Project Description for the Micro Modular Reactor™ Project at Chalk River

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ABBREVIATIONS

This list contains the abbreviations frequently used in this document.

Abbreviation or Acronym	Definition
AECL	Atomic Energy of Canada Ltd.
APM	Adaptive Phased Management
CANDU	CANada Deuterium Uranium (reactor)
CEAA	*Canadian Environmental Assessment Act*
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CRL	Chalk River Laboratories
CSA	Canadian Standards Association
DGR	Deep Geological Repository
FCM™	Fully Ceramic Micro™ encapsulated (fuel)
GFP	Global First Power Ltd.
HTGR	High Temperature Gas-cooled Reactor
km	Kilometres
LLW	Low Level (radioactive) Waste
m	Metres
m^3/s	Cubic meters per second
MMR™	Micro Modular Reactor™
MNO	Métis Nation of Ontario
MWt/MWe	Megawatt thermal/electrical
NWMO	Nuclear Waste Management Organization
OPG	Ontario Power Generation Inc.
PPE	Personal Protective Equipment
SMR	Small Modular Reactor
TRISO	Triple Coated Isotropic (fuel)
USNC	Ultra Safe Nuclear Corporation

1. Introduction

This document describes the proposed Micro Modular Reactor™[1] (MMR™) Project at Chalk River; hereafter also referred to as the "MMR Project" or the "Project". The purpose of the document is to provide the Canadian Nuclear Safety Commission (CNSC) with the information necessary to make an Environmental Assessment Determination under the *Canadian Environmental Assessment Act* (CEAA) 2012 [1] and to establish the requirements for the project. The contents of this project description address the requirements identified in the CEAA 2012 Regulations "Prescribed Information for the Description of a Designated Project" [2].

Global First Power (GFP), the Project proponent, is proposing a Small Modular Reactor (SMR) project using MMR technology and having it sited on the Chalk River Laboratories (CRL) property, which is Federal land owned by Atomic Energy of Canada Limited (AECL). The CRL property is located in Renfrew County, Ontario, on the shore of the Ottawa River, approximately 200 km northwest of Ottawa. The CRL property has a total area of approximately 4,000 hectares and is situated within the boundaries of the Corporation of the Town of Deep River, Ontario.

The proposed Project will involve the site preparation, construction, operation, and decommissioning of one MMR nuclear reactor and supporting infrastructure on a Project site within the CRL property. The main physical works related to the Project are a Nuclear Plant, which includes an MMR High Temperature Gas-cooled Reactor (HTGR) that will provide approximately 15 MWt of process heat to a (non-nuclear) Adjacent Plant via molten salt, as well as all the equipment required to transport the heat from the reactor, support the operation of the Nuclear Plant and ensure its safety. The process heat will be used in the Adjacent Plant to generate electrical power and/or heat that could be used by CRL, or electrical power to the area grid, over an anticipated life span of 20 years.

If an agreement with AECL and Canadian Nuclear Laboratories (CNL) can be reached, the Project would thus have the capability to replace most of the greenhouse gas emitting heat and power sources currently employed on the CRL site with the new MMR technology clean and reliable energy source. It would also enhance the power and heat source reliability at the CRL site during interruptions in grid power supply due to failures induced by local harsh weather conditions.

[1] The Micro Modular Reactor (MMR) is a Trademark of Ultra Safe Nuclear Corporation. Everywhere the terms "Micro Modular Reactor" or "MMR" are used in this document, it should be noted that a Trademark is associated with them.

The Project will support and have access to the strong local research community. It will enhance the research and skilled workers community locally and will contribute to CNL's Long-Term Strategy for siting an SMR by 2026 and position itself as a global hub in SMR technology development support. On a larger scale, the MMR technology will have the potential to provide Canada with economic benefits related to developing a domestic supply chain as well as export opportunities.

GFP has partnered with Ultra Safe Nuclear Corporation (USNC), the MMR technology supplier, who is based in Seattle, United States, and with Ontario Power Generation Inc. (OPG), who will provide licensing and operations capability for the MMR facility during the construction, operation, and decommissioning phases of the project.

2. General Information

2.1. Project Name, Nature and Location

Project Name: Micro Modular Reactor (MMR) Project at Chalk River

Project Nature: The proposed Project is the first commercial deployment of a private sector funded Small Modular Reactor (SMR) technology in Canada. The proposed Project will involve the site preparation, construction, operation, and decommissioning of one MMR nuclear reactor and supporting infrastructure on a Project site within the CRL property.

Project Location: The MMR is proposed to be located on the Chalk River Laboratories (CRL) property. The CRL site is well positioned to host GFP's MMR plant. 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 Exhibit 2-1. The CRL site has a total area of approximately 4,000 hectares 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 CRL site.

A plan view of the CRL property is shown in Exhibit 2-2. Most of the current nuclear and associated support facilities are located within a relatively small industrial area of the CRL site called the "Built-up Area" located adjacent to the Ottawa River. The "Built-up Area" is surrounded by a larger area which is mostly undeveloped, known as the "Supervised Outer Area", and consists largely of forest interspersed with small lakes.

A site feasibility study conducted by CNL identified feasible project candidate sites for the MMR Project. The most suitable three project candidate sites (see Exhibit 2-3) are located in the "Supervised Outer Area." Section 4 provides more information on these candidate sites.

