



Environmental Assessment (and/or Environmental Effects Review)

PROJECT DESCRIPTION: NEAR SURFACE DISPOSAL FACILITY AT CHALK RIVER LABORATORIES

232-509200-ENA-001

Revision 1

Prepared by
Rédigé par

Klukas Martin H - Environmental
Analyst

Reviewed by
Vérifié par

Needham Sharon - Regulatory
Approvals Manager

Approved by
Approuvé par

Dolinar George M -
Environmental Program Authority

2016/09/30
UNRESTRICTED

2016/09/30
ILLIMITÉ

©Canadian Nuclear
Laboratories

©Laboratoires Nucléaires
Canadiens

286 Plant Road
Chalk River, Ontario
Canada K0J 1J0

286, rue Plant
Chalk River (Ontario)
Canada K0J 1J0



Environmental Assessment (and/or Environmental Effects Review)

Project Description: Near Surface
Disposal Facility at Chalk River
Laboratories

Near Surface Disposal Facility (NSDF) Project

**232-509200-ENA-001
Revision 1**

2016 Sept

UNRESTRICTED

© Canadian Nuclear
Laboratories

286 Plant Road
Chalk River, Ontario
Canada K0J 1J0

sep 2016

ILLIMITÉE

© Laboratoires Nucléaires
Canadiens

286, rue Plant
Chalk River (Ontario)
Canada K0J 1J0



Revision History

Liste de révisions

UNRESTRICTED

ILLIMITÉE

Page 1 of /de 1

CW-511300-FM-168 Rev. 2

Ref. Procedure CW-511300-PRO-161

Document No. / Numéro de document:

232	509200	ENA	001
Doc. Collection ID ID de la collection de doc.	SI Répertoire du sujet	Section	Serial No. N° de série

Document Details / Détails sur le document

Title Titre	Total no. of pages N ^{bre} total de pages
Project Description: Near Surface Disposal Facility at Chalk River Laboratories	38

For Release Information, refer to the Document Transmittal Sheet accompanying this document. / Pour des renseignements portant sur la diffusion, consultez la feuille de transmission de documents ci-jointe.

Revision History / Liste de révisions

Revision / Révision		Details of Rev. / Détails de la rév.	Prepared by Rédigé par	Reviewed by Examiné par	Approved by Approuvé par
No./N°	Date (yyyy/mm/dd)				
D1	2016/02/10	Issued for "Review and Comment".	J. Luiz	I. Bainbridge J. Buckley N. Chan C. Fahey C. Gallagher M. Klukas S. Liblong M. Mackay A. Morin S. Needham S. Titterington	G. Dolinar
0	2016/03/30	Issued as "Approved for Use".	J. Luiz	S. Needham	G. Dolinar
1	2016/10/03	Clarification of the waste characteristics, and stakeholder/ aboriginal engagement updates. Issued as "Approved for Use"	M. Klukas	S. Needham	G. Dolinar

TABLE OF CONTENTS

SECTION	PAGE
1.	INTRODUCTION.....1-1
1.1	Project Proponent.....1-1
1.2	Acronyms.....1-2
2.	GENERAL INFORMATION.....2-1
2.1	Project's Name, Nature and Proposed Location2-1
2.2	Contact Information.....2-4
2.3	Description of Communication Activities.....2-4
2.4	Future Engagement Activities2-6
2.5	Environmental Assessment and Regulatory Requirements of other Jurisdictions2-7
3.	PROJECT INFORMATION.....3-1
3.1	Project Context and Objectives3-1
3.1.1	Project Context3-1
3.1.2	Project Objectives3-1
3.2	Regulations Designating Physical Activities3-2
3.3	Physical Works Related to the Project.....3-2
3.3.1	Near Surface Disposal Facility Mound.....3-2
3.3.2	Waste Water Treatment Plant.....3-7
3.3.3	Supporting infrastructure3-7
3.4	Project Phases and Schedule3-7
3.5	Project Activities3-8
3.6	Waste Generation and Management3-9
4.	PROJECT LOCATION INFORMATION4-1
4.1	Project Location4-1
4.2	Project Proximity to Residences4-3
4.3	Project Proximity to Reserves, Traditional Territories and Land/Resources used by Aboriginal Peoples.....4-3
4.4	Project Proximity to Federal Lands4-3
5.	FEDERAL INVOLVEMENT5-1
6.	ENVIRONMENTAL EFFECTS.....6-1
6.1	Physical and Biological Setting6-1
6.2	Chalk River Laboratories Site6-1

TABLE OF CONTENTS

SECTION	PAGE
6.3 East Mattawa Road Site	6-3
6.4 Alternate Site	6-6
6.5 Changes to the Environment by the Project	6-7
6.5.1 Fish, Fish Habitat and Aquatic Species	6-7
6.5.2 Migratory Birds	6-7
6.5.3 Changes to the Environment on Federal Land, in a Province other than Ontario, or Outside Canada	6-7
6.5.4 Effects on Aboriginal Peoples	6-7
7. SUMMARY	7-1
8. REFERENCES.....	8-1

TABLES

Table 2-1 Public Stakeholder and Aboriginal Communication Activities.....	2-5
Table 2-2 Public Open House Dates and Locations	2-6

FIGURES

Figure 2-1 Location of Chalk River Laboratories	2-1
Figure 2-2 Overview of the Chalk River Laboratories Property Showing the Developed Area and Waste Management Areas	2-3
Figure 2-3 Photograph Showing the Chalk River Laboratories Built-up Campus	2-4
Figure 3-1 Illustrative Layout of the Near Surface Disposal Facility at the EMR Site	3-4
Figure 3-2 Conceptual Cross-Section of the Mound with a Typical Base Liner and Final Cover System.....	3-5
Figure 3-3 Cross-Section of a Typical Base Liner System	3-6
Figure 3-4 Cross-Section of a Typical Final Cover System	3-6
Figure 4-1 Locations Under Consideration for the Near Surface Disposal Facility	4-2
Figure 6-1 Drainage Basins within the Chalk River Laboratories Site	6-2
Figure 6-2 Physical and Natural Features of the Two Candidate Sites for the NSDF	6-5

1. INTRODUCTION

This document describes the activities related to the development, operation, post-closure and monitoring of a proposed Near Surface Disposal Facility (NSDF) on the Chalk River Laboratories (CRL) property to accommodate Low-Level Waste (LLW) and other suitable radioactive wastes.

Essentially all of the waste to be emplaced in the NSDF will be LLW. That is, material with radionuclide content above established clearance levels and exemption quantities, but generally with limited amounts of long-lived activity [1] [2]. The NSDF Project may also accept a very small amount of intermediate-level waste (ILW) and mixed wastes. ILW are wastes with higher levels of radioactivity that may require shielding for worker protection during handling, and may contain higher concentrations of longer-lived radionuclides [1] [2]. The estimated amount of ILW to be disposed of at the NSDF is approximately 1% by volume. Mixed waste is radioactive waste that also contains hazardous substances. All waste to be disposed at the NSDF Project will be required to meet the waste acceptance criteria (WAC) established to assure operational and long-term safety requirements.

The purpose of the document is to provide Canadian Nuclear Safety Commission (CNSC) Staff with the information necessary to make a determination of Environmental Assessment (EA) requirements for the project under the Canadian Environmental Assessment Act, (CEAA) 2012 [3]. The contents of the project description address information requirements identified in the CEAA 2012 Regulations Prescribed Information for the Description of a Designated Project [4].

1.1 Project Proponent

Atomic Energy of Canada Ltd. (AECL) is a federal Crown corporation, with a core mandate to deliver on Canada's radioactive waste and decommissioning responsibilities, provide nuclear expertise to support federal responsibilities, and offer services to users of the nuclear laboratories on commercial terms. It fulfils this mandate through a long-term contractual arrangement with Canadian Nuclear Laboratories (CNL) for the management and operation of AECL's sites, facilities and assets, and the performance of AECL's waste and decommissioning responsibilities, under a Government-owned, Contractor-operated ("GoCo") model.

Canadian Nuclear Laboratories is a private-sector company that is contractually responsible for the management and operation of AECL's nuclear sites, facilities and assets, including the CRL property located in Ontario and the performance of AECL's waste and decommissioning responsibilities. Canadian Nuclear Laboratories is proposing the carrying out of a designated project on land that is held in the name of AECL and is therefore, property of the Crown. Therefore, CNL is the proponent for the NSDF project.

1.2 Acronyms

AECL	Atomic Energy of Canada Limited
ASL	Above Sea Level
CEAA	Canadian Environmental Assessment Act
CNSC	Canadian Nuclear Safety Commission
CNL	Canadian Nuclear Laboratories
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRL	Chalk River Laboratories
EA	Environmental Assessment
EMR	East Mattawa Road
LLRWMO	Low-Level Radioactive Waste Management Office
ILW	Intermediate-Level Waste
LLW	Low-Level Waste
NSDF	Near Surface Disposal Facility
PHAI	Port Hope Area Initiative
SARA	Species at Risk Act
THR	Threatened
WAC	Waste Acceptance Criteria
WMA	Waste Management Area
WWTP	Waste Water Treatment Plant

2. GENERAL INFORMATION

2.1 Project's Name, Nature and Proposed Location

The NSDF project is a proposed engineered Near Surface Disposal Facility for radioactive waste disposal planned for CRL. The CRL property contains several licence-listed nuclear facilities, including the National Research Universal reactor, Waste Management Areas (WMAs), and many other nuclear and non-nuclear facilities and laboratories. The CRL property is located in Renfrew County, Ontario, on the shore of the Ottawa River, approximately 200 kilometres (km) northwest of Ottawa as shown in Figure 2-1. The site has a total area of approximately 4 000 hectares (ha), and is situated within the boundaries of the Corporation of the Town of Deep River. The Ottawa River, which flows northwest to southeast, forms the north-easterly boundary of the property. The Department of National Defence Garrison Petawawa abuts the CRL property to the southeast, and the Village of Chalk River in the Municipality of Laurentian Hills lies immediately to the southwest of the site.

