

FINAL

**Class 1 Environmental Assessment Registration
Asbestos Waste Disposal Cell
Yarmouth County Solid Waste Management Association
South Ohio, Nova Scotia**

Prepared by:

Fracflow Consultants Inc.
2 Fielding Ave., Suite D
Dartmouth, NS
B3B 1E1

in association with:

Envirosphere Consultants Limited
120 Morison Drive, Unit 5
PO Box 2906
Windsor, NS
B0N 2T0

In Situ
7 Thompson Street
Dartmouth, NS
B2Y 2X8

Submitted to:

Yarmouth County Solid Waste Management Authority
400 Main Street, Yarmouth, NS
B5A 1G2

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Fracflow Consultants Inc.

Environmental, Hydrogeological and
Geotechnical Engineering Consultants

September 28, 2018

File 803-4

Ms. Bridget Tutty
Environmental Assessment Officer
Nova Scotia Environment
Suite 2085, 1903 Barrington Street
Halifax, NS
B3J 2P8

Dear Ms. Tutty:

RE: Class 1 Environmental Assessment Registration, Asbestos Waste Disposal Cell, Yarmouth County Solid Waste Management Association

The enclosed document has been prepared in support of a Class 1 Environmental Assessment (EA) Registration for a proposed new Asbestos Disposal Cell at the existing Municipal Solid Waste (MSW) Management Facility in South Ohio, Yarmouth County, Nova Scotia. This submission has been prepared on behalf of the Yarmouth County Solid Waste Management Authority in accordance with Part IV of the *Environment Act* and the associated *Environmental Assessment Regulations*.

Specific studies were conducted within the Project Area in 2018 to supplement the available environmental database and complete the characterization of Valued Components. The EA for this project found no significant impacts for the Asbestos Disposal Cell on the environment at the MSW Management Park and adjoining areas.

We would like to express our appreciation to you and your department for the guidance we have received to date and look forward to receiving comments from the reviewers, as well as other groups, organizations and the public during the review period. Please contact the undersigned if you require any additional information regarding this submission.

Sincerely,

Fracflow Consultants Inc.

G. Glenn Bursey, M.Sc., P.Geo.
Vice President and Senior Hydrogeologist

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Submission Checklist (as per Section 9(1A) of the *Environmental Assessment Regulations*)

Description of Item	Section No.	Page No.
All applicable fees described under the Act	Sealed Envelope	
Name of the proposed undertaking	1.1	1-1
Location of the proposed undertaking	1.1	1-1
Name, address and identification of the proponent	1.4	1-2
List of contact persons for the proposed undertaking and their contact information.	1.4	1-2
Name and signature of the Chief Executive Officer or a person with signing authority, if the proponent is a corporation	1.4	1-2
Details of the nature and sensitivity of the area surrounding the proposed undertaking	1.7	1-4
Purpose and need for the proposed undertaking	1.3	1-2
Proposed construction and operation schedules for the undertaking	2.5	2-9
Description of the proposed undertaking	2.0	2-1
Environmental baseline information	5.0	5-1
List of licences, certificates, permits, approvals and other forms of authorization required for the proposed undertaking	1.6	1-3
All sources of any public funding for the proposed undertaking	1.5	1-3
All steps taken by the Proponent to identify the concerns of the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	3.0	3-1
List of all concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	3.3	3-1
All steps taken or proposed to be taken by the proponent to address concerns of the public and aboriginal people	6.0	6-1

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Executive Summary

This Project, which is an undertaking by the Yarmouth County Solid Waste Management Authority (YCSWMA), will involve the construction and operation of a new Asbestos Disposal Cell at the existing Municipal Solid Waste (MSW) Management Park. The new cell will be constructed on property owned by YCSWMA. The Project Area is a brownfield site that currently hosts an MSW transfer station and other facilities for Household Hazardous Goods, Construction and Demolition Debris (C&D), Petroleum Contaminated Soils Remediation, and Asbestos Disposal. The MSW Management Park has been issued separate Approvals from Nova Scotia Environment for all of those operations.

The current Asbestos Disposal Cell is 30 metres by 30 metres in size and it has reached 90 percent of its capacity. YCSWMA is in the process of preparing to cap the current Asbestos Disposal Cell and it needs to construct a new disposal cell to meet the growing demand for disposal of that waste material. The proposed Asbestos Disposal Cell will be approximately 100 metres by 100 metres in size and will occupy approximately 4 percent of the total MSW Management Park area of 23.47 hectares.

This Project is subject to provincial regulatory approval under the *Nova Scotia Environment Act*. This Environmental Assessment (EA) Registration document has been prepared to fulfil the requirements for a Class 1 undertaking under the *Environmental Assessment Regulations* because it falls under the waste management category for disposal of asbestos waste.

The EA for this project found no significant impacts for the Asbestos Disposal Cell on the environment at the MSW Management Park and adjoining areas. The scope of the EA was broad and provided comprehensive background information on local surface water resources, rare and sensitive flora, wetlands, fish, wildlife, groundwater, archaeological and heritage resources, air quality, and the socio-economic environment. In addition, extensive monitoring data is available for this site. Water level and water quality data were available for quarterly and annual sampling events, for the 2006 through 2017 period. Aquatic habitat invertebrate habitat surveys have also been conducted on a semi-annual basis since 2012.

Specific studies were conducted within the Project Area in 2018 to supplement the available environmental database and complete the characterization of Valued Components (VCs). Those studies included an Archaeological Resource Impact Assessment (ARIA), a botanical survey, wildlife and wildlife habitat survey, and a geotechnical investigation. The Proponent and its

consultants also contacted regulatory agencies, the Kwilmu'kw Maw-Klusuaqn Negotiation Office (KMKNO), Acadia First Nation, municipal government and the general public to identify, understand and address any and all concerns related to the Project.

The Project Area has a relatively small footprint, it is located in a rural/agricultural area, and a broad list of VCs were assessed in order to establish the environmental baseline, potential impacts, and mitigation strategies, where needed. The VCs were:

- Archaeological and heritage resources;
- Atmospheric environment;
- Fish habitat and fish;
- Groundwater resources;
- Land uses;
- Socio-economic environment;
- Surface water resources;
- Freshwater aquatic habitat (ponds and water courses) and wetlands;
- Vegetation, including rare and sensitive flora; and
- Wildlife habitat and wildlife.

In general, the Proponent and the Project team have concluded that there will be no significant adverse effects on the VCs. The Project will involve no new activities in relation to the management and disposal of asbestos, which is already an approved activity at this MSW management facility.

Consistent with the findings of other undertakings along Hardscratch Road, the Proponent and its Project team did not identify any archaeological or heritage resources within the Project Area and the risk of encountering such resources is considered to be low. The Proponent and its Project team also established that there will be no significant impacts to air quality, vegetation, wildlife and their habitat, species at risk, fish and their habitat, or to the existing water resources. However, contingency plans have been developed to deal with any unexpected outcomes.

Table of Contents

Submission Checklist	v
Executive Summary	vii
List of Figures	xiv
List of Tables	xv
List of Appendices	xv
Glossary of Terms	xvi
1.0 INTRODUCTION	1-1
1.1 Name and Location of Undertaking	1-1
1.2 Project Overview and Background	1-1
1.3 Purpose and Need for the Undertaking	1-2
1.4 Proponent Information	1-2
1.5 Property Ownership and Funding	1-3
1.6 Regulatory Framework	1-3
1.7 Nature and Sensitivity Based on Other Undertakings in the Area	1-4
1.7.1 <u>Environmental Assessment for YCSWMA (2010)</u>	1-4
1.7.2 <u>Environmental Assessment for Aberdeen Paving Limited</u>	1-5
1.7.3 <u>Environmental Assessment for Quality Concrete (Larfarge)</u>	1-6
1.8 Qualifications of the Project Team	1-8
2.0 PROJECT DESCRIPTION	2-1
2.1 Nature of the Waste Materials	2-1
2.1.1 <u>Composition, Properties and Uses of Asbestos</u>	2-1
2.1.2 <u>Regulatory Definition of Asbestos Waste</u>	2-2
2.1.3 <u>Sources and Pathways for Entering the Environment</u>	2-2
2.1.4 <u>Forms and Fate in the Aquatic Environment</u>	2-3
2.1.5 <u>Hazards Associated with Buried Asbestos</u>	2-3
2.2 Siting and Design Considerations	2-4

2.3 Project Components	2-6
2.3.1 <u>Access Road and Site Clearing</u>	2-6
2.3.2 <u>Drainage and Ditches</u>	2-6
2.3.3 <u>Asbestos Disposal Cell</u>	2-6
2.3.4 <u>Site Security</u>	2-7
2.4 Project Activities	2-7
2.4.1 <u>Construction of Waste Disposal Cell</u>	2-7
2.4.2 <u>Operations and Maintenance</u>	2-8
2.4.3 <u>Capping and Closure</u>	2-9
2.4.5 <u>Inspection and Monitoring</u>	2-9
2.5 Project Schedule for Construction and Operation	2-9
3.0 CONSULTATION	3-1
3.1 Regulatory Consultation	3-1
3.2 Mi'kmaw Consultation	3-1
3.3 Public Consultation	3-2
4.0 SCOPE AND METHODS OF ENVIRONMENTAL ASSESSMENT	4-1
4.1 Scope of Work	4-1
4.2 Identification of Valued Components (VCs)	4-2
4.3 Environment Assessment Methods	4-2
4.3.1 <u>Boundaries of the Project Area</u>	4-2
4.3.2 <u>Characterization of the Environmental Baseline</u>	4-2
4.3.3 <u>Assessment of Potential Environmental Impacts</u>	4-3
5.0 ENVIRONMENTAL BASELINE	5-1
5.1 Archaeological and Heritage Resources	5-1
5.1.1 <u>Archaeological Resource Impact Assessment</u>	5-1
5.1.2 <u>Potential Interactions</u>	5-2
5.2 Atmospheric Environment	5-2
5.2.1 <u>Climate Normals</u>	5-2
5.2.2 <u>Air Quality</u>	5-3
5.2.3 <u>Noise</u>	5-3
5.2.4 <u>Significance of Impacts</u>	5-4
5.3 Terrestrial and Aquatic Habitat	5-4
5.3.1 <u>Terrestrial Habitat</u>	5-4

5.3.2	<u>Freshwater Aquatic Habitats</u>	5-6
5.3.3	<u>Wetlands</u>	5-7
5.3.4	<u>Significance of Impacts</u>	5-7
5.4	Land Use	5-8
5.4.1	<u>Natural Land Cover and Soil</u>	5-8
5.4.2	<u>Municipal Zoning</u>	5-8
5.4.3	<u>Parks and Protected Areas</u>	5-8
5.4.4	<u>Recreational Use</u>	5-10
5.4.5	<u>Traditional Land</u>	5-10
5.4.6	<u>Significance of Impacts</u>	5-10
5.5	Wildlife	5-11
5.5.1	<u>Amphibians and Reptiles</u>	5-11
5.5.2	<u>Mammals</u>	5-12
5.5.3	<u>Birds</u>	5-13
5.5.4	<u>Fish Habitat and Fish</u>	5-14
5.5.5	<u>Species at Risk</u>	5-15
5.5.6	<u>Significance of Impacts</u>	5-17
5.5.6.1	<i>Terrestrial and Aquatic Habitat</i>	5-17
5.5.6.2	<i>Wetlands</i>	5-18
5.5.6.3	<i>Recreational Use</i>	5-18
5.5.6.4	<i>Parks and Protected Areas</i>	5-19
5.5.6.5	<i>Wildlife</i>	5-19
5.5.6.6	<i>Hunting and Trapping</i>	5-19
5.5.6.7	<i>Fish and Fish Habitat</i>	5-20
5.5.6.8	<i>Recreational and Commercial Fisheries</i>	5-20
5.5.6.9	<i>Species at Risk</i>	5-20
5.6	Socio-Economic Considerations	5-21
5.6.1	<u>Population and Employment</u>	5-21
5.6.2	<u>Land Use</u>	5-21
5.6.3	<u>Mining and Agriculture</u>	5-21
5.6.4	<u>Recreational, Commercial and Mi'kmaw Fisheries</u>	5-22
5.6.5	<u>Hunting and Trapping</u>	5-22
5.6.6	<u>Transportation</u>	5-23
5.6.7	<u>Significance of Impacts</u>	5-23
5.7	Surficial and Bedrock Geology	5-23
5.7.1	<u>Surficial Geology</u>	5-23

5.7.2	<u>Bedrock Geology</u>	5-24
5.7.3	<u>Geotechnical Conditions</u>	5-24
5.7.4	<u>Significance of Impacts</u>	5-26
5.8	Water Resources	5-26
5.8.1	<u>Surface Water</u>	5-26
5.8.1.1	<i>Drainage Area</i>	5-26
5.8.1.2	<i>Monitoring Stations</i>	5-27
5.8.1.3	<i>Surface Water Quality</i>	5-27
5.8.1.4	<i>Significance of Impacts</i>	5-28
5.8.2	<u>Groundwater</u>	5-29
5.8.2.1	<i>Aquifer Characteristics and Potable Supplies</i>	5-29
5.8.2.2	<i>Monitoring Well Network</i>	5-30
5.8.2.3	<i>Water Table and Directions of Groundwater Flow</i>	5-30
5.8.2.4	<i>Groundwater Quality</i>	5-31
5.8.2.5	<i>Water Balance</i>	5-31
5.8.2.6	<i>Significance of Impacts</i>	5-32
6.0	MITIGATION AND MONITORING	6-1
6.1	Archaeological Contingency Plan	6-1
6.2	Protection of Natural Habitat and Wildlife	6-1
6.3	Asbestos Waste Handling	6-2
6.4	Control of Dust and Noise	6-3
6.4.1	<u>Dust Control</u>	6-3
6.4.2	<u>Noise Control</u>	6-4
6.5	Sediment and Erosion Control	6-4
6.5.1	<u>Operational Sediment and Erosion Control Measures</u>	6-4
6.5.2	<u>Long-Term Sediment and Erosion Control Measures</u>	6-4
6.5.3	<u>Monitoring Fish and Fish Habitat</u>	6-5
6.5.4	<u>Water Quality Monitoring</u>	6-5
6.6	Vegetation Control	6-6
6.7	Restricted Access to Protect Human Health and Wildlife	6-6
6.8	Climate Change Considerations	6-6
6.9	Site Closure	6-7
7.0	CONTINGENCY PLANS	7-1
7.1	Emergency Response	7-1

7.2 Containment and Clean-up	7-2
7.3 Regulatory and Other Reporting Requirements	7-2
8.0 REFERENCES	8-1

List of Figures

- Figure 1 General site location.
- Figure 2 Detailed site plan.
- Figure 3 Conceptual design of Asbestos Disposal Cell.
- Figure 4 Temperature and precipitation, Canadian Climate Normals recorded at Yarmouth (1981-2010).
- Figure 5 Study area, sampling and survey locations.
- Figure 6 Land cover in the Project Area.
- Figure 7 Land zoning in the Project Area.
- Figure 8 Surficial geology of the Project Area.
- Figure 9 Bedrock geology of the Project Area.
- Figure 10 Tertiary watershed boundaries, surface water drainage patterns and inferred directions of groundwater flow.
- Figure 11 Locations of surface water monitoring stations and local drainage patterns.
- Figure 12 Known potable and non-potable water supply wells, on and near the Project Area.
- Figure 13 Locations of monitoring wells, stand pipes, and inferred directions of local groundwater flow.

List of Tables

Table 1	Water quality measurements of surface waters located near the proposed Asbestos Disposal Cell.
Table 2	Summary of parks and protected areas located near the MSW Management Park.
Table 3	Birds occurring or suspected of breeding in and around the Project Area in breeding bird surveys, 1990-2010.
Table 4	Bird species heard or observed during dawn breeding bird survey, MSW Management Park.
Table 5	Determination of fish presence/absence, June 19-20, 2018.
Table 6	Records of species of concern within a 5 km radius of the MSW Management Park.
Table 7	Five-year summary of recent reported wildlife harvested in Yarmouth County and Nova Scotia.