Exhibit 2-1: Geographical Location of Chalk River Laboratories

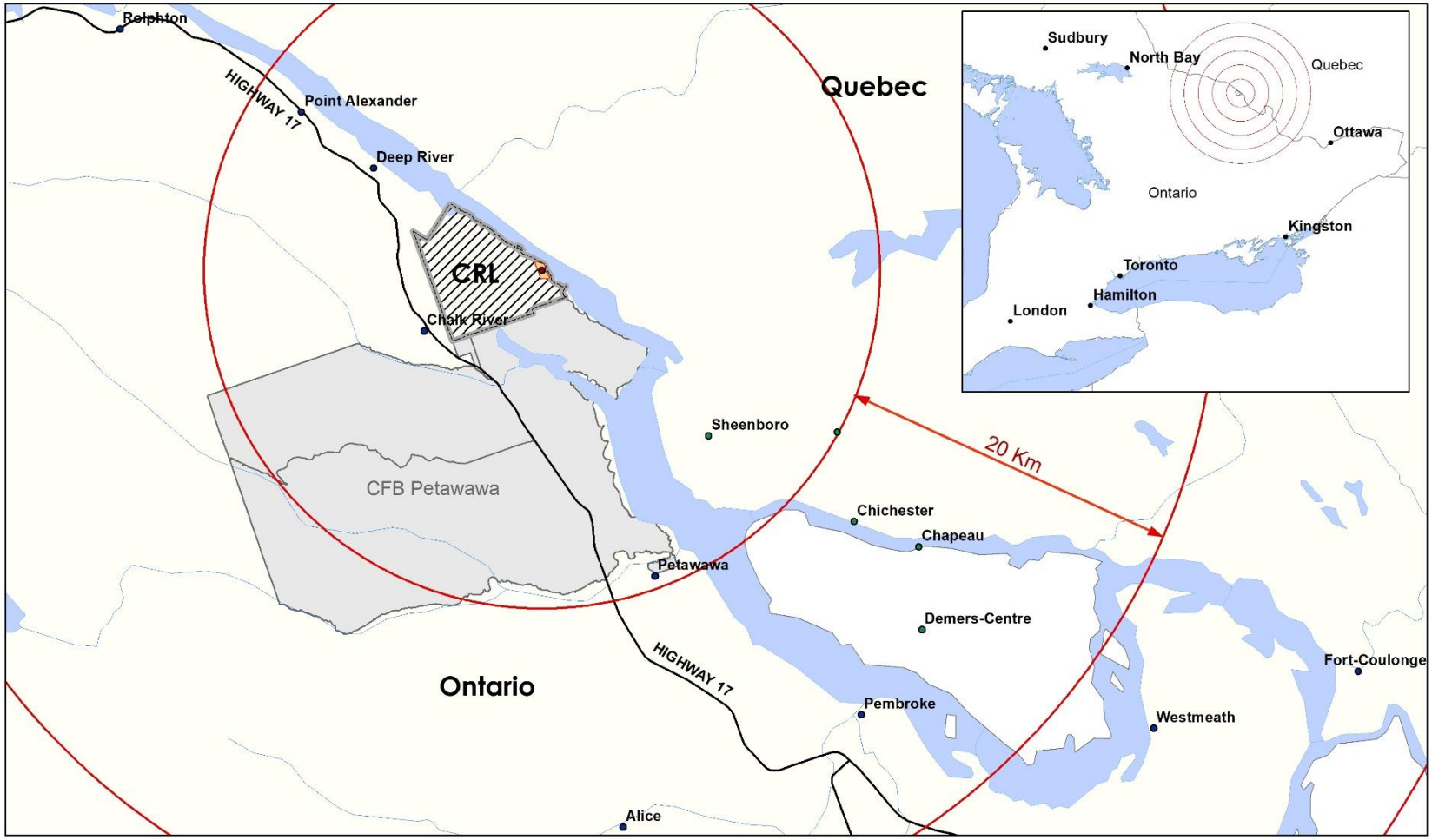


Exhibit 2-2: Overview of the Chalk River Laboratories Property

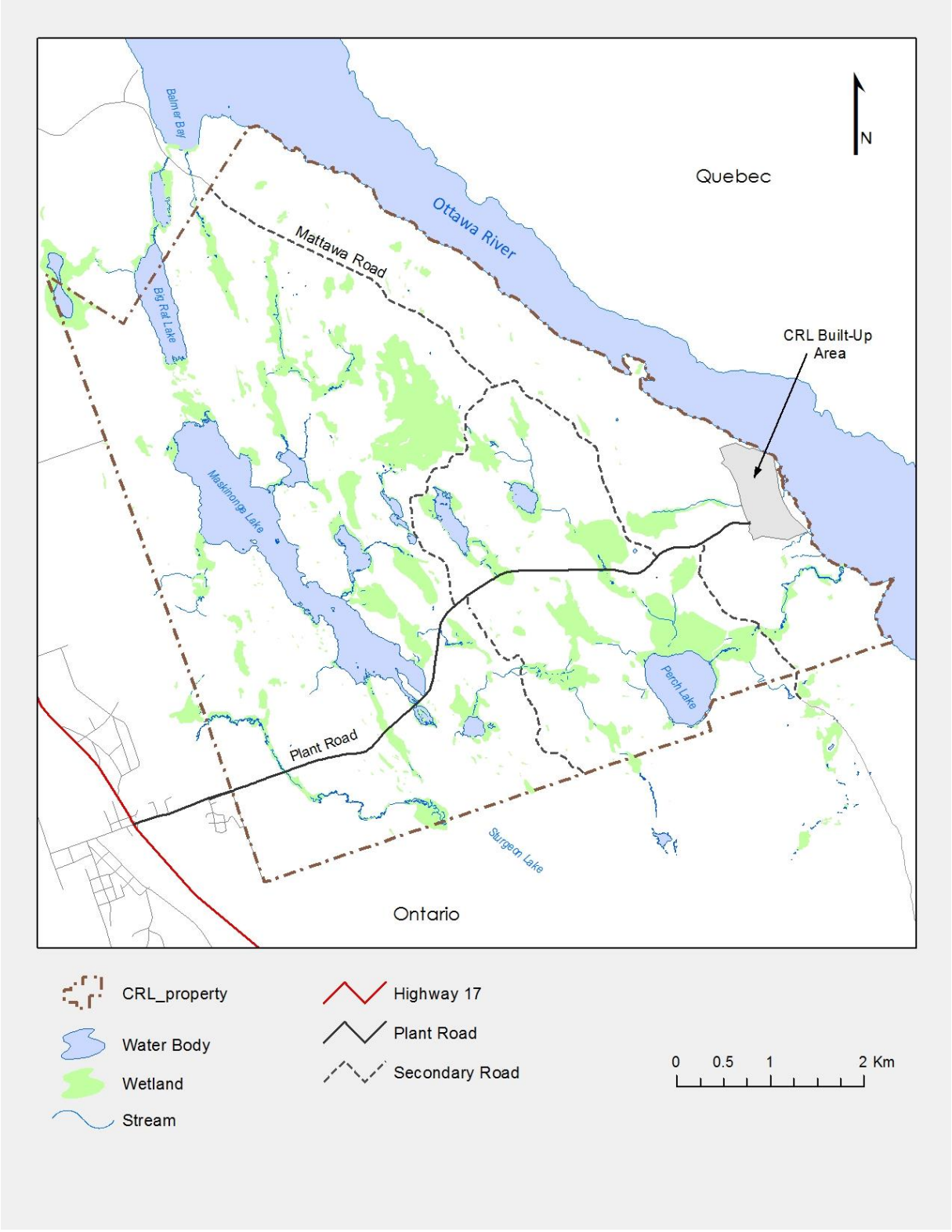
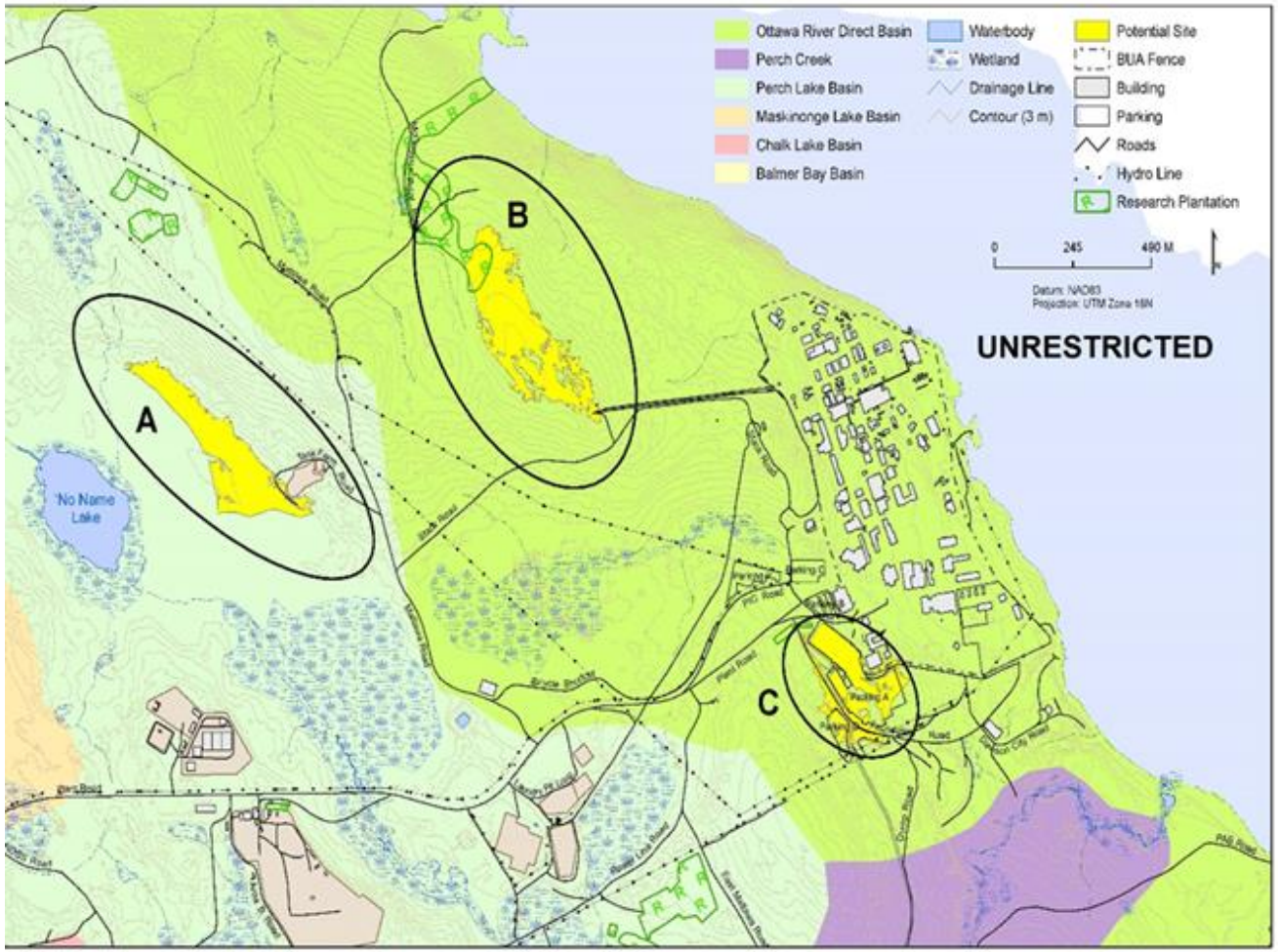


Exhibit 2-3: Project Candidate Sites within the Chalk River Laboratories Site



2.2. Project Team

2.2.1. Project Proponent

Global First Power Ltd. (GFP) is the Project proponent. GFP is a company incorporated in Canada, specializing in small nuclear project development and project financing. GFP has been developing capabilities to function as a smart buyer of nuclear technology and specifically for the use of the MMR technology. GFP is responsible for supporting the Environmental Assessment of the Project and is the applicant for the Licence to Prepare Site.

2.2.2. Proponent Contact Information

The proponent for this Project is GFP. GFP's Chief Executive Officer (CEO) is:

Mr. Joe Howieson
Chief Executive Officer
Global First Power
4 Robert Speck Parkway, Suite 4
Mississauga, Ontario, Canada, L4Z 1S1
Tel: 905-366-7303
Email: joe.howieson@globalfirstpower.com

The contact information of the primary representative for the purposes of this Project Description document is:

Dr. Robert Ion
Licensing Director
Global First Power
4 Robert Speck Parkway, Suite 4
Mississauga, Ontario, Canada, L4Z 1S1
Tel: 905-366-7303
Email: robert.ion@globalfirstpower.com

2.2.3. Project Support

GFP is supported on this Project by Ultra Safe Nuclear Corporation (USNC), Ontario Power Generation Inc. (OPG), and Canadian Nuclear Laboratories (CNL).

USNC is a nuclear technology developer based in Seattle, Washington, USA. USNC owns the design intellectual property for the MMR reactors and for the Fully-Ceramic Micro-encapsulated (FCM™[2]) fuel. USNC is the reactor technology supplier for the MMR Project at Chalk River.

OPG is a corporation wholly owned by the Government of Ontario. OPG is responsible for approximately half of the electricity generation in the Province of Ontario, Canada. Sources of electricity include nuclear, hydroelectric, wind, gas, solar and biomass. OPG is the owner and operator of CANDU nuclear power plants within Ontario. OPG, or a subsidiary of OPG, will provide the required services to support the licensing and operations of the MMR plant during the construction, operation, and decommissioning phases of the project.

CNL is Canada's premier nuclear science and technology organization. CNL develops peaceful and innovative applications from nuclear technology through its expertise in physics, metallurgy, chemistry, biology and engineering. Highly skilled employees deliver a range of nuclear services ranging from research and development, design and engineering to specialized technology, waste management and decommissioning. CNL maintains and operates several AECL owned nuclear sites in Canada, including the CRL site. The Project will be undertaken on Federal lands (i.e., AECL's property at CRL). GFP will enter into a formal agreement with AECL to use a suitable parcel of the CRL site for the Project, as the Project's site. It is envisaged that CNL will support GFP, OPG and USNC with various services including support to siting activities, nuclear power plant operations, research and development support. CNL is also a potential end user of the energy and/or heat produced by the Project.