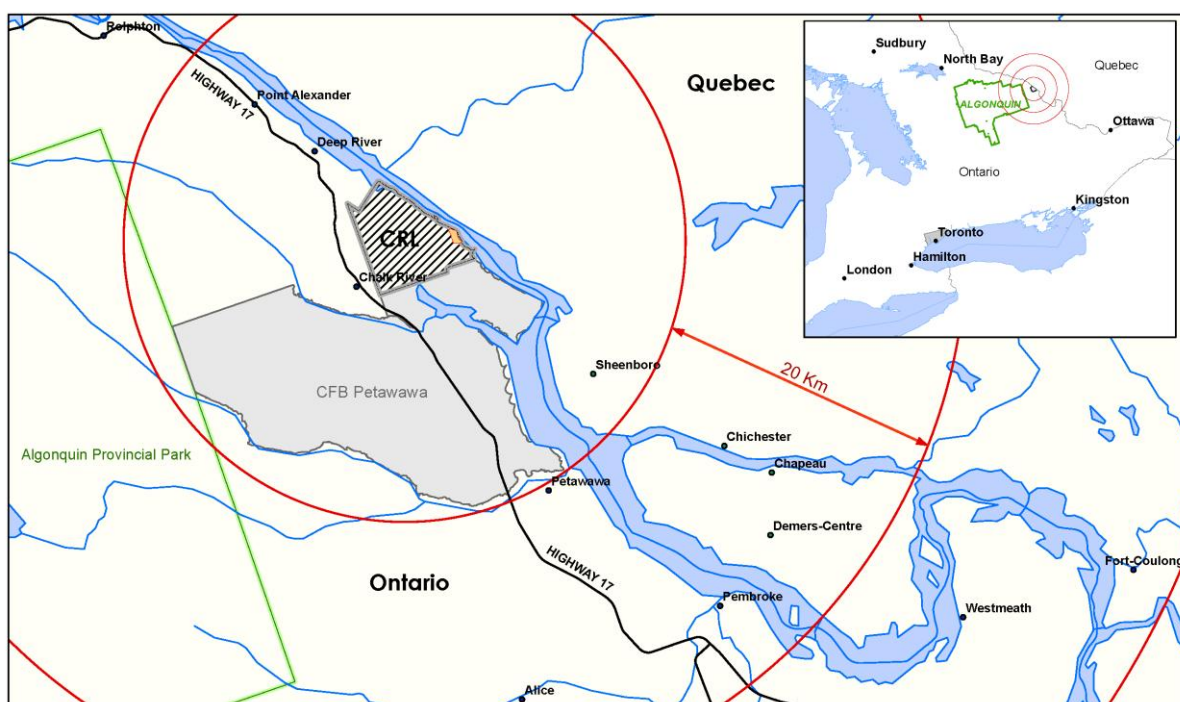


Figure 2-1 Location of Chalk River Laboratories

A plan view of the CRL property is shown in Figure 2-2. Most of the nuclear and associated support facilities are located within a relatively small industrial area of the site (called the Developed Area or built-up campus) adjacent to the Ottawa River Figure 2-3. The built-up campus is surrounded by a larger area which is mostly undeveloped (known as the “Outer Area”). The Outer Area consists primarily of forest interspersed with small lakes. The WMAs for radioactive and non-radioactive wastes are located along the southwest to northeast corridor formed by the main road (Plant Road) leading from the Village of Chalk River to the CRL built-up campus.

A site selection process has identified two candidate sites to locate the NSDF, called the East Mattawa Road (EMR) Site, and the Alternate Site (Figure 4-1). Section 4 provides more information on both sites.

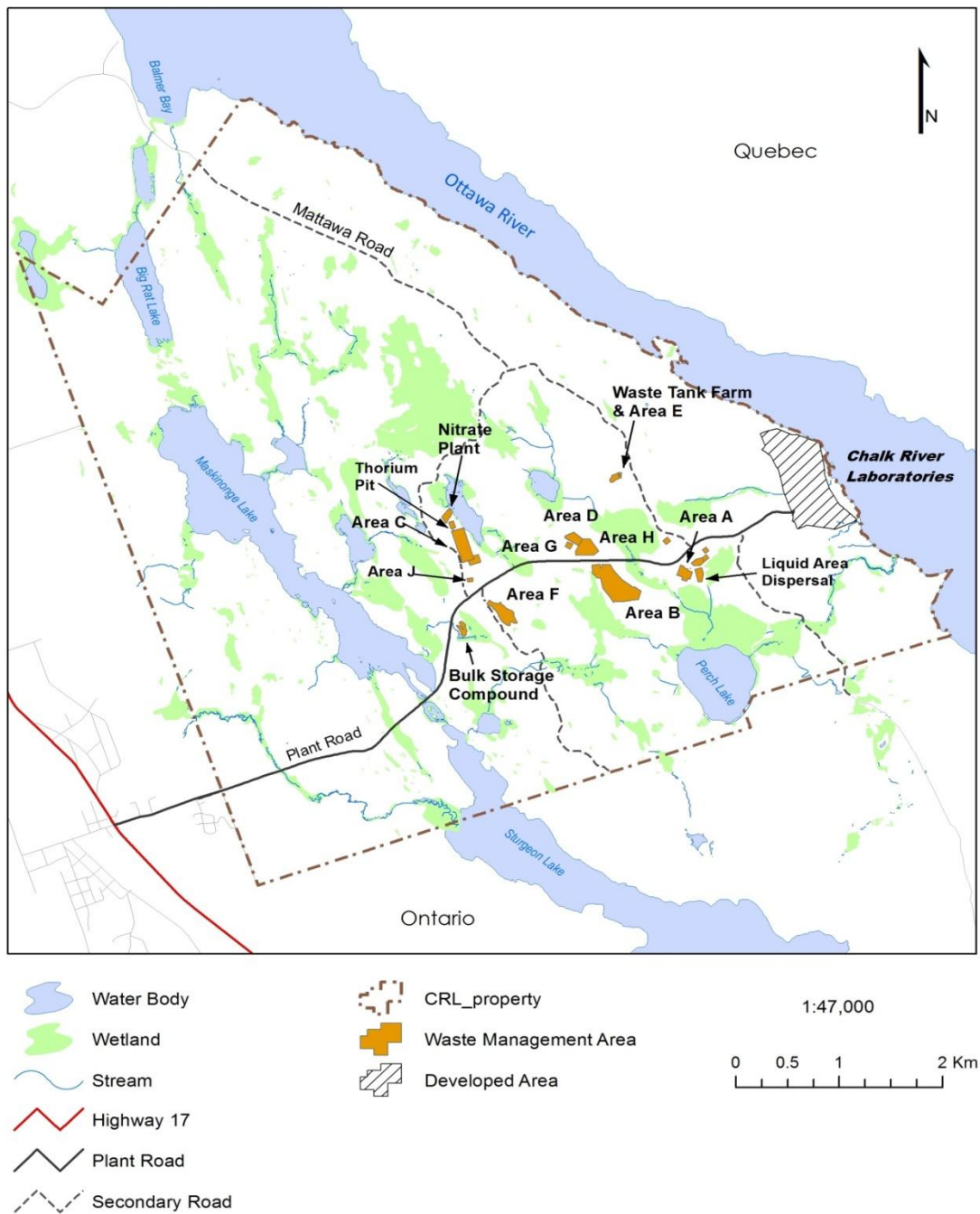


Figure 2-2 Overview of the Chalk River Laboratories Property Showing the Developed Area and Waste Management Areas



Figure 2-3 Photograph Showing the Chalk River Laboratories Built-up Campus

2.2 Contact Information

The proponent for this project is CNL.

The contact information of the primary representative for the purposes of the description of the project is:

Mr. Pat Quinn
Director, Corporate Communications
Canadian Nuclear Laboratories
Chalk River Laboratories
286 Plant Road, Building 700
Chalk River, Ontario, K0J 1J0
Tel. #: 613 584 8811 ext. 43417
Fax #: 613 584 8272
Email: pat.quinn@cnl.ca

2.3 Description of Communication Activities

Canadian Nuclear Laboratories provides regular communication updates to public stakeholder groups to inform and educate on the company vision and current and future activities.

Table 2-1 below lists the dates and public stakeholder and aboriginal groups to whom CNL has provided a brief overview of the proposed NSDF within the context of a larger vision of the

company. CNL has also provided presentations to public stakeholders and aboriginal groups focussing on the NSDF project. These are also listed in Table 2-1 and identified with an asterisk.

