and having steeper banks. The channels will not be eliminated by the establishment of saltmarsh cordgrass. The channels are an integral part of the salt marsh habitat since they allow water to drain out of the salt marsh when the tide falls. They also provide important habitat for fish and invertebrates.

Saltmarsh cordgrass is a key species in the development of salt marshes in eastern North America. It forms a dense grass sward which traps sediment resulting in the salt marsh increasing in elevation over time. If the supply of sediment is sufficient, saltmarsh cordgrass can typically maintain the elevation of the surface of the salt marsh even if sea levels are rising. Although this grass is not directly grazed by herbivores, the dead foliage from previous years decays and is swept out of the salt marsh by tidal action and enters the adjacent estuary. The leaf fragments are colonized by bacteria which in turn are eaten by invertebrates such as snails. In this way, salt marshes contribute substantially to the productivity of coastal waters by providing a source of organic carbon. Salt marshes are extremely productive wetlands. The development of a salt marsh in the diversion channel is an asset for reclamation of the site due to the historical loss of much of Nova Scotia's salt marsh habitat. The natural development of this salt marsh has the additional benefit in that it provides a highly valued habitat with no intrusive reclamation work required.

Photo 6 Visualization of the diversion channel in 2026 after decommissioning of ANGS assets and reclamation at the River Site

Fish Species

There is a high diversity of fish species present in the estuary including various diadromous (i.e., migrates between fresh and salt waters), marine, and freshwater species. Many of these species are of interest from conservation and/or fisheries perspective including, but not limited to: Atlantic sturgeon (*Acipenser oxyrhynchus*), brook trout (*Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*), striped bass (*Morone saxatili*), gaspereau/alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), Atlantic tomcod (*Microgadus tomcod*) and American eel (*Anguilla rostrata*) (ANGS 2015; Thaumas Environmental Consultants Ltd. 2019). Many of these species spawn in the Shubenacadie-Stewiacke watershed. The Inner Bay of Fundy population of Atlantic salmon is listed as *endangered* on Schedule 1 of SARA. The Bay of Fundy population of striped bass is assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *endangered*. American eel and Atlantic sturgeon (Maritimes population) are assessed by COSEWIC as *threatened*. The Shubenacadie River is one of only two estuaries in Atlantic Canada known to support the successful spawning of striped bass and is the only confirmed nursery habitat for the Bay of Fundy population of striped bass (Duston et al. 2018).

Terrestrial Habitat

The River Site contains six distinct plant communities associated with various current and historical land uses in the area.

The dike that was constructed for the Project is dominated in 2021 by herbaceous vegetation and has no trees or shrubs present. The dominant species along the dike is reed canary grass (*Phalaris arundinacea*). Orchard grass (*Dactylis glomerata*), tufted vetch (*Vicia cracca*), quack grass (*Elymus repens*), and common Timothy (*Phleum pratense*) are also common, and alsike clover (*Trifolium hybridum*) and garden bird's-foot trefoil (*Lotus corniculatus*) are scattered throughout the area. There is a remnant of an old dike that was not accessible but is assumed to have similar dominant vegetation.

The freshwater storage pond is approximately 5 m deep and contains little aquatic vegetation (Photo 7). It appears to have a mud bottom with scattered boulders. Wetland vegetation exists around the margin of the pond and is dominated by canary reed grass, with some creeping bent grass (*Agrostis stolonifera*), red fescue (*Festuca rubra*), and broad-leaved cattail (*Typha latifolia*).

Photo 7 Freshwater storage pond and fringing wetland vegetation (2021)

The brine storage pond, located south of the freshwater storage pond, is slightly elevated above the rest of the site, to limit the amount of overland flow into the pond. This pond has an impervious liner and contains no vegetation (Photo 8).

Photo 8 Brine storage pond with liner visible on edge (2021)

Several borrow pit areas exist in the vicinity of the two ponds, where material was excavated to construct the dike and other features in the area. These have no trees or shrubs and are strongly dominated by reed canary grass (Photo 9). Other species that are scattered throughout the area include broad-leaved cattail, tufted vetch, field sow thistle (*Sonchus arvensis*), Canada goldenrod (*Solidago canadensis*), fowl blue grass (*Poa palustris*), and Kentucky blue grass (*P. pratensis*).

Photo 9 Vegetation that has established within borrow pit areas (2021)

Agricultural land exists to the north, east, and southeast of the River Site (Photo 10). These areas are pastureland that have been left untouched since prior to construction of the Project. The agricultural land is dominated by reed canary grass. Other species that are common within these fields include tufted vetch, smooth brome (*Bromus inermis*), various species of blue grass (*Poa* spp.), common Timothy, common dandelion (*Taraxacum officinale*), and autumn hawkbit (*Scorzoneroides autumnalis*).

Photo 10 Dominant vegetation within agricultural lands (2021)

An area that is here described as old field, is located at a low elevation and has more imperfectly drained soils (Photo 11). This area forms a band located west of the access road to the River Site. It was used in the past for hay and is strongly dominated by reed canary grass. Bedstraw (*Galium* sp.), tufted vetch, bull thistle (*Cirsium vulgare*), dock (*Rumex* sp.), spotted jewelweed (*Impatiens capensis*), and grass-leaved goldenrod (*Euthamia graminifolia*) are also scattered throughout the area.

Photo 11 Dominant vegetation within old field site (2021)

A subsoil stockpile area located east of the freshwater storage pond was used to store soil excavated for pond construction (Photo 12). This soil seems to be low in organics and may contain naturally occurring salt, which limits vegetative growth. The soil stockpiles are sparsely vegetated and are dominated by smooth crab grass (*Digitaria ischaemum*), with lesser amounts of prairie cordgrass (*Sporobolus michauxianus*) and redtop (*Agrostis gigantea*).

Photo 12 Sparsely vegetated soil stockpile area (2021)

Terrestrial habitat like that found at the River Site provides breeding habitat for bird species such as bobolink (*Dolichonyx oryzivorus*, listed as threatened under SARA and vulnerable under NS ESA) and common nighthawk (*Chordeiles minor*, listed as threatened under SAR and NS ESA), and other migratory birds, which are protected by the *Migratory Birds Convention Act*. Little brown myotis (*Myotis lucifugus*) (listed as endangered under the NS ESA and SARA) likely forages within or near the River Site.

4.2 PROPOSED DECOMMISSIONING AND RECLAMATION PLAN

ANGS proposes to minimize the need for in-water decommissioning work at the River Site, to avoid potential impacts on fish and fish habitat, and leave the sedimented diversion channel and replacement dike in place. These features have never entered into operation and have naturally infilled and revegetated. To reduce the impact on the current formation of the salt marsh in the diversion channel, decommissioning and reclamation activities will be limited to the removal of structures in the diversion channel that are present above the ordinary high water mark including the exposed portion of the gabion wall and water intake structures, salinity monitors and the exposed armour rock to return the site to the natural landscape as much as possible. Buried structures (including the buried portion of the gabion wall and buried brine outfall pipes) will remain in place. Reclamation of any disturbed surfaces will be leveled, covered with topsoil and hydroseeded with the seed mix recommended for use by the NS Department of Agriculture.