List of Appendices

Appendix 1	Figures
Appendix 2	Tables
Appendix 3	Registry of Joint Stock Companies - Profile
Appendix 4	Approval to Operate the Existing Asbestos Storage and/or Disposal Facility
Appendix 5	First Nations and Public Consultations
Appendix 6	Archaeological Resource Impact Assessment
Appendix 7	Botanical Survey
Appendix 8	Atlantic Canada Conservation Data Centre (ACDC) Report
Appendix 9	Aquatic Invertebrate Habitat Assessment (Fall 2017)
Appendix 10	Geotechnical Investigation
Appendix 11	Annual (2017) Hydrogeological Report

Glossary of Terms

ACMs

Asbestos Containing Materials

AFN

Acadia First Nation

ARD

Acid-Rock Drainage

ARIA

Archaeological Resource Impact Assessment

CCH

Nova Scotia Department of Communities, Culture and Heritage

C&D

Construction and Demolition Debris

Environment

The components of the earth and includes:

- (i) air, land and water;
- (ii) the layers of the atmosphere;
- (iii) organic and inorganic matter and living organisms;
- (iv) the interacting systems that include components referred to in subclauses (i) to (iii); and
- (v) for the purposes of Part IV, the socio-economic, environmental health, cultural and other items referred to in the definition of environmental effect.

Environmental Assessment

A process by which the environmental effects of an undertaking are predicted and evaluated and a subsequent decision is made on the acceptability of the undertaking.

Environmental Assessment Report

A report that presents the results of an Environmental Assessment.

Environmental Effect

With respect to an undertaking,

- (i) any change, whether positive or negative, that the undertaking may cause in the environment, including any effect on socio-economic conditions, on environmental health, physical and cultural heritage or on any structure, site or thing including those of historical, archaeological, paleontological or architectural significance; and
- (ii) any change to the undertaking that may be caused by the environment, whether the change occurs inside or outside the Province.

KMKNO

Kwilmu'kw Maw-Klusuaqn Negotiation Office

Leq

Equivalent sound levels

MBCA

Migratory Birds Convention Act

Mitigate

With respect to an undertaking, the elimination, reduction or control of the adverse effects or the significant environmental effects of the undertaking, and may include restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

MSW

Municipal Solid Waste

NSDNR

Nova Scotia Department of Natural Resources

NSTIR

Nova Scotia Department of Transportation and Infrastructure Renewal

NSE

Nova Scotia Department of the Environment

PCSRF

Petroleum Contaminated Soils Remediation Facility

Proponent

A person who,

- (i) carries out or proposes to carry out an undertaking or activity;
- (ii) is the owner or person having care, management or control of an undertaking or activity.

Significant

With respect to an environmental effect, an adverse impact that occurs or could occur as a result of any of the following: the magnitude of the effect, the geographic extent of the effect, the duration of the effect, the frequency of the effect, the degree of reversibility of the effect, and/or the possibility of occurrence of the effect.

TDG

Transportation of Dangerous Goods

Undertaking

A enterprise, activity, project, structure, work or proposal that, in the opinion of the Minister, causes or may cause an adverse effect or an environmental effect, and may include, in the opinion of the Minister, a policy, plan or program or a modification, extension, abandonment, demolition or rehabilitation, as the case may be, of an undertaking.

VCs

Valued Components

Wetland

Land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near or above the land's surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions.

WHMIS

Workplace Hazardous Materials Information System

YCSWMA

Yarmouth County Solid Waste Management Authority

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1.0 INTRODUCTION

1.1 Name and Location of Undertaking

The Yarmouth County Solid Waste Management Authority (YCSWMA) operates a Municipal Solid Waste (MSW) Management Park at 1936 Hardscratch Road, South Ohio, Yarmouth County. The facility (PID 90245424) is owned by the YCSWMA, having its office located at 400 Main Street, Yarmouth, NS, B5A 1G2. Coordinates for the centre of the Project Area are: N43° 54' 57.3" and W66° 02' 17.5" (Northing 5376414.2, Easting 4864920.7, ATS77).

YCSWMA provides waste management services on behalf of the Municipalities of Argyle, Yarmouth and the Town of Yarmouth. The MSW Management Park hosts a Transfer Facility, a Household Hazardous Waste facility, a Construction and Demolition (C&D) disposal site, an Asbestos Disposal site, and a Petroleum Contaminated Soils Remediation facility. The general location of the site is shown in **Figure 1**. That figure and all others referenced herein can be found in **Appendix 1**. All tables are presented in **Appendix 2**.

The YCSWMA is proposing to construct and operate a new Asbestos Disposal Cell within the boundaries of the MSW Management Park that it owns and operates. The proposed Project must be registered for Environmental Assessment under the *Environmental Assessment Regulations* of the *Nova Scotia Environment Act* as a Class I Undertaking. This report was completed in order to fulfil the requirements for project registration under that Act and its associated Regulations.

1.2 Project Overview and Background

YCSWMA currently operates a 30 metre by 30 metre Asbestos Disposal Facility at the MSW Management Park. On December 20, 2007 the Nova Scotia Department of Environment (NSE) issued the former owner, Waste Check, the approval to operate an Asbestos Storage and/or Disposal Facility. That Asbestos Disposal Facility was originally operated under the guidelines outlined in Approval No. 2007-060497. Site ownership was recently transferred to the YCSWMA and it now operates the facility under revised Approval No. 2007-060497-02. The current Asbestos Disposal Facility has reached 90 percent of its capacity. YCSWMA is in the process of preparing to cap that site and it needs to construct a new Asbestos Disposal Cell to meet the growing, local demand for disposal of that waste material.

The proposed Asbestos Disposal Cell will be approximately 100 metres by 100 metres in size. The location of that cell is shown in **Figure 2**. Construction and operation of the proposed Asbestos Disposal Cell will involve: grubbing of all vegetation within the footprint of the cell; removal of large rocks and construction of a new entrance with concrete culvert, if required; soil/waste placement and compaction in lifts and final capping to bring the area back up to grade; and, installation of a security fence with a locked gate and signage. Construction is scheduled to begin in late 2018. The life span of the Asbestos Disposal Cell is expected to be approximately 20 to 25 years.

1.3 Purpose and Need for the Undertaking

The current Asbestos Disposal Facility has been filled to near capacity and will soon be capped and closed. YCSWMA needs to construct a new disposal cell to meet the growing, local demand for disposal of asbestos waste materials that are being generated by demolition projects within Yarmouth County. The alternative is to truck the waste to other disposal facilities outside of the county at considerable cost, increasing the carbon footprint of the operation.

1.4 Proponent Information

Name of the Proponent: Yarmouth County Solid Waste Management Authority
Company Number: 3236305
Postal Address: 400 Main Street, Yarmouth, NS, B5A 1G2
Tel: (902) 742-2521
Fax: (902) 742-6422

Chairman of the Board

Name: Guy Surette
Postal Address: RR#2 Tusket, Box 202-A, NS, B0W 3M0
Tel: (902) 648-7827
Email: gsurette@munargyle.com

Officers Signature: _____



Site Manager

Name: Glendon Ring
Site Location: 1936 Hardscratch Road, South Ohio, NS, B5A 1G2
Tel/Facsimile: (902) 742-4404
Cell: (902) 740-5519
Email: manager@ycwastepark.ca

Environmental Site Professional

Name: G. Glenn Bursey, M.Sc., P.Geo.
Title: Vice President and Professional Geoscientist
Address: Fracflow Consultants Inc.
2 Fielding Ave., Suite D, Dartmouth, NS, B3B 1E1
Tel: (902) 468-1317
Facsimile: (902) 468-4704

Registry information for the Proponent at the Registry of Joint Stock Companies is presented in **Appendix 3**.

1.5 Property Ownership and Funding

This project will be co-funded by the Town of Yarmouth, the Municipality of the District of Yarmouth and the Municipality of the District of Argyle. The tipping fee for asbestos waste disposal will be in the order of \$125/tonne (minimum 1 tonne charge) and the facility typically receives only 2 tonnes per year on average. In 2016, the facility received 63 tonnes of asbestos waste. The capital cost is expected to be amortized over a twenty-year period, depending upon the volumes of asbestos waste that are received per annum.

1.6 Regulatory Framework

The YCSWMA currently operates its existing Asbestos Disposal Facility under Approval No. 2007-060497-02. An expansion of that facility requires the following regulatory approvals:

- NSE Industrial Approval to Construct and Operate (Part IV) the Project site; and

- NSE Class 1 Environmental Assessment.

1.7 Nature and Sensitivity Based on Other Undertakings in the Area

In addition to the Environmental Assessment (EA) for the current site, EA Registrations were previously completed at three sites that are on, or near, the current site. EA Approvals were later issued to: (1) YCSWMA in 2010 to operate a Petroleum Contaminated Soil Remediation Facility at its existing MSW Management Park; (2) Aberdeen Paving Limited in 2010 for an extension to its Hardscratch Road Quarry; and (3) Lafarge Canada Inc. (Quality Concrete) in 2013 for an extension to its Hardscratch Road Quarry. The scope of those environmental assessments were broad and provide relevant background information on local surface water resources, rare and sensitive flora or fauna, wetlands, fish, wildlife, groundwater, archaeological and heritage resources, air quality, and the socio-economic environment. Summaries of the relevant findings are provided below for each of those undertakings.

1.7.1 Environmental Assessment for YCSWMA (2010)

YCSWMA operates a MSW Management Park at 1936 Hardscratch Road. Various Approvals have been issued for the various waste managements streams, including Approval No. 2006-053331-T03 for the Construction and Demolition Disposal Facility, Approval No. 2006-053290-T01 for the Transfer Station, and Approval No. 2007-060497-02 for the existing Asbestos Disposal Facility. An EA Registration for the Petroleum Contaminated Soil Remediation Facility was completed by ABL Environmental and Bio-logic Environmental Systems (ABL Environmental, 2010). The location of that facility is shown in **Figure 2**. The ambient environment of the proposed facility, located at 1936 Hardscratch Road, was classified by the Proponent and its Project team as a brownfield site given the nature of the existing Approvals for operation of the MSW Management Park.

There were no rare or endangered species reported on the property and subsequent biological monitoring did not reveal any species of concern or any environmental impacts. The nearest residence was 500 metres away and all agricultural areas were reported to be at least 2,000 metres away. There were no recorded concerns expressed by First Nations groups or the general public.

The EA was accepted by NSE and Approval No. 2013-085222-A01 was issued to YCSWMA in December 2015.

1.7.2 Environmental Assessment for Aberdeen Paving Limited

Aberdeen Paving Limited operates a quarry at 2128 Hardscratch Road (**Figure 1**). An EA Registration for the quarry extension was completed by Stantec (2010). The MSW Management Park is located south of the quarry, within an 800 m quarry buffer. There were no known agricultural, recreational, industrial or potable uses of the surface water located on the Aberdeen Project property. Water courses on the Project site were not expected to bear fish, as a result of the multiple barriers to fish passage, but have a direct connection downstream to Agard Lake and mitigation measures were recommended.

Several rare or uncommon plant species were identified, including Yellow Nodding Ladies'-Tresses and Boreal American-Aster, which were of greatest concern due to the direct loss of wetland habitat. The Project footprint was reduced from that originally planned to reduce the loss and degradation of wetland habitat of these plant species.

Field surveys did not reveal the presence of any rare or sensitive bird species within the Project Area. However, to remain compliant with the *Migratory Birds Convention Act* (MBCA), it was recommended that clearing of areas to be used for the Project to be conducted outside of the breeding season of most bird species (April 1 to August 1) so that the eggs and flightless young of birds would not be harmed.

Field surveys also did not reveal the presence of any rare or sensitive mammal or herpetile species within the Project Area, due to the lack of favorable habitat conditions and/or limitations in range distributions. The habitats present in the Project Area were found to be common throughout the Province of Nova Scotia and unlikely to provide habitat for rare small mammal species. No critical areas for mammals such as deer wintering areas or critical herpetile habitats were identified.

Background research found no evidence of First Nation's or historic settlement within the study area and the vicinity of the quarry contained no resources that would have elevated the archaeological potential of the area. The archaeological potential for the study area was reported to be low.

Quarrying activities have the potential to generate dust (i.e., particulate emissions), which can be transported offsite. The primary potential sources of airborne particulate emissions were noted to be road dust, wind erosion on storage piles, removal of overburden, blasting, crushing, materials handling and transport, and truck loading and unloading. Recommended control measures included covering work and laydown areas with blasted materials, covering stockpiled topsoil with seed and hay, speed control to reduce dust generated by moving trucks, proper truck loading, and the application of water for dust suppression.

Quarrying activities will produce noise from equipment operation and blasting. Recommended measures to minimize sound emissions included the use of mufflers on all engines and vehicles, adhering to strict maintenance policies, and scheduling of any potential noisy activities during daytime hours.

Assuming the effective application of mitigative measures (e.g., Pit and Quarry Guidelines, dust suppression) significant adverse Project-related effects on the socio-economic environment were not expected to occur. The quarry was viewed to be a positive economic activity, providing local business and employment opportunities.

The EA was accepted by NSE and the Minister's decision to approve of the quarry extension was issued on August 25, 2010 (Approval No. not available).

1.7.3 Environmental Assessment for Quality Concrete (Larfarge)

Quality Concrete (a current affiliate of Lafarge Canada inc.) operates a quarry at 1546 Hardscratch Road, approximately 2,000 metres south of the YCSWMA's MSW Management Park (**Figure 1**). An EA for the quarry extension was completed for Lafarge Canada Inc. by Stantec (2013). There were no known agricultural, recreational, industrial or potable uses of the surface water located on the Aberdeen Project property. Watercourses on the Project site were not expected to bear fish, as a result of the multiple barriers to fish passage, but the water contained in the watercourses do have a direct connection downstream to the Cheboque River, which is fish bearing, and mitigation measures were recommended.

Several rare or uncommon plant species were identified and the Project was viewed as having the potential to influence the populations of Southern Twayblade, Yellow Nodding Ladies'-Tresses, Wood-Rush and Sharp-fruited RUsh. Standard mitigative measures to minimize the

environmental effects of the Project on plant communities were recommended, including the use of seed mixtures free of noxious weeds and invasive species during site reclamation, or seed mixes containing naturalized species which are well established in Nova Scotia. Assuming the recommended mitigative measures were employed, significant Project-related effects on rare and sensitive flora were not expected to occur.

Field surveys did not reveal the presence of any rare or sensitive mammal or herpetile species within the Project Area, and it was reported that there was a small possibility that hoary bat may make use of the Project Area. Clearing of vegetation outside of the breeding season for birds will minimize the potential for contravention of the *Migratory Birds Convention Act* (MBCA) and will also minimize the potential for adverse effects of the Project on hoary bats since this species is not present in the winter. The habitats present in the Project Area are common throughout the Province of Nova Scotia and thought unlikely to provide habitat for rare small mammal species. No critical areas for mammals such as deer wintering areas or critical herpetile habitats were reported to exist within the Project Area. Assuming application of the recommended mitigation measures, significant Project-related effects on wildlife were not expected to occur.

Background archaeological research found no evidence of First Nation's or historic settlement within the study area and it contained no resources that would have elevated the archaeological potential of the area. The archaeological potential for the study area was reported to be low.

Quarrying activities have the potential to generate dust (i.e., particulate emissions), which can be transported offsite. The primary potential sources of airborne particulate emissions were noted to be road dust, wind erosion on storage piles, removal of overburden, blasting, crushing, materials handling and transport, and truck loading and unloading. Recommended control measures included covering work and laydown areas with blasted materials, covering stockpiled topsoil with seed and hay, limiting speeds to 40 kph to reduce dust generated by moving trucks, proper truck loading, and the application of water for dust suppression.

Quarrying activities will produce noise from equipment operation and blasting. Recommended measures to minimize sound emissions included the use of mufflers on all engines and vehicles, adhering to strict maintenance policies, and scheduling of any potential noise-generating activities during daytime hours.

Assuming the effective application of mitigative measures (e.g., Pit and Quarry Guidelines, dust suppression) significant adverse Project-related effects on the socio-economic environment were

not expected to occur. The quarry was viewed to be a positive economic activity, providing local business and employment opportunities.

The EA was accepted by NSE and the Minister's decision to approve of the quarry extension was issued on December 11, 2013 (Approval No. not available).