Public open houses were scheduled, advertised and held in 2016 June and July. The locations for the open houses are listed in Table 2-2. Locations were chosen based on proximity to the NSDF site and population size.

Table 2-1
Public Stakeholder and Aboriginal Communication Activities

Date	Group
2015 September 15	Renfrew County Elected Officials and Stakeholders
2015 October 7	Professional Engineers of Ontario (Algonquin Chapter)
2015 October 21	Ottawa Valley Economic Development Summit
2015 October 22	Town of Deep River Planning Committee
2015 October 28	Renfrew County Council
2015 October 29	Environmental Stewardship Council
2015 November 18	Ontario CANDU Industries Annual General Meeting
2015 December 1	Algonquins of Pikwàkanagàn
2015 December 11	Town of Deep River
2015 December 17	Garrison Petawawa
2016 February 25	Canadian Nuclear Association Conference
2016 March 24	Environmental Stewardship Council
2016 June 16	Environmental Stewardship Council
2016 July 15	World Nuclear University Site Visit
2016 July 20	*Métis Nation of Ontario (MNO) Information Session
2016 July 20	Rotary Club of North Renfrew
2016 July 26	*Northwatch Site Visit
2016 August 10	*Algonquins of Ontario (AOO) Consultation Office and Technical Staff Information Session
2016 August 26 - 29	Métis Nation of Ontario (MNO) Annual General Assembly

* Presentation made to Stakeholder/Aboriginal Group focusing on NSDF Project. For activities not denoted by an asterisk, a brief overview of the NSDF was provided in the broader context of a vision for the company.

Table 2-2 Public Open House Dates and Locations

Date	Location
2016 June 20	Rapides-des-Joachims, QC
2016 June 21	Deep River, ON
2016 June 22	Stonecliffe, ON
2016 June 29	Sheenboro, QC
2016 July 6	Pembroke, ON
2016 July 7	Petawawa, ON
2016 July 12	Chalk River, ON

2.4 Future Engagement Activities

Canadian Nuclear Laboratories recognizes that it must conduct its business in a manner that is both socially and environmentally responsible. Canadian Nuclear Laboratories demonstrates this commitment through its public information program. The program's objective is to inform our stakeholders about the activities ongoing at CNL sites, the potential impacts of these activities on the health and safety of workers, members of the public, and on the environment. The overriding objective of the program is to build public awareness, understanding and a supportive appreciation of the Laboratories' value and relevance to Canadians.

These objectives (among others) form the basis of communication efforts with stakeholders and help to direct the establishment of long-term mutually beneficial working relationships. Engagement with stakeholders in relation to the NSDF project will include:

- Formal notification of the project.
- Regular and consistent communication on the project (e.g. website, newsletters).
- Targeted community initiatives.
- Site visits.
- Project information sessions and opportunities for public involvement.
- Speaking engagements.

2.5 Environmental Assessment and Regulatory Requirements of other Jurisdictions

This project is being undertaken on Federal lands. No EA or regulatory requirements of jurisdictions other than Federal requirements have been identified.

3. PROJECT INFORMATION

3.1 Project Context and Objectives

3.1.1 Project Context

Canadian Nuclear Laboratories has an immediate requirement for a new facility at its CRL property for the disposal of large quantities of radioactive wastes generated from past, present and future activities at CRL and at its other business locations. The NSDF project will provide a safe, permanent solution for the disposal of LLW and other suitable waste streams that meet the WAC. The Project will replace the current CNL practice to place these wastes in temporary storage.

The priority for the NSDF is rooted in the requirements established by AECL, on behalf of the Government of Canada, to substantially reduce the risks associated with the CNL legacy wastes, liabilities and the cost of laboratory operations to taxpayers in the 10-year period 2016-2025 and to create the conditions for the revitalization of the CRL site. To respond to these requirements, CNL intends to reduce its radioactive wastes stores, to decommission more than 100 buildings and structures that are not needed for future CNL missions, and to remediate various waste management areas at the CRL site. Canadian Nuclear Laboratories will also close the Whiteshell Laboratories and Nuclear Power Demonstration (NPD) prototype reactor sites and take actions to increase revenues generated from commercial activities and lower the cost of laboratory operations. The NSDF project will provide the asset to dispose of the radioactive waste resulting from the aforementioned actions and is essential to enable the risk and cost reduction objectives of AECL and the Government of Canada to be met.

3.1.2 Project Objectives

The project objective is to design, licence, construct and commission the NSDF for operation. Canadian Nuclear Laboratories aims to have the NSDF operational and ready to accept waste by 2020 March.

The facility is expected to be operational for approximately 50 years. The NSDF will be sized to hold 1 000 000 m³ of radioactive waste. The wastes to be disposed in the NSDF include the following:

- a) Waste now in storage that has resulted from legacy CNL operational and decommissioning activities and past commercial activities.
- b) Waste to be generated from the decommissioning of existing CNL buildings and structures and the remediation of contaminated lands.
- c) Future waste arising from continuing CNL operations, commercial activities, the decommissioning of buildings and structures that have not yet been constructed, and the remediation of soils from the final closure of the CRL site.

The wastes identified in a) and b) above is expected to consume approximately 50% of the total NSDF capacity while waste addressed by c) is expected to require the remaining 50%.

All waste to be disposed in the NSDF will be required to meet the Waste Acceptance Criteria¹ (WAC) that will form part of CNL's licence application. Though future waste (i.e. waste not yet generated) cannot be defined at the project outset, waste destined for disposal in the NSDF will be required to meet the WAC.

The NSDF will accept radiologically contaminated hazardous wastes (mixed waste). If required, mixed waste will be treated to comply with the WAC prior to its transfer to the NSDF.

3.2 Regulations Designating Physical Activities

Under the CEAA 2012, EAs are required for Designated Projects identified in the Regulations Designating Physical Activities [5].

The NSDF qualifies as a Designated Project as per Section 37(b) of these regulations:

37. The construction and operation of a new

(b) facility for the long term management or disposal of irradiated fuel or nuclear waste.

The Regulations Designating Physical Activities identify the CNSC as the Responsible Authority for projects of this type. As such, the CNSC is responsible for the conduct of the EA.

3.3 Physical Works Related to the Project

The design of the NSDF is currently under development. It will be designed as an engineered mound, built at near-surface level on the CRL property, and resembling the plan for the Port Granby Project and licensed waste landfills established on many US Department of Energy sites; e.g. Idaho CERCLA Disposal Facility, Fernald On Site Disposal Facility and the Oak Ridge Environmental Management Waste Management Facility.

The main physical works related to the project are the engineered mound that will contain the waste, the waste water treatment plant (WWTP) and supporting infrastructure. The sections below describe the mound and supporting infrastructure in further detail.

3.3.1 Near Surface Disposal Facility Mound

The engineered mound will consist of multiple disposal cells. These cells will be built on a schedule that is coordinated with anticipated decommissioning waste delivery activities and reflected in the waste sequencing plan. The NSDF project will build the initial cell(s) required to accommodate approximately 500 000 m³ of LLW and other suitable wastes and then turn over the facility to CRL's Facility Authority for WMAs for waste emplacement, capping of the cell(s) when filled, and construction of future cell(s) to establish the remainder of the 1 000 000 m³

¹ The Waste Acceptance Criteria will include physical (size and packaging), radiological and chemical parameters of the waste to be emplaced in the NSDF.

total waste capacity. The construction of the future cell(s) is anticipated to begin 10-20 years following the start of NSDF operation.

The facility will be designed and constructed to operate and accept waste year round; however, waste emplacement in the mound will only occur when conditions are suitable; e.g. when ground compaction requirements can be met. Specific waste emplacement requirements will be determined as part of the detailed design of the NSDF.

The project has produced a conceptual design layout of the NSDF at one of the sites (the EMR Site). The site layout, depicted in Figure 3-1, is illustrative of a typical near surface disposal facility and based on nuclear industry applications. The detailed design, to be developed in 2016-2017, will provide the final NSDF site layout for the selected site.

The NSDF project has produced a conceptual cross-section of the mound that illustrates typical base liner and final cover systems for a nuclear industry application, as shown in Figure 3-2, Figure 3-3 and Figure 3-4. The design details, to be developed in 2016-2017, will provide the final construction specifications for these systems.

In terms of design, the mound will consist of:

- Base liner system (including leachate collection and leak detection systems).
- Final cover system.
- Surface water management system.
- Environmental monitoring systems.

The base liner system will mitigate the release of contaminants to the subsurface and groundwater. It will include both a primary and secondary liner system, each comprising multiple layers of natural and synthetic materials, as well as a compacted clay liner base. The primary liner will contain the leachate collection system, which will control the accumulation of leachate and hydraulic head on the base liner system. The secondary liner will house the leak detection system which will be used to detect leaks in the unlikely event that the primary liner system fails. The secondary liner will also protect the natural environment from leachate migration if the primary liner system fails.

The final cover system (cap for the mound) will be designed to eliminate exposure to direct contact with the waste, and provide gamma radiation shielding. It will also limit the infiltration of precipitation to the waste, thereby, reducing leachate generation.

The surface water management system will control clean surface water quantity and quality onsite while preventing contact with contaminated areas. The surface water management system will enable infiltration and suspended particulate settling, and control discharge to the downstream natural receiving systems.