Private land owned by ANGS will be reclaimed to support future agricultural and/or recreational use by a future buyer. Hydroseeding will be conducted using a seed mix recommended by NSDA during

construction of the replacement dike (Section 4.3). Table 4.1 outlines the decommissioning and reclamation activities for the River Site. Appendix B provides a visualization and comparison of the existing conditions in 2021 acquired with high-resolution aerial imagery with reclamation of the River Site anticipated by 2026 using a constructed 3D model, rendering software and anticipated vegetation growth.

Table 4.1 Overview of Decommissioning and Reclamation Activities at the River Site

Component	Proposed Decommissioning and Reclamation Activities
Diversion channel	The diversion channel will remain in place and provide new salt marsh habitat on the Shubenacadie River. The development of a salt marsh in the brine discharge channel is an asset for reclamation of the site due to the historical loss of much of Nova Scotia's salt marsh habitat. The natural development of this salt marsh has the additional benefit in that it provides a highly valued habitat with no intrusive reclamation work required.
Dike	The Crown land lease will be terminated. The replacement dike will remain in place. The current dike is likely to perform better than the original dike. The replacement dike has a locally higher crest elevation to provide additional flood protection, has been mostly revegetated, and is performing as designed. No benefit appears to be gained by causing further site disturbance to re-instate a structure that is lower and less resistant to flooding. Intake and outfall units will be plugged from the landward side (not from the diversion channel end of pipe) and remain in place. This will help reduce risk of water ingress and potential subsidence risk. The aeration unit will remain in place. On completion of all works, As-built drawings will be provided to the Department of Agriculture.
Gabion wall (water intake)	Components above the ordinary high water mark will be removed. Associated piping will be plugged (as noted above).
Pumphouse	All equipment/valving/piping will be salvaged and sold or scrapped. The building will be dismantled and removed, infilled to grade. Cement will be cut down to 1.2 m below grade.
Electrical building/MCC	All equipment will be salvaged, sold and removed from site. The building will be dismantled and removed. Cement will be cut down 1.2 m below grade.
Freshwater storage pond	The pond will be tested and if deemed appropriate, slowly drained over land under closely monitored conditions. Berms will be excavated and some of this material may be used to backfill the emptied pond to regrade the surface of the site in this area. Land will be regraded and revegetated using an approved seed mix. Alternatively, the pond may remain in place if requested by the future landowner.
Brine storage pond	The pond (which has filled with rainwater and never contained brine) will be tested and if deemed appropriate, slowly drained over land under closely monitored conditions. The liner will be removed and if it cannot be repurposed, will be disposed of in an approved manner. Land will be regraded to be consistent with surrounding conditions and revegetated using an approved seed mix.
Buried piping	Buried piping and valves will remain abandoned in place where these are buried at a minimum depth of 1.2 m below the surface. Where buried piping and valves are known to exist in depths shallower than 1.2 m, these will be removed. Manholes with valves and instrument attachments to buried piping will be infilled with concrete brought down to 1.2 m below surface.
Road/driveways	The onsite road and driveways will be reclaimed to functional surrounding conditions. Alternatively, these features may remain in place if requested by the future landowner.
Electrical service	Power will be disconnected by NSPI and the power poles and lines will be removed. Lands will be reclaimed to functional surrounding conditions. Alternatively, these services may remain in place if requested by the future landowner.

4.3 CONSIDERATION OF ALTERNATIVES

The preferred approach to decommissioning and reclamation at the River Site as outlined above was selected in consideration of the guiding principles and objectives outlined in Section 1.4. ANGS's goal is to reclaim equivalent land capability. However, in some cases, restoring the site to pre-Project conditions may result in greater adverse effects and/or remove land use improvements that could provide benefits for future land users. Alternative approaches to site decommissioning and reclamation are described below in Table 4.2.

Table 4.2 Decommissioning and Reclamation Alternatives at the River Site

Site Component	Options Considered	Rationale
Diversion channel and dike	Leave channel and replacement dike in place	The sediment channel has begun to fill with sediment and vegetative growth is occurring. This progression of naturalization is expected to continue. The diversion channel does not preclude existing or future human use of the tidal Shubenacadie River estuary.
	Remove diversion channel and/or structures in the channel and dike	Removing the diversion channel will disturb the estuary, involve considerable earthworks reconstruction activity, and could require authorization under the *Fisheries Act* for the harmful alteration, disruption or destruction of fish habitat. This option would also include destruction of developing salt marsh habitat. Restoration would result in disturbing and reshaping the material that was used to construct the dike raising and realignment. To reinstate the former dike across the channel, the construction of coffer dams would likely be required on the downstream side to protect earth fill from erosion from the tide. The constructability and stability of constructing a dike on recently deposited sediment would be challenging for contractors.
Water intake and brine outfall and associated piping/instrumentation	Plug intake and outfall units; remove components above the OHWM	Removing components above the OHWM will not involve intrusive work and will restore the visual landscape along the river shoreline and dike.
	Remove intake and outfall units and associated equipment in the channel/dike	Removing all the above-grade and buried components in the channel/dike may require in-water work and could cause environmental effects that could require authorization under the *Fisheries Act* for the harmful alteration, disruption or destruction of fish habitat. Removal of the buried components in the dike could also potentially cause slope stability issues. Destruction of developing salt marsh habitat would also occur.

Table 4.2 Decommissioning and Reclamation Alternatives at the River Site

Site Component	Options Considered	Rationale
Pumphouse and electrical/MCC buildings	Remove buildings and cut foundations to 1.2 m below grade	Future ownership and use of the site is unknown. The future landowner may prefer to leave structures and other site components intact. Retaining structures and facilities in place will reduce disturbance associated with decommissioning and reclamation activities. However, given uncertainty of future ownership and use of the site, and the goal to reclaim equivalent land capability, ANGS is currently planning to remove these components.
	Leave buildings and foundations intact	
Freshwater and brine storage ponds	Drain and reclaim one or both storage ponds	Future ownership and use of the site is unknown. The future landowner may prefer to leave one or both of the storage ponds intact. If the ponds are not removed as currently planned, there will be no need for dewatering or earthworks construction. However, given uncertainty of future ownership and use of the site, and the goal to reclaim equivalent land capability, ANGS is currently planning to remove the ponds. ANGS is also concerned with residual risk to public safety associated with abandoned ponds.
	Keep pond(s) intact	
Buried piping and valves	Abandon in place	The proposed approach to abandon buried piping and valves in place where it is buried deeper than 1.2 m below the surface is preferred as it will result in less disturbance to terrestrial habitat and lower risk of erosion at the site. However, leaving buried piping and valves in shallower depths in place may interfere with future land uses. If piping is excavated for removal, additional site reclamation will be required.
	Remove buried piping	
Onsite roads/driveways	Reclaim to functional surrounding conditions	Future ownership and use of the site is unknown. The future landowner may prefer to leave the road and driveways intact. This alternative would mean less site disturbance and could be beneficial for future site use. However, given the uncertainty of future ownership and land use, ANGS is proposing to reclaim the road and driveways.
	Leave road and driveways intact	
Electrical power service	Disconnect power and remove poles and lines	Future ownership and use of the site is unknown. The future landowner may prefer to retain electrical service to the site. If the poles and lines are not removed, there will be less site disturbance. However, given the uncertainty of future ownership and land use, ANGS is proposing to remove these structures.
	Suspend electrical service and retain the power poles and lines for future servicing of the site.	