1.8 Qualifications of the Project Team

The Lead Consultant and Project Manager for this undertaking was Glenn Bursey, Fracflow Consultants Inc. Mr. Bursey is the company's Vice President, Principal and Senior Hydrogeologist and Aqueous Geochemist. He is a registered Professional Geoscientist with the Association of Professional Geoscientists of Nova Scotia and a Certified Environmental Site Assessor with the Auditing Association of Canada. He has more than 30 years of relevant project experience and has conducted surface water and groundwater monitoring at the YCSWMA's MSW Management Park since 2015 (Fracflow, 2016; Fracflow, 2017; Fracflow, 2018).

The Qualified Archaeologist for this undertaking was Laird Niven. Mr. Niven is a Professional Archaeologist and President of a company called In Situ, which was established in 1996 as an archaeological consulting company. He has been practicing archaeology in Nova Scotia since 1984 and his qualifications are recognized by the Nova Scotia Department of Communities, Culture and Heritage (CCH). Mr. Niven has experience in all aspects of archaeology in Nova Scotia, from the Palaeo-Indian period to the late nineteenth century, and he completed the Archaeological Resource Impact Assessment work for both the Aberdeen EA and the LaFarge EA, described above.

Envirosphere Consultants Limited is a biological and environmental consulting firm based in Windsor, Nova Scotia, specializing in environmental assessment, fish habitat, water quality, and monitoring and assessment studies of terrestrial and aquatic environments. The company has carried out environmental impact assessments, wetland and fish habitat studies and assessments, benthic invertebrate studies, landfill and industrial monitoring, as well as research on aquatic ecosystems for industry, government and the consulting-engineering sector for more than two decades. It has been involved in environmental impact assessments for the registration of industrial facilities and quarries under the *Nova Scotia Environment Act*, wetland alteration approvals, marine and freshwater habitat assessments, research studies and laboratory services. Envirosphere has conducted aquatic invertebrate habitat assessments at the MSW Management

Park since 2012 and the findings from those reports are described in this EA. The botanical survey, wetlands survey, and wildlife and wildlife habitat surveys were also completed by Envirosphere Consultants Limited for the MSW Management Park.

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2.0 PROJECT DESCRIPTION

This Project will involve the construction and operation of a new Asbestos Disposal Cell that is one hectare in size and located at the existing Municipal Solid Waste (MSW) Management Park at 1936 Hardscratch Road, South Ohio, NS (**Figure 2**). The proposed location for the new Asbestos Disposal Cell is south of the MSW Transfer Station and west of the Petroleum Contaminated Soils Remediation Facility. An access road will be built from the existing paved surface in front of the Transfer Station.

The construction phase of the Project will consist of tree-clearing, excavation of perimeter drainage ditches that will connect with the existing runoff control system, installation of culverts where drainage is required beneath the existing roads and new access road, and installation of a security fence. The cell itself will require no subsurface engineering features such as a liner or leachate collection system. Waste materials will be buried in trenches and covered with native fill in a phased manner that will be based on the demand for waste disposal. The operations and maintenance of the cell will be in accordance with the procedures that have already been established and approved for the MSW Management Park. The cell is expected to operate for a period of 20 to 25 years, after which time the cell will be closed, capped, and environmental monitoring will continue.

The project description was developed with a clear understanding of the nature of the Asbestos-Containing Materials (ACM) to be handled and disposed of at the MSW Management Park. The nature of ACM is reviewed below before discussing the project components and project activities in detail.

2.1 Nature of the Waste Materials

2.1.1 Composition, Properties and Uses of Asbestos

Asbestos is a group of fibrous, ferro-magnesium silicate minerals that belong to the serpentine (chrysotile) and amphibole (actinolite, amosite, anthophyllite, crocidolite, tremolite) mineral groups. Rock types that host deposits of asbestos include altered ultramafic, mafic rocks and some carbonates (marble and dolostone). Asbestos is not associated with sulphides and, therefore, does not contribute to the generation of acidic runoff.

The fire-resistant properties of asbestos made it a valuable component in fireproofing materials, and the tensile strength and flexibility of the non-friable forms of asbestos made it suitable for manufacturing heat-resistant textiles. Building materials that contained asbestos included insulation (for both heat and noise protection), floor and ceiling tiles, asphalt felts, coating and patching compounds, sheets and pipes. Asbestos was also used in brake linings and clutch facings because of its friction-resistant qualities, and in electrical insulation and certain paper products (CCME, 2008). The majority of the asbestos that is expected to arrive at the MSW Management Park is contained in building materials that are derived from local demolition projects.

2.1.2 Regulatory Definition of Asbestos Waste

Asbestos waste is defined in the *Asbestos Waste Management Regulations* as a friable waste material containing asbestos fibres or asbestos dust in a concentration greater than 1 percent by weight. Asbestos can take the form of a friable or non-friable material. Asbestos is considered friable when it can be crumbled, pulverized or reduced to powder by hand pressure, when dry.

2.1.3 Sources and Pathways for Entering the Environment

Asbestos is mined, milled and used in the manufacture of a variety of products and asbestos is reported to be slightly soluble (USEPA, 1992). Asbestos fibres enter the environment by natural weathering and erosion processes, from industrial sources, atmospheric pollution, and can be introduced directly into water supplies from asbestos-cement pipes. Solid waste disposal was reported to be the single largest contributor of asbestos to the environment (CCME, 2008). Chrysotile was the predominant type of asbestos detected in a national survey of the water supplies of seventy-seven communities in Canada; concentrations varied from not detectable to 2,000 million fibres per litre, with the median fibre length ranging between 0.5 and 0.8 μm (WHO, 2003).

2.1.4 Forms and Fate in the Aquatic Environment

Asbestos is composed of silicon, oxygen, hydrogen and one or more metal cations, including sodium, magnesium, calcium and iron. Its forms and fate in the aquatic environment, as reported in the published literature (CCME, 2008) are summarized below.

- Unlike other asbestos minerals, chrysotile fibres have a positive charge in aqueous systems and will attract, or be attracted to, most dispersed materials.
- The highly reactive surface of asbestos causes many surface reactions, ranging from simple adsorption to true chemical reaction.
- The fate of asbestos fibres in aquatic environments is believed to be affected by sedimentation, resuspension and migration, although the residence time of asbestos in water is unknown.
- Experimental studies have suggested that chrysotile is slowly solubilized in water under conditions of continuous extraction. It has also been suggested that the presence of trace metals will produce a suspension of chrysotile in water which will persist until sufficient magnesium is leached from the chrysotile structure.
- It appears that sediment does not have an adsorptive affinity for solid materials, such as asbestos, normally encountered in natural waters. However, numerous inorganic and organic materials may be adsorbed to asbestos.
- There is little information on the accumulation of asbestos fibres in the tissues of aquatic organisms. Fish living in water with high asbestos fibre concentrations do not accumulate levels of asbestos, which could be a threat to human health. No evidence was found regarding the bioaccumulation of asbestos in aquatic organisms.

2.1.5 Hazards Associated with Buried Asbestos

Asbestos is a known human carcinogen by the inhalation route, but when buried in a secure facility, transport in groundwater is the only available pathway to receptors. Epidemiological

studies did not support the hypothesis that an increased cancer risk was associated with the ingestion of asbestos in drinking-water, and asbestos did not consistently increase the incidence of tumours of the gastrointestinal tract in animals during extensive feeding studies (WHO, 2003). WHO (2003) concluded that in the absence of convincing evidence to suggest that ingested asbestos is hazardous to health, there was no need to establish a guideline for asbestos in drinking water. The most current guidelines issued by Health Canada (2017) also state that a guideline value for asbestos in drinking water is not necessary because there is no evidence of any adverse health effects from exposure through drinking water.

The most significant hazards posed by Asbestos-Containing Materials is during transport, handling and burial. Those hazards are best managed by ensuring the ACM is properly bagged or contained for disposal in accordance with the *Asbestos Waste Management Regulations*, shipped by a licensed carrier, and handled on site by trained workers. Once the ACM is placed in a secure disposal cell and covered with relatively low permeability soil, within twenty-four hours or less, the human health and environmental risk is considered to be low.

2.2 Siting and Design Considerations

In Nova Scotia, the *Asbestos Waste Management Regulations* permits the disposal of asbestos waste by burial at: (1) an active municipal solid waste disposal site approved by an Administrator to accept asbestos waste; (2) at an industrial site, with an approval issued under the Act which includes a provision for the disposal of asbestos waste; or (3) at an approved waste disposal site. Asbestos disposal at the MSW Management Park is considered to fall under the third category.

There are no specific siting and design criteria specified by NSE in the regulations for an asbestos disposal site. Therefore, the Municipal Solid Waste Landfill Guidelines (NSEL, 2004), Construction and Demolition (C&D) Debris Disposal Site Guidelines (NSEL, 2003), and the National Guidelines for Hazardous Waste Landfills (CCME, 2006) were considered in siting and designing the proposed Asbestos Disposal Cell. An engineered hazardous waste landfill facility design includes a combination of natural protection and engineered systems that work together to contain or control the waste. The attributes of a natural environment may be used in place of engineered systems if they achieve an equivalent level of protection for the environment and human health (CCME, 2006).

Notwithstanding the above, it is equally important not to over-design a facility and incorporate engineering features that are incompatible with the nature of the waste materials, or the natural environmental setting. As stated earlier, the hazards associated with asbestos are largely airborne and leachate generation and chemical impacts to groundwater and surface water have not been not recognized by regulators as serious concerns when dealing with bagged, separated asbestos. For that reason, a low permeability, engineered liner and leachate collection system are not required elements for burial and containment of asbestos waste. The key requirement is to ensure that the ACMs remain securely covered and that the covering soil remains intact and undamaged by physical processes such as frost heave and erosion.

The following features that are typical of an approved C&D facility were incorporated into the site selection process and design of the proposed Asbestos Disposal Cell.

1. A plan for the placement of cover over the ACMs.
2. Controlled site entry and exit infrastructure.
3. A drainage plan for surface water, including control infrastructure (i.e., Sedimentation Control Pond).
4. Appropriately designed road surfaces.
5. Signs that indicate the name of the disposal facility, hours of operation, emergency contacts and all materials acceptable for disposal.
6. Weigh scales.
7. A separation distance of 30 metres from the active disposal area to the nearest property boundary and public highway.
8. A separation distance of 30 metres from the active disposal area to the nearest bank top or high water mark of any surface water course or water body, including salt water, or to any potable water supply well.
9. A separation distance of 90 metres from the active disposal area to the foundation of the nearest off-site structure used for commercial, industrial, residential or institutional purposes.
10. Ground water monitoring wells including one groundwater monitoring well installed hydraulically up-gradient from the disposal cell and at least three monitoring wells installed hydraulically down-gradient from that cell.

2.3 Project Components

2.3.1 Access Road and Site Clearing

The Asbestos Disposal Cell will be constructed to the south of the MSW Transfer Station and west of the Petroleum Contaminated Soils Remediation Facility. An access road will be built from the existing paved surface in front of the Transfer Station. The location is shown in **Figure 2**. All merchantable wood within the footprint of the Asbestos Disposal Cell will be cut, stacked and provided for use by the general public. Other immature trees, shrubs, and grubblings will be processed for compost at the Compost Facility located within the MSW Management Park.

2.3.2 Drainage and Ditches

The driveway leading into the Asbestos Disposal Cell will cross over a drainage ditch, to be constructed, and a culvert will be installed to accommodate site drainage and runoff. The cell will also be surrounded by drainage ditches that will be graded to connect with the existing ditches at the site. Runoff will eventually make its way through the network of ditches and into the Sedimentation Control Pond.

2.3.3 Asbestos Disposal Cell

The proposed Asbestos Disposal Cell will be approximately 100 metres by 100 metres and located within the current boundaries of the MSW Management Park (**Figure 2**). A conceptual design of the Asbestos Disposal Cell is shown in **Figure 3**. ACM that is delivered to the MWS Management Park site will be buried in the Asbestos Disposal Cell in trenches that are 2 metres wide, separated by a 1 metre thick wall of undisturbed native till. The base of each trench will be excavated to within 0.5 metres to 1 metre of the bedrock surface and buried. The Project will not result in acid-rock drainage, as discussed later in this document under the section on geology.

2.3.4 Site Security

Access to the Project site will be restricted by gated access to the MSW Management Park at its entrance on Hardscratch Road, as well as with a locked gate and signage at the entrance to the proposed Asbestos Disposal Cell. Signage will include information pertaining to the days and hours of operation, a list of acceptable/unacceptable waste, and emergency contact numbers.

2.4 Project Activities

YCSWMA currently operates an Asbestos Storage and/or Disposal Facility at its MSW Management Park in accordance with Approval No. 2007-060497-02. A copy of that Approval is presented for reference in **Appendix 4**. Project activities at the proposed Asbestos Disposal Cell are expected to follow the same set of well-established policies and procedures that have been developed and implemented by YCSWMA in accordance with the *Nova Scotia Environment Act* and its associated *Asbestos Waste Management Regulations*. It is further expected that operation of the proposed Asbestos Disposal Cell will be subject to additional and site-specific terms and conditions set out in the aforementioned Approval for the existing Asbestos Disposal Facility.

2.4.1 Construction of Waste Disposal Cell

The proposed Asbestos Disposal Cell will be constructed with a buffer zone that separates it from other disposal or waste management areas at the MSW Management Park. The area will be prepared by constructing a new entrance, with a concrete culvert, clearing all vegetation within the footprint of the cell, and removing any large rocks. The waste cell will not require an engineered liner. The base and sides of the waste cell will be formed by *in situ* native material that is expected to have a hydraulic conductivity of 1×10^{-7} metres per second (m/s) or less, and a minimum thickness above bedrock of 0.5 metres. Sediment and erosion control features will be deployed around the perimeter of the cell in accordance with the Erosion and Sediment Control Handbook for Construction Sites (NSE, 1988). Site runoff will be directed through silt fences, deep-rooted cordgrass (*Spartina*), and into drainage ditches for eventual discharge into the existing Sedimentation Control Pond. Detention of runoff in that pond provides time for suspended sediment to settle out of the water column prior to release into the environment.

2.4.2 Operations and Maintenance

The proposed Asbestos Disposal Cell will become part of an expanded Asbestos Storage and/or Disposal Facility, as defined in the Approval, and will be operated and maintained in a manner consistent with the existing Operations and Maintenance Manual for the MSW Waste Management Park, and the requirements listed below.

- Each shipment of ACM will be placed in a pre-prepared trench. Each trench will be excavated to a width of approximately 2 metres and to a depth of approximately 2.5 metres, leaving approximately 0.5 metres to 1 metre of native soil between the base of the cell and the bedrock surface (**Figure 3**). Each trench will be separated by a wall of undisturbed native till that will be approximately 1 m wide and will extend to bedrock.
- ACM will not be placed in the disposal cell during periods of high wind or high precipitation.
- Only personnel trained in Transportation of Dangerous Goods (TDG) and Workplace Hazardous Material Information Systems (WHMIS) procedures will be involved in the asbestos waste disposal operation.
- A daily soil cover will be placed over the asbestos waste materials. Native soil will be used as the cover material and the minimum thickness of that material will be 0.25 metres thick. It is also expected that processed soil from the PCSRF can be used as daily soil cover, if available. Above that soil will be a layer of coloured tape to denote the top of the ACM.
- Daily inspections will be conducted to ensure that cover materials have been placed over the ACM for each day that disposal occurs.
- Equivalent sound levels (Leq), if measured at the boundaries of the MSW Management Park, will not exceed 65 dBA between 0700 and 1900 hours, 60 dBA between 1900 and 2300 hours, and 55 dBA between 2300 and 0700 hours. Monitoring will be conducted at the request of NSE.
- The generation of fugitive dust will be suppressed by the application of water or other suitable dust suppressants such that particulate emissions, if measured, will not exceed a

daily average of $120 \mu\text{g}/\text{m}^3$ and an Annual Geometric Mean of $70 \mu\text{g}/\text{m}^3$ at the boundaries of the MSW Management Park. Monitoring will be conducted at the request of NSE.

2.4.3 Capping and Closure

Upon abandonment or discontinuance of the designated Asbestos Disposal Cell, a soil cap having a minimum thickness of 1.25 metres will be placed over the top of that cell. The cap will be mounded from the centre and graded to the edges at a slope of approximately 2 percent to shed runoff. The hydraulic conductivity of that material, in compacted form, is expected to be in the order of 1×10^{-7} m/s or less. The cap will be hydro-seeded to stabilize the soil surface (**Figure 3**).