2.3. Description of Communication Activities

The Project is proposed at a location currently managed by CNL who has identified in its Long-Term Strategy its vision of siting a new SMR by 2026. In April 2018, CNL issued a public invitation seeking proponents of SMR demonstration projects to participate in the evaluation process for the construction and operation of an SMR at a CNL-managed site. CNL, as the organization leading the process, had initial accountability for all communications and engagement with Indigenous communities, stakeholders and the general public. Due to the nature of the

[2] The term Fully Ceramic Micro-encapsulated (FCM) is a Trademark of Ultra Safe Nuclear Corporation. Everywhere the terms "Fully Ceramic Micro-encapsulated" or FCM" are used in this document, it should be noted that a Trademark is associated with them.

selection process, GFP was not able to publicly discuss its involvement, except with stakeholders directly involved in the commercial review process.

On February 15, 2019, CNL announced that GFP's proposal had advanced to Stage 3 of the review process. That milestone, along with the submission of the Project Description, signaled the opportunity for GFP to begin fulsome public and Indigenous engagement. As such, GFP has begun communications and engagement activities that meet the requirements of CNSC REGDOC-3.2.1 [3].

GFP understands that engagement with Indigenous communities, stakeholders and the general public is a continuous process that will span the Project's full lifecycle.

2.4. Environmental Assessment and Studies

2.4.1. Environmental Assessment and Regulatory Requirements of other Jurisdictions

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

2.4.2. Environmental Studies of the Region where the Project is to be Carried Out

CNL is currently conducting an Environmental Assessment for a proposed Near Surface Disposal Facility to be located at the CRL site (CEAA reference # 80122). There is an existing Environmental Risk Assessment for the CRL site that was completed in compliance with the Canadian Standards Association's CSA N288.6, "Environmental Risk Assessment for Class I Nuclear Facilities and Uranium Mines and Mills." In addition, CNL has extensive environmental and effluent monitoring programs that are conducted in accordance with CSA N288.4, "Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills" and CSA N288.5, "Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills," respectively.

3. Project Information

3.1. Project Context and Objectives

3.1.1. Project Summary and Context

The proposed Project involves the site preparation, construction, operation, and decommissioning of one MMR nuclear reactor and supporting infrastructure on a site on CRL property in Ontario. The Project will consist of two major parts, the Nuclear Plant and the Adjacent Plant, as well as supporting infrastructure, collectively also referred to as the "MMR facility." The Nuclear Plant includes an MMR High Temperature Gas-cooled Reactor which provides process heat to the (non-nuclear) Adjacent Plant via molten salt, as well as all the equipment required to transport the heat from the reactor, support the operation of the Nuclear Plant and ensure its safety. The Nuclear Plant is independent of the Adjacent Plant, requiring no supporting services for any event for its safe operation. The Adjacent Plant consists of the equipment and systems that convert the process heat to electrical power or other forms of energy as per client requirements. The Nuclear Plant would generate approximately 15 MWt of process heat that could supply electrical power and/or heat to the Chalk River Laboratories for CNL as the potential end user. The electrical power could also be supplied to the area grid, over an anticipated life span of 20 years.

The MMR technology is an economically competitive alternative to greenhouse gas emitting diesel power and heat generation, with a smaller environmental footprint. The MMR technology has been developed by USNC and is based largely on proven designs with inherent safety features, further augmented with specific novel safety features. The degree of such proven inherent safety design features confers confidence in the operability and safety of the facility, while the novel safety features further enhance the confidence in the safety of the technology. One such feature is the use of the Fully Ceramic Micro encapsulated (FCM) fuel that ensures containment of radioactivity during operations and accident conditions, which means that almost no fission products are released out of the fuel. Compared to most current operating reactor technologies which rely on highly specialized and complex safety systems to prevent and mitigate further releases of fission products that escape their fuel in case of postulated accidents, the MMR's fuel itself already performs the function of containing fission products during such accidents.

3.1.2. Overall Project Objectives

The MMR Project at Chalk River will produce 15 MWt of process heat. Although a formal agreement with CNL/AECL does not yet exist, it is envisaged that this heat could satisfy the needs of the Chalk River Laboratories, and thus could replace most of the current greenhouse gas emitting heat sources currently employed on the CRL site with the new MMR technology clean and reliable energy source. The electrical power could also be supplied to the area grid, over an anticipated life span of 20 years.

The Project could also enhance the power and heat source reliability at the CRL site during interruptions in grid power supply due to failures induced by local harsh weather conditions.

The Project will support and have access to the strong local research community. It will enhance the research and skilled workers community locally by locating the MMR operator training centre at the CRL location which could also serve future deployments of this technology.

The MMR technology design characteristics which include small size, passive and inherent safety features, and modularized construction concept makes it an option for deployment in areas where cleaner power and/or heat is needed and where employing currently large operating nuclear power plant technologies (such as CANDU and Light Water Reactors) is not practical, such in small and/or remote communities and near mines. The MMR features contribute to reduced effects on the environment and people due to a smaller site footprint, lower construction duration, lower safety risks.

The Project will contribute to CNL's Long-Term Strategy for siting an SMR by 2026 and position CNL as a global hub in SMR technology development support.

The Project will demonstrate the commercial viability of the MMR technology to prospective customers (e.g., remote communities and mining industry) with no access to grid power for their heating and electricity needs. The MMR technology will replace their current reliance on costly and greenhouse emitting fossil fuels with a clean and reliable nuclear-powered energy source, which can potentially be combined with other renewables sources.

3.2. Regulations Designating Physical Activities

The Project qualifies as a Designated Project per section 35 of the CEAA 2012 Regulations "Designating Physical Activities" (SOR/2012-147) [4], specifically as it

relates to “The construction, operation and decommissioning of a new nuclear fission or fusion reactor.” These Regulations identify the CNSC as the Responsible Authority for projects of this type. As such, the CNSC is responsible for the conduct of the Environmental Assessment.

3.3. Physical Works Related to the Project

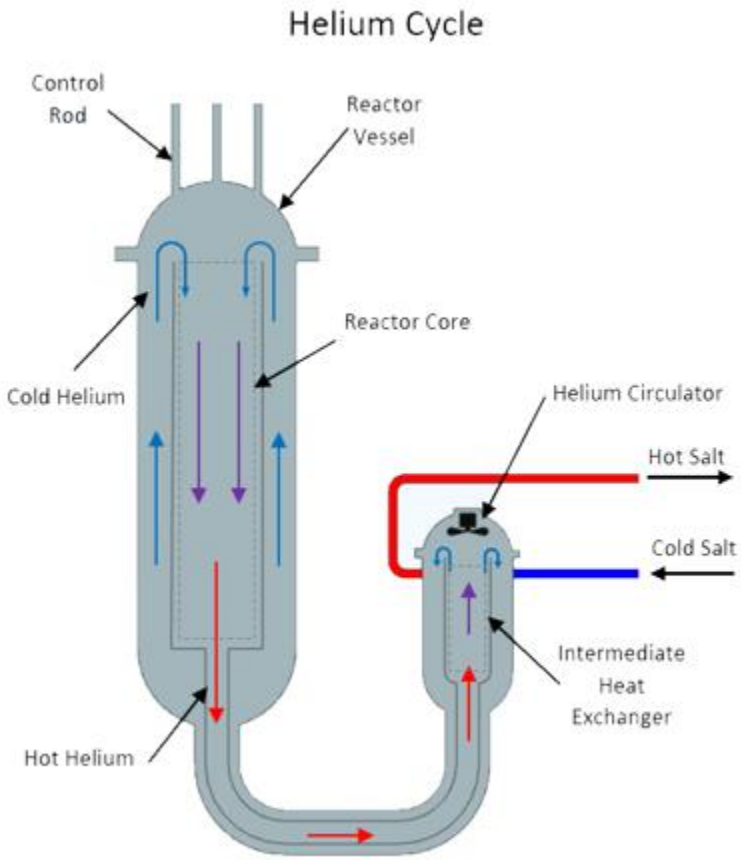
3.3.1. The MMR Facility

The MMR facility includes a Nuclear Plant containing an MMR reactor, and an Adjacent Plant, which are the main physical works related to the Project. The Nuclear Plant provides process heat to the Adjacent Plant where it is converted to electrical power and/or heat as per client requirements.

The Nuclear Plant uses a closed helium cycle that is contained within the reactor vessel assembly. The helium removes the heat generated by the nuclear reactor during normal operation. Helium passes through the nuclear core and is heated by the controlled nuclear fission process.

The heated helium passes through the Intermediate Heat Exchanger where the heat is transferred to the molten salt within the Nuclear Plant Molten Salt System. The cooled helium is recirculated back through the reactor core using an electrically powered circulator. Cold molten salt entering the Nuclear Plant passes through the Intermediate Heat Exchanger and is heated up by the helium. The hot molten salt is then transported from the Nuclear Plant to a non-nuclear facility, the Adjacent Plant. The Adjacent Plant uses the heated molten salt heat and then returns cooled molten salt to the Nuclear Plant. Exhibit 3-1 provides a simplified process diagram within the Nuclear Plant.

Exhibit 3-1: Nuclear Plant – Simplified Process Diagram



The Adjacent Plant is a power plant generating power from the heat supplied by the Nuclear Plant. The Adjacent Plant contains all the equipment to generate electrical power and supply it to the customer. The Adjacent Plant can also supply process heat to customer applications. A gas-fired furnace is used to maintain the molten salt temperature when the nuclear plant is shutdown and undergoes maintenance activities.

Exhibit 3-2 provides a simplified process diagram within the Adjacent Plant. The proposed integrated MMR facility layout (combined Nuclear Plant and Adjacent Plant) is shown in Exhibit 3-3. This layout is preliminary and will be subject to modification based on the final Project site location.