5.0 WATER AND BRINE PIPELINES

5.1 SITE DESCRIPTION

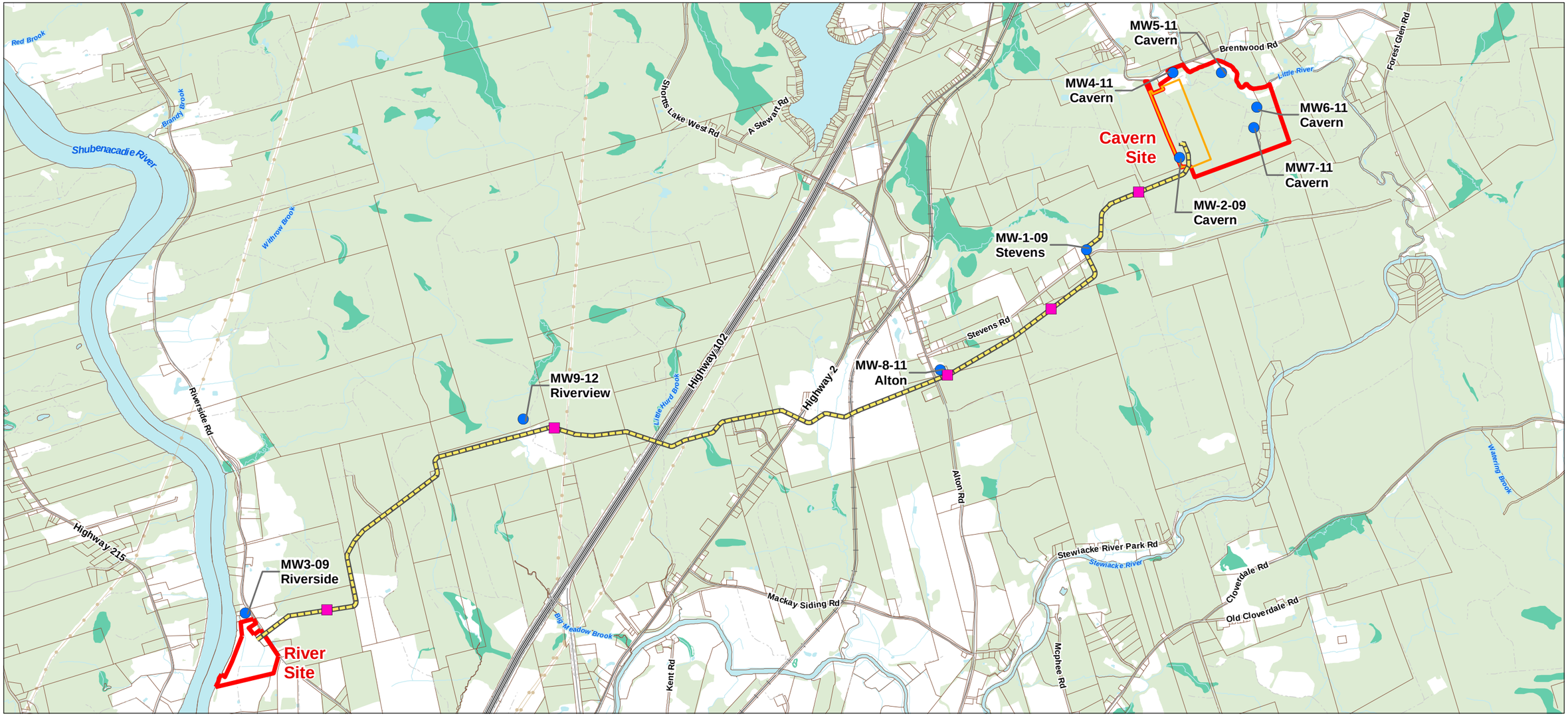
The water and brine pipelines connect the River Site to the Cavern Site, which is approximately 12 km away. Figure 5.1 provides the route for the pipelines RoW.

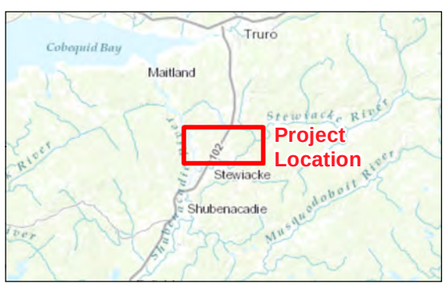
5.1.1 Site Infrastructure

The water (supply) line was intended to transport water from the tidal Shubenacadie River to a solution mining operation at the Cavern Site. The brine (return) line was intended to return brackish water from the solution mining process to the river. Both pipelines are 400 mm HDPE pipes, installed in a common trench, approximately 4.5 m in width within an approximate 20 m wide RoW. Neither pipeline was commissioned and neither has held fresh water or brine.

The pipeline RoW crosses several privately-owned and Crown land parcels, watercourses, two NSPI easements (with overhead power transmission lines), a CN Rail line, and several trails and roads, including Riverside Road, Highway 102, Highway 2, Alton Road, and Stevens Road. Typical depth of cover over the pipelines is 1.2 m, except at road crossings where depth of cover increases to approximately 1.6 m.

There are 12 watercourse crossings, the majority of which were completed by performing open cuts and reconstructions of the surrounding environment. Horizontal directional drilling (HDD) was used for pipe installation under watercourse 2 (Big Meadow Brook) and 3 (Little Hurd Brook) as well as under Highway 102 and the CN Rail line.