2.4.5 Inspection and Monitoring

During operations, daily inspections will be conducted to ensure safe handling and disposal practices by trained personnel, and placement of an adequate amount of cover material over the asbestos waste. Following site closure and final capping, monthly inspections will be conducted to ensure that the final cover remains intact, that sediment and erosion control measures are effective, and that any necessary repairs are completed in a timely fashion.

Any additional details of any monitoring programs required by NSE for surface water, noise, dust, etc. will be developed in consultation with NSE and outlined in the Industrial Approval amendment application.

2.5 Project Schedule for Construction and Operation

The construction of the new Asbestos Disposal Cell is expected to begin in the fall of 2018, pending the issuance of an EA Approval and an amendment to the existing Industrial Approval to operate an Asbestos Storage and/or Disposal Facility. The facility will be open and available to receive waste between the hours of 8:00 am and 4:00 pm weekdays, and between the hours of 9:00 am to 3:00 pm on Saturdays. The life span of the Asbestos Disposal Cell is expected to be between 20 and 25 years.

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3.0 CONSULTATION

3.1 Regulatory Consultation

The Proponent and the Project Manager for the Project team had preliminary discussions about the project with representatives from NSE's Environmental Assessment Division (Halifax), as well as with the District Engineer for the Inspection, Compliance and Enforcement Division (Yarmouth) in the fall of 2017. A Proponent's Guide to Environmental Assessment (NSE, 2017) was also used to determine the scope and focus of this EA.

The Project Archaeologist consulted with representatives from the Nova Scotia Department of Communities, Culture and Heritage (CCH) and submitted the background ARIA report to CCH for review in March 2018 (In Situ, 2018a). CCH accepted the conclusion that the project should proceed as planned without the need for further archaeology (see letter from CCH dated May 9, 2018, in **Appendix 5**).

Other consultations with the regulatory agencies were conducted throughout the EA process, including a discussion between Fracflow's Project Manager and a Species at Risk Biologist at the Nova Scotia Department of Natural Resources (NSDNR) at the start of the project.

3.2 Mi'kmaw Consultation

Acadia First Nation (AFN) and the Kwilmu'kw Maw-Klusuaqn Negotiation Office (KMKNO) were first advised of the Project in February 2018. Fracflow's Project Manager discussed the scope of work with the Chief of the Acadia First Nation, and the Project Archaeologist made direct contact with the Staff Archaeologist at KMKNO, as required by CCH.

The background ARIA report (In Situ, 2018a) was submitted to KMKNO for review in March 2018 and a concern was identified. The Assembly of Nova Scotia Mi'kmaq Chiefs, KMKNO and the Mi'kmaw Nation in Nova Scotia highlighted the need for subsurface testing to confirm the absence of archaeological remnants from L'nu'k ancestors. Those concerns were mitigated by the completion of a shovel testing program in June 2018, the results of which were documented and submitted to KMKNO (In Situ, 2018b).

The findings supported the background research and the Qualified Archaeologist concluded that the project should proceed as planned without the need for further archaeology. A record of the communications between the Project Team, AFN and KMKNO is presented in **Appendix 5**.

3.3 Public Consultation

The Proponent has not received any comments from the general public, to date, about the Project. However, the Proponent is taking steps to help facilitate future public engagement by designing a dedicated web page, with both English and French versions, with direct links to the web pages of the Municipalities of Argyle, Yarmouth and the Town of Yarmouth. That web page is expected to be activated by mid-September. An opportunity for public viewing of this EA Report, at the municipal offices in Argyle and the Town of Yarmouth, will be announced on that web page, in the local newspaper (The Vanguard) and the Chronicle Herald.

4.0 SCOPE AND METHODS OF ENVIRONMENTAL ASSESSMENT

4.1 Scope of Work

The scope of the Environmental Assessment (EA) in relation to the proposed undertaking was determined by the Proponent and its Project team and is based upon the proposed components and activities, the professional judgment and expertise of the study team, consultations with First Nations groups, the general public and regulatory authorities, and on the results of site-specific field work conducted in support of this EA. A Proponent's Guide to Environmental Assessment (NSE, 2017) was also used to help determine the scope of the EA.

The proposed undertaking must be registered for environmental assessment under the *Environmental Assessment Regulations* of the *Nova Scotia Environment Act* as a Class I Undertaking. This report was completed in order to fulfil the requirements for project registration under that Act and its associated Regulations.

The Proponent and Project Manager for the Project team met with NSE representatives on December 22, 2017 to discuss the proposed expansion of the Asbestos Disposal Facility, and elements and activities associated with the proposed Project, in an effort to identify Project priorities, confirm the planned location of the Asbestos Disposal Cell, and to help focus the scope of the assessment. It was determined that a geotechnical investigation to confirm the location of the Asbestos Disposal Cell could not proceed until contact was made with First Nations Groups, an Archaeological Resource Impact Assessment (ARIA) was conducted, and the bird and botanical surveys were completed. All site assessment work was successfully completed by August 2018 and the location of the Asbestos Disposal Cell was confirmed as shown in **Figure 2**.

This EA Registration document has been submitted for review to the provincial regulators. Any comments received will be included in **Appendix 5** and will be addressed in the final version of the EA report.

4.2 Identification of Valued Components (VCs)

The Project Area is located within the boundaries of the approved MSW Management Park, which is a recognized brownfield site. The Project Area has a relatively small footprint (i.e., 1 hectare) and is located within a largely rural/agricultural area with both natural features and nearby industrial development. The list of Valued Components (VCs) is comprehensive and includes many different elements of the biophysical environment. The following is a generalized list of VCs, presented in the order in which they are discussed in Section 5 of this report:

- Archaeological and heritage resources;
- Atmospheric environment;
- Terrestrial and Aquatic Habitat
- Land use;
- Wildlife;
- Socio-economic considerations;
- Surficial and bedrock geology; and
- Water resources.

4.3 Environment Assessment Methods

4.3.1 Boundaries of the Project Area

The Project Focus Area for the EA is the area within a one kilometre radius, centred on the MSW Management Park. More specifically, this area includes the locations down-gradient as far as Beaverdam Meadows in the east, the area north to the Aberdeen quarry, the area south to the Lafarge quarry, and the area west of Hardscratch Road to the local watershed divide.

4.3.2 Characterization of the Environmental Baseline

The Environmental Baseline condition of the Project Area was established by recent studies carried out for this Project as well as by information from previous studies including YCSWMA's Petroleum Contaminated Soils Remediation Facility, and EA reports prepared for Aberdeen Paving Limited and Lafarge Canada Inc. (Quality Concrete). Recent site-specific work for the Project included: an Archaeological Resource Impact Assessment, semi-annual aquatic habitat

assessments by EnviroSphere Consultants Limited since 2012; quarterly surface and groundwater sampling by Dillon Consulting, between 2006 and 2015, and by Fracflow Consultants between 2015 and 2017; a geotechnical investigation by Fracflow in 2018; and wildlife (breeding bird, mammal, and herpetile), vegetation, and wetland field surveys by EnviroSphere Consultants Ltd. in 2018.

4.3.3 Assessment of Potential Environmental Impacts

The potential environmental effects of the undertaking, and the significance of those effects, were judged by the Project team. In particular, the team:

- Determined if there were interactions between the Project activities and VCs;
- Assessed whether the interactions would result in any effects and the magnitude of those effects; and
- Ensured that the management actions proposed would successfully mitigate those effects.

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5.0 ENVIRONMENTAL BASELINE

Baseline conditions are described below for each of the VCs identified in Section 4 of this report.

5.1 Archaeological and Heritage Resources

5.1.1 Archaeological Resource Impact Assessment

Archaeological and heritage resources are defined as any physical remnants found above or below the ground surface that are indicative of past human use and interaction with the physical environment. Those resources may be from the earliest time of human occupation in the Project Area until the recent past, and are generally considered to include historic period sites such as cemeteries, heritage buildings and sites, monuments, and current and pre-historic areas of significance to First Nations or other groups.

Work requiring physical disturbances at the site could not be conducted until an Archaeological Resource Impact Assessment (ARIA) was completed and there was documented confirmation of the absence of archaeological and heritage resources. Laird Niven, a Qualified Archaeologist recognized by the Nova Scotia Department of Communities, Culture and Heritage (CCH) and the Nova Scotia Museum, was retained to complete that assessment.

The initial ARIA work consisted of background research followed by a walkover survey (i.e., site walkover) to determine the archaeological potential of the Project Area. The walkover involved following a predetermined transect pattern using a hand-held GPS unit and recording and photographing observations. The archaeological potential for the study area was deemed to be low and it was recommended that the project proceed as planned without the need for further archaeology. The report was accepted by CCH and no further work was requested or required by the regulator. A copy of the initial ARIA report (In Situ, 2018a) is presented in **Appendix 6**.

At the behest of KMKNO, the findings of the background research was ground truthed by way of a shovel testing program. A grid pattern, consisting of alternating 20 metre squares, was established within the 100 metre by 100 metre footprint of the Asbestos Disposal Cell and shovel tests were completed at 10 metre intervals. A total of ninety-two shovel tests, having dimensions of 0.4 metres by 0.4 metres, were excavated and inspected. The findings supported the initial

background research and the Qualified Archaeologist confirmed the original conclusions and recommendations for proceeding with the project as planned without the need for further archaeology. KMKNO reviewed the first draft of the supplementary report and were concerned that the shovel tests had terminated at a shallow depth, within the A soil horizon, and were not excavated to the C horizon, as is standard archaeological practice. A revision to the report was issued to explain that the depths of the shovel tests were dictated by site conditions and specifically by shallow refusal depths on hard/rocky ground. The results were documented in the final version of the supplementary report (In Situ, 2018b), which is appended to this report (**Appendix 6**). A copy of that report was also submitted to CCH for information purposes.

5.1.2 Potential Interactions

The archaeological potential of the area is deemed to be low. However, an Archaeological Contingency Plan has been developed in the event of the unlikely discovery of resources or artifacts during site operations. That Plan is presented in Section 6 of this EA Report.

5.2 Atmospheric Environment

5.2.1 Climate Normals

Areas along the Atlantic coast of Nova Scotia generally receive between 1,200 mm and 1,600 mm of rain each year. According to Environment Canada's climate normals (1981-2010) for its station at Yarmouth Airport (www.climate.weatheroffice.ec.gc.ca), the mean annual precipitation was 1,292.9 mm and 84 percent of that total occurred as rain. The mean annual temperature for the same climate station was 7.2°C. The climate normals for temperature and precipitation are displayed in **Figure 4**.

Precipitation amounts have varied considerably relative to the normals in recent years. Total precipitation recorded at Yarmouth Airport in 2014, 2015 and 2016 were respectively 1,641.8 mm, 1,397.9 mm, and 1,078.1 mm. The year 2016 was an exceptionally dry year and it was described as a drought condition with many private wells, especially dug wells, going dry. Total precipitation recorded at that station in 2017 was 1,228.4 mm.

Evapotranspiration, which includes direct evaporation from soil and water bodies combined with transpiration from vegetation varies between 200 and 400 mm a year across the province (Nova Scotia Museum, 1996).

5.2.2 Air Quality

NSE monitors ambient air quality at seven locations in Nova Scotia. The closest station to the Project Area is at Aylesford Mountain, near Kentville. The pollutants that are monitored at that station are:

- Ground-level ozone (O₃);
- Fine particulate matter (PM_{2.5});
- Carbon monoxide (CO);
- Sulphur dioxide (SO₂);
- Total reduced sulphur (TRS);
- Nitrogen oxides (NO_x), nitric oxide (NO), and nitrogen dioxide (NO₂).

Ambient air quality at the Aylesford Mountain station was examined for the months of January and August 2017 to provide a general indication of variability. The respective average concentrations of O₃ and PM_{2.5} for January 2017 were 34.6 parts per billion (ppb) and 6.6 micrograms per cubic metre (µg/m³). The respective average concentrations of O₃ and PM_{2.5} for August 2017 were 23.7 ppb and 8.8 µg/m³.

Ambient air quality is not monitored by any government groups in South Ohio, NS or at the MSW Management Park. However, NSE has no records of any complaints filed against YCSWMA regarding air quality issues at the MSW Management Park. It should also be noted that the Project Area is bounded by private quarry operations to the immediate north and south of the facility. Operations at those sites have the potential to impact air quality in the Project Area.

5.2.3 Noise

Ambient noise levels are not monitored by any government groups in South Ohio, NS or at the MSW Management Park. However, NSE has no records of any complaints filed against

YCSWMA regarding excessive noise generated by site operations at the MSW Management Park. Various sources of noise such as the MSW Management Park, the adjacent Hardscratch Road, and private quarry operations immediately north and south of the facility have the potential to create noise pollution in the Project Area.

5.2.4 Significance of Impacts

The operation of the proposed Asbestos Disposal Cell may generate dust and noise. A mitigation plan for control of dust and noise has been developed and is described in Section 6 of this EA Report.

5.3 Terrestrial and Aquatic Habitat

Terrestrial and aquatic habitat was assessed by field surveys in 2018 to assess botany, breeding birds, and other more general site characteristics. The findings are presented below.

5.3.1 Terrestrial Habitat

Locations of the terrestrial habitat survey area are shown in **Figure 5** and a complete copy of the Botanical Survey Report is presented in **Appendix 7**.

The MSW Management Park is located in a region of Yarmouth County dominated by mixed forest, which has been extensively harvested, leaving most areas at the early stages of regeneration. Generally low slopes in the area often lead to the accumulation of surface water which leads to the formation of wetlands and meadows such as Beaverdam Meadows located northeast of the site and Chebogue Meadows located to the south, as well as the occurrence of various wetland types in the surroundings. The immediate vicinity of the proposed Asbestos Disposal C is located at the high point of the local watershed and is comparatively well-drained due to soil conditions, the overall slope, and ditching for drainage management associated with the landfill development. The soil conditions within the footprint of the proposed Asbestos Disposal Cell does not support the accumulation of surface water, which would otherwise support the development of wetlands. Recently clear-cut forested areas and newly regenerated stands

border the landfill site. No wetlands in the study area were encountered during walkovers by the botanist (Ruth Newell) and project biologists.

The area in and around the proposed Asbestos Disposal Cell consists of approximately one-third coniferous woodland on the east and south side and two-thirds mixed forest on the west side. The ground surface in both woodland types is slightly uneven (undulating) with shallow, damp, depressions dominated by sphagnum moss, alternating with gentle more mesic hummocks. The damp depressions with sphagnum moss tend to be more common in the coniferous woodland (i.e. on the east side) than in the mixed woodland.

Ground cover in the vicinity of the proposed asbestos disposal cell includes deciduous leaf litter primarily in mixed woodland areas, coniferous needles mainly in coniferous areas, as well as Red-stemmed Feather Moss (*Pleurozium schreberi*) and Sphagnum moss (*Sphagnum spp.*). The main over-storey species present in the coniferous woodland portion include Balsam Fir (*Abies balsamea*), Larch (*Larix laricina*), White Spruce (*Picea glauca*) and Black Spruce (*Picea mariana*); with Red Maple (*Acer rubrum*) and Showy Mountain Ash (*Sorbus decora*) present but uncommon. Shrub species in coniferous woods include Black Huckleberry (*Gaylussacia baccata*), Sheep Laurel (*Kalmia angustifolia*), and Velvet-leaved Blueberry (*Vaccinium myrtilloides*). Overstorey in the mixed woodland includes Red Maple (*Acer rubrum*), White Birch (*Betula papyrifera*), Showy Mountain Ash (*Sorbus decora*), as well as Balsam Fir (*Abies balsamea*), Larch (*Larix laricina*), White Spruce (*Picea glauca*) and Black Spruce (*Picea mariana*).

Common herbaceous species present in both woodland types in the vicinity of the proposed Asbestos Disposal Cell include Bunchberry (*Cornus canadensis*), Twinflower (*Linnaea borealis*), Starflower (*Trientalis borealis*), Wild Lily-of-the-valley (*Maianthemum canadense*), Cinnamon Fern (*Osmunda cinnamomea*) and Wood Ferns (*Dryopteris spp.*). Hay-scented Fern (*Dennstaedtia punctilobula*) is most common in the mixed woodland particularly towards the west edge of the property.