Exhibit 3-2: Adjacent Plant – Simplified Process Diagram

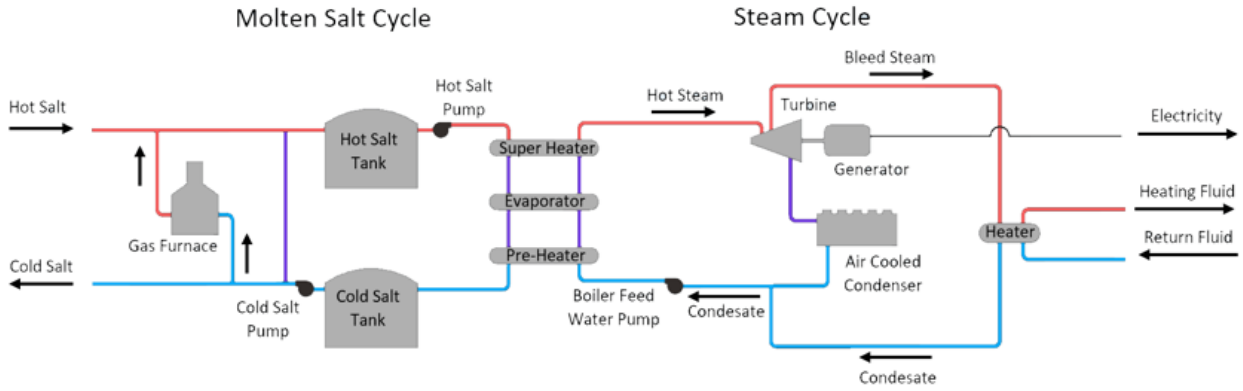
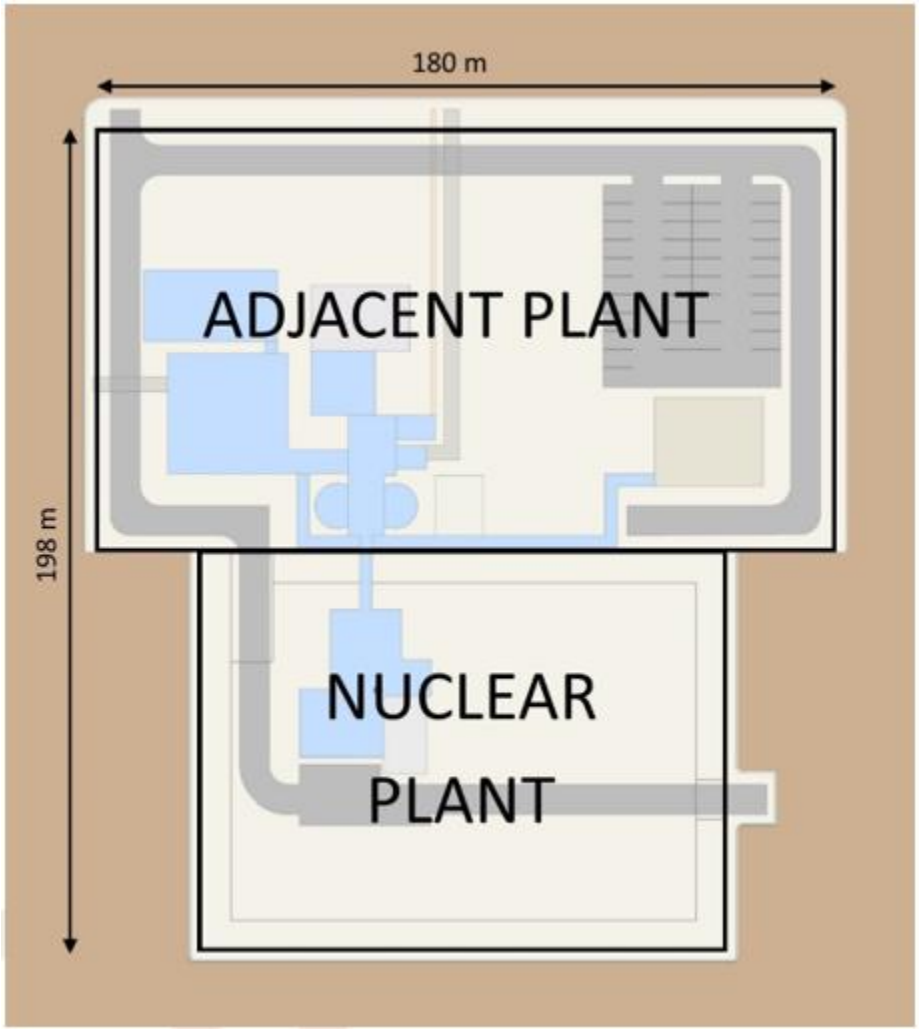


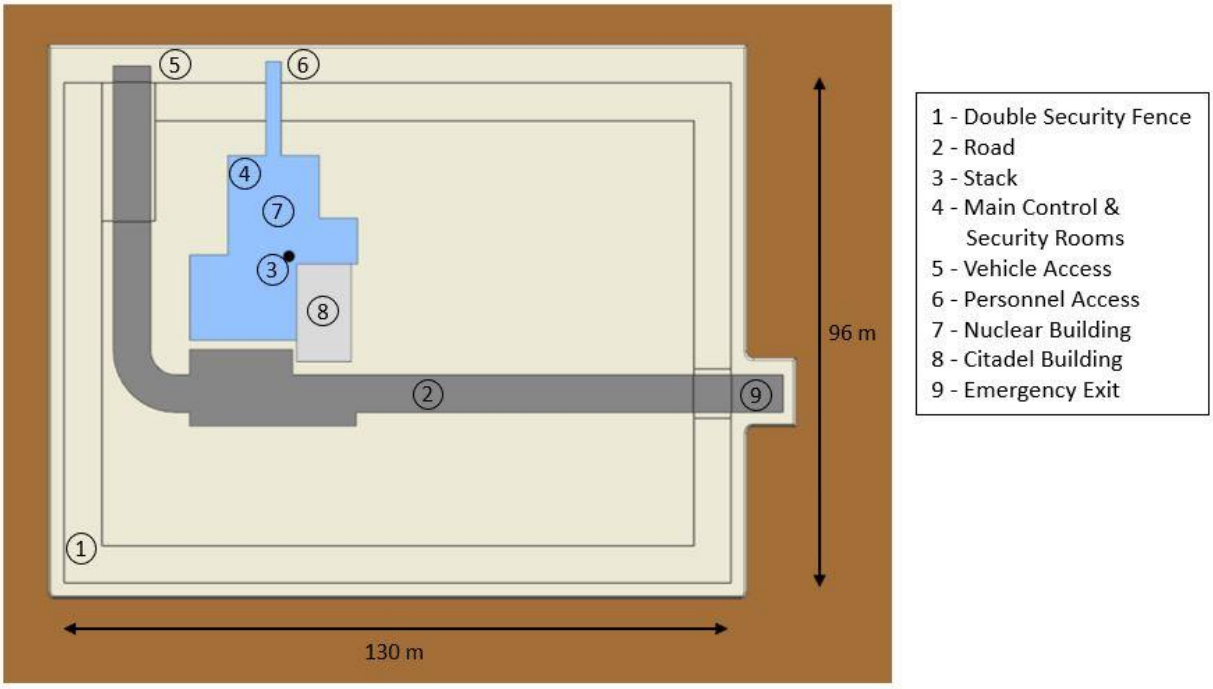
Exhibit 3-3: Proposed Integrated Facility Layout



3.3.2. Nuclear Plant

The Nuclear Plant contains the Nuclear Building and the Citadel Building, which houses the MMR reactor and its associated Nuclear Heat Supply System. The tallest structure of the Nuclear Plant is expected to be the Nuclear Plant stack with an approximate height of 30 metres. The second tallest structure is expected to be the Nuclear Building within an approximate height between 7 and 10 metres. The stack and Nuclear Building heights will be confirmed following detail calculations in support of the safety case and during the detail design phase. An illustrative Nuclear Plant layout is shown in Exhibit 3-4.

Exhibit 3-4: Illustrative Nuclear Plant Layout



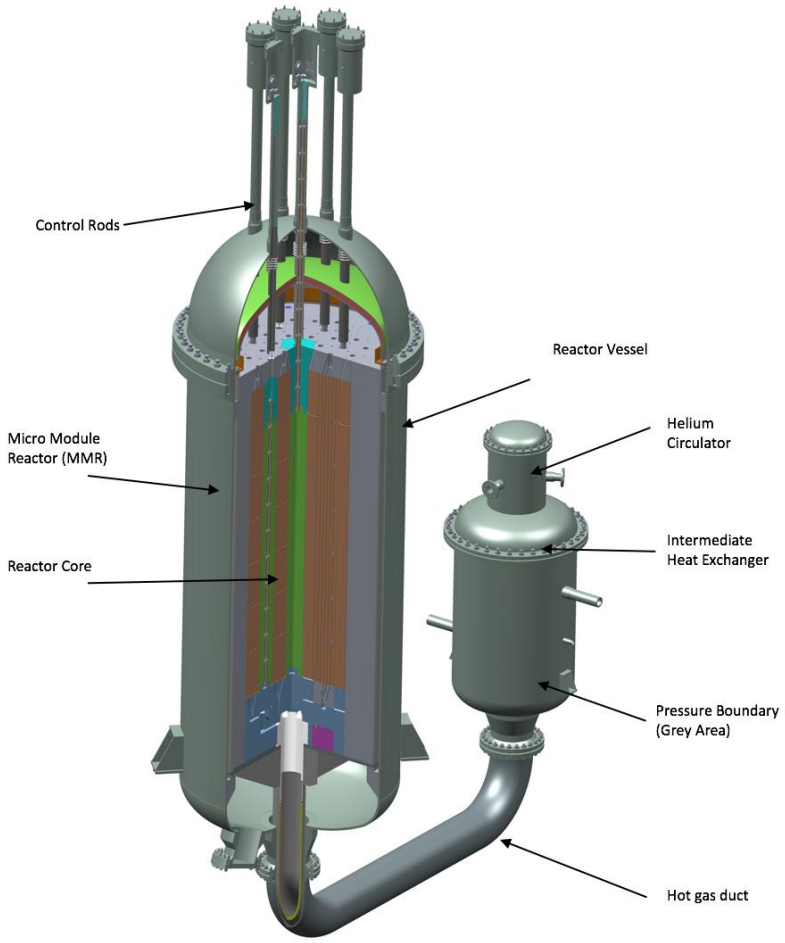
3.3.2.1. Nuclear Heat Supply System

The main function of the Nuclear Heat Supply System is to remove heat generated by the reactor core and transfer it to a secondary loop by means of the Intermediate Heat Exchanger. The Nuclear Heat Supply System also provides reactivity control in the reactor core, long-term burnup compensation and low power control during startup through the operation of the control rods. The Nuclear Heat Supply System allows for passive removal of residual heat from the core. The Nuclear Heat Supply System includes the reactor, the hot gas duct, the Helium Circulator, and the

Intermediate Heat Exchanger. It also forms the pressure boundary for the helium coolant. An illustration of the Nuclear Heat Supply System is provided in Exhibit 3-5. High-temperature molten salt is used in the secondary loop.