- Approximate Air Release/Vacuum Valve Chamber Location
- Monitoring Well
- Water and Brine Pipelines
- Fence
- ANGS Property Boundary
- Highway
- Main Road
- Secondary Road
- Street
- Railroad
- Resouce Rail / Trail
- Transmission Line
- Other Property Boundary
- Watercourse
- Waterbody
- Wetland
- Wooded Area

0 300 600 900 1,200 Metres

(At original document size of 11x17)
1:38,000

N

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Client
3. Background: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User CommunityGovNS

Stantec

Project Location — Prepared on 2021-08-26
Colchester, NS

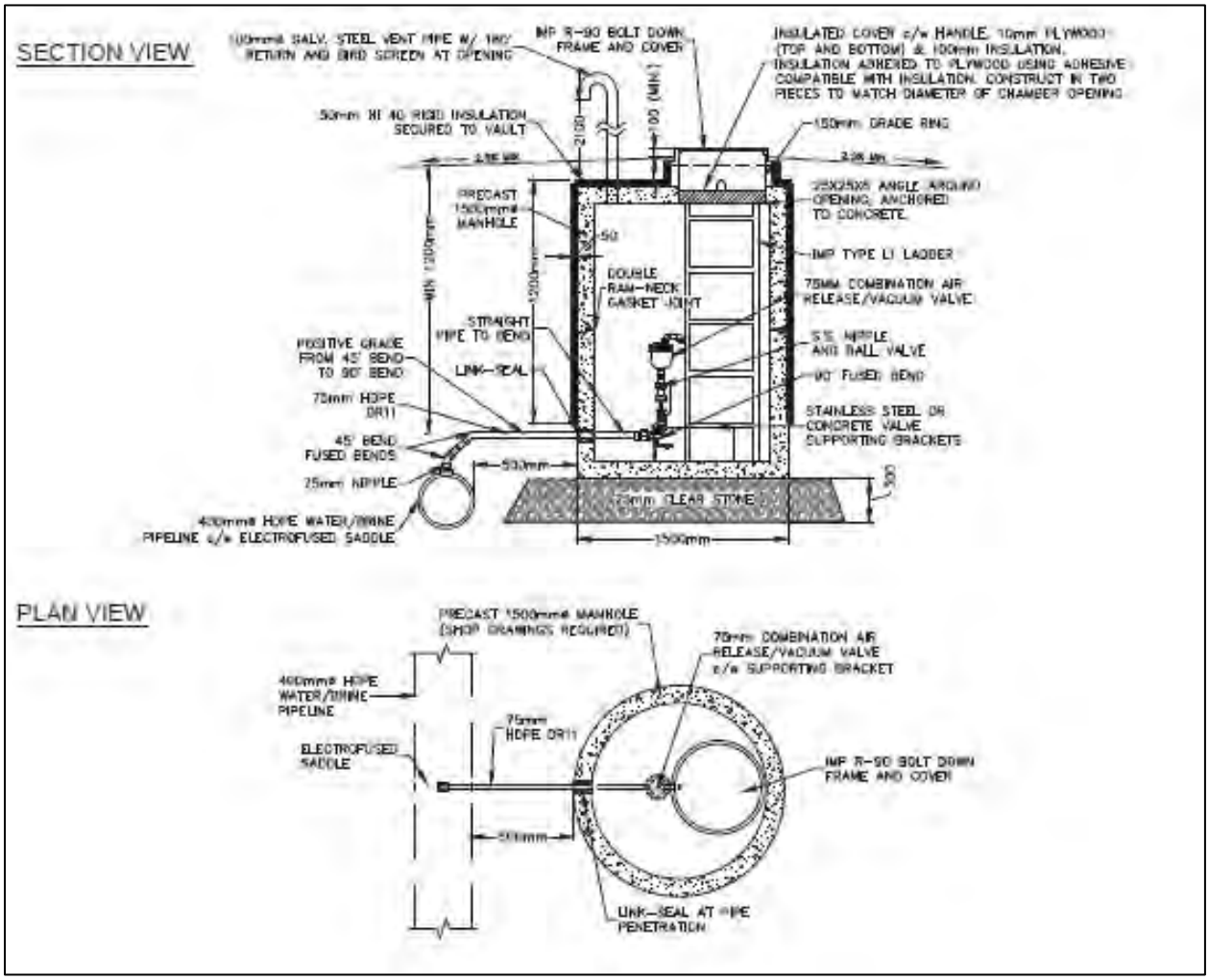
Client/Project — 121417145_004
Alton Natural Gas Storage (ANGS) Limited Partnership

Figure No.
5.1

Title
Water and Brine Pipelines Route

V:\121417145\active\121417145\03_data\gis_cad\gis\mapping\mxd\report\121417145_004_Water_Brine_PipelinesROW.mxd Revised: 2021-09-02 By: mblackwood

Along the length of the RoW, there are a total of five air release/vacuum valve chambers (Figure 5.2 and Photo 13). Vents were installed as a means of preventing pipe collapse under vacuum conditions and also to provide a means of venting during planned maintenance on sections of the lines or providing access to piping at planned locations. Figure 5.2 is a typical detail of the vent chamber configuration. In some locations the chambers extend well above the native grade, requiring sloped backfill to cover the concrete manhole structure. As with the pipelines, these structures never entered operation.



Source: Alton Design Drawing Package; WSP 2015

Figure 5.2 Typical detail of air release/vacuum valve chamber design

Photo 13 Surface of air release/vacuum valve chamber on RoW (2021)

Between 2009 and 2012, several groundwater monitoring wells were installed at the River Site (1), along the Water and Brine Pipelines RoW (4), and around the perimeter of the Cavern Site (4). These wells, with depths ranging from approximately 5 to 12 m below grade, were installed to monitor groundwater quality and potential effects on residential water supply wells. The locations of these wells are shown on Figure 5.1.

5.1.2 Environmental Setting

The vegetation within the pipeline RoW has been regenerating since construction was completed in 2014. There is currently very little shrub or tree cover within the RoW (Photo 14).

Canada goldenrod is present nearly throughout the RoW. In well-drained areas of the RoW, other common species include red fescue, grass-leaved goldenrod, hairy flat-top white aster (*Doellingeria umbellata*), and bracken fern (*Pteridium aquilinum*). Poorly drained areas, including areas of dense soils, low and compacted spots within the RoW, and areas adjacent to off RoW wetlands, dominant species can include soft rush (*Juncus effusus*), hairy flat-top white aster, common woolly bulrush (*Scirpus cyperinus*), broom sedge (*Carex scoparia*), and common boneset (*Eupatorium perfoliatum*).

Photo 14 Typical vegetation within the RoW (2021)

Mounds surrounding the air release/vacuum valve chambers are approximately 3 m x 3 m, and approximately 0.5 m in height relative to the surrounding RoW. These sites contain vegetation consistent with well-drained areas of the RoW described above (Photo 15).

Photo 15 Vegetation surrounding an air release/vacuum valve chamber (2021)

Wetlands were avoided in route planning; therefore, the likelihood of encountering wetlands during decommissioning activities is limited.

Habitats within the RoW could potentially provide habitat for bird SAR and other migratory birds, which are protected by the *Migratory Birds Convention Act* (MBCA).

5.2 PROPOSED DECOMMISSIONING AND RECLAMATION

ANGS proposes to abandon the water and brine pipelines in place, except where prohibited by landowner agreement. Examples of HDPE drainage or sewer pipes being abandoned in place are referenced in Appendix A.