Vegetated habitats to the immediate south of the proposed Asbestos Disposal Cell include plant communities around a pond in the southwest corner of the site, riparian communities along a bermed intermittent stream leading to the pond, as well as low herbaceous vegetation and shrubs on a small rectangular “pad” adjacent to Hardscratch Road. Margins of the intermittent stream supplying the pond were occupied by sphagnum moss (*Sphagnum spp.*), with occasional vascular plants such as Starflower (*Trientalis borealis*), Tall White Aster (*Doellingeria umbellata*), Bristly

Dewberry (*Rubus hispidus*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Speckled Alder (*Alnus incana*), Swamp Candle (*Lysimachia terrestris*), Cinnamon Fern (*Osmunda cinnamomea*) and New York Fern (*Thelypteris noveboracensis*). Little to no flow was observed in the watercourse, and any water present was stagnant. Berms running along the length of the watercourse were high and flat on top, and vegetated. Plant communities along the shoreline of the pond consisted of almost complete coverage by sphagnum moss and primarily Speckled Alder (*Alnus incana*) although other shrub species were present.

No vascular plant species listed under either federal species-at-risk legislation or provincial species-at-risk- legislation were observed during the June 2018 survey. Some later flowering and/or fruiting species could not be identified at the time of the June survey due to their immaturity or absence of necessary structures required for accurate identification. However, it was the opinion of the botanist (Ruth Newell) that a fall survey would not be required.

5.3.2 Freshwater Aquatic Habitats

Limited open water aquatic habitat occurs at the YCSWMA site overall and none in the immediate vicinity of the proposed Asbestos Disposal Cell. Runoff at the site is channeled mostly through ditches or flowages which have been modified by the placement of berms and it is unlikely that much of the current drainage pattern is natural. The natural topography at the site is level overall (3 to 4 percent slope to the east). A small pond (0.04 ha) which has been modified by the placement of berms around the margin, is located near the western boundary of the landfill site about 130 m southwest of the proposed asbestos cell (**Appendix 7**). The pond contains submergent aquatic vegetation including Twin-stemmed Bladderwort (*Utricularia geminiscapa*), and emergent species such as Bur-reed (*Sparganium sp.*) and bedstraw (*Galium sp.*), both occurring near the outlet. Water quality in the pond is poor with low dissolved oxygen and pH (i.e. below CCME guideline levels for sustaining aquatic life, CCME 1999) and measurements from June 20, 2018, can be found in **Table 1**. A turtle (unconfirmed as a Wood Turtle) was observed during the June 19th - 20th 2018 site survey, but no fish were seen or trapped. During May 1st and June 7th 2018 surveys Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Rana sylvatica*), and Common Toad (*Bufo bufo*) were heard.

The pond, which has been modified by the placement of berms along the margin, is supplied by an intermittent flow of groundwater from under the highway as well as surface runoff from the highway ditch along Hardscratch Road. Discharge from the pond, which is also intermittent,

flows east through an area that has been disturbed by equipment traffic before merging with ditches from other parts of the property and becoming part of an overall managed drainage system for the MSW Management Park. Sampling locations can be seen in **Figure 5**. Water quality measured throughout the system is generally acceptable for sustaining aquatic life in terms of pH while oxygen levels are low; measurements from June 20, 2018, can be found in **Table 1**. Overall, these are not uncharacteristic measurements of natural waters in intermittent streams in upper watershed areas such as those that occur on the site. The remaining open water consists of a constructed Sedimentation Control Pond located on the eastern side of the facility. Intermittent discharge from that pond is released into wetlands that form the source of a permanent stream that emerges some 250 metres to 300 metres farther to the east and discharges into Beaverdam Meadows. Beaverdam Meadows drains through Cloverhill Brook into the Annis River system. Several lakes on the Annis system include Ellenwood Lake, Agard Lake, Hibbards Lake and Harris Lake, which are located about 2.5 kilometres to 3.5 kilometres east.

5.3.3 Wetlands

Botany and field surveys at the site included walkovers of the property by personnel experienced in wetland identification. No wetlands occur in the immediate study area, in particular within the proposed footprint of the Asbestos Disposal Cell, or in areas influenced by surface waters leaving the disposal site. The areas downslope of the site are highly modified, including being extensively ditched, bermed and disturbed by heavy equipment operations at the site. Several small wetlands are found east of the YCSWMA site, but are not directly influenced by runoff from the vicinity of the proposed Asbestos Disposal Cell, and were not included in the field surveys.

5.3.4 Significance of Impacts

The construction of the proposed Asbestos Disposal Cell will not contribute to any significant loss of habitat given its small footprint. There are no mitigation measures required for this VC.

5.4 Land Use

5.4.1 Natural Land Cover and Soil

Much of the land cover in the area of the MSW Management Park is forested, characterized predominantly by softwood and mixed wood, or is rough open land (**Figure 6**). Undisturbed soils in the area have been mapped as part of the Liverpool Soil Series, which consist of greyish brown sandy loam over yellowish brown sandy loam (Cann et al., 1960). Those soils form in areas with undulating to gently rolling topography, moderate stoniness and imperfect drainage. The present land use capability was described as fair to poor for cropland and agricultural development (Cann et al., 1960). One kilometre to the northeast of the MSW Management Park, there is an approximately 40-hectare parcel of Crown Land that encompasses the Beaverdam Meadows wetland. Merchantable wood on that land is currently being harvested under a licensed agreement with the Province of Nova Scotia.

5.4.2 Municipal Zoning

The Municipality of the District of Yarmouth's Land Use By-Law applies to all lands located within the municipal boundaries and has divided the municipality into land-use zones. The MSW Management Park is designated a Rural Industrial Zone, surrounded by areas that fall into the Rural Development Zone or Rural Commercial Zone (**Figure 7**). The Rural Development Zone permits a mixture of residential and commercial uses, while the Rural Commercial Zone allows a mixture of recreational and commercial uses (Municipality of the District of Yarmouth, 2017).

There are two other developments zoned Rural Industrial in the vicinity of the MSW Waste Management Park. The Aberdeen Hardscratch Quarry owned by Aberdeen Paving Ltd. is located approximately one kilometre north, and the Lafarge (Quality Concrete) Hardscratch Quarry owned by Lafarge Canada Inc. is approximately two kilometres south.

5.4.3 Parks and Protected Areas

Parks and protected areas in the vicinity of the YCSWMA site include provincial parks, nature reserves and wilderness areas, a national wildlife area, privately owned land trusts or easements,

as well as municipal/county managed areas. A summary of parks and protected areas in the vicinity of the YCSWMA are presented in **Table 2**. Such areas focus on protecting representative natural and natural heritage features; valuable ecosystem services; habitat for rare or endangered species; archaeological or historically significant features; as well as for recreational and educational opportunities associated with wilderness and wildlife for the public. The closest parks and protected areas to the site are Ellenwood Lake and Chebogue Meadows Provincial Parks, less than three kilometers northeast and south, respectively, and Beaverdam Meadows which is a Crown Land Managed Wetland located less than one kilometer east of the MSW Management Park. Types of parks and protected areas include:

Nova Scotia Nature Reserves are established to preserve and protect areas representative of natural ecosystems and associated plant and animal species. Scientific research and education are the primary uses of nature reserves and recreation is generally restricted. These areas are protected under the Special Places Protection Act.

Wilderness Areas are provincially-significant areas that protect representative examples of natural landscapes, native biological diversity, and outstanding natural features of Nova Scotia. They are used for scientific research, education and a variety of recreation and nature-tourism related activities such as hiking, canoeing, sea-kayaking, sport-fishing and hunting. These areas are designated under Nova Scotia's Wilderness Areas Protection Act.

Provincial Parks protect provincially or regionally significant natural heritage values such as coastlines and beaches, scenic views, diverse landscapes, forests, and lakes and rivers, for recreational use and general enjoyment by residents and tourists. Provincial Parks are important in conserving biodiversity as well as contributing to a high quality nature experience for users of the parks and economic development for nearby communities. Provincial Parks are established under the Provincial Parks Act.

National Wildlife Areas are created to conserve nationally significant habitat for wildlife, and to provide opportunities for research and interpretation. Environment and Climate Change Canada uses an ecosystem approach to manage and plan national wildlife areas and controls human activity in them to minimize impact. National Wildlife Areas are established under the Canada Wildlife Act.

5.4.4 Recreational Use

Residents and visitors to Yarmouth County pursue a variety of outdoor recreational activities including paddling, camping, hiking, cross-country skiing/snowshoeing, snowmobiling and ATV use, swimming, wildlife viewing, and hunting and fishing. Coastal areas near the study site attract visitors interested in wildlife viewing, bird watching, camping and beach use. The Carleton, Tusket and Barrington Rivers are popular paddling routes with wilderness campsites (Canoe Kayak Nova Scotia, 2018). Protected areas in the vicinity, particularly those associated with sensitive Coastal Plain Flora, offer opportunities for hiking and educational outings. Several privately-owned campgrounds and provincial parks are found in the area, including nearby Ellenwood Provincial Park, which offers opportunities for swimming, hiking, paddling and fishing. Nature trails and walking routes can be found within several kilometers of the study site, including the Yarmouth County Rail Trail that runs immediately west of the study site, Forchu River Trail in Hebron, and Chebogue Meadows Wilderness Trail located along Hardscratch Road about 2.5 km from the YCSWMA site. The area also hosts Yarmouth Links, a 18-hole golf course located about 20 km southwest of the study site.

5.4.5 Traditional Land

The nearest First Nations reserve (Acadia First Nation Yarmouth Reserve) is located approximately 10 kilometres south of the Project site. The Proponent and Project Team recognize that the MSW Management Park and surrounding lands are considered traditional lands of the Mi'kmaw people.

5.4.6 Significance of Impacts

The construction and operation of the proposed Asbestos Disposal Cell will be confined to the boundaries of the existing MSW Management Park. Therefore, there will be no adverse environmental effects on third-party land use other than those already contemplated and approved by NSE in the various Operating Approvals issued for the MSW Management Park.

5.5 Wildlife

5.5.1 Amphibians and Reptiles

Limited open water habitat at the study site provides suitable habitat for many of the common Nova Scotian amphibians and reptiles, which likely occur but were not seen at the site, including Yellow-spotted Salamander (*Ambystoma maculatum*), Green Frog (*Rana clamitans*), Common Garter Snake (*Thamnophis sirtalis*), and Northern Painted Turtle (*Chrysemys picta*). During early May and early June surveys Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Rana sylvatica*), and Common Toad (*Bufo bufo*) were heard. During the June 19 - 20, 2018 site visit, no amphibians were observed or detected, however a turtle (unconfirmed Wood Turtle (*Glyptemys insculpta*)) was observed swimming in a pond in the southwest corner of the site. Wood Turtle is a species of conservation concern known to occur in the general area, as noted in the Atlantic Canada Conservation Data Centre report (ACCDC, 2018) in **Appendix 8**. However, the ideal habitat (shallow slow flowing rivers with flood plains) for the Wood Turtle was not present at the site.

Four federally (SARA) and provincially (NS Endangered Species Act) protected reptile species are known to occur within 100 kilometres of the area and include:

- Blanding's Turtle (*Emydoidea blandingii*), is listed as 'endangered' under both SARA and the Nova Scotia Endangered Species Act. It has a General Status of 'at risk' according to NSDNR and is ranked as 'S1' by the ACCDC indicating that they are extremely rare within the province. The nearest sighting of this species is approximately 55 kilometres from the study site.
- Wood Turtle (*Glyptemys insculpta*), is listed as 'threatened' under SARA and the Nova Scotia Endangered Species Act. It is ranked as 'S2' by the ACCDC, and has a general status of 'sensitive' by NSDNR. The nearest record of wood turtle is approximately 63 kilometres from the study site. A sighting of the wood turtle noted above is unconfirmed.
- The Atlantic population of the Eastern Ribbon Snake (*Thamnophis sauritus*), is listed as 'threatened' under SARA and the Nova Scotia Endangered Species Act. This population

has a rank of ‘S2S3’ by the ACCDC and is considered ‘at risk’ by NSDNR. The nearest record of Eastern Ribbon Snake to the study site is approximately 34 kilometres.

- Snapping Turtle (*Chelydra serpentina*), listed as a ‘special concern’ under SARA and ‘vulnerable’ under the Nova Scotia Endangered Species Act. Additionally, it is ranked at ‘S3’ by the ACCDC and is considered ‘sensitive’ by NSDNR. The closest record of this species to the study site is approximately 17 kilometres.

5.5.2 Mammals

Various large and small mammals, including game and fur-bearing species, are found in Yarmouth County. Mammal species with potential for regular or occasional occurrence at the site are expected to reflect types which occur in the upland habitat of the area, which includes mixed forest and wetlands. No significant or unique mammals or signs were detected during site visits and walkovers in the study area. During the site visit conducted on June 19 - 20, 2018, occasional unidentified scat were observed and Red Squirrels were also seen.

Terrestrial mammals known to occur in the general area and within 100 kilometres of the study site include carnivores such as coyote, lynx, Black Bear, Red Fox, bobcat, weasel, marten, fisher and raccoon; as well as rodents and small mammals including beaver, muskrat, squirrels and the Long-tailed Shrew (NSDNR, 2018). Of the terrestrial mammals known to occur within the 100-kilometre radius are six species of conservation interest. Three species are listed as “Endangered” under the Nova Scotia Endangered Species Act, including the mainland moose (*Alces americanus*), Canada lynx (*Lynx canadensis*), and American marten (*Martes americana*). These species also have a general status listing of ‘At Risk’ within Nova Scotia and are assigned an ACCDC ranking of ‘S1’ indicating that they are extremely rare throughout their range. A large (>300,000 ha) mainland moose concentration area is located approximately 25 kilometres northeast of the study site. The remaining four species of conservation concern potentially occurring in the area include two species of bats, Little Brown Myotis (*Myotis lucifugus*) and Northern Long Eared Bat (*Myotis septentrionalis*), Eastern Pipistrelle (*Perimyotis subflavus*), and Southern Flying Squirrel (*Glaucomys volans*). Little Brown Myotis and Eastern Pipistrelle are listed as “Endangered” federally (SARA) and under the Nova Scotia Endangered Species Act, have a general status of “At Risk” in Nova Scotia, and an ACCDC ranking of ‘S1’. There is no natural habitat on site for bats, except perhaps in some of the existing MSW buildings. The Southern Flying Squirrel has a general status listing in Nova Scotia of “Sensitive” and an

ACCDC ranking of ‘S2S3’, and requires mature deciduous or mixed forests, both of which are not present on the site.

5.5.3 Birds

Birds are an important component of ecosystems in the vicinity of the Yarmouth County Solid Waste Management Facility. Approximately 154 bird species may occur in Southwestern Nova Scotia (Maritime Breeding Bird Atlas, 2018), some of which have the potential to occur at the site; and 88 bird species potential breeding have been identified in the 10 by 10 kilometre survey square which includes the facility (**Table 3**). Habitat types in and around the study site include medium-aged and regenerating deciduous and mixed forest, disturbed environments associated with the closed landfill cells and presently operating waste management facility, and open water environments such as natural and artificial ponds. The site is close to the coast of the Bay of Fundy and is visited by various seabirds and other water associated bird species, and is also on a migratory pathway, which results in birds occurring at the site during migration, but not breeding at the site.

No species of conservation concern were detected during an owl survey and standard breeding bird surveys at the site. Surveys were conducted by experienced birders and followed standard protocol. Walkovers of the site and a night owl survey (0150 hrs to 0300 hrs) were conducted on May 1, 2018. Site reconnaissance and ten-minute dawn point count surveys were conducted at seven points (**Figure 5**) on June 7, 2018. The area occupied by the MSW management facility is relatively small and the seven locations ensured birds calling in all parts of the site could be heard.