The reactor core is housed within a reactor vessel. The MMR reactor is designed for a 20-year operating life with no need nor provision for refueling. Therefore, there will be no additional fresh fuel or used fuel on the Project's site during the Nuclear Plant operation. During decommissioning, the fuel will be moved to long-term storage as described later in this document.

Exhibit 3-5: Illustration of the Nuclear Heat Supply System



3.3.2.1.1. Reactor Fuel

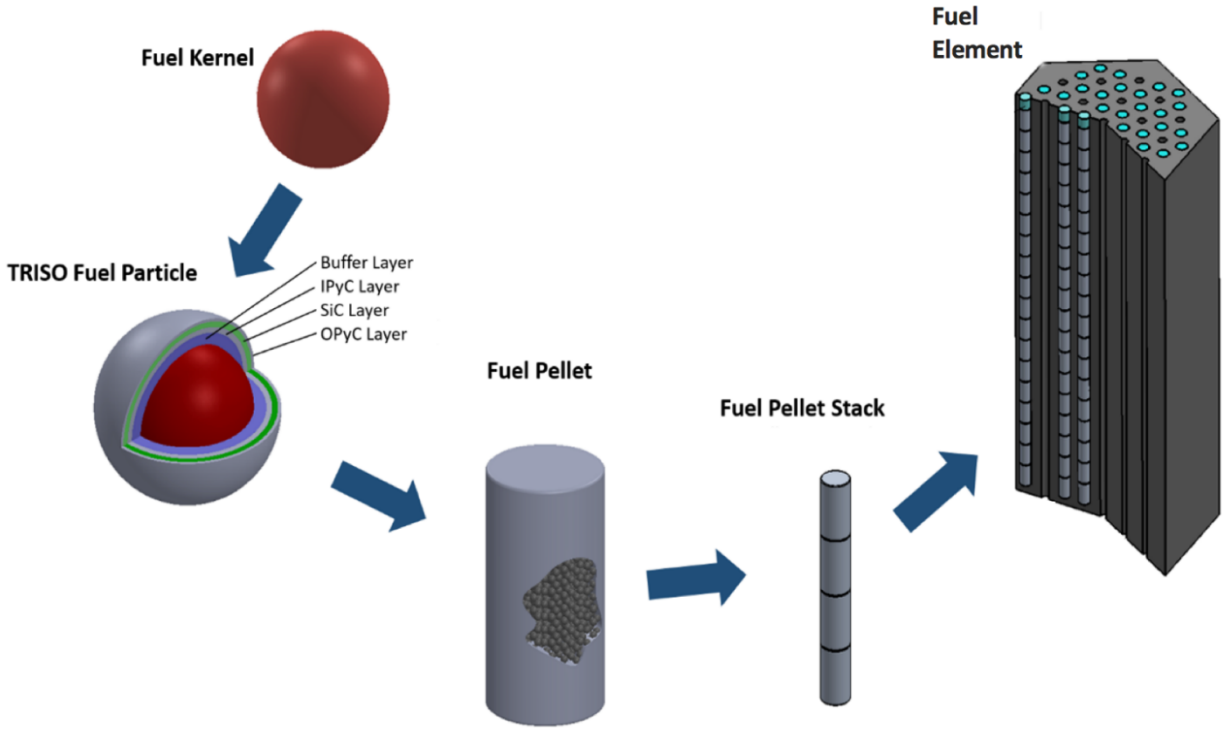
The MMR reactor fuel contains low-enriched uranium. The fuel is manufactured with Triple Coated Isotropic (TRISO) fuel particles, whose primary purpose is to retain fission products.

The fundamentals of ceramic coated particle fuel were developed in the 1960s. TRISO fuel was then applied to gas-cooled reactors. In the 1980s TRISO fuel was adapted for even higher temperature operation in the High Temperature Gas-cooled Reactors (HTGRs). TRISO technology has demonstrated irradiation performance. This reliable and historically proven TRISO fuel is suitable for use in the MMR reactor. The TRISO particles are highly proliferation resistant and provide environmental protection during and after operations.

The TRISO particles are bonded together to form fuel pellets. TRISO particles provide containment of radioactive materials during operations and accident conditions. The TRISO particles can be bonded together in graphite or in silicon carbide to form the fuel pellets. Exhibit 3-6 illustrates the MMR fuel concept.

The MMR fuel would be fabricated in a separate fuel fabrication facility, independent of the Project and not located within the Project's site.

Exhibit 3-6: The MMR Fuel and Fuel Elements



3.3.2.1.2. Reactor Core

The Reactor Core consists of hexagonal graphite blocks containing stacks of fuel pellets and full-length channels for helium flow, together called fuel elements (see

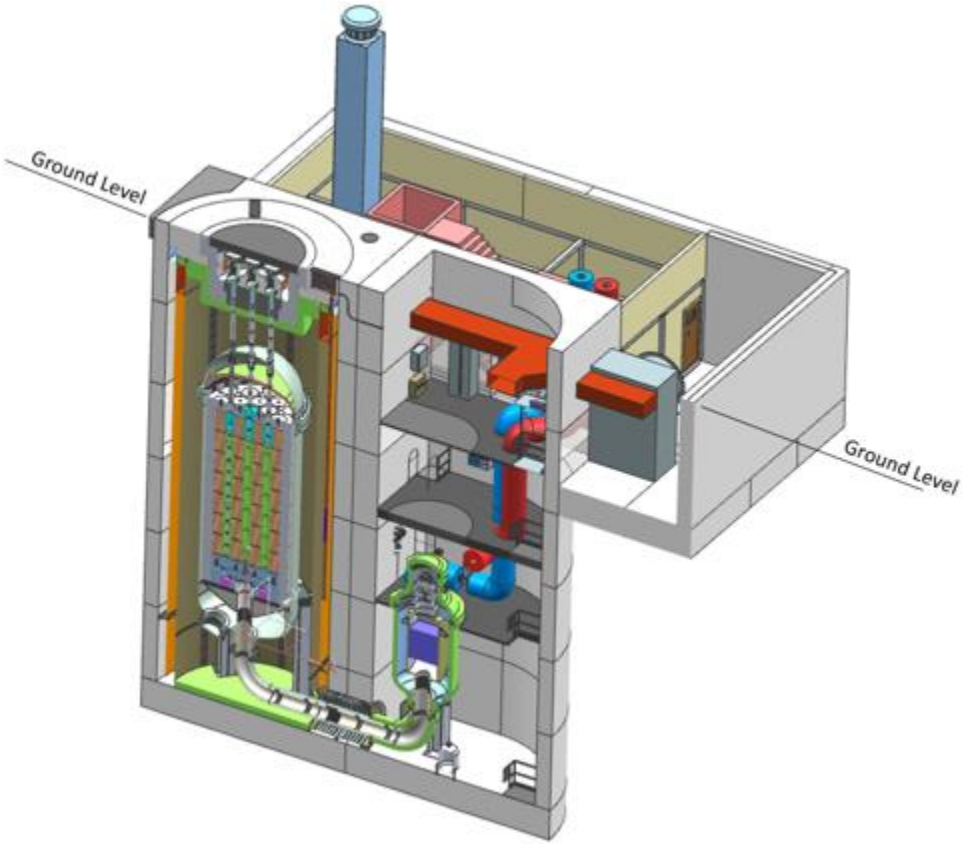
Exhibit 3-6). The hexagonal fuel elements are stacked to form columns, which rest on support structures in the reactor.

The core provides adequate coolant flow paths for heat removal, and the graphite material itself assists with further heat removal. The graphite core provides a neutron moderation and reflection function. The core also provides for areas for insertion of control rods. The MMR reactor core has a low power density and a high heat capacity resulting in very slow and predictable temperature transients.

3.3.2.2. Citadel Building

The Nuclear Heat Supply System (that includes the reactor core) is housed in a vertical cylindrical concrete structure, named the Citadel Building (Exhibit 3-7). The Citadel Building protects the reactor and the Intermediate Heat Exchanger from hazards (both external and internal to the Citadel Building), and the Citadel Building wall provides biological shielding that mitigates against possible radiation exposure from the reactor.