The environmental monitoring systems will monitor air, water and groundwater consistent with CRL site licence requirements.

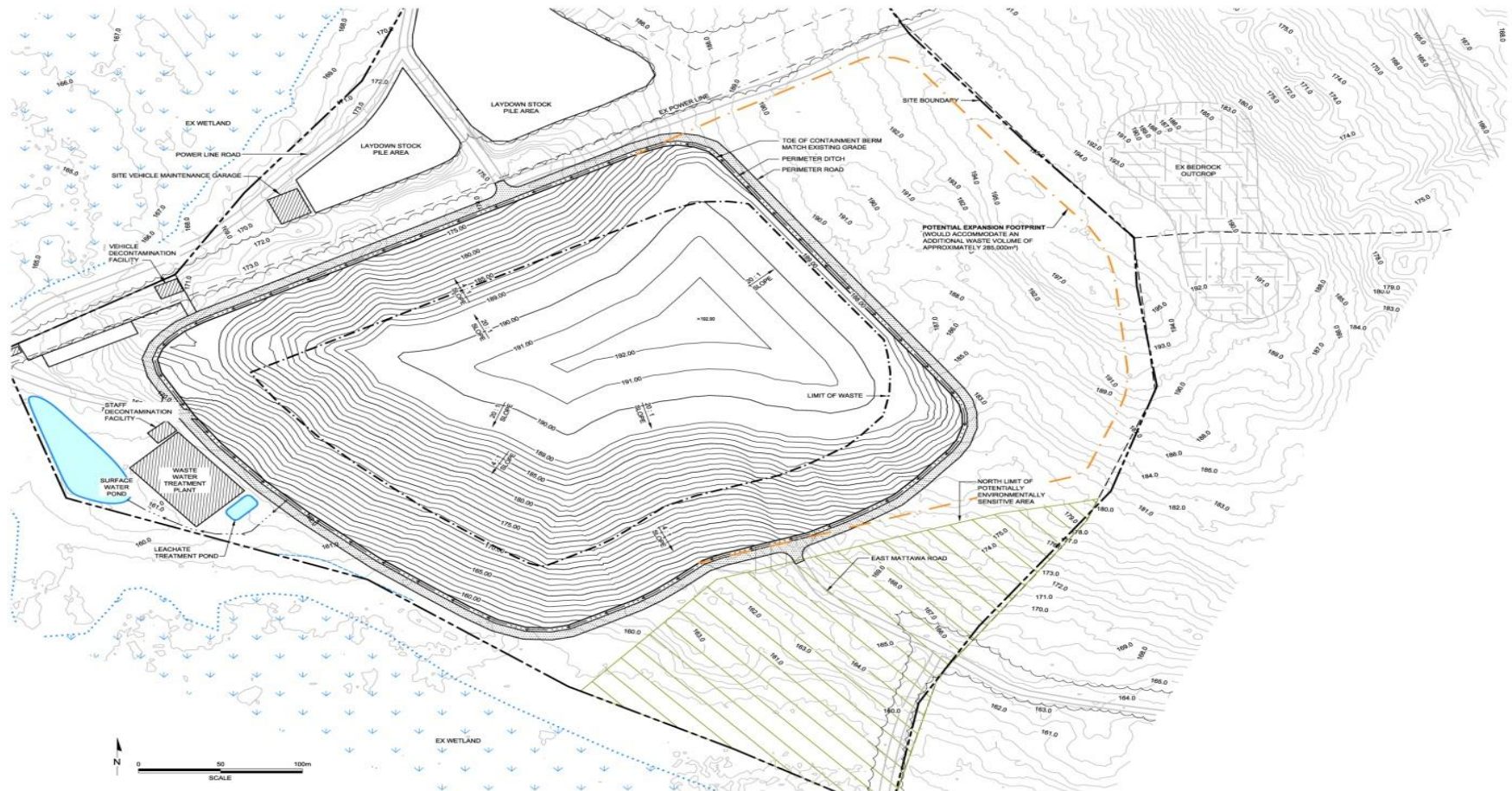


Figure 3-1 Illustrative Layout of the Near Surface Disposal Facility at the EMR Site

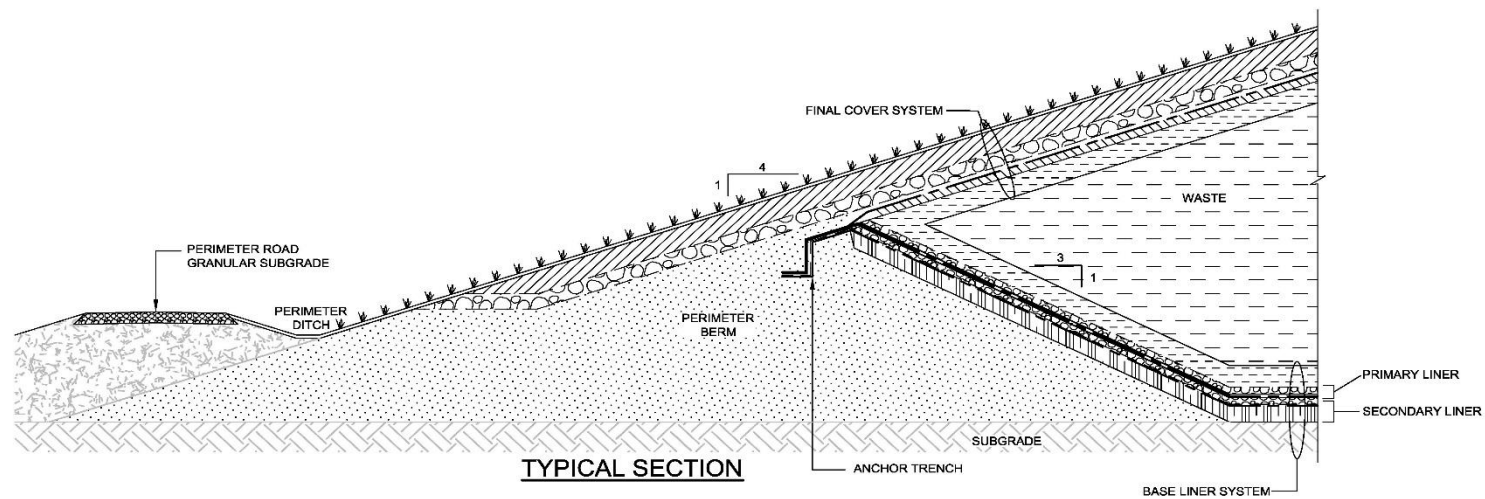


Figure 3-2 Conceptual Cross-Section of the Mound with a Typical Base Liner and Final Cover System

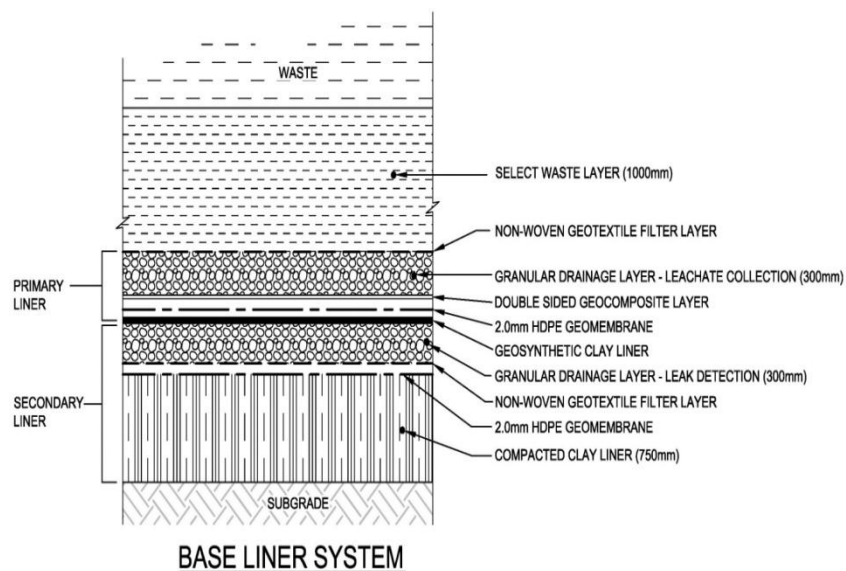


Figure 3-3 Cross-Section of a Typical Base Liner System

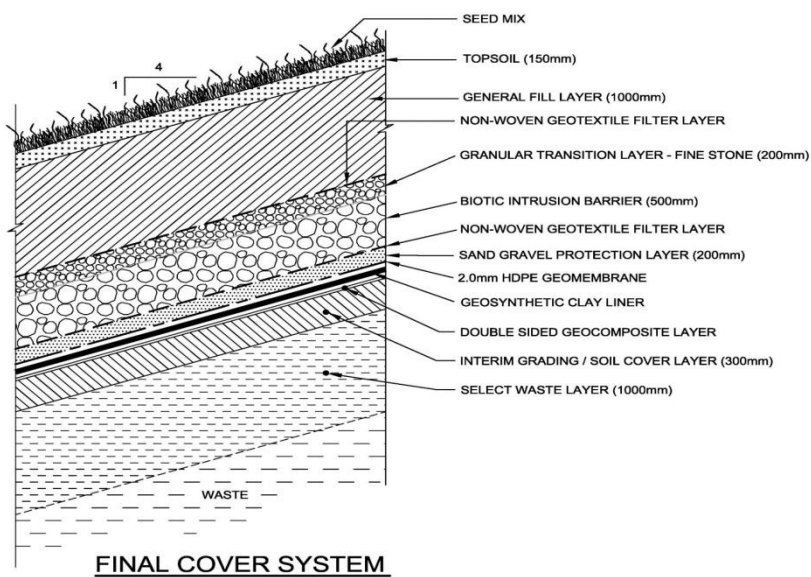


Figure 3-4 Cross-Section of a Typical Final Cover System

3.3.2 Waste Water Treatment Plant

The WWTP will be required to treat leachate and wastewater from NSDF supporting operations. It will be designed to have an operational lifetime of 50 years. The WWTP will be designed such that it could be modified in the future to treat other liquid waste streams from the CRL site, should an operational need arise.