Conditions for the owl survey (May 1) were near ideal with slight winds, clear sky and a near full moon. No owls were heard on the landfill site, which included the proposed Asbestos Disposal Cell, however, two pairs of Saw Whet Owls were heard west of Hardscratch Road opposite the main gate. A Great Horned Owl was also heard from a location that was believed to be outside the eastern boundary. The June point-count survey was also carried out under clear observing conditions of low wind and precipitation. A total of 39 species of songbirds were documented (**Table 4**), most of which were expected based on the Maritimes Breeding Bird Atlas records for the area. The most common and abundant species overall at the site were American Crow, Black-throated Green Warbler, American Robin, Ovenbird, Red-eyed Vireo, Swainson’s Thrush, Magnolia Warbler, Dark-eyed Junco, and Yellow-rumped Warbler. Common and abundant

species in forested areas in and around the proposed Asbestos Disposal Cell included: American Crow, Swainson's Thrush, Black-throated Green Warbler, Golden-crowned Kinglet, American Robin, Ovenbird and Yellow-rumped Warbler. Species characterizing developed parts of the site and forest margins of open areas included Red-eyed Vireo, American Robin, Black-throated Green Warbler, Ovenbird, Blue-headed Vireo, American Crow and Hermit Thrush. Killdeer were observed in the point count survey in June and also during the owl survey; and a pair of nesting Canada Geese were seen on closed landfill cells in the south part of the waste management site in early May. Additional records obtained outside the survey period included a Common Loon flyover, Ruffed Grouse, Broad-winged Hawk (observed west of Hardscratch Road), Black-backed Woodpecker and Pileated Woodpecker. One occurrence of an adult male Orchard Oriole during the point-count survey is believed to be a drop-in migrant passing through the area.

5.5.4 Fish Habitat and Fish

Two unnamed streams drain the reclaimed (closed) landfill to the south and one stream drains the C&D Debris Landfill at the MSW Management Park. The aquatic habitats at two sites on one of the streams at the reclaimed landfill site and at two locations draining the C & D Debris Landfill site were assessed on June 12, 2017 (Envirosphere, 2017a) and October 24, 2017 (Envirosphere, 2017b). At each location, water quality measurements, observations, and photographs of the biological environment; sediment samples for stream invertebrates; and measurements of water quality parameters (temperature, dissolved oxygen, and pH) were taken. Envirosphere's aquatic habitat assessments occurred within a few weeks of Fracflow's surface water and groundwater sampling events in 2017.

Nova Scotia Environment (NSE) requires that YCSWMA conduct an aquatic habitat assessment on a semi-annual basis to monitor for any impacts of site activities on adjacent watercourses. Envirosphere Consultants Ltd. has provided that service since the fall of 2012. A copy of Envirosphere's Fall 2017 sampling report is presented in **Appendix 9**. Overall, the physical site conditions were found to be acceptable for the maintenance of aquatic life and biological communities (benthic invertebrates) at the C & D landfill/MSW transfer station site. Stressed conditions were reported at all monitoring stations, but it was Envirosphere's opinion that those conditions were more likely due to seasonal variability (i.e. low flow) rather than being due to landfill influences.

There are no waters supporting fish and fish habitat in the immediate vicinity of the proposed asbestos disposal site, and there appear to be no downstream connections to watercourses outside the project site. However, an American eel - a species listed under COSEWIC as Threatened, and one which can move overland - was observed on one occasion on rocks along the edge of the Sedimentation Control Pond as recently as 2013 - 2014 (G. Ring, personal communication, 2018). The site, however, is not suitable habitat for the American eel. Otherwise, surface water drainage through the site consists of intermittent flowages and ditches, incapable of supporting fish spawning or rearing habitat. The only permanent open water at the site is a pond at the southwestern part of the study area and it does not appear to support a fish population, based on visual observations and minnow trapping (June 19 - 20, 2018) during the study (**Table 5**). The pond is not directly influenced by runoff or groundwater flow from the area proposed for the disposal cell. Waters in the downstream watershed of the area (e.g. Tusket River Watershed) support Atlantic Salmon (Salmon Fishing Area 21, Fundy Atlantic Shore of Nova Scotia) as well as White Sucker, trout (Brook and Brown), perch (White and Yellow), American eel, Blueback herring/Alewife, Brown Bullhead, Chain Pickerel, Smallmouth Bass and small fish (Golden Shiner and Banded Killifish) (Alexander et al., 1986).

5.5.5 Species at Risk

Species at Risk are plants or animals whose existence is threatened or which are in danger of being threatened, by human activities or natural events. The Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC) presently recommends species to be listed for legal federal protection under the federal Species at Risk Act (SARA). At the provincial level, the Nova Scotia Species at Risk Working Group completes assessments and recommendations for a species' status. Nova Scotia maintains a list of legally protected species under the Nova Scotia Endangered Species Act. A third status list is the Nova Scotia General Status of Species, which is a provincial system used as a "first-alert tool" for identifying and prioritizing species potentially at-risk and does not provide legal protection. General status rankings are assigned by a provincial General Status Species Assessment process based on expert scientific evaluation of a set of criteria. Species that may be at risk of extirpation or extinction are candidates for a detailed risk assessment by COSEWIC, or provincial or territorial equivalents.

Species of conservation concern listed under federal or provincial legislation as well as those having a provincial 'general status' that occur within five kilometres of the Yarmouth County Waste Management Asbestos Disposal study site include both fauna and flora (**Table 6**).

Historical records indicate that Atlantic Whitefish, a species listed under SARA as Endangered, at one time were present in local watersheds such as the Tusket River, but the species is now believed to be extirpated (Fisheries and Oceans, 2018; Weseloh-McKeane, 2018).

The varied habitat at the site, including regenerating deciduous woodland and coniferous stands, open disturbed areas, road margins etc., and ponds, flowages and wet areas, supports a range of bird species from season to season but breeding activity of many species is limited by a lack of prime habitat.

Species of conservation concern known to occur within five kilometers of the study site include Eastern Wood Pewee, Common Nighthawk, Canada Warbler, Bobolink, Chimney Swift, Wood Thrush, Evening Grosbeak, Barn Swallow, and Bank Swallow (listed under the federal Species at Risk Act (SARA) and by COSEWIC, Atlantic Canada Conservation Data Centre, 2018). None of these species were seen or heard during breeding bird surveys at the site. Eastern Wood Pewee prefer undisturbed mature deciduous forests, but also frequent edges of forest such as along roadsides, as well as in woods near meadows and ponds-both of which occur within the study area. Common Nighthawk can occur in semi-open areas such as forest clearings and reclaimed landfill cells within the surrounding study area. Canada Warbler are typically found in moist shady woods and in the forest understory and could occur around pond areas, such as occur at the site, although the typical habitat was not observed here. Bobolink occupy open field environments such as agricultural cropland and the compost curing area beside the proposed disposal site may provide suitable habitat, but none were seen. Barn Swallow may be found in open and wet areas such as fields, and marshes adjacent to the study area but nesting would require buildings, and this species was not seen in the survey. Chimney Swift are known to nest in buildings, chimneys and cavities of large trees; and Wood Thrush are found in mainly deciduous forests near streams, and neither species are likely to be found in the study area. Evening Grosbeak occur in mixed forest stands and Bank Swallow, require exposed banks for nesting, both are not likely to be found within the Project Area. No suitable habitat for any of these species was seen and there were no birds of federal or provincial species-at risk status observed during the June breeding-bird surveys by F. Lavender and R. Hatch.

Other animals of conservation concern which occur in Southwestern Nova Scotia in the general vicinity of the site include Little Brown, Northern Long-Eared, and Tri-coloured bats, which are federally listed as Endangered under SARA. Bat species have been documented as occurring in the general vicinity of the study site foraging (Weseloh-McKeane, 2018). The Wood Turtle, a species listed as Threatened under SARA has not been previously documented in the area,

however a suspected Wood Turtle sighting was made in a pond at the site (June 20, 2018). The pond will not be influenced by the proposed Asbestos Disposal Cell.

The Project Area is in the Tusket River Watershed, an important area for Coastal Plain Flora, which occur on shores of many of the lakes in the area including Ellenwood Lake, but none of the species occur at the site, based on the botany survey of the study area, and the absence of wetlands and other typical habitat. Coastal Plain Flora are a group of plant species which occur along the shores of lakes and streams in southwestern Nova Scotia, but are not found in similar habitats elsewhere in Nova Scotia. A number of plant species with Nova Scotia general status ranks including Coastal Plain Flora have been documented within five kilometres of the study area. Pink Coreopsis (*Coreopsis rosea*) and Plymouth Gentian (*Sabatia kennedyana*) both ranked as At Risk are known to occur in the general area. General status rank of May Be At Risk species include Low Flatsedge (*Cyperus diandrus*), Coastal Plain Blue-eyed Grass (*Sisyrinchium fuscatum*), Northern Maidenhair Fern (*Adiantum pedatum*), Coastal Plain Joe-pye-weed (*Eupatorium dubium*) and Porcupine Sedge (*Carex hystericina*) (Atlantic Canada Conservation Data Centre, 2018). Additionally, seven Sensitive species, Hairy Lettuce (*Lactuca hirsuta* var. *sanguinea*), Halberd-leaved Tearthumb (*Polygonum arifolium*), Southern Rein Orchid (*Platanthera flava* var. *flava*), Boreal Aster (*Symphotrichum boreale*), Spotted Pondweed (*Potamogeton pulcher*), Smooth Alder (*Alnus serrulata*) and Woods-Rush (*Juncus subcaudatus* var. *planisepalus*), have been documented in the Yarmouth County/South Ohio area (Atlantic Canada Conservation Data Centre, 2018).

A complete list of plants and animals of concern within a 100-kilometer radius of the study site is included in **Appendix 9**. There was no plant species of federal or provincial species-at risk status observed during the spring botany survey.

5.5.6 Significance of Impacts

5.5.6.1 *Terrestrial and Aquatic Habitat*

The MSW Management Park is in an area of regenerating mixed forest, in the upper watershed of the Annis River - Tusket River system. The project will remove a hectare of regenerating mixed forest, an area which is comparatively small compared to the overall extent of mixed forest in the vicinity of the landfill site. The forest ecosystems and aquatic habitat at the site are modified by

previous forest cutting, and are affected by adjacent landfill activities, such as ditching etc., and are of lower quality in terms of diversity and suitability for natural ecosystems than areas beyond the site. The overall effect of the Project on terrestrial habitat in the vicinity of the site is expected to be small.

5.5.6.2 Wetlands

There are no wetlands on the site or directly influenced by it, although the site is connected through a series of wetlands to Beaverdam Meadows, an important managed wetland located about 500 m northeast. Creation of the Asbestos Disposal Cell will not result in significant changes to the overall volume of runoff from the landfill, although the flow may experience sudden ‘flashy’ runoff events. It is expected that the overall drainage system of the site will absorb some of the peak flows and moderate the flow leaving the landfill. Another important wetland in the vicinity of the site is Chebogue Meadows, but it is not connected hydraulically and is not influenced by the MSW Management Park.

5.5.6.3 Recreational Use

Tourists and locals using Hardscratch Road and nearby recreational facilities at Ellenwood Lake Park and Chebogue Meadows Trail are unlikely to notice the change to the landfill as a result of the addition of the proposed Asbestos Disposal Cell. The Project will not be seen from the highway or other roads in the vicinity, as views are obscured by remaining forested areas along Hardscratch Road, as well as south of the disposal site, and between the entrance road to the landfill and the site. No increase in traffic volume is expected due to the project, as the new asbestos cell is replacing an existing disposal area of similar size. Tourists and other users of the area are not likely to notice the activity there. The MSW Management Park is off limits to any recreational uses such as ATVs, snowmobiles, cyclists etc. and construction of the Asbestos Disposal Cell will not affect such activities.

5.5.6.4 Parks and Protected Areas

Construction of the disposal cell will involve temporarily increased noise levels associated with heavy equipment, and will result in temporary additional traffic on adjacent roads. Although Provincial Parks including Ellenwood Lake Provincial Park and Chebogue Meadows Provincial Park are near the site, there should be no overall difference in perception by users, compared with the normal disturbance caused by operation of a modern landfill. Noise levels arising from the landfill, which may be heard at nearby Chebogue Meadows Provincial Park and Trail, as well as at Ellenwood Provincial Park, will not change as the result of the project. A quarry separates the project from Chebogue Meadows on the south and a cumulative effect of the two operations is not expected. Traffic volumes to the site will not change overall as the result of the project and road access by users of these sites will only be changed temporarily during construction, and may be avoided by planning for work to take place outside of the summer tourist season, generally June to September. The Project is small enough to have a minimal impact on wildlife in the area, and in particular no noticeable effect on wildlife abundance is expected to occur at the Provincial parks.

5.5.6.5 Wildlife

Removal of natural forest cover over approximately one hectare of the Project Area will reduce the habitat for wildlife (birds, mammals, herpetiles etc.). Although the Asbestos Disposal Cell will permanently remove that land from future use by wildlife, it has only a small footprint compared with the much larger area of land surrounding the site and on the west side of Hardscratch Road. The planned footprint of the Asbestos Disposal Cell has been placed as far north as possible to preserve a wildlife corridor through the site, in order to reduce the overall impact on wildlife within the Project Area.

5.5.6.6 Hunting and Trapping

Development of the Asbestos Disposal Cell will cause a small reduction in the forest habitat in the area which would otherwise be available for habitat for the ecosystem which supports furbearers and upland game. The area affected is comparatively small in relation to the overall area of forest in the Yarmouth area and such an effect will most likely be negligible. No hunting

and trapping takes place on the landfill property and probably not in the immediate vicinity, and consequently the disposal cell will not impact hunting and trapping activity in the Yarmouth area.

5.5.6.7 Fish and Fish Habitat

Construction of the Asbestos Disposal Cell will not result in significant changes to the overall volume of runoff from the MSW Management Park, and it will not affect fish habitat of any kind.

5.5.6.8 Recreational and Commercial Fisheries

The Project does not directly affect watercourses on the site, and projects of this nature, typically involve improvements to water quality, including increasing pH (i.e. making the water less acid) as well as helping to control suspended sediment levels and flashy flow regimes through drainage management. No trout or suitable habitat for this species occurs on the site, and activities will therefore not impact populations of these species. Recreational angling for trout and other species; as well as commercial fisheries for alewives on the Annis River system; and Mi'kmaw food and ceremonial fisheries, will not be affected by construction of the asbestos cell.

5.5.6.9 Species at Risk

The Project will not affect turtle species found in the pond at the southwest corner of the study area and there is no indication that it is a permanent resident of the pond. A pond is not a normal habitat for Wood Turtle (potentially sighted during the June 19- 20, 2018 site visit) and the sighting may represent a chance occurrence of the species as it moves over the landscape. No species at risk plants or animals of conservation concern were seen at the site.

Prior to construction it is recommended that a general biological screening of the area be conducted, including examination of the pond, to determine if the species is present. During construction and operation, employees and crew should be encouraged to be alert for the presence of turtles on site and to avoid disturbing them.

5.6 Socio-Economic Considerations

5.6.1 Population and Employment

The MSW Management Park on Hardscratch Road, South Ohio, is situated in the Municipality of the District of Yarmouth. According to Statistics Canada (2016), the municipal district has a population of 9,845. The population in that area decreased by 2.6 percent between 2011 and 2016. The employment rate in the district is 56.9 percent and the unemployment rate is 8.2 percent. The experienced labour force of the area consists of 25 percent sales and service occupations, 12 percent as trades, transport and equipment operators, and related occupations, and another 12 percent in the natural resources and agriculture sectors.

5.6.2 Land Use

The Proponent owns the MSW Management Park and the proposed Asbestos Disposal Cell will be constructed on its land with no new purchase or expropriation of third-party property required. Activities on adjacent lands around the MSW Management Park are not expected to interfere with, or be subject to inference from, the proposed undertaking.

5.6.3 Mining and Agriculture

A review of NSDNR's Abandoned Mine Openings Database indicates that there is a mica mine shaft situated approximately 2 kilometres south of the Project Area, near the Lafarge (Quality Concrete) Hardscratch Quarry. The area is not part of an active mining district and will not influence the proposed undertaking.

Agricultural areas are located within the general area of South Ohio, but the closest agricultural lands are located over 2 kilometres west of the Project Area. Forestry operations have been identified in the region approximately 1.5 kilometres to the east of the Project Area.