Exhibit 3-7: A Typical Citadel Building



3.3.2.3. Nuclear Building

The Nuclear Building is constructed on top of the Citadel Building. The Nuclear Building contains the equipment associated with the:

- Main Control Room and Security Room, including Instrumentation and control equipment
- Heating, Ventilation and Air Conditioning and electrical equipment room, including Instrumentation and control equipment
- Radiation change-over area and change room
- Waste storage and decontamination area

3.3.2.4. Nuclear Plant Molten Salt System

The Nuclear Plant Molten Salt System is a system of pipes, valves and drainage equipment that connects to the Adjacent Heat Supply System and transfers heat through circulating molten salt to the Adjacent Plant Molten Salt System (discussed in section 3.3.3.1). The Nuclear Plant Molten Salt System can be isolated/disconnected from the Adjacent Plant if required.

3.3.2.5. Waste Handling and Storage Area

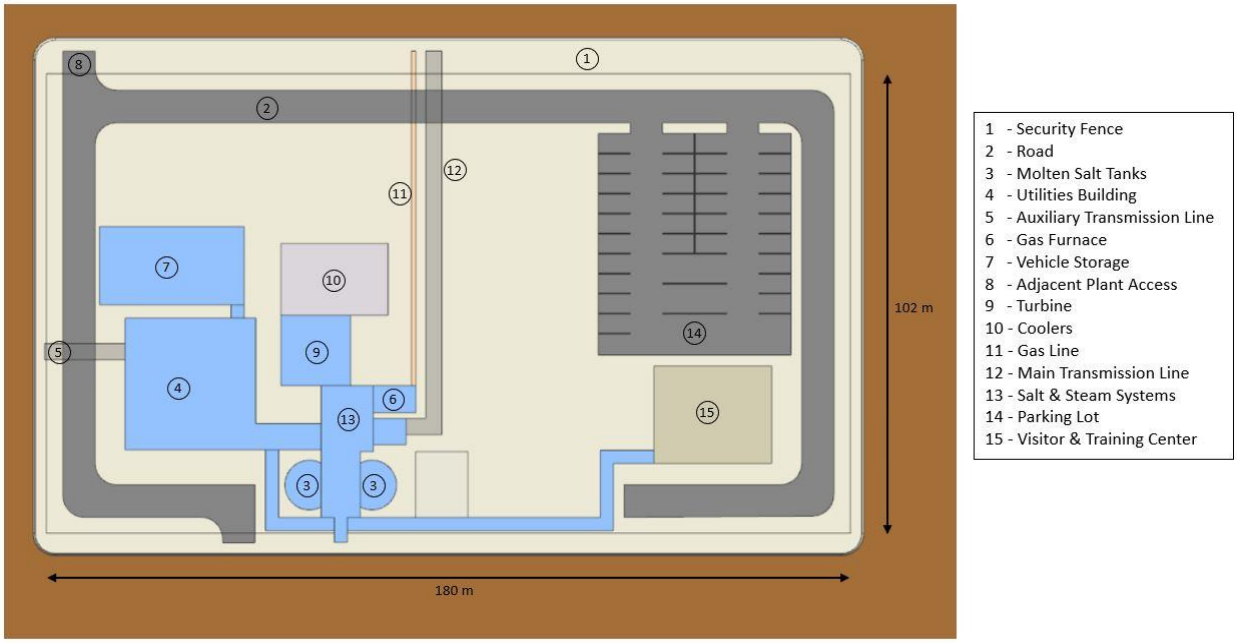
The Waste Handling and Storage area within the Nuclear Plant includes provision for the processing, packaging and storage of Low-Level Waste and Intermediate-Level Waste. Low and Intermediate Level Waste will be packaged and stored on the Project's site and/or periodically transported off-site to be managed at an appropriately licensed facility and, where required, would be transferred for long-term management and storage. Waste management plans will be developed to provide estimates of the waste volumes, characteristics, and further assess suitability for on-site disposition. Waste transported off-site will be managed according to the Transportation of Dangerous Goods Regulations.

3.3.3. Adjacent Plant

The Adjacent Plant buildings contain the equipment required for the generation of electricity from the heat supplied by the Nuclear Plant and to interface with any customer end-use facilities. Additionally, there are offices, a training and a visitor centre on the Project site. Access to the Project site would be controlled and monitored. The buildings are enclosed within a dedicated fence. The tallest

structure in the Adjacent Plant is a gas furnace, which stands approximately 17 metres above ground level. The second tallest structure is the Turbine Hall, which is approximately 12 metres above ground level. The Adjacent Plant structures' heights will be confirmed during the detailed design phase. An illustrative layout of the Adjacent Plant is provided in Exhibit 3-8.

Exhibit 3-8: Illustrative Adjacent Plant Layout



3.3.3.1. Adjacent Plant Molten Salt System

The Adjacent Plant Molten Salt System acts as an intermediary to transport the heat generated in the Nuclear Plant and transfer it through heat exchangers to a steam cycle for the purpose of generating power and the supply of heat for customer applications.

The Adjacent Plant Molten Salt System consists of pumps and pipes containing molten salt as well as hot and cold storage tanks. These tanks serve as an energy storage system and help to regulate the flow of molten salt. The molten salt is pumped to the hot storage tank from where it can be pumped to a steam generator. The steam generator to be used is standard commercial off-the-shelf plant equipment identical to that successfully used within a Concentrated Solar Plant. The molten salt is then transferred to a cold storage tank before it returns to the Nuclear Plant for reheating. A gas-fired furnace is used to maintain the molten salt

temperature when the Nuclear Plant is shutdown and undergoing maintenance activities.

The Adjacent Plant Molten Salt System can be disconnected/isolated from the Nuclear Plant when required.

3.3.3.2. Power Generation System and Steam Turbine Generator

The function of this system is to generate electricity from the heat supplied from the Nuclear Plant via the molten salt. The Power Generation System consists of the turbine generator and supporting infrastructure. The Adjacent Plant will have a main electrical grid connection for supply of the electrical power generated via transmission infrastructure, which will be confirmed once the Project's site location has been finalized. Additionally, there will be an auxiliary grid connection to provide station power when the main connection is not available.

3.3.3.3. Air Cooled Condenser System

In the operation of the steam turbine, water is heated to steam from the heat received from the molten salt. The steam is then used to power the turbines that generate electricity. The steam within the power plant is condensed to a liquid state before it can be re-used in a closed loop arrangement. The excess heat that is removed during steam condensation is dissipated to the atmosphere via air cooled condensers or dry cooling towers that do not use any form of external water source for operation, such as a lake or river system. The cooled condensate is then returned to be heated again by the molten salt.

3.3.4. Modularization

The MMR facility uses standardized modules which will be to the extent possible assembled, commissioned and tested off-site, prior to transport, and then installed at the Project site. Piping, cabling, lighting, etc., will be included in the modules with specific interfaces for ease of connection during installation. Minimum work is foreseen for assembling the modules at the Project site.

Similarly, pre-cast concrete structures are used as much as practical, which reduces the need for on-site pouring of concrete, thus reducing the number of cement transport vehicles and their associated greenhouse gas emissions.

The modules will be sized to allow usage of International Standards Organization standard shipping containers to expedite transport and site installation. The sizing

of the modules is the same as what is used for regular road transport and thus minimizes the impact to traffic on local roads during transport to the Project site.

3.4. Project Phases and Schedule

The Project has the following lifecycle phases:

- Project Development
- Site Preparation and Construction
- Plant/Facility Operation
- Decommissioning
- Abandonment

The current preliminary schedule for each Project phase for Environmental Assessment purposes is provided below.

Project Phase:	Bounding Estimated Start-End Dates:
Project Development	2016–2021
Site Preparation and Construction	2021–2027
Plant Operation	2023–2054
Decommissioning	2044–2058
Abandonment	2058-2060

The dates shown above are bounding start and end dates for each of the project phases, based on estimated early and late start and finish dates for specific phase activities. The expected effective durations of the activities within these phases are discussed in the following section.

3.5. Project Activities

3.5.1. Project Development

The Project development activities are currently in progress and they include identification and assessment of potential environmental impacts of the project. The Project site characterization and site surveys activities that are part of the Project development phase are formally initiated with the submission of this

document to the CNSC and CNSC's Notice of Commencement of an Environmental Assessment. Under the Project site characterization and site survey activities, the Project site will be fully characterized, which will include analysis, surveys and inspections of the Project site to gather information for the design, for the required hazard analysis and for the estimates to complete the environmental assessment and impact studies.

The project development phase including design activities are estimated to take approximately five years. At the end of this phase, a formal Project schedule will be finalized to take into account detailed planning activities.

3.5.2. Site Preparation and Construction

The Site Preparation and Construction phase activities are estimated to take approximately two yearst and will include all general activities needed to prepare the Project site for construction and then to construct the facility.

3.5.2.1. Site Preparation

The following main activities are necessary to prepare the site and would be anticipated to be conducted under the site preparation licence:

- Construction of site access control measures
- Clearing and grubbing of vegetation
- Excavation and grading of the site to a finished elevation
- Installation of services and utilities required to service the future project facilities (e.g., domestic water, fire water, sewage, electrical, communications, natural gas)
- Construction of support buildings inside the site, if any
- Construction of required environmental monitoring and mitigation systems
- Construction of required flood protection and erosion control measures
- Demolition and removal of existing structures (if required)
- Construction/paving of parking area(s), access ways and roads
- Drilling and installation of support pilings
- Excavation of the Citadel building foundation

- Erection of temporary storage and laydown areas as well as a construction yard including handling of commodities and tools.