3.3.3 Supporting infrastructure

To enable NSDF operations, both temporary and permanent supporting infrastructure will be required.

Temporary structures that are likely to be required at the NSDF include:

- Construction trailers.
- Marine containers or tents for storage of construction materials.

Permanent infrastructure will include:

- New roads and upgrading of existing roads within the NSDF site boundary.
- Laydown and stockpile areas.
- Vehicle decontamination facility.
- Vehicle monitoring and weighing.
- Site vehicle maintenance garage.
- Work stations and change facilities (including emergency showers).
- Security systems to monitor access and egress.

Several site improvement projects are planned or underway that will enable the NSDF to tie-into new or existing roads and services relatively close to the construction site. These enabling projects include, e.g. the installation of natural gas, the upgrade of electrical services, the widening and upgrade of site roads and emergency routes, and the construction of new buildings as part of the revitalization of the CRL site. The scope of the roads and services work within the NSDF project scope will accordingly be limited to those within the NSDF site boundaries and the spur lines required to reach the nearest CRL site tie-in points.

3.4 Project Phases and Schedule

The NSDF project has three phases: Project development, Operations and future expansion, and Post-closure and monitoring. The estimated duration of each project phase is outlined below:

Project development: 2016 - 2020

Operations and future expansion: 2020 - 2070

Post-closure and monitoring: 2070 - 2400

3.5 Project Activities

The main project activities associated with each project phase are outlined below:

Project development activities will include:

- Design, procurement and regulatory approvals.
- Site clearing/grubbing, excavation, grading, and compacting.
- Construction and inactive commissioning of the initial cell(s) of the engineered mound (including the liner systems, leachate system, and drainage system), WWTP, and supporting infrastructure.

Operations and future expansion activities will include:

- Active commissioning of the NSDF.
- Waste verification to ensure that the WAC is met. The primary waste verification will be done by the waste generator.
- Emplacement of the wastes into the disposal cell, including required stabilisation activities (e.g. grouting to fill voids).
- Construction of subsequent cells, on a schedule that matches the waste sequencing plan.
- Installation of final cover to cap each cell when filled to capacity.
- Leachate collection and transfer. The leachate will be collected, sampled and treated at the WWTP such that it meets appropriate discharge criteria prior to transfer to an approved discharge location.
- Monitoring (e.g. sample collection and analysis of groundwater to confirm the liner and leachate collection system integrity).
- Cover inspection and maintenance to mitigate intrusion, tree growth and/or erosion caused by runoff. Maintenance activities include the placement of topsoil and vegetation.

Post-closure and monitoring activities will include:

- Cover inspection and facility maintenance/monitoring.
- Decommissioning of any equipment and associated infrastructure following completion of operations (once all cells of the mound have been filled to capacity and the cover has been installed).
- Monitoring and maintaining leachate collection and removal systems, leak detection systems, and gas collection systems to protect the surrounding environment and population from releases.
- Implementing institutional control measures such as land use controls, activity and use limitations and/or environmental use restrictions.

3.6 Waste Generation and Management

Some NSDF project activities will generate waste that requires management.

Dust and non-radioactive emissions such as nitric oxide (NO_x) are anticipated to be produced as a result of site clearing activities and heavy machinery use. Vegetation that is removed during site clearing operations will be managed in accordance with CNL's Environmental Protection, Radiation Protection and Waste Management program requirements.

If contaminated soil is encountered during excavation, it will be managed as contaminated waste. It may be stockpiled on the site and used as fill in the NSDF mound during operations.

Clean waste from construction activities will be either stockpiled on the CRL property or sent to on-site or off-site landfills. Clean waste such as general office waste will be sent to on-site or off-site landfills. Food waste may be composted. Contaminated personal protective equipment will likely be disposed at the NSDF.

Any leachate generated will be captured by the leachate collection system and treated at the WWTP. The leachate will be treated such that it meets appropriate discharge criteria prior to transfer to an approved discharge location.

Off gases from wastes emplaced in the mound will be vented, and monitored/filtered (if required) according to CNL's Environmental Protection program requirements.

Waste water from NSDF sanitary facilities will be managed either through a septic system, in the sewage treatment plant located at CRL or through the WWTP. Waste water from emergency showers and vehicle decontamination will be collected, sampled, treated through the WWTP if required, and transferred to an approved discharge location.

4. PROJECT LOCATION INFORMATION

4.1 Project Location

A site selection process has identified the EMR Site and the Alternate Site as the two candidate sites suitable for the NSDF. The location of the two sites is shown in Figure 4-1. Both sites are on CRL's property and have an area measuring approximately 30 ha. The final site selection decision will be made following the completion of biodiversity and archaeological studies scheduled for the spring and summer of 2016, and ongoing public consultation activities.

The approximate geographic coordinates of the EMR Site are 46 02' 33"N, 77 22' 13"W. The distance from the center of the EMR Site to the closest point on the Ottawa River is approximately 1.1 km. Perch Lake is located southwest of the site and the south and west boundaries are abutting the Perch Lake wetland complex. The Emergency Route #3 (also called EMR) bisects the site in a north-south direction, and the site is also traversed by two high-voltage power lines. To the northwest of this site is WMA A, the Laundry Pit, Chemical Pit, and Reactor Pits 1 and 2 (waste disposal areas from past operations at CRL).

The approximate geographic coordinates of the Alternate Site are 46 1' 47"N, 77 23' 29"W. This site is located between Toussaint Lake on the west and Perch Lake on the east, close to the south boundary of the CRL site, which is adjacent to the Garrison Petawawa property. The distance from the center of the Alternate Site to the closest point on the Ottawa River is approximately 3.3 km. A gravel road is adjacent to the western border of the Alternate Site. A medium-sized wetland complex is abutting the north side, and there is a smaller wetland unit on the east side of the site.

The EMR Site is currently considered to be more suitable for the NSDF. The advantages of the EMR Site include:

- **Environmental:** Shorter travel distance for trucks delivering waste to the NSDF from the CRL campus where the vast majority of new waste will be generated. By road, the EMR Site is approximately 4 km closer to the campus than the Alternate Site. Similarly, the EMR Site is 2-3 km closer to interim waste stores that will be moved to the NSDF. As such fuel consumption and exhaust emissions associated with transport vehicles will be significantly less for the EMR Site.
- **Safety and Security:** Shorter travel distance and therefore shorter response times for CRL emergency crews responding to calls for assistance (e.g. fire, security). Emergency vehicles are situated at the edge of the main CRL campus.
- **Stewardship:** Minimizes use of virgin (undeveloped) property at CRL by establishing NSDF in the same vicinity as most of the existing WMAs and reduces the area of the CRL site that will require long-term management and institutional control.