5.6.4 Recreational, Commercial and Mi'kmaw Fisheries

The Project will have no direct interaction with recreational, commercial or Mikmaw fisheries in the area. Recreational fishing is permitted in the region (NSFA, 2017). Recreational fishing provides an important resource and pastime for residents of Yarmouth County; and commercial fisheries provide an important source of income for many residents of the area. The YCSWMA facility falls within Recreational Fishing Area 4 in the Tusket River watershed, which is important for trout (brook and brown), as well as smallmouth bass, perch (white and yellow), and chain pickerel. Ellenwood Lake, located northeast of the Project site, is stocked with speckled trout; and Big Meadow Brook, a tributary of Tusket River, is designated as a special trout management area, and is a catch-and-release waterbody (Nova Scotia Anglers Handbook, 2018). There is no recreational salmon fishery in the Yarmouth area this season (Salmon Fishing Area 21 is closed for salmon fishing). In Yarmouth County, trout fishing can occur from April 1 to September 30 in inland and tidal waters with some conditions (September 1 to 30; smallmouth bass from April 1 to October 31; and fishing for species such as Chain Pickerel, White Perch and Yellow Perch can occur from April 1 to October 31 (Nova Scotia Anglers Handbook, 2018). Other species, which may be fished in the general area, are Gaspereau/Blueback Herring, smelt and eel. Of all the species fished, only Gaspereau/Blueback Herring have commercial importance, and a fishery occurs in the Tusket and Annis rivers. In addition, eel pots are placed occasionally in Argyle River as part of a small eel fishery, however, there is no elver fishery in Yarmouth County (R. MacCleve, Fisheries Officer, Tusket Branch, personal communication 2018). Species fished for food, society, and ceremonial purposes in inland waters by Mi'kmaw in the Tusket and Annis rivers include elvers, Gaspereau and trout as well as occasional other species (R. MacCleve, Fisheries Officer, Tusket Branch, personal communication 2018).

5.6.5 Hunting and Trapping

Recreational hunting is permitted in the region (NSDNR, 2017). The YCSWMA site is expected to support occasional occurrences of furbearing wildlife species characteristic of Yarmouth County; however no hunting or trapping is expected on or in the immediate vicinity of the site. Predominant fur-bearing species reported in trapping catches for Yarmouth County are listed in **Table 7** (NSDNR, 2018). Muskrat, Mink and Beaver are trapped most, and Snowshoe Hare is the most abundant upland game species, along with Ruffed Grouse and Ring-necked Pheasant. White-tailed Deer and Black Bear both occur in the area, but harvest of these animals in

Yarmouth County is relatively low, representing only 1.0 % and 3.7 % of the provincial harvest from 2011 - 2016, respectively. Overall, there is little habitat at the site for fur-bearing and game species and no hunting or trapping takes place at the site. Therefore, the impact of the Project on those VCs is negligible.

5.6.6 Transportation

The Project Area is located approximately 1 kilometre south of the intersection of Hardscratch Road and Highway 340, and approximately 3 kilometres north of the intersection of Hardscratch Road and Tinkham Road. The MSW Management Park is accessed via a private road that branches off of Hardscratch Road (**Figure 1**). The roads surrounding the Project Area are in good repair and the Project is not anticipated to result in significant increase in the volume of truck traffic on public roads compared to current levels.

5.6.7 Significance of Impacts

The proposed undertaking is not expected to have an adverse effect on the socio-economic environment. The existing MSW Management Park provides local employment, with the number of people working at the site varying between four and five individuals throughout the year depending on the level and type of activity. Transporting ACMs to the MSW Management Park helps to secure the work of private contractors in the local area that specialize in the demolition and transport of ACMs.

5.7 Surficial and Bedrock Geology

5.7.1 Surficial Geology

The MSW Management Park is situated in a stony till plain where drumlins and pockets of organic deposits are found (**Figure 8**). The till generally consists of a stony and sandy matrix derived from local bedrock sources. The till plain usually varies in thickness from 2 to 20 m, but can reach up to 30 m in thickness where drumlin facies are present. The organic deposits are

generally sedge peat swamps of thickness less than two metres in depressions and low-lying areas (Stea et al. 1992).

5.7.2 Bedrock Geology

Bedrock underlying the MSW Management Park consists of grey, medium-grained, foliated syenogranite to monzogranite of the Brenton Pluton (**Figure 9**). The pluton is situated in a shear zone that is oriented northeast-southwest. To the northwest of the pluton, the bedrock is part of the White Rock Formation consisting of grey, biotite-bearing slate, phyllite, schist and metasandstone interlayered with green mafic to intermediate lithic metatuff and tuffaceous metasandstone and amphibolite. To the southeast of the pluton, the bedrock consists of the Acacia Brook Formation of the Halifax Group formed by dark grey, laminated slate with minor, thin beds and lenses of light grey metasilstone where sulphide-bearing minerals are common (White, 2012).

The potential for acid rock drainage (ARD) to form as a result of the exposure of the granitic rocks beneath the MSW Management Park is considered to be low. If some rock fragments from the Acacia Brook Formation are present in the surficial materials, localized ARD is possible.

5.7.3 Geotechnical Conditions

A geotechnical investigation was undertaken by Fracflow within the footprint of the planned Asbestos Disposal Cell. The clearing of an access corridor for the excavator was delayed until the week of August 6, 2018 to fall outside of the breeding season for most bird species (April 1 to August 1) and to avoid disturbing any eggs and flightless young birds. A copy of the detailed report is presented in **Appendix 10**.

The geotechnical investigation was conducted on August 14 and 15, 2018 after the completion of the bird survey, wetlands/botanical survey and ARIA. Those surveys confirmed that there were no sensitive site features, plants, birds or animals in the area that would otherwise prevent the work from being carried out, or that required any unusual mitigative measures to be developed and employed. The boundaries of the planned Asbestos Disposal Cell and associated ground elevations were established by Acker & Doucette Surveying. In early August 2018, trees were

removed from a 3 m to 4 m wide path through the centre of the planned cell and along the southern and northern boundaries of the cell to permit excavator access.

Five test pits were excavated by the Proponent using a track-mounted CAT 348C excavator, equipped with a standard duty, 0.6 m (24 inch) wide bucket and finger. Those test pits were designated TP1 through TP5. The goal of the excavation work was to inspect subsurface conditions across the footprint area to the maximum reach of the excavator or until refusal occurred. The maximum reach of the excavator was approximately 3.6 m (12 feet) and refusal occurred before the maximum reach was achieved at each location.

There were no fill materials observed at any of the locations that were excavated. The native materials generally consisted of a 0.1 m to 0.3 m thick layer of roots and organic matter followed by fine sandy silt with varying degrees of gravel, cobbles and boulders (glacial till). Bedrock (or possibly large boulders) was inferred at depths of between 2.59 m and 3.05 m below ground surface at Test Pits TP1, TP3, TP4 and TP5. Zones of groundwater seepage occurred near the bottom of all test pits. The measured depths to static groundwater were 2.13 m below ground surface in Standpipe SP1 (at TP1), 1.33 m below ground surface in Standpipe SP2 (at TP2), and 2.06 m below ground surface in Standpipe SP3 (at TP4). The inferred direction of groundwater flow was from west to east.

Infiltration tests were conducted in native, undisturbed soil at Test Pits TP3 and TP5, from a depth of 1.3 m before the excavations were advanced to refusal. There was no measurable decline in water level during either of those tests, which from experience suggests that the hydraulic conductivity (K) of the till materials was smaller than 1×10^{-9} m/s. A water level recovery test was conducted in TP4 prior to backfilling. Using data from that test, the estimated K value for undisturbed materials at that bottom of that test pit was 3.5×10^{-9} m/s. Water-level recovery tests were conducted in Standpipe SP1 (at TP1) and in Standpipe SP2 (at TP2). Those data were processed and estimated K values were obtained for disturbed till surrounding the well screens at each location. The estimated K value for SP1 was 7.9×10^{-9} m/s. The estimated K value for SP2 was 1.4×10^{-8} m/s.

Particle-size distribution data for seven representative soil samples that were collected from the test pits showed that the soils were generally well graded. K values that were calculated using Hazen's formula ranged between 4.0×10^{-9} m/s and 4.3×10^{-7} m/s.

There are no stated guideline values for minimum K values for *in situ* soils at an asbestos disposal site, or for soils used for capping materials at such a site. However, if one considers the requirements specified in the Construction and Demolition Debris Disposal Site Guidelines issued by Nova Scotia Environment (formerly Nova Scotia Department of Environment and Labour) (2003), the thickness and permeability of the native soils encountered during the current work are suitable for disposal of bagged, separated asbestos.

5.7.4 Significance of Impacts

The subgrade soil at this site has a relatively high content of fines and it will be moderately-to-highly susceptible to frost heave. The soil also has a relatively low permeability and will tend to act as an aquitard, potentially trapping water near the ground surface. In order to maintain the integrity of the final cap after closure, the cap will need to be crowned or sloped to promote drainage toward the perimeter ditches. The invert elevation of those ditches should also be below the base elevation of the trenches that contain the ACM to help control the water table. The ditches also need to be lined with well-drained granular materials, such as a Type 2 Gravel as specified in the Standards Specifications of the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR).

As noted above under bedrock geology, the potential for ARD at this site is considered to be low. A mitigation plan is not required at this time, given the naturally low pH and elevated iron that is currently found in groundwater in up-gradient areas of the MSW management Park, coupled with the high alkalinity and buffering capacity of water in the receiving area, namely the Sedimentation Control Pond.

5.8 Water Resources

5.8.1 Surface Water

5.8.1.1 *Drainage Area*

The Project Area is in the Annis River secondary watershed and the Tusket River primary watershed. Elevations at the MSW Management Park vary from approximately 70 m above mean

sea level in the west to 40 m in the east. The land generally slopes to the northeast with the majority of the site runoff being captured by the Sedimentation Control Pond. Water released from that pond drains into the Beaverdam Meadows wetland complex to the northeast of the site. That wetland area is part of the Annis River secondary watershed and the Tusket River primary watershed. Beaverdam Meadows drains into Cloverhill Brook, which flows into Harris Lake, one of a chain of lakes on the Annis River (also including Salmon Lake and Pleasant Lake), which eventually flows into the Atlantic Ocean (NSE, 2011). The boundaries of the tertiary watershed are shown in **Figure 10**.

5.8.1.2 Monitoring Stations

Four surface water monitoring stations have been established at the MSW Management Park. The baseline station is designated SW06-3, and the non-baseline stations are designated SW06-4, SW5 and SW6. Their locations are shown in **Figure 11**. A copy of the last annual report on surface water quality monitoring (Fracflow, 2018) is attached in **Appendix 11**. The results are summarized below.

5.8.1.3 Surface Water Quality

Surface waters are monitored quarterly for general chemistry, total metals, biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total suspended solids (TSS). Surface waters are monitored annually for petroleum hydrocarbons (BTEX/TPH), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHS). In addition, the Sedimentation Control Pond is being sampled for BTEX/TPH on a quarterly basis, and effluent from the Petroleum Contaminated Soils Remediation Facility is being sampled for metals, BTEX/TPH, and PAHs on a quarterly basis.

Selected indicator parameters, namely alkalinity, chloride, pH and total dissolved solids (TDS), are being used to examine water quality trends at four surface water monitoring stations at the MSW Management Park. The overall trends are indicative of seasonal variations in precipitation, but weak trends toward decreasing concentrations since 2009 are evident (based on linear regression analysis). The only chemical parameters that consistently exceed the applicable

guideline values at both baseline and non-baseline stations are total metals. Details are provided in the last annual report in **Appendix 11**.

5.8.1.4 *Significance of Impacts*

The construction and operation of the proposed Asbestos Disposal Cell is not expected to have a significant adverse effect on surface water quality, but it will affect the quantity of runoff that is generated. Clearing off trees within the 100 metre by 100 metre footprint of the new cell will reduce groundwater recharge and enhance runoff generation. There will likely be as much as a 4 percent increase in the quantity of water that has to be handled through drainage ditches and at the Sedimentation Control Pond. A set of proven procedures for monitoring the Sedimentation Control Pond, as set out in the Operations and Maintenance Manual, will continue to be followed. Those procedures are summarized below.

- The Sedimentation Control Pond will be visited on a daily basis and the water level recorded.
- Sediment depth on the bottom of the Sedimentation Control Pond will be measured and recorded on a quarterly basis. Removal and disposal of pond sediments will be undertaken in accordance with applicable regulations.
- A visual inspection of Sedimentation Control Pond embankments and general area will be performed daily to identify signs of erosion or sloughing of soil, litter, or vandalism.
- All ditches, inlet structures, outlet structures shall be inspected daily to identify debris or ice blockages.
- Weather forecasts will be obtained daily from the nearest office of the Environment Canada Atmospheric Environment Service in order to prepare the pond (e.g., pumping down of water level) for potential use. If rainfall is forecast to occur during weekends or holidays, make arrangements for a qualified staff member to visit the site and prepare the pond as required.

5.8.2 Groundwater

5.8.2.1 *Aquifer Characteristics and Potable Supplies*

The surficial deposits on and around the Project Area are thin and reported to vary between 1 metre and 15 metres in thickness. Those deposits are generally stratified, with discontinuous internal layering. They are, therefore, not likely to store any significant quantity of water for a sustainable water supply. It should be noted that many private wells in southwestern Nova Scotia went dry during the drought conditions experienced in 2016, and dry wells were being reported in August 2018.

The primary hydrostratigraphic unit in the South Ohio of Nova Scotia is the fractured granite bedrock. The hydrogeological properties of fractured-bedrock aquifers, in general, can be highly variable depending on the nature of the porosity and permeability (Fracflow, 2004). The granite is a hard rock that has no significant matrix porosity. The capacity of that rock to store and transmit water depends on the extent of fracturing and whether or not a producing well has been completed in the regularly-fractured rock or if it intersects some high permeability, water-bearing features such as large fractures or shear zones, or open bedding planes. The Project Area is situated upon, and surrounded by granite and the fracture networks that exist in that rock type are quite variable in three dimensional space (i.e., anisotropic and heterogeneous). The zone of influence that forms around a pumping well in fractured granitic rocks will often be more elliptical than circular, with the long axis of the ellipse oriented parallel to the most permeable fracture set.

Water supply wells in Nova Scotia are almost always completed as vertical wells and those wells are predisposed to intersecting a greater number of horizontal and sub-horizontal discontinuities than they are to intersect vertical discontinuities. Horizontal fractures can have a high transmissivity, but tend to contribute little in the way of yield in the long term (Gale, 1975). That finding underscores the importance of the vertical fractures in delivering water to the sub-horizontal features and, thereby, creating aquifer systems.

The locations of known potable wells in the Project Area are shown in **Figure 12**. Most of those wells are drilled wells although a few are dug wells. The two wells owned and operated by YCSWMA were constructed as potable wells, but are only used to supply non-potable water to the facility.

5.8.2.2 *Monitoring Well Network*

There are ten active monitoring wells at the MSW Management Park. Those wells are designated MW06-1 through MW06-8, and MW15-1 and MW15-2. Well locations are shown in **Figure 13**. In addition, Standpipes SP1, SP2, and SP3 were installed at the planned Asbestos Disposal Cell. Standpipe locations are also shown in **Figure 13**.

5.8.2.3 *Water Table and Directions of Groundwater Flow*

It is generally accepted that the shape of the water table will tend to mimic the ground surface contours, although in a subdued fashion. Based on 1:50,000 scale topographic mapping for the area, as shown in **Figure 10**, the inferred direction of 'regional' groundwater flow is expected to be toward the southeast. Water levels recorded at all standpipes and monitoring wells in August 2018 were contoured and the inferred direction of groundwater flow was generally from west to east, at the local scale (**Figure 13**). The average horizontal gradient was approximately 0.035 m/m through the middle of the MSW Management Park.

Current and historical groundwater elevations were plotted for all monitoring wells up to the end of 2017 (see **Appendix 11**). Periods of rising and falling water levels, which respectively coincide with wet and dry periods of the year, occur at the same monitoring dates at all monitoring wells in the western and central areas of the MSW Management Park (MW06-1, MW06-2, MW06-3, MW06-4, MW06-5, MW15-1 and MW15-2). The depth to water at those well locations has varied between 0.58 metres and 2.81 metres below ground surface, with the average depth being 1.5 metres. Drainage conditions at MW06-2 and MW06-3 are expected to be most representative of those at the proposed Asbestos Disposal Cell. The depths to water at those well locations varied between a minimum of 1.2 metres and a maximum of 2.8 metres below ground surface, averaging 1.73 metres.

The patterns of rising and falling water levels in the eastern portion of the site (MW06-6, MW06-7 and MW06-8), which is at lower ground elevations, are more subdued relative to the other monitoring wells. The depth to water at those well locations has varied within a smaller range of between 0.93 metres and 2.60 metres below ground surface, with the average depth being 1.5 metres. Those three wells are located in the lower part of the flow system and may be influenced by an upward-directed component of vertical groundwater flow. The most easterly

well, MW06-8, is located on the down-gradient side of the existing Asbestos Disposal Area. The depths to water at MW06-8 has varied between a minimum of 0.93 metres to a maximum of 1.87 metres below ground surface, averaging 1.19 metres.