3.5.2.2. Construction

The following main activities are anticipated to be necessary to construct the facility in addition to those listed for site preparation. These would be anticipated to be conducted under the site construction licence:

- Concrete structures - off-site pre-cast concrete structures will be used. In-situ concrete will either be delivered to site pre-mixed or will be mixed on site.
- Preparation of building foundations
- Construction of waste management facilities for the segregation and temporary storage of stockpiles of construction waste on the Project site
- Excavation and preparation of the concrete base for the Citadel Building
- Construction of the main structures and buildings
- Assembly of the pre-fabricated modules of the Nuclear Plant and Adjacent Plant and installation of Nuclear Plant and Adjacent Plant main systems
- Installation of required fencing

3.5.3. Plant Operation

The Operation phase activities will take approximately 20 years, once the reactor has been constructed and commissioned. Operation and maintenance activities can largely be categorized into the following:

- Commissioning of the facility and verification of performance
- Operation of the Nuclear Plant and Adjacent Plant systems
- Verification, sampling, testing and maintenance during operation
- Inspections
- Maintenance, repairs and cleaning during planned shutdowns and outages
- The processing and handling of waste on the Project site, including radioactive and hazardous waste, and the preparation for shipping off-site to an appropriate licensed facility

- Environmental monitoring, including follow-up on performance predictions, and radiation protection on the Nuclear Plant
- Decontamination work during planned shutdowns and outages of the Nuclear Plant.

3.5.4. Decommissioning

The Decommissioning phase activities are anticipated to take approximately two to three years.

The Nuclear Plant will be designed to support immediate dismantling and decommissioning, which will start as soon as possible after the permanent shutdown of the plant. All radioactive material above a specified level will be identified and removed, to ensure the Project site or the facility can be cleared or used without any regulatory restrictions.

The spent reactor core contains most of the radioactive inventory and contamination in the plant. In general, decommissioning activities can be described as follows:

- Dismantling – Equipment within the plant may be dismantled; equipment within the buildings that are non-radioactive can be removed for possible re-use, and the buildings dismantled.
- Interim storage of used fuel – A purpose-built storage cask can be used to contain the reactor vessel with the used fuel inside in a dry-storage configuration. This will be either stored on the Nuclear Plant site or transferred to an interim storage facility. An alternate option to the purpose-built storage casks is to leave the reactor vessel with the used fuel inside in-situ within the Citadel Building, which will serve as the a protected below ground storage cask.
- Final disposal of used fuel – Once the Adaptive Phased Management (APM) plan has been commissioned by the Nuclear Waste Management Organization (NWMO) in preparation for final disposal in a Deep Geological Repository (DGR), the reactor vessel will be opened, and the graphite blocks containing the used fuel (i.e., fuel elements) will be transferred to the DGR. The NWMO will determine what adaptations, if any, are required for the current used fuel containers to safely contain and isolate the MMR used fuel elements, while also meeting regulatory requirements.
- Demolition and Project site clearance – When the final stage of dismantling is complete, all remaining buildings are demolished, and radioactive wastes

removed to storage or disposal facilities. The Project site is thus cleared and restored. Project site monitoring will be conducted until the Project site's radiation levels are demonstrated to meet all regulatory requirements and the site will then be available for re-use.

3.5.5. Abandonment

Following successful decommissioning, GFP will apply to the CNSC for a Licence to Abandon. Abandonment is the release of the site from CNSC regulatory control and occurs when the licensee has successfully decommissioned the facility and restored the site to a state in which it can be released for future use (e.g., green field or brown field [industrial]). Abandonment phase activities are anticipated to take approximately two to three years.

3.6. Waste Generation

The anticipated sources of radioactive and non-radioactive waste for each of the Project activities are provided in Exhibit 3-9.

Exhibit 3-9: Anticipated Sources of Radioactive and Non-radioactive Waste for Each of the Project Activities

Project Activities	Radioactive Waste	Non-radioactive Waste
Site Preparation and Construction	There is no radioactive waste generated during this phase. If contaminated soil is encountered during excavation, it will be managed as contaminated waste.	The following types of non-radioactive waste are anticipated: • Domestic waste • Recyclable material (e.g., plastics, paper) • Builders rubble • Construction consumables • PPE • Vegetation Waste will be collected and stored in the appropriate location within the storage area or sent to off-site landfills. Clean waste will be recycled if possible.
Plant Operation and Maintenance	During these activities the following potential types of radioactive waste will be generated: • PPE - Tyvek type disposable overcoats, dust masks and gloves • Filter cartridges • Helium purification system consumables • Desiccants, resins • Liquid waste from decontamination Radioactive waste will be stored in the waste storage area until removed from the Project site to a licensed facility. Liquid waste will be monitored and stored in a holding tank, for further processing. The volume of liquid effluent is low. As the contamination in the liquid will be due to solids entrapped in the liquid, volume reduction by concentrating the effluent will be performed in the decontamination area.	A waste storage area will be used for the storage of non-radioactive waste. During these activities the following potential types of non-radioactive waste will be generated: • Domestic waste • PPE • Filter cartridges • Sewage
Decommissioning and Project Site Restoration	All types of radioactive waste specified for activities immediately above. In addition, activated and contaminated equipment and materials will be removed from the Project site to a licensed facility.	All types of non-radioactive waste specified for the activities above, not including vegetation.

All waste will be handled and processed in a responsible and safe manner that ensures minimum exposure to all personnel handling, transporting and processing the waste. Waste will be segregated at source as non-radioactive waste and radioactive or potentially radioactive waste. Waste will be temporarily stored on the Project site in defined areas and transported to authorized processing facilities at appropriate times, dependent on the category and type of waste.

Radioactive waste will be monitored and further categorized as to the type of waste and processing options for the various types of waste. After the fuel loading during reactor commissioning, material and personnel exiting the controlled zones will be monitored and contaminated items will be appropriately processed. All radioactive waste generated during normal operation and routine scheduled maintenance will be transferred within the controlled zone to the designated waste area, where it will be categorized and packaged for removal from the Project site.

Non-radioactive waste will be transferred to the designated on-site waste area for sorting and temporary storage. This area will have designated locations for recyclable items (paper, plastic, glass and batteries). The recyclable items will be placed in the appropriate storage bins. These will be collected by a recycling contractor at a defined interval. The remainder of the non-radioactive waste will be placed in covered bins for collection by a selected contractor at a defined interval. Local suppliers of waste removal services in the area will be identified and contracted when Project site preparation activities are authorized. The final options for processing of sewage will be determined once the actual Project site has been selected. There are currently three options: connection to an existing sewage system, a septic tank, or a holding tank that is emptied by a contractor at regular intervals.

4. Project Information

4.1. Project Location

The MMR is proposed to be located on the CRL property site which is Federal land owned by Atomic Energy of Canada Limited (AECL). The current legal description of the CRL property is included in the Ontario Land Registry under the PIN's 57075-0003(LT), 57074-021(LT), 57076-0049(LT). Evidence of AECL ownership of the CRL property site as recorded in the Ontario Land Registry is provided in Appendix A. Further evidence of AECL ownership is documented in the Treasury Board of Canada Directory of Real Federal Property for Property 11357 and provided in Appendix B.

The CRL site is well positioned to host GFP's MMR plant. The CRL property is located in Renfrew County, Ontario, on the shore of the Ottawa River, approximately 200 kilometres northwest of Ottawa as shown in Exhibit 2-1. The CRL site has a total area of approximately 4,000 hectares 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 CRL site. A plan view of the CRL property is shown in Exhibit 2-2. Most of the nuclear and associated support facilities are located within a relatively small industrial area of the CRL site, called the Built-up Area, located adjacent to the Ottawa River. The Built-up Area is surrounded by a larger area which is mostly undeveloped, known as the "Supervised Outer Area", and consists largely of forest interspersed with small lakes.

The Project site[3] selection process was initiated through a feasibility study conducted by CNL of candidate sites within the CRL property. The feasibility study considered criteria that includes aspects of the required total footprint for the facility, land availability, and ability to connect to water and power services, critical habitat of threatened and endangered species, archeological sites. The CNL feasibility study resulted in ten sites on CRL's property that were considered suitable Project sites with various degrees of suitability based on the above criteria.

[3] In general, throughout this document, the term "site" is used to mean the MMR Project site, unless specified otherwise.

The three most suitable Project sites amongst the ten are currently further undergoing a site selection process. The location of these three candidate sites on the CRL property is shown in Exhibit 2-3. The final site selection decision of the preferred site will be made following results of additional supporting studies.

The three candidate sites are further described below; for the purpose of this document, they are called Site A, Site B, and Site C.

The approximate geographic coordinates of **Site A** are 46 02’ 09” N, 77 22’ 44” W. The distance from the center of Site A to the closest point on the Ottawa River is approximately 1.3 km. Site A is situated approximately 2.1 km west of the CRL Built-up Area (BUA) by road (see Exhibit 2-3). Site A is located between No Name Lake, approximately 320 m from the western border of the site and Mattawa Road on the east, which acts as the CRL emergency response route and gives access to Site A, through a secondary road. This site is mostly vegetated and flat terrain; the sloped area of the site is stable. A non-operational waste management area on the CRL property is located North-East from Site A. An existing CRL building (called Building 538), which is a series of tanks containing legacy liquid waste that are currently being emptied, is also located northeast from Site A.

The approximate geographic coordinates of **Site B** are 46 03’ 20” N, 77 22’ 45” W. The distance from the center of Site B to the closest point on the Ottawa River is approximately 0.5 km. Site B is approximately 2.5 km directly west of the CRL Built-up Area, by road (see Exhibit 2-3). Stack Road, a secondary route off Mattawa Road, runs perpendicular to the site. This site is predominantly undisturbed land, heavily forested with steep terrain. The site is next to a CRL property building (called Building B109) which houses the effluent monitoring equipment for the National Research Universal reactor and is adjacent to the future site of a domestic water reservoir.

The approximate geographic coordinates of **Site C** are 46 02’ 50” N, 77 21’ 55” W. The distance from the center of Site C to the closest point on the Ottawa River is approximately 0.6 km. This site is approximately 0.3 km by road south of the CRL Build-Up Area (see Exhibit 2-3). This site is a combination of open undisturbed land and developed land, some of which was previously contaminated. A portion of this site currently houses one of the main CRL employee parking lots and is also close to the proposed site for a new co- or tri-generation station for the CRL site. This site is close to the Built-up Area and would provide ease of tie-in to required services. This candidate site is approximately 6.7 km from CNL’s outer gate (property boundary) and is not in close proximity to municipal borders.