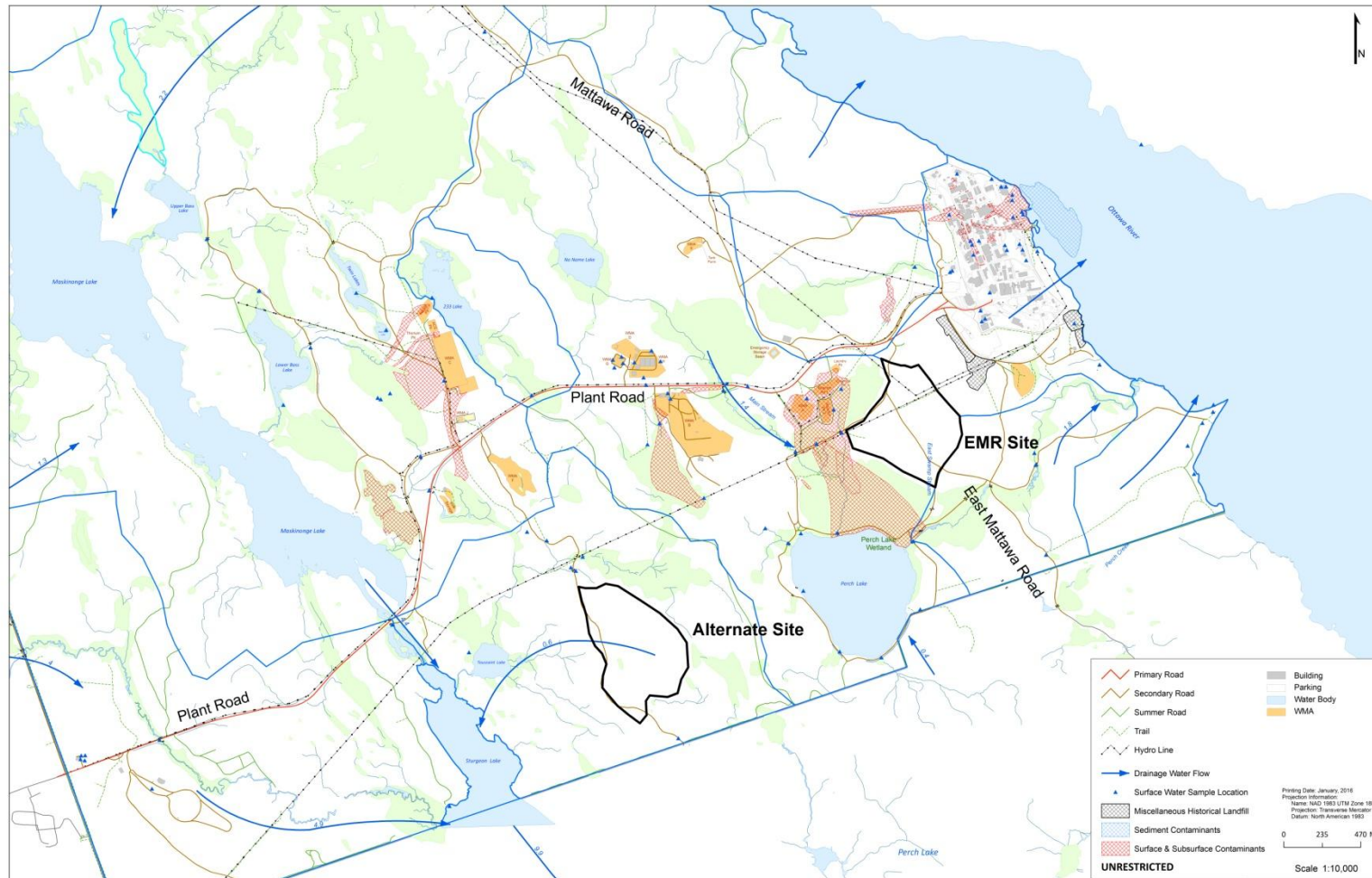


Figure 4-1 Locations Under Consideration for the Near Surface Disposal Facility

4.2 Project Proximity to Residences

Both candidate sites are located in the Outer Area of the CRL property. The nearest population center to the CRL site is the Village of Chalk River (population 954), approximately 6 km west. Pontiac County, Québec is located across the Ottawa River from the CRL property. While its population is approximately 14 000, there are less than 50 registered properties in Pontiac County within 9 km of the CRL site, and most are located on Lake Esher approximately 6 km northeast of the CRL site. The four properties of Pontiac County that are closest to the CRL site are located on the Québec shore of the Ottawa River, across from the CRL site. One of these properties is permanently occupied, and the remainder are occupied on a seasonal/temporary basis. During the summer months, the population of the Québec shore increases slightly due to seasonal/temporary occupancy of cottages. This increased population is typically less than 20 individuals.

The next closest population centres are the Town of Deep River, located 10 km upstream of CRL and the Town of Laurentian Hills (formed by the union of the Village of Chalk River and the Townships of Rolph, Buchanan, Wylie, and McKay) that surrounds the Town of Deep River, and is north and west of the CRL property. Deep River has approximately 4 000 residents and Laurentian Hills has a total population of approximately 3 000 residents. The Town of Petawawa is 20 km downstream from the CRL property, with a population of approximately 16 000. Another larger centre is Pembroke and area, 35 km downstream with approximately 14 500 residents.

4.3 Project Proximity to Reserves, Traditional Territories and Land/Resources used by Aboriginal Peoples

The closest First Nations community is the Algonquins of Pikwàkanagàn, located at Golden Lake, approximately 50 km southeast of the CRL property. The Algonquins of Pikwàkanagàn First Nations have declared an interest in lands in the Ottawa Valley, which they consider their traditional homelands. The Algonquins of Pikwàkanagàn First Nation Chief and Council are negotiating with the Federal and Ontario government to secure a land claim agreement. The area that is the subject of the Algonquin claim in Ontario includes the National Capital Region, all of Renfrew County and most of Algonquin Park.

Canadian Nuclear Laboratories is currently reviewing the Aboriginal groups to be engaged in dialogue about the NSDF project. This includes an assessment of the significance of potential adverse impacts and consideration such as asserted rights, historical or traditional practices and land claims. Canadian Nuclear Laboratories review activities will meet the CNSC requirements for Aboriginal engagement [6].

4.4 Project Proximity to Federal Lands

Garrison Petawawa is adjacent to CRL. The Garrison Petawawa property boundary is located approximately 700 metres (m) south of the EMR Site and approximately 500 m south of the Alternate Site.

5. FEDERAL INVOLVEMENT

The NSDF project will be undertaken on Federal Lands (the property of CRL). Atomic Energy of Canada Limited is providing financial support to allow this project to be carried out.

Permits, licences or other authorizations that may be required are:

- Canadian Nuclear Safety Commission: Licence to Construct and Operate.
- Environment Canada:
 - A permit from Environment Canada may be required under the Species at Risk Act (SARA S73).
 - Petroleum storage tank permit(s) may be required, depending on the size of diesel tanks installed on the site.
 - A Wastewater Systems Effluent Regulations permit may be required, if sewage waste is treated at the WWTP.
- Fisheries and Oceans Canada: a project review may be required, depending on the design of any water intake and discharge.

6. ENVIRONMENTAL EFFECTS

6.1 Physical and Biological Setting

6.2 Chalk River Laboratories Site

Geology

Unconsolidated sediments of thickness 10 to 20 m cover bedrock over much of the CRL property. The bedrock in the region lies within the Grenville Province of the Canadian Shield and is Precambrian, predominantly monzonitic gneiss. The overburden consists of bouldery, silty sand till deposited during the most recent glaciation, overlain with fine to medium sands. The till contains a wide range of size fractions, from large blocks of rock to fine silts and clay.

Hydrology

The Ottawa River is the dominant drainage feature in the area. River flow rates are measured at the Des Joachims generating station, 35 km upstream of CRL and typically range from a low of approximately 200 cubic metres per second (m^3/s) in late summer to a high of 2 000 m^3/s during spring run-off. The average annual flow rate is approximately 800 m^3/s .

Drainage basins on the CRL site are shown in Figure 6-1. All surface drainage on the CRL site ultimately drains to the Ottawa River. The CRL site contains several small drainage basins that drain directly to the Ottawa River or to smaller lakes and streams on site, which in turn drain to the Ottawa River.