Following construction, the RoW was revegetated and has become naturalized with native species present in surrounding landscape. By leaving buried pipelines in place, environmental disturbance particularly habitat destruction, including around watercourses, will be substantially reduced. The potential for air and noise emissions, erosion and sedimentation would also be reduced. However, it is proposed that the air release/vacuum valve chambers be demolished and groundwater monitoring wells be removed as these structures represent potential physical hazards and impediments to future land use. Table 5.1 outlines the decommissioning and reclamation activities for the pipelines and associated structures.

Table 5.1 Proposed Decommissioning and Reclamation Activities for the Water and Brine Pipelines

Component	Proposed Decommissioning and Reclamation Activities
Water and brine pipelines	Abandoned in place unless prohibited by landowner agreement. RoW will be excavated at the Highway 102 and CN Rail crossings to allow access to the pipelines so the segments underlying the highway and rail line may be filled with cement or flowable grout. Once these pipeline segments are infilled and capped, disturbed areas associated with the pipeline excavation will be restored.
Air release/vacuum valve chambers	The chamber frames, covers, the 75 mm combination air release/vacuum valves and any other appurtenances will be removed. These items will be salvaged for sale or recycled for future use. The precast concrete structure will be demolished at a minimum depth of 1.2 m below the top of chamber, with the rubble used as backfill. If the adjacent sections of the pipelines are not to be filled, temporary plugs will be placed in each line connecting to the chamber in preparation for filling the manhole. The disturbed area will be revegetated using an approved seed mix.
Groundwater monitoring wells	Groundwater monitoring wells will be decommissioned and abandoned in accordance with NSECC guidance (NSEL 2007) to prevent surface water infiltration into the aquifer and remove potential physical hazards. All equipment will be removed from the well. If feasible, the entire well casing will be removed from the well. Where removal of casing may result in geological formation collapse into the borehole, the casing will not be removed and instead will be cut off a minimum of 0.3 m below grade. The borehole will then be filled with grout or bentonite chips to the top of the casing. A minimum of 0.3 m of compacted natural fill will be used to fill to grade and cover (e.g., sod/gravel/asphalt) will be applied to match the site conditions. A written report will be submitted to NSECC documenting the location of each decommissioned well and the details of decommissioning to confirm correct methods were followed.

5.3 CONSIDERATION OF ALTERNATIVES

The options for decommissioning the water and brine pipelines are driven primarily by landowner agreements along the easement and informed by industry practices. Table 5.2 presents the various options considered for decommissioning and reclamation of the water and brine pipelines and associated structures.

Table 5.2 Decommissioning and Reclamation Alternatives for the Water and Brine Pipelines

Site Component	Alternatives Considered	Rationale
Water and brine pipelines	Leave pipelines buried with no treatment	RoW is stable and vegetated. No ground disturbance activities would be required which will avoid or reduce impacts to the environment. Likelihood of environmental-induced degradation of pipes is low. Given the relatively small size of the pipelines (400 mm diameter), even a total collapse of the pipe is unlikely to cause significant settlement on the ground surface in open field installation.
	Leave and fill in place (e.g., fill with blown-in sand and capped, or flowable grout/fill)	Somewhat reduced environmental impact compared to removal of pipeline, although would still require numerous excavations along the RoW that would be disruptive to the environment and to land users (e.g., air and noise emissions, traffic interruptions, safety concerns). Multiple access ports to the pipeline (e.g., every 60 m) along the alignment would be necessary to achieve a reasonably high rate of fill. Where the pipe profile may vary considerably, high points and low points would need to be confirmed and many additional access ports would need to be provided by open cut excavation.
	Partial leave and fill in place (depending on landowner requirements and/or site constraints)	Common approach used by industry for pipelines under major utility RoWs or sensitive environments. The preferred option is to leave the pipeline in place and infill beneath the rail line and Highway 102. Reduced environmental impact compared to removal of pipeline, and filling in complete pipeline, although could still require numerous excavations along the RoW depending on extent of fill.
	Remove completely	Most intrusive option, resulting in substantial environmental effects and disturbance to land users (e.g., air and noise emissions, traffic interruptions, safety concerns). This option will require use of heavy equipment for excavation and materials for backfilling and extensive surface restoration. The entire RoW would be disturbed and would require remediation with reclamation monitoring. The pipeline could be recycled. This is the least preferred option.

Table 5.2 Decommissioning and Reclamation Alternatives for the Water and Brine Pipelines

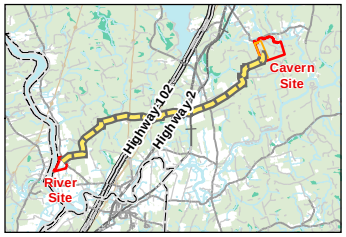
Site Component	Alternatives Considered	Rationale
Water and brine pipelines	Remove partially (e.g., where required by landowner agreement)	Less intrusive than removing entire pipeline, but still with considerable environmental effects and disturbance to land users as indicated above. Remediation and reclamation monitoring requirements would be similar as indicated above, although only for certain portions along the RoW.
Air release/vacuum valve chambers	Removal of chamber frame, valves and other associated equipment/attachments	Removal will require use of heavy equipment for demolition and removal resulting in environmental disturbance along the RoW. However, once removed, it will eliminate potential constraints for future land use and long-term liability concerns. This is the preferred option.
	Leave in place (all)	Leaving the chambers and associated equipment in place will eliminate the need for heavy equipment and ground disturbance. However, their continued presence may constrain future land use and may represent a long-term liability.
	Selective removal	Some chambers could be removed where others may remain in place, depending on landowner agreements. See above for implications of leaving in place or removing chambers.
Groundwater monitoring wells	Remove well casing	Decommissioning plans for the monitoring wells will be in accordance with NSECC guidelines, which allow for the removal or abandonment of the well casing during decommissioning. For deeper wells, where removal of the well casing cannot be done by hand, it is recommended that these casing remain in place to avoid use of heavy equipment access to the site.
	Leave well casing in place	

6.0 CAVERN SITE

6.1 SITE DESCRIPTION

The Cavern Site is located approximately 12 km from the River Site, near Alton, NS. The Cavern Site is comprised of land privately owned by ANGS that was partially developed for cavern construction and natural gas storage operations. Although the site itself is partially developed, cavern development has not occurred and the site has never entered operation (Figure 6.1 and Photo 16).

Photo 16 Aerial view of the Cavern Site (2019)



- Fence
- Access Road
- Tanks / Buildings
- Well Pad
- Water and Brine Pipelines
- ANGS Property Boundary
- Other Property Boundary
- Secondary Road
- Resource Road / Trail

* Additional buried piping not shown.