5.8.2.4 Groundwater Quality

Groundwater quality at all monitoring wells, excluding the Petroleum Contaminated Soil Remediation Facility (PCSRF), is being monitored quarterly for general chemistry and dissolved metals. Groundwater quality is monitored annually for petroleum hydrocarbons (BTEX/TPH), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHS). Monitoring wells MW15-1 and MW15-2 at the PCSRF require quarterly analysis for BTEX/TPH and semi-annual analysis for VOCs, PAHs, and dissolved metals.

The only chemical parameters that consistently exceed the guideline values are dissolved metals. Selected indicator parameters, namely alkalinity, chloride, pH and total dissolved solids (TDS) are being used to examine trends in groundwater quality. Monitoring wells that have maintained low concentrations of total dissolved solids (less than 100 mg/L), since well construction in 2006, are MW06-1, MW06-2, and MW06-7. Variations in water quality at each of those well locations are relatively minor and appear to be controlled by seasonal changes in groundwater recharge and not waste management activities. Locations where on-going or historical waste management activities appear to be having some effect on groundwater quality are at monitoring wells MW06-3, MW06-4, MW06-5, MW06-6 and MW06-8. The most significant impacts appear to be from a northeastward-advancing leachate plume that is originating from the closed MSW Landfill to the south. Details are provided in the last annual report in **Appendix 11**.

5.8.2.5 Water Balance

Between 5 and 15 percent of the total precipitation typically infiltrates ground surfaces in Nova Scotia and become available as recharge to thin-overburden, fractured-bedrock flow systems. That is equivalent to between 65 and 194 mm of water using the climate normal of 1,292.9 mm of mean annual precipitation. That amount of water infiltrating the ground surface over the entire 8,621,900 square metres of the tertiary watershed would represent between approximately 560,423 and 1,672,649 cubic metres per day. Those values bracket the upper and lower limits on

the volume of groundwater that is estimated to be available to groundwater users as a sustainable resource within that tertiary watershed.

The current water balance of the MSW management facility will shift toward an increase in surface water runoff as a result of vegetation removal. If one assumes zero recharge within the 10,000 m² footprint of the Asbestos Disposal Cell, then the 5 to 15 percent of normal groundwater recharge will be diverted to runoff. On a mean annual basis, that would amount to between 646 and 1,939 m³ per year, or between 1.77 and 5.31 m³ per day. Those amounts represent an exceedingly small fraction of the total groundwater available within the tertiary watershed, and an overall negligible impact for the Project.

5.8.2.6 Significance of Impacts

The construction and operation of the proposed Asbestos Disposal Cell is not expected to have any significant impact on groundwater quality, but it may alter groundwater flow patterns in the local area, due to changes in recharge and runoff patterns around the cell. Any changes in water levels or in groundwater quality will likely be detected by continued monitoring of the groundwater monitoring network.

6.0 MITIGATION AND MONITORING

6.1 Archaeological Contingency Plan

There were no known archaeological or heritage resources identified within the Project Area. The Project Archaeologist concluded that the risk of encountering such resources was low. However, it is recognized that the potential will always exist to encounter archaeological and heritage resources during future excavation work for burial of asbestos-containing materials.

All archaeological and heritage sites located within the Project Area fall under the jurisdiction of the *Special Places Protection Act*, which is administered by CCH and the Nova Scotia Museum. If a potential archaeological or heritage resource is encountered while trenching for ACM burial, all work shall be stopped immediately. Staff at YCSWMA will flag off the area of concern, prevent public entry, and not attempt to move or remove any artifacts unless the integrity of those artifacts are threatened. YCSWMA's Site Manager will contact the Project Archaeologist who will conduct an initial investigation and, if necessary, report the findings to the relevant authorities and collaborate with those authorities regarding the management of the discovered resources. The Project Archaeologist will, at a minimum, contact the Curator of Archaeology, Nova Scotia Museum (NSM) and the Manager, Special Places, for CCH. If the potential archaeological resource(s) is/are suspected to be of Mi'kmaw origin, the Project Archaeologist will also be required to contact KMKNO and AFN.

The Qualified Archaeologist will develop and deliver a training workshop to staff at YCSWMA. Qualified Archaeologists from KMKNO will be encouraged to help deliver that session. The training is necessary to educate staff in recognizing potential artifacts during excavation work and to explain the proper steps to be taken for notification and protection of such artifacts.

6.2 Protection of Natural Habitat and Wildlife

Clearing of areas to be used for the Project will be conducted outside of the breeding season for most bird species (April 1 to August 1) to avoid disturbing the eggs and flightless young birds that are protected under the *Migratory Birds Convention Act* (MBCA).

6.3 Asbestos Waste Handling

ACMs entering the MSW Management Park are required to be packaged and handled in accordance with the *Asbestos Waste Management Regulations* pursuant to the *Nova Scotia Environment Act*. Those regulations require that ACMs be disposed at a designated, provincially approved site.

The proposed Asbestos Disposal Cell is approximately 100 metres by 100 metres in size and includes perimeter drainage, access road and gate to secure it from public entry (**Figure 2**). The area will be delineated by installation of four permanent corner markers and clearly identified with appropriate signage. Operational provisions will be as per the Operations and Maintenance Manual and the requirements listed below.

- All disturbed soil shall be stabilized by hydro-seeding or by other appropriate methods as soon as possible following backfilling.
- The Site Supervisor shall receive advance notice prior to accepting any asbestos waste.
- The Site Supervisor shall ensure that all incoming quantities of asbestos waste are covered by a shipping document as prescribed by NSE prior to acceptance.
- All asbestos waste delivered to the site must be directed to the designated area by the Site Supervisor and buried within 24 hours of receipt.
- Asbestos waste delivered as part of another cargo or in a compaction-type vehicle will not be accepted.
- All site personnel handling or burying asbestos must wear appropriate personal protective equipment (PPE) as prescribed by provincial health and safety legislation. A compound will be erected inside the gated area of the cell that will contain a complete array of spare PPE, including tyvek suits, respirators equipped with particle filters, boots, gloves, fire extinguisher and first aid kit.
- Cover material must be provided as follows: 0.25 m of soil cover within 24 hours of burial; and 1.25 m of final soil cover upon abandonment or discontinued use of the disposal area.

- Site records are to include information on each incoming shipment of asbestos waste, including generator, quantity, receipt/burial date and burial location within the Asbestos Disposal Cell.
- The Asbestos Disposal Cell shall be inspected monthly and relevant information included in regular reports to NSE. The relevant information will be maintained on site and forwarded to NSE during regular reporting by the General Manager.

6.4 Control of Dust and Noise

6.4.1 Dust Control

Dust control measures will be implemented as per the existing Operations and Maintenance Manual for the MSW Management Park and the requirements listed below.

- The site shall be monitored daily for dust generation during dry weather.
- Completed disposal areas shall be seeded or sodded as soon as practical.
- Vehicle speeds shall be limited on-site to 20 kph, particularly during dry periods. Adequate signage shall be posted, and limits enforced.
- On-site roads shall be maintained to minimize dust emissions.
- Calcium chloride shall be applied to roads as necessary. The rate of application shall be recorded using the daily checklists provided in the Operations Manual.

6.4.2 Noise Control

As per the Operations and Maintenance Manual, all equipment powered by internal combustion engines shall have appropriate mufflers installed and will be maintained in accordance with the manufacturer's recommendations. Scheduling of any potential noise-generating activities will occur daytime hours. In addition, a buffer of natural vegetation shall be maintained around the facility to aid in minimizing noise impacts beyond the facility boundary.

6.5 **Sediment and Erosion Control**

6.5.1 Operational Sediment and Erosion Control Measures

Sediment and erosion control measures outlined in the Operations and Maintenance Manual will be followed. Identification and implementation of required erosion and sediment control procedures is a standard part of the day-to-day operation of the site. Regular monitoring of surface water conditions and site operations will determine the need for improvements in sediment control measures.

Disturbed soil areas will be covered with suitable materials to significantly reduce erosion and sediment generation in surface water. Any disturbed areas expected to be exposed for between one month and a year will be covered or stabilized. This may be accomplished with ground wood chips, mulch or straw or other suitable material. For periods less than one month, cover shall be used as required (e.g., an impending heavy rainfall).

Sedimentation control structures, such as traps, synthetic materials, dams and barriers, will be used as part of the facility's operational plan. It is noted that these items require regular inspection and maintenance. These devices will be installed as deemed required by the Site Supervisor.

6.5.2 Long-Term Sediment and Erosion Control Measures

If the proposed Asbestos Disposal Cell is expected to be idle for extended periods (e.g., in excess of one year or following closure), the cap will be vegetated by manual seeding, hydroseeding, and/or by placement of sod during the optimum seed germination season (early spring to June 15,

and August 15 to October 15). The seed mix will be fresh, clean, Canada No. 1 grade mixture in a proportion similar to that used by the Nova Scotia Department of Transportation and Infrastructure Renewal for road ditch restoration: 40% Creeping Red Fescue; 15% Timothy; 15% Tall Fescue; 10% Kentucky Bluegrass; 10% Alsike Clover; 5% Red Top; and 5% Perennial Ryegrass.

The soil surface will be scarified to a minimum depth of 50 mm prior to seed application and the seeding rate will be 150 kilograms per hectare. Mulch will be applied at the rate of 1 tonne per hectare to protect the seed during dry conditions. The seed will then be fertilized at the rate of 50 kilograms per hectare. In the absence of sufficient rainfall, the Site Supervisor will spray water over the seeded areas at least twice per week to ensure growth.

It is imperative that the integrity of the cap and lateral drainage trenches be maintained. If at any time the cap integrity is compromised then immediate action will be taken to repair the cap. The lateral drainage ditch will be maintained on an as needed basis.

6.5.3 Monitoring Fish and Fish Habitat

The ongoing fish habitat assessment and invertebrate sampling program for the MSW Management Park will provide suitable monitoring information. If changes in aquatic habitat are identified, the need for corrective measures will be reviewed in consultation with YCSWMA, Fracflow, EnviroSphere and NSE.

6.5.4 Water Quality Monitoring

The ongoing surface water and groundwater quality monitoring program for the MSW Management Park is expected to be suitable for detecting any impacts from the proposed Asbestos Disposal Cell.

6.6 Vegetation Control

Vegetation management of exposed areas will be undertaken to prevent development of weeds and other invasive species. This will include using seed mixtures that are free of noxious weeds and invasive species. Wherever practical, native plants or seed mixes containing naturalized species that are well established in Nova Scotia will be used.

Vegetation that roots in the final cover of the Asbestos Disposal Cell will protect the soil from the effects of erosion. However, the roots of some woody plant species can penetrate the soil layers and affect the integrity of the landfill cap. The vegetation covering the landfill cap must not exceed 0.6 metres in height. Any vegetation in excess of 0.6 metres should be cut to a maximum of 0.3 metres in height on an as-needed basis. Vegetation control measures will include brush cutting and mulching of alders, trimming of alder stumps, and mulching and raking of grass.

6.7 Restricted Access to Protect Human Health and Wildlife

The use of a secure fence, gated access and video surveillance will deter public access, as well as entry by large animals.

6.8 Climate Change Considerations

Climate change will require municipalities to deal with more frequent storm events, increased storm intensity, changes in precipitation and extreme precipitation events, sea level rise, storm surges and floods, accelerated coastal erosion, flooding and flash-floods, wetter winters, drier summers with droughts and more forest fires, and water (availability) constraints (NSE, 2009). The Town of Yarmouth completed its Climate Change Action Plan (Town of Yarmouth, 2013). Climate change adaptation for an existing or planned containment system should focus on evaluating the system's vulnerability to climate change and implementing adaptation measures, when warranted, to ensure the remedy continues to prevent human or environmental exposure to contaminants of concern (USEPA, 2014).

The MSW Management Park is located at an inland site, at elevations above 40 metres, where the major risks associated with climate change will be related to intense rainfall events, runoff,

erosion, and localized flooding. The specific concerns associated with the proposed Asbestos Disposal Cell are potential cover material erosion, loss of surface grade integrity, side slope failure, washout, and the uncontrolled spread of silt and asbestos into the surrounding environment. It should also be noted that the effect of extreme precipitation events may be exacerbated if preceded by longer periods of hot, dry weather. The recommended adaptation measures for the proposed Asbestos Disposal Cell include the following:

- Construction of the base of the cell above the water table;
- Placement of a low permeability cap over the waste material and grading of the cap from the centre toward the sides of the cell;
- Hydroseeding of the cap surface to reduce erosion;
- Construction of a perimeter drainage ditch that will intercept the water table;
- Planting of deep-rooted cordgrass (*Spartina*) just above the perimeter drainage ditch, and installation of a silt curtain above that cordgrass;
- The use of coarse granular material in the base of the drainage ditch that surrounds the cell to minimize scouring;
- Monthly monitoring of the integrity of the cap, silt control system and drainage ditches; and
- Weekly watering of the vegetated surface of the cap during periods of drought.

6.9 Site Closure

A closure plan for the proposed Asbestos Disposal Cell will be incorporated into the Site Closure Plan for the MSW Management Park. As outlined in the Operations and Maintenance Manual, development of the Site Closure Plan will commence approximately three years prior to scheduled closure and will include updating the facility survey, a complete site inspection, a review and evaluation of all site monitoring data, preparation of engineering drawings and specifications defining final closure (i.e., cap installation) requirements, preparation of a

post-closure record drawing, and preparation of a post-closure Operations Manual defining long-term maintenance, monitoring and reporting requirements.

7.0 CONTINGENCY PLANS

A detailed Contingency Plan for Emergency Response has been prepared and adopted by the YCSWMA. The details of that plan, as outlined in the Operations and Maintenance Manual, includes the existing Asbestos Disposal Facility and is applicable to the proposed Asbestos Disposal Cell. The key elements are summarized below.

7.1 Emergency Response

An emergency is defined as any accident, incident, or unplanned event or situation that requires immediate and urgent action to prevent or minimize harm to persons, the environment, or property. Such an occurrence would include unexpected hazardous material mixed with a load of asbestos-containing materials (ACMs), fire, accident or personal injury, spill or release of ACMs due to equipment malfunction, presence of wildlife, unauthorized dumping of material, etc.

Once an emergency has been confirmed and declared by the general Manager, the General Manager will declare the state of that emergency, which will dictate the actions and responses. In the case of a **Level III Emergency**, all personnel are to continue with their duties unless otherwise directed by the General Manager, and shall constantly monitor communications for changes in the status of the emergency. In the case of a **Level II Emergency**, all personnel will abandon their duties in a controlled manner, and gather on-site at the Muster Point (outside or inside the Scale House or at the main site entrance gate). In the case of a **Level I Emergency**, all personnel will evacuate the site via the main access road at the direction of the General Manager, using the designated exit route and meeting at the designated gathering area beyond the site.

The existing communications network used during normal operations at the site will be used in the event of an emergency, including direct contact, two-way radio, or telephone (fixed, mobile, and cellular). Once an emergency is declared, all site personnel are to maintain an open communication line with the General Manager at all times. A call to 911 will be made, the scale house will be shut down and all non-emergency personnel and equipment will be denied entry.

7.2 Containment and Clean-up

The containment and clean-up procedures will be specific to the nature of the emergency. Site personnel will act with due diligence in coordinating with emergency response organizations such as the Fire Department, Police, NSTIR, NSE, NSDNR, and municipal groups.

7.3 Regulatory and Other Reporting Requirements

Brief but accurate records will be kept during an emergency by all coordinators. This will assist with post-emergency assessment, reporting, and plan revisions. Within five working days of the resolution of the event, the Site Supervisor will provide the General Manager with a brief written report concerning the emergency, with a copy sent to NSE and other government departments as needed. The report will include an account of the circumstances that caused the emergency, an account of the events during the emergency, including a chronology, the current status of the site with respect to the emergency, and measures to be taken to minimize future occurrences. An evaluation of the performance of coordinators, site personnel and planned measures to address any deficiencies in the Contingency Plan will be prepared by the General Manager for review by YCSWMA and the regulators and emergency response organizations, as needed.

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