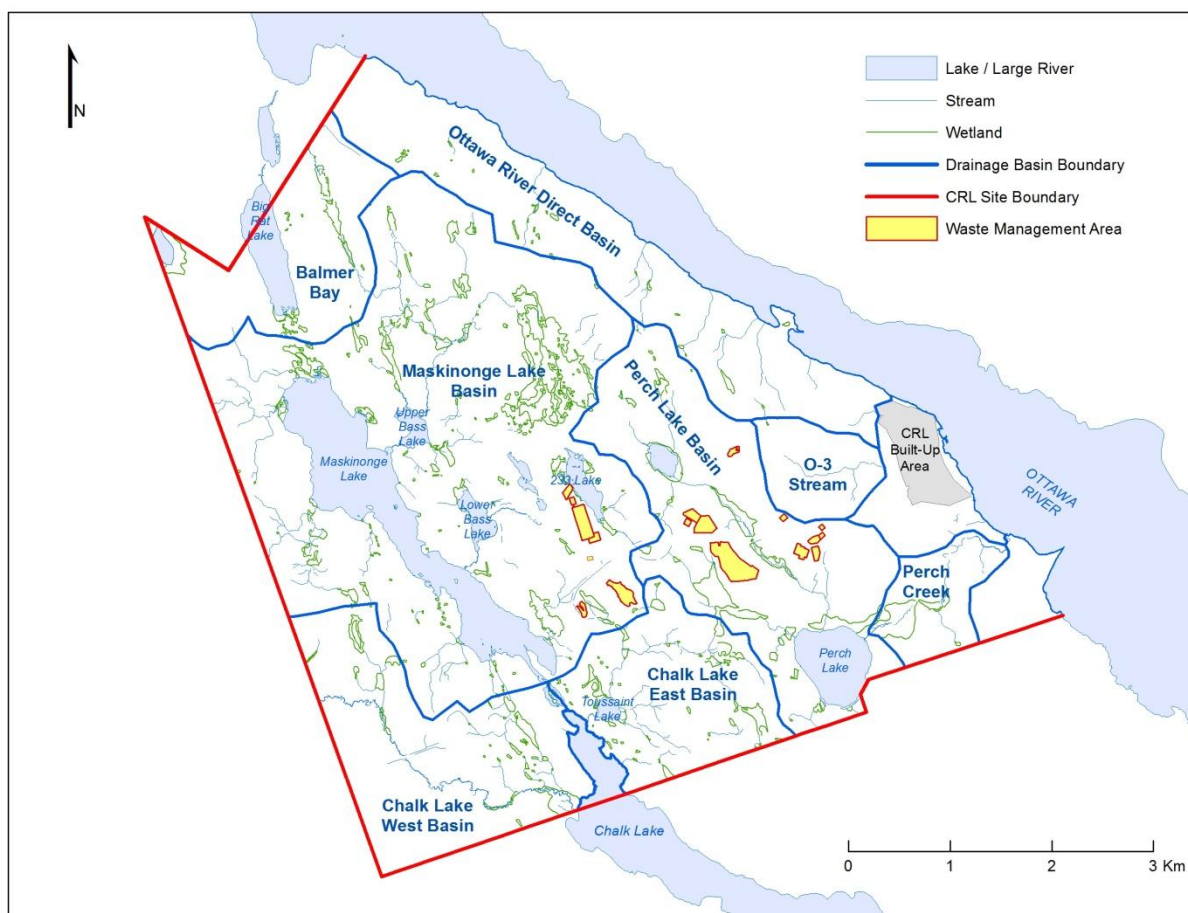


Figure 6-1 Drainage Basins within the Chalk River Laboratories Site

Terrestrial Biota

The CRL property supports a diverse mix of upland and wetland habitats. Terrestrial features and biota on the CRL property have been mapped in a number of environmental baseline studies. Vegetation includes deciduous and coniferous forest and a wide variety of plant species. Wildlife species found on the CRL property are generally typical for a boreal region in Ontario. A total of 24 species at risk have been confirmed at CRL including the Blanding's Turtle and several forest songbirds. Threatened (THR) species are those likely to become endangered if limiting factors are not reversed; and species of Special Concern are those that have characteristics that make it particularly sensitive to human activities or natural events.

Aquatic Biota

The CRL site is located in the Allumette Lake and Lac Coulange reach of the Ottawa River, which extends approximately 90 km between La Passe and the Des Joachims Dam and consists of

several “lakes” separated by short rapids. This reach supports diverse fish communities consisting of at least 55 documented species. Typical catches from the river include walleye, northern pike, channel catfish, small mouth bass and lake sturgeon, channel catfish being the most abundant. A study completed in 2001 identified a total of 20 species in the Ottawa River adjacent to CRL, consisting primarily of trout, perch and rainbow smelt.

Other species in the Ottawa River include:

- River Redhorse and Brook Lamprey, which are listed under the Schedule 1 of the SARA as Special Concern species and listed on the Endangered Species Act of Ontario.
- The American eel and Lake Sturgeon, which are proposed to be listed as THR species by COSEWIC. Both species are listed on the Endangered Species Act of Ontario (American Eel as Endangered and the Lake Sturgeon as THR).

Fish in inland lakes on the CRL property include pumpkinseed, northern pike, bass, and yellow perch. Minnow species such as shiner, dace and chub are abundant in streams and lakes on the CRL site.

6.3 East Mattawa Road Site

Geology

The bedrock geology of the EMR Site is similar to that of the CRL property in general (see Section 6.2).

Hydrology

The EMR Site is situated in the Perch Lake basin (Figure 6-1), which drains approximately 18% of the CRL property. This region generally drains toward Perch Lake into Perch Creek which flows in a north-easterly direction and empties into the Ottawa River. Many of the CRL’s WMAs are located in the Perch Lake basin. Figure 4-1 shows the surface and subsurface contamination originating from these WMAs and passing through the Perch Lake Wetland, which is located to the south and west of the NSDF site, and which is already known to require long term management.

Soil, Bedrock and Groundwater Characteristics

A geotechnical survey was carried out in 2016 January and February, involving test pit excavations, borehole drilling, preliminary groundwater observations, and limited geotechnical testing.

Preliminary results indicate that ground surface elevations range from a low of approximately 160 mASL (meters above sea level) within the low-lying and relatively flat terrain bordering the north side of Perch Lake, to a high of 196 mASL along the crest of a ridge to the east of EMR that separates the Perch Lake and Ottawa River drainage basins.

The surficial geology at the site consists primarily of fine sands, underlain locally by glacial till. The overburden thickness at the site typically ranges from approximately 0 to 10 m, depending on bedrock topography. The surficial geology at the EMR site consists primarily of sands,

underlain by dense sandy silt till which contains some cobbles and occasional boulders. More recent organic soils (e.g. peat) have been deposited in the low-lying and wetland areas.

Seven boreholes were drilled as part of the investigation. In general, the boreholes penetrated a thin layer (0 to 0.23 m) of organic soil (topsoil) overlying a sequence of loose to compact fine silty sand. Probable bedrock was encountered in all of the boreholes at depths ranging from 0.5 to 11.4 m below ground surface.

Groundwater levels ranged from about 0.5 to more than 11.4 m depth, corresponding to elevations of between approximately 173 and 158 mASL.

Terrestrial and Aquatic Biota

In the western region of the site, approximately 2.6 ha of land is occupied by a Petawawa research forest plantation (Figure 6-2). The plantation was established in 1956 to determine frost and White Pine weevil resistance in Norway Spruce trees. The Petawawa Research Forest has confirmed it no longer has any interest in this plantation.

The EMR site is adjacent to the Perch Lake wetland. Although Ontario regulations do not apply to CRL, the Perch Lake wetland qualifies as a Provincially Significant Wetland, triggered by the presence of three or more species at risk with a THR status. Species at risk confirmed in the wetlands surrounding the area include; Canada Warbler, Eastern-wood Pewee, Golden-winged Warbler, Whip-poor-will, Snapping Turtle, Wood Thrush, and Blanding's Turtle. These wetlands represent ecosystems with outstanding biological, social or hydrological value and are identified by using the criteria outlined, e.g. in the Ontario Wetland Evaluation System [7]. No work will be undertaken in the Perch Lake wetland.

Biodiversity studies will take place in the spring and summer of 2016. Specific species to be surveyed include:

- Amphibians
- Song Birds
- Bats
- Blanding's Turtles

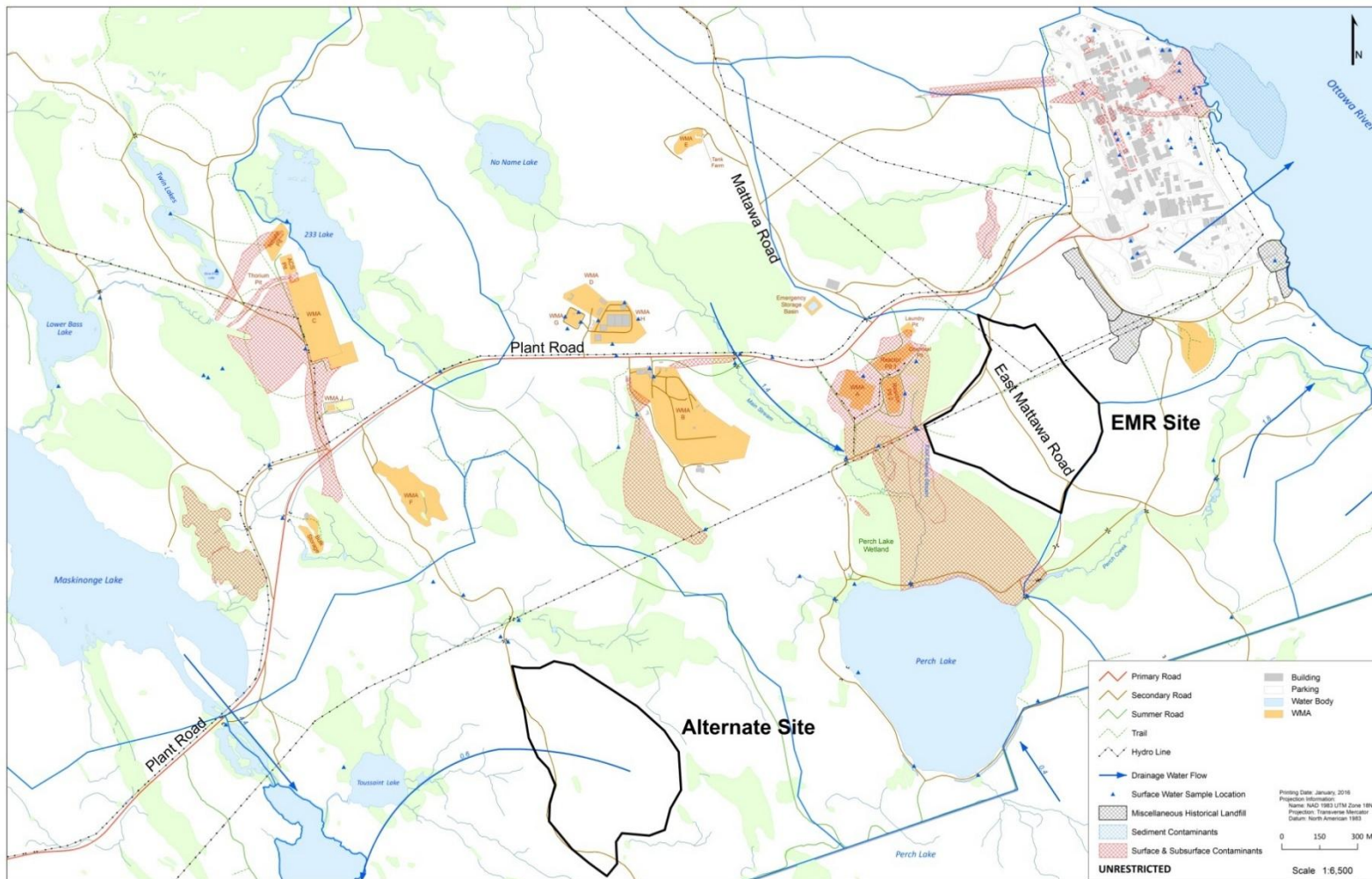


Figure 6-2 Physical and Natural Features of the Two Candidate Sites for the NSDF

6.4 Alternate Site

Geology

The bedrock geology of the Alternate Site is similar to that of the CRL property in general (see Section 6.2).