N

0 80 160 metres

(At original document size of 8.5x11)
1:7,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: Client
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User CommunityGovNS

Stantec

Project Location
Brentwood Rd
Colchester, NS

Prepared on 2021-09-02

Client/Project
Alton Natural Gas Storage (ANGS) Limited Partnership

121417145_003

Figure No.
6.1

Title
Cavern Site Plan

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6.1.1 Site Infrastructure

The Cavern Site is fully fenced with locked gates at either end, with an unpaved access road extending from the entrance off Brentwood Road to the back of the Cavern Site where the buried water and brine pipelines enter the site. The site contains three well sites, a steel frame building on slab containing equipment for the cavern solution mining process, a containerized nitrogen skid in a trailer, water and brine storage tanks, and buried piping. A gravel access road runs the length of the site. There are no water or septic services at the site, although there is electrical power serviced by Nova Scotia Power Inc.

Well Sites

Each of the three well sites consist of a cleared well pad and a wellhead/tree (assembly of valves, spools and fittings protruding from the wellhead); but otherwise, each well site is at varying levels of development. Two of the three wells (Wells 1 and 2) (see Figure 6.1 and Photos 17 and 18) have buried water and brine lines that connect to the building and associated mechanical infrastructure at the site. Well 1 has a containerized tank and associated pump system for withdrawing brine and removing grit prior to pumping to brine storage. The third well has no infrastructure. None of these wells or associated equipment has been used in salt cavern development. Photos 17 to 19 show the three different well sites, with Well Site 1 having the most infrastructure and Well Site 3 only consisting of a wellhead/ tree.

Photo 17 Well Site 1 (2021)

Photo 18 Well Site 2 (2021)

Photo 19 Well Site 3 (2021)

Building Site

The building site is secured by a chain-link fence and contains a building with industrial, mechanical and electrical equipment required for the cavern solution mining process, a nitrogen generator and compressor, water tanks and associated piping (Photo 20).

Photo 20 Building Site at Cavern Site (2021)

The building contains three high pressure water injection pumps, an air compressor tank, a motor control centre room with electrical equipment and motor starters to control the pumping process, and an overhead crane/hoist and beam. The building is steel frame construction on a concrete slab.

A nitrogen generator and compressor are located within a steel trailer adjacent to the building. Nitrogen was intended to be used as an inert control fluid in the formation of the salt caverns. Nitrogen would be compressed into the cavern where it would stay on the surface of the brine to prevent brine from contacting the cavern roof. Since cavern development did not occur, the nitrogen generator was never used.

There are three vertical steel water storage tanks (100 m^3) on a concrete pad, connected to the buried water pipeline from the River Site. There is also one vertical steel brine tank on a concrete pad and a horizontal brine separator tank. All the water and brine tanks on the site are empty. Buried water and brine piping comprised of HDPE pipe and/or braided stainless steel materials exist between the building area and two of the three wells for supply of water and storage of brine from caverns. Piping was never operated.

6.1.2 Environmental Setting

The fenced portion of the Cavern Site was established within an area that was clearcut within the previous decade. Most of the fenced site was cleared, grubbed, and graded prior to the installation of Project components. Additional forested area exists outside of the fenced portion, which was not investigated. Five vegetation communities were observed at the Cavern Site.

Well-drained areas, typically located at higher elevations, are sparsely vegetated (Photo 21). These areas are dominated by rabbit's-foot clover (*Trifolium arvense*), white clover (*T. repens*), and Canada goldenrod, with scattered occurrences of Kentucky blue grass, calico aster (*Symphyotrichum lateriflorum*), redtop, grass-leaved goldenrod, common evening primrose (*Oenothera biennis*), and branched centaury (*Centaurium pulchellum)*.

Photo 21 Well-drained area within Cavern Site (2021)

Mesic, or moderately well-drained areas, have denser vegetation relative to dry areas (Photo 22). Dominant species in these areas include various clovers (*Trifolium* spp.), white sweet-clover (*Melilotus albus*), Queen Anne's Lace (*Daucus carota*), Kentucky blue grass, and common Timothy, with scattered autumn hawkbit, foxtail barley (*Hordeum jubatum*), and Canada horseweed (*Erigeron canadensis*).

Photo 22 Vegetation within moderately well-drained area within Cavern Site (2021)

Poorly-drained depressions within flat areas are sparsely vegetated, and dominated by typical wetland and marginal wetland species, including broom sedge, broad-leaved cattail, Kentucky blue grass, purslane speedwell (*Veronica peregrina*), ovate spikerush (*Eleocharis ovata*), and foxtail barley, with scattered common woolly bulrush and branched centaury (Photo 23). One of the poorly-drained depressions contains a small patch (3 m x 2 m) of common reed (*Phragmites australis*), an invasive species.

Photo 23 Vegetation within poorly-drained area within Cavern Site (2021)

Some smaller areas were not grubbed and contain early successional deciduous forest, composed of approximately 10-year-old regenerating trees and shrubs (Photo 24). The canopy is dense and consists primarily of gray birch (*Betula populifolia*) and red maple (*Acer rubrum*), along with small quantities of beaked hazelnut (*Corylus cornuta*). The ground vegetation layer is dominated by hairy flat-top white aster, red raspberry (*Rubus idaeus*), and rough-stemmed goldenrod (*Solidago rugosa*), with lesser amounts of New York fern (*Parathelypteris noveboracensis*), late lowbush blueberry (*Vaccinium angustifolium*) and interrupted fern (*Claytosmunda claytoniana*).

Photo 24 Early successional deciduous forest (2021)

In areas where the regenerating forest was recently cleared (one to two years ago), the vegetation is dominated by scattered speckled alder (*Alnus rugosa*) and regenerating red maple, gray birch and balsam fir (*Abies balsamea*) (Photo 25). The ground vegetation layer is well-developed and is dominated by hairy flat-top white aster, rough-stemmed goldenrod, and red raspberry, with lesser quantities of Canada goldenrod, bluejoint reed grass (*Calamagrostis canadensis*), smooth blackberry (*Rubus canadensis*), common lady fern (*Athyrium filix-femina*) and white-edged sedge (*Carex debilis*).

Photo 25 Recently cleared area (2021)

Given the majority of the Cavern Site was cleared within the previous decade and grubbed and graded prior to the installation of Project components, there is limited terrestrial habitat for wildlife. The site may provide limited breeding habitat for bird species at risk such as common nighthawk, and other migratory birds, which are protected by the *Migratory Birds Convention Act*. Little brown myotis may forage within or near the Cavern Site.

6.2 PROPOSED DECOMMISSIONING AND RECLAMATION PLAN

The Cavern Site is privately owned by ANGS and will require minimal site modifications for decommissioning in preparation for sale. The caverns were never developed and therefore do not require decommissioning. ANGS will evaluate the condition of the wells (including consideration of the fact that the caverns were never developed or otherwise used to store hydrocarbons) and develop an appropriate well decommissioning program in discussion with the UARB to determine the applicability of CSA Standard Z-341 and the Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002. Infrastructure which may be considered an asset to future industrial use of the site will remain and little to no grading will be required. Table 6.1 outlines the decommissioning and reclamation activities for the site.

Table 6.1 Proposed Decommissioning and Reclamation Activities for the Cavern Site

Component	Proposed Decommissioning and Reclamation Activities
Building (including mechanical and electrical equipment)	Industrial equipment will be salvaged from the building for sale, reuse or recycling. The empty building (with the overhead crane and beam) and concrete pad will remain on site for future property use.
Water and brine tanks	The water and brine tanks and associated above-grade piping will be removed for sale, reuse or recycling. Concrete pads will remain in place.
Wells and well pads	ANGS will develop an appropriate well decommissioning program in discussion with the UARB which complies with the CSA Standard Z-341, AER Directive 020, and the Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002 as applicable. Well pads will remain graveled and will not be revegetated.
Nitrogen generator and compressor skid	The nitrogen skid is contained in a trailer. Once disconnected from other equipment, this trailer and equipment will be removed for offsite storage or sale.
Buried piping	Buried water and brine piping comprised of HDPE pipe and/or FlexSteel materials will be removed where it is known to be buried less than 1.2 m below the surface.
Fence	Perimeter fencing around the outer boundary of the Cavern Site and around the building will remain in place for future property use.
Electrical service	Powerlines to the site will remain in place for future property use.

6.3 CONSIDERATION OF ALTERNATIVES

The preferred approach to decommissioning and reclamation at the Cavern Site as outlined above in Section 6.2 was selected in consideration of the guiding principles and objectives outlined in Section 1.4. ANGS's goal is to reclaim equivalent land capability. However, in some cases, restoring the site to pre-Project conditions may result in greater adverse effects and/or remove land use improvements that could provide benefits for future land users. Alternative approaches to site decommissioning and reclamation are described below in Table 6.2.

Table 6.2 Decommissioning and Reclamation Alternatives at the Cavern Site

Proposed Decommissioning and Reclamation Activity	Alternatives Considered	Rationale
Building and internal Equipment	Equipment removed; building stays intact	Future ownership and use of the site is unknown. The building may be regarded as a property improvement for future use. Keeping the building intact as proposed by ANGS reduces physical disturbance at the site and retains valuable assets for prospective landowners who may wish to use the site for commercial or industrial use.
	Building and equipment removed	
Water and brine storage tanks and associated piping	Tanks and associated piping removed; concrete pad remains	The tanks and associated piping were specifically designed for the proposed cavern development process and are unlikely to be useful for future land uses. However, the concrete pad may serve a purpose for future land use. Keeping the concrete pad intact as proposed by ANGS reduces physical disturbance at the site and retains valuable assets for prospective landowners who may wish to use the site for commercial or industrial use.
	Tanks and associated piping removed; concrete pad removed	
Wells and well pads	ANGS will develop an appropriate well decommissioning program in discussion with the UARB which complies with the CSA Standard Z-341, AER Directive 020, and the Code of Practice Respecting the Underground Storage of Hydrocarbons, Nova Scotia 2002 as applicable. Well pads will remain graveled and will not be revegetated.	
Nitrogen generator and compressor unit	Removed for offsite storage or sale; no alternative option considered.	
Fencing	Fencing remains for future property use	Future ownership and use of the site is unknown. Fencing is regarded as a property improvement for future use. Removal of fencing will result in physical disturbance and loss of a potential surface improvement for future land use.
	Fencing removed	
Electrical power service	Suspend electrical service and retain the power poles and lines for future servicing of the site.	Future ownership and use of the site is unknown. Power service is regarded as a property improvement for future use. Retaining the poles and lines also means there will be less physical disturbance associated with decommissioning and abandonment at the site. However, given the uncertainty of future ownership and land use, ANGS is proposing to remove these structures.
	Disconnect power and remove poles and lines	

7.0 STAKEHOLDER AND INDIGENOUS ENGAGEMENT

A plan has been prepared to guide engagement activities with regulatory and public stakeholders and the Mi'kmaq of Nova Scotia. ANGS contacted local Mi'kmaq communities and organizations and government regulators on October 22, 2021 to inform them of the decision to decommission the Project. The public was engaged by posting the decision to decommission on the Project's website, www.altonnaturalgasstorage.ca, on the same day and by sharing the decision with local media outlets for dissemination. Local Mi'kmaq communities, regulators and the public will be invited to comment on this Decommissioning Plan to help understand potential issues of concern and expectations around decommissioning and reclamation activities. Feedback will be considered as decommissioning and reclamation planning proceeds. Details and updates on the decommissioning process will be posted on the Project website. Contracting opportunities for Indigenous and local contractors and suppliers to provide earthwork services and goods for the ANGS decommissioning and reclamation will also be shared.

8.0 SCHEDULE

Following engagement with regulatory agencies, and considering historical feedback from the Mi'kmaq of Nova Scotia and key stakeholders, ANGS intends to file a Decommissioning and Reclamation Plan with regulatory agencies to obtain the necessary regulatory approvals to proceed with decommissioning and abandonment activities. Once ANGS receives approval to proceed, decommissioning and reclamation activities are scheduled to start in the spring of 2022 and be completed in the fall of 2022. Post-reclamation monitoring programs, where necessary, will be developed in consultation with applicable regulatory agencies, Indigenous groups and stakeholders (e.g., landowners). Figure 8.1 outlines the proposed decommissioning and reclamation schedule. Figure 8.2 presents the schedule in a Gantt chart format.