Hydrology

The Alternate Site is located in the Chalk Lake Basin (Figure 6-1). About 18% of the CRL site drains to Chalk Lake (also called Sturgeon Lake). The site drains via a stream to small lake (Toussaint Lake) which in turn drains to Chalk (Sturgeon) Lake.

Soil, Bedrock and Groundwater Characteristics

A geotechnical investigation of soil and groundwater conditions was carried out in the late fall 2013.

The ground surface of the site is undulating, ranging in elevation from 172 m ASL in the east/northeast, to a low of approximately 115 m ASL in the wetland areas in the southwestern region of the site (Figure 6-2). Overall, the ground surface slopes to the west. The southwestern region of the site is well drained, but much of the central portion of the site is low-lying terrain, resulting in seasonal accumulations of surface water and spongy ground.

The site is generally overlain by a thin layer of organic soil overlying a sequence of loose to compact fine sand. At six of the sixteen drilled boreholes, probable bedrock was encountered at depths between 2.45 m and 9.2 m. The remaining ten boreholes were terminated within overburden deposits without encountering bedrock.

No known contamination exists in the area of the Alternate Site.

Terrestrial and Aquatic Biota

A biodiversity study of the site was undertaken in 2012-2013 to support the site selection process and to identify biodiversity features that may require management or protection under the SARA, the Fisheries Act and/or the Migratory Birds Convention Act 1994.

One sighting of a Blanding's turtle was recorded in 2013 along the road at the edge of the proposed site. This sighting was recorded as part of a project to track Blanding's Turtles using radio-telemetry, indicating that at least one individual used the wetland located on the North side of the proposed site during the summer. The smaller wetland unit located on the east side of the proposed site also contains sightings of a Blanding's turtle, of painted turtle, green frog, spring peeper, gray tree frog, and mink frogs.

One sighting of a Marten has been recorded along the road in the middle of the area. The presence of a Marten is generally representative of an undisturbed habitat including mature and old forests, cavity trees and coarse woody material [8] which is not the case of this site. The vegetation cover type is consistent with most upland forest types on the CRL property,

dominated by main canopy species of over mature poplar, balsam fir and white pine but does not have the attributes of an old growth forest.

Finally, no butternut trees were observed on or near the site.

Additional biodiversity studies are scheduled to take place in the spring and summer 2016. Specific species to be surveyed at this location include:

- Amphibians
- Bats
- Fish species in Toussaint Lake.

6.5 Changes to the Environment by the Project

6.5.1 Fish, Fish Habitat and Aquatic Species

There is no fish habitat within either of the two candidate sites. The nearest water bodies to the EMR Site are East Swamp Stream, and Perch Creek, located approximately 25 m west and 200 m southwest of the site boundary, respectively. Perch Lake is located roughly 400 m southwest of the site. These water bodies have known contamination.

The nearest water body to the Alternate Site is Toussaint Lake (Figure 6-2), approximately 500 m west of this site.

The nature of in-water work or effluent discharges to water bodies will be determined during the detailed design of the facility.

Impact to fish or fish habitat (as defined in subsection 2(1) of the Fisheries Act) and on aquatic species (as defined in subsection 2(1) of the SARA) will be evaluated as the design of the facility proceeds.

6.5.2 Migratory Birds

During site preparation, tree clearing will be required. Any impact on migratory birds (as defined in Subsection 2(1) of the Migratory Birds Convention Act, 1994) will be minimized by prohibiting tree clearing during the Migratory Birds breeding season.

6.5.3 Changes to the Environment on Federal Land, in a Province other than Ontario, or Outside Canada

The environmental effects of this project are expected to be limited to the CRL site. No changes to the environment on federal land, in a province other than Ontario, or outside Canada are expected.

6.5.4 Effects on Aboriginal Peoples

The CRL property is not currently used for traditional purposes (hunting, fishing, trapping etc). The Algonquins of Pikwàkanagàn have been informed about this project (Table 2-1).

Canadian Nuclear Laboratories is currently reviewing the Aboriginal groups to be engaged this includes an assessment of the significance of potential adverse impacts and consideration such as asserted rights, historical or traditional practices and land claims. Canadian Nuclear Laboratories review activities will be aligned with the CNSC's REGDOC-3.2.2 Aboriginal Engagement.

The EMR Site has high archaeological potential. Two relic shorelines cross this site, which could yield aboriginal pre-contact material. A Stage 2 archaeological assessment will be completed in the spring and summer of 2016 to determine the extent of the deposits and decide if further assessment is necessary to determine heritage significance.

A partial Stage 2 archeological assessment of the Alternate Site was undertaken in the spring of 2014. The study revealed no significant archeological material in the area surveyed and therefore, heritage clearance was given to a portion of the site. The remainder of this site warrants further study to determine heritage significance and will also be assessed during the spring and summer of 2016.

7. SUMMARY

Canadian Nuclear Laboratories is proposing to develop and operate an engineered NSDF on the CRL property, to accommodate LLW and other suitable radioactive wastes generated at CRL and off-site locations that meet the WAC.

The CRL property is located in Renfrew County, Ontario, on the shore of the Ottawa River, approximately 200 km northwest of Ottawa. The site has a total area of approximately 4 000 ha, and is situated within the boundaries of the Corporation of the Town of Deep River.

The NSDF is a proposed engineered near-surface disposal facility, and is planned to be operational by 2020. The NSDF will have an operating life of approximately 50 years for accepting waste.

The facility will be designed with a capacity to accommodate approximately 1 000 000 m³ of existing and future wastes from CNL operational, decommissioning, and commercial activities. The NSDF will also accept radiologically contaminated hazardous wastes (mixed waste). All wastes identified for disposal in the NSDF will meet the waste acceptance criteria (WAC) established to assure operational and long-term safety requirements.

The main physical works related to the project are the engineered mound that will contain the waste, the WWTP and supporting infrastructure.

The NSDF project has prepared a conceptual design. The engineered mound will consist of multiple disposal cells and feature the following elements:

- Base liner system (including leachate collection and leak detection systems).
- Final cover system.
- Surface water management system.
- Environmental monitoring systems.

The WWTP will be required to treat leachate and wastewater from NSDF supporting operations. The WWTP will treat leachate and wastewater such that it meets discharge criteria prior to transfer to an approved discharge location.

The supporting infrastructure includes key installations such as a vehicle decontamination facility, vehicle monitoring and weighing stations, office and change room facilities, and security systems.

A site selection process has identified two candidate sites to locate the NSDF. Both sites are approximately 30 ha in area (Figure 4-1). The final site selection decision will be made following the completion of biodiversity and archaeological studies scheduled for the spring and summer of 2016 as well as public consultation activities. The EMR Site is currently considered to be more suitable for the NSDF for environmental, safety and security and stewardship reasons. Initial geotechnical surveys have demonstrated that the site has the necessary characteristics upon which to construct the NSDF.

Any impacts on fish or fish habitat (as defined in subsection 2(1) of the Fisheries Act) or on aquatic species (as defined in subsection 2(1) of the SARA) will be determined during the design of the facility. During site preparation, tree clearing will be required for the site. Any impact on migratory birds (as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994) will be minimized by prohibiting tree clearing activities during the Migratory Birds breeding season.

The environmental effects of this project are expected to be limited to the CRL property. No changes to the environment on federal land, in a province other than Ontario, or outside Canada are expected.

Canadian Nuclear Laboratories regularly informs and educates local stakeholder groups on the company vision and current and future activities. An overview of the proposed NSDF has been presented (within the context of a larger vision of the company) at several engagements in late 2015 and early 2016. Additional communications activities are planned for the future.

This project is being undertaken on Federal lands. As the NSDF is a facility for the disposal of nuclear waste, it qualifies as a Designated Project as per Section 37(b) of Regulations Designating Physical Activities under CEAA 2012. The CNSC is the Responsible Authority for projects of this type.

8. REFERENCES

- [1] International Atomic Energy Agency (IAEA). 2009. GSG-1, "Classification of Radioactive Waste", International Atomic Energy Agency, Vienna. General Safety Guide No. GSG-1
- [2] CSA N292.0-14, General Principles for the Management of Radioactive Waste and Irradiated Fuel
- [3] *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52).
- [4] *Prescribed Information for the Description of a Designated Project Regulations*, (SOR/2012-148).
- [5] *Regulations Designating Physical Activities* (SOR/2012-147).
- [6] Canadian Nuclear Safety Commission, *Aboriginal Engagement*, REGDOC-3.2.2, 2016 February.
- [7] Ontario Ministry of Natural Resources, *2013 Ontario Wetland Evaluation System: Northern Manual. 1st Edition*, Version 1.2, OMNR Queen's Printer for Ontario, Toronto.
- [8] OMNR. 2010, *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales*, Toronto: Queen's Printer for Ontario. 211 pp.