Figure 8.1 Overview of proposed decommissioning and reclamation schedule

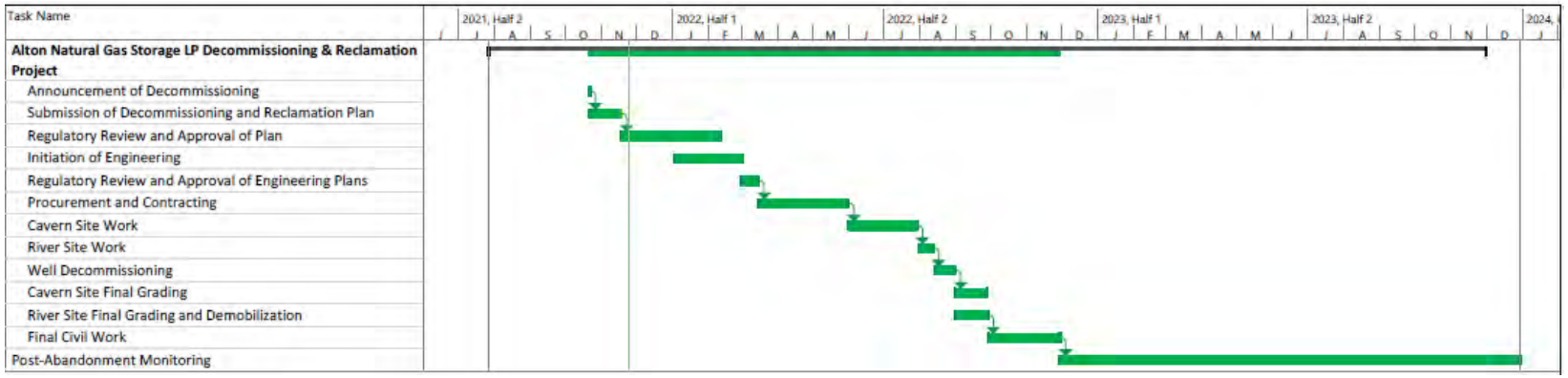

Figure 8.2 Gantt chart of proposed decommissioning and reclamation schedule

9.0 ENVIRONMENTAL MANAGEMENT

9.1 ENVIRONMENTAL PROTECTION PLANNING

An Environmental Protection Plan (EPP) will be developed to guide Project decommissioning and reclamation activities such that these activities are undertaken in a manner to achieve ANGS's decommissioning and reclamation objectives (Section 1.4). The EPP will describe roles and responsibilities, general best management practices, site-specific activities for environmentally sensitive features, contingency/emergency response plans, and environmental monitoring programs.

Key mitigation for decommissioning and reclamation activities at the River Site pertains to the avoidance of harmful alteration, disruption or destruction of fish habitat in the tidal Shubenacadie River as well as avoidance of disruption/destruction of developing salt marsh habitat. Work in the diversion channel will be avoided or minimized to the extent possible, with no planned disturbance below the OHWM. Prior to dewatering the freshwater and bring storage ponds, accumulated water in the ponds will be tested for suitable water quality prior to controlled discharge over land.

Mitigative requirements for the Water and Brine Pipelines will vary considerably depending on the selected decommissioning and reclamation approach. The proposed approach to decommissioning and reclamation at the Cavern Site will result in overall minimal surface disturbance and is expected to require minimal mitigation measures.

Examples of key general measures to be included in the EPP are presented below.

- Perimeter control structures (e.g., silt fencing, sediment traps, settling ponds) will be installed prior to any land disturbance associated with decommissioning activities near water. Sediment control structures will be maintained by inspecting and repairing structural problems during and after storm events, removing accumulated sediment at regular intervals or at designated capacities, and by disposing of it at an approved site.
- Land disturbance activities will be avoided during the bird breeding season (predominantly from April 1 to August 31) as much as practicable. If required, additional mitigation measures will be undertaken to avoid disturbance of nesting species (e.g., nest searches and buffering of active nests).
- To discourage spread of invasive species, decommissioning equipment will be thoroughly cleaned and inspected prior to transport so no vegetative matter or seeds are attached to the equipment. A high-pressure water wash prior to transport may facilitate this process.
- Maintenance and cleaning and refueling of mobile equipment will not be carried out within 30 m of a watercourse.
- Seed mixes used in reclamation will comprise native species compatible with surrounding land use and may vary depending on the location and timing. As an example, the seed mix to be used in reclaimed areas at the River Site will include: creeping red fescue (*Festuca rubra*), Canada blue grass (*Poa compressa*), Timothy (*Phleum pretense*), red top (*Agrostis alba*), Alsike clover (*Trifolium hybridum*), red clover (*Trifolium pretense*), perennial rye grass (*Lolium perenne*) and annual rye grass (*Lolium multiflorum*).

- Disposal of waste will be conducted in accordance with provincial and municipal waste management requirements. Where possible, equipment and infrastructure in good working order will be sold / reused or scrapped for recycled value.

Additional mitigative details will be included in the EPP.

9.2 MONITORING

Monitoring will be undertaken during decommissioning and reclamation to confirm compliance with the EPP and regulatory requirements.

A monitoring plan will be developed once the Decommissioning and Reclamation Plan has been approved by regulators. The Monitoring Plan will provide a program to confirm that potential environmental effects of decommissioning activities have been mitigated effectively. These programs will be informed by the contents of the approved Decommissioning and Reclamation Plan and input from regulators, the Mi'kmaq of Nova Scotia, and stakeholders.

At a minimum, it is expected that monitoring of the diversion channel at the River Site will include monitoring of the revegetation and stabilization of the decommissioned intake and outfall structures as well as visual inspections of the stability of the channel slopes and vegetation growth in naturally reclaimed areas of the diversion channel. Revegetation monitoring will include the establishment of 1 m x 1 m plots within reclaimed areas where abundance of vascular plant species will be measured. The data from these plots will be compared to similar plots established in the channel, and will note the overall vegetation cover, the progress of the natural succession of salt-tolerant plant species, and the presence/abundance of non-native, invasive species. Landscape monitoring will assess the reclaimed areas relative to a reference site for terrain instability, subsidence, grade inconsistencies, and erosion. The timing, frequency and duration of monitoring will depend on the timing and extent of disturbance and initial monitoring results. At a minimum, monitoring will be conducted for one growing season after the completion of site decommissioning activities.

10.0 CONCLUSIONS

ANGS proposes to decommission the partially constructed Alton Natural Gas Storage Project. The Project was designed to be a hydrocarbon storage facility to store natural gas underground in salt caverns for distribution and sale to market. The Project was partially constructed and never entered operations. Following construction and the completion of several focused studies to help refine Project design, a company repositioning to focus on assets elsewhere in North America combined with challenging economics for development led to the decision to decommission. Pending regulatory approval to proceed, decommissioning and reclamation activities are proposed for spring 2022 and are expected to be completed before the end of 2022. Post-abandonment monitoring may continue after 2022.

This Plan describes the current infrastructure and existing natural environment at the River Site, along the Water and Brine Pipelines route, and the Cavern Site. Decommissioning and reclamation activities for these sites are proposed in consideration of legal and regulatory requirements (including applicable industry codes and standards), previous commitments made by ANGS, relevant experience on comparable decommissioning projects, and site-specific conditions. Where applicable, alternative options for decommissioning are evaluated.

The Decommissioning and Reclamation Plan described herein will achieve the following objectives as previously defined by ANGS:

- Comply with applicable legal and regulatory requirements
- Promote environmental stewardship across the full life cycle of the Project, including decommissioning and reclamation, minimizing environmental impacts of decommissioning activities
- Consider beneficial re-use of facilities, equipment and land
- Reduce public safety risk and potential long-term liabilities
- Provide a means to invite input from local communities and the Mi'kmaq of Nova Scotia on the decommissioning activities and objectives proposed

ANGS is planning to engage applicable provincial and federal regulatory agencies, the Mi'kmaq of Nova Scotia, and other key stakeholders to communicate proposed plans and obtain feedback to help refine decommissioning and reclamation planning. This feedback will be incorporated into a final version of the Plan and reflected in an EPP to be developed to guide decommissioning and reclamation activities and follow-up measures.

11.0 REFERENCES

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