4.2. Project Proximity to Residences

The nearest population center to the CRL site is the Village of Chalk River (current approximate 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 along the Québec shore increases slightly due to seasonal/temporary occupancy of cottages. The increased seasonal 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). Laurentian Hills surrounds the Town of Deep River and is located north and west of the CRL site. 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 site, with a population of approximately 16,000. Another larger centre is Pembroke and its surrounding area and is located 35 km downstream of CRL with approximately 14,500 residents.

4.3. Project Proximity to Reserves, Traditional Territories and Land Resources used by Indigenous Peoples

The location of the proposed Project at the CRL site is expected to generate interest by Indigenous communities located in the proximity of the proposed Project site.

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.

GFP has identified the Indigenous communities most likely to be interested in the MMR Project at CRL, which included an assessment of the significance of potential adverse impacts and considerations such as asserted rights, historical or traditional practices and land claims. GFP's engagement activities will meet the CNSC requirements for Aboriginal engagement [5]. A summary of identified Indigenous communities and the rationale for selecting them is provided in Exhibit 4-1. This is a preliminary assessment based on existing and available information on Aboriginal and treaty rights in the vicinity of the Project and is subject to change based on information and dialogue with the identified communities.

Exhibit 4-1: First Nation and Métis Communities Selected for MMR Project Engagement Activities

First Nation and Métis Community or Group	Location and Approximate distance to Chalk River site	Identification Rationale
Algonquins of Ontario (AOO)	The AOO are comprised of 10 Algonquin communities: • Antoine (219 km) • Algonquins of Pikwàkanagàn First Nation (72 km) • Bonnechere (68 km) • Greater Golden Lake (Petawawa) (22 km) • Kijicho Manito Madaouskarini (Bancroft) (166 km) • Mattawa/North Bay (114/176 km) • Ottawa (183 km) • Shabot Obaadjiwan (Sharbot Lake) (205 km) • Snimikobi (Ardoch) (171 km) • Whitney and Area (149 km)	• Aboriginal rights in the project area confirmed with the Agreement in Principle pending modern treaty with Ontario and Canada
Algonquins of Pikwàkanagàn	• Member of the AOO • Pikwàkanagàn is adjacent to Golden Lake, Ontario within the County of Renfrew (72 km)	• Established Aboriginal rights in the project area • Aboriginal rights in the project area confirmed with the Agreement in Principle pending modern treaty with Ontario and Canada
Algonquin Anishinabeg Nation Tribal Council	The Algonquin Anishinabeg Nation Tribal Council (AANTC) represents seven members within Quebec. Three AANTC First Nations communities in the province of Quebec are relatively close to the project. • The Kitigan Zibi Anishinabeg First Nation adjacent to the Town of	• Asserted rights in the project area

First Nation and Métis Community or Group	Location and Approximate distance to Chalk River site	Identification Rationale
	Maniwaki in the province of Quebec (219 km) • Kebaowek (formerly Eagle Village First Nation) – Kipawa adjacent to the Town of Temiscaming in the province of Quebec (216 km) • Wolf Lake First Nations are one of ten communities representing the Algonquin Nation of Canada. They currently reside at Hunter's Point, Temiscaming, QC (216 km)	
Métis Nation of Ontario	The Métis Nation of Ontario represents communities and individuals recognized by the Métis Nation within Ontario. The closest rights-bearing, historically recognized Métis community to the projects site is the Mattawa Métis Council, although engagement will take place with Consultation Committees in MNO Regions 5 and 6. • Ottawa Community Council, Region 6 (187 km) • High Land Waters Community Council, Region 6 (187 km) • Peterborough Community Council, Region 6 (274 km) • Mattawa Community Council, Region 5 (114 km) • North Bay Community Council, Region 5 (176 km)	• Asserted rights in the project area
Williams Treaties First Nations (WTFN)	• Hiawatha First Nation is based out of the north side of Rice Lake in Peterborough County, Ontario (286 km) • Beausoleil First Nation is in Cedar Point, Ontario (434 km) • Alderville First Nation is in the south side of Rice Lake near Roseneath in Peterborough County, Ontario (296 km) • Curve Lake First Nation is based out of two islands and a peninsula in Buckhorn Lake, 15 km north of Peterborough, Ontario (261 km) • Chippewas of Georgina Island First Nation is in three islands in the south-eastern portion of Lake Simcoe adjacent to the Regional Municipality of York, Ontario (332 km) • Chippewas of Rama First Nation is an Anishinaabe (Ojibway) First Nation located 90 minutes north of Toronto, on approximately 2,500 acres of interspersed land on the eastern shore	• June 2018 agreement between WTFN and Ontario and Canada reaffirmed WTFN treaties boundaries and Aboriginal rights in the project area

First Nation and Métis Community or Group	Location and Approximate distance to Chalk River site	Identification Rationale
	of Lake Couchiching within the township of Ramara, Ontario (367 km) • The Mississaugas of Scugog Island First Nation is in Scugog Island in Lake Scugog adjacent to the Regional Municipality of Durham, Ontario (344 km)	
Union of Ontario Indians	N/A	Umbrella organization that has members with potentially affected rights
Algonquin Nation Secretariat	N/A	Umbrella organization that has members with potentially affected rights

4.4. Project Proximity to Federal Lands

The Department of National Defence Garrison Petawawa is adjacent to the Chalk River Laboratories property, which is Federal land owned by AECL. The Garrison Petawawa property boundary is located approximately 2 km from candidate Site C and even further from Sites A and B.

5. Federal Involvement

Federal authorities are not providing financial support to the Project.

The Project will be undertaken on Federal lands (CRL property). GFP will enter into a formal agreement with Atomic Energy of Canada (AECL), the Crown corporation that owns the property, to use a suitable parcel of the CRL site for the Project, as the Project's site.

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

- Canadian Nuclear Safety Commission: Licence to Prepare Site, Licence to Construct, Licence to Operate, Licence to Decommission, Licence to Abandon.
- Environment and Climate Change Canada:
  - A permit from Environment and Climate Change Canada may be required under the *Species at Risk Act* (SARA S73).

6. Environmental Effects

6.1. Physical and Biological Setting – CRL Site

This subsection provides information about the physical and biological setting of the CRL site. Located within the CRL site, any of the MMR Project candidate sites will be bounded by the CRL site characteristics, and each Project candidate site is expected to have a sub-set of those characteristics. It is foreseen that an initial assessment to determine the Valued Components for the potential candidate sites would be conducted before the preferred/final Project site is selected. If necessary, once the preferred Project site is selected, further biodiversity studies will be performed to support relevant components of the Environmental Impact Statement.

6.1.1. Geology

Unconsolidated sediments of thickness 10 to 20 metre bedrock cover 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.

6.1.2. Hydrology

The Ottawa River is the dominant drainage feature in the area. All surface drainage on the CRL site ultimately drains to the Ottawa River. 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 as related to Sites A, B, and C are shown in Exhibit 2-3. The CRL site contains several small drainage basins that drain directly to the Ottawa River or to smaller lakes and streams on CRL site, which in turn drain to the Ottawa River.

6.1.3. Terrestrial Biota

The CRL property supports a diverse mix of upland and wetland habitats. Many 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 typical for a boreal region in Ontario.

6.1.4. Aquatic Biota

The CRL site is located in the Allumette Lake and Lac Coulonge 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 supports diverse fish communities consisting of at least 55 documented species. Typical catches from the river include Walleye, Northern Pike, Channel Catfish and Small Mouth Bass. 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.

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.

6.2. Potential Changes to the Environment by the Project

Section 3.5 provides information about the Project’s activities throughout its life cycle, section 3.6 provides information about waste generation and its management throughout the Project life cycle, and sections 4 and 6.1 provide information about the Project’s location and physical and biological setting.

This section identifies the potential interactions between the MMR facility activities and the environment and the likely effects on the environment. The Project works and activities previously described in this document will, to a greater or lesser extent, lead to interactions with the existing environment in and around the Project’s site. The potential interactions as currently understood by GFP and its supporting partners’ specialists are estimated to be similar to some extent with site preparations and construction of facilities that have similar layout and building sizes, and to other operating facilities with similar nuclear power production capacity. There will also be some differences as further noted below.

During the Project’s site preparation and construction of the facility, the greatest potential for changes is to the terrestrial environment primarily as a result of the

excavation necessary to prepare the Project site for the main structures associated with the facility and the temporary soil stockpiling on the site. However, it has been previously noted in this document the relatively small size of the facility's layout and buildings, which would result in a relatively small terrestrial impact.

Related to construction, there are short-term changes that are typical of construction projects, such as dust and sediment generation, local increases in noise and reduced air quality during construction. However, it has been previously noted in this document, the modular construction techniques that will be employed for this project and the consequently small duration of the construction period. This will result in lower effects in terms of dust, sediment, noise generation and air quality compared to current conventional nuclear power plant technologies with longer construction durations and conventional construction techniques. Construction best practices, such as storm water management systems and waste management programs, will be implemented to minimize these effects. Any hazardous wastes generated during Project site preparation and construction will be managed in accordance with applicable requirements. Activities associated with Project site preparation and construction will lead to some increased employment; at the same time, required work forces during the modular construction of the facility are not as large such they would strain local housing resources or municipal services.

During the facility operation, including maintenance activities, the interactions with the environment are more limited and associated with the very small exposure of workers, the environment around the plant, and to members of the public to radiation. Radiological accidents and malfunctions are also identified as a potential source of releases. However, the MMR technology's inherent safety characteristics and innovative novel features contribute to enhanced safety (lower radiological effects and consequences) compared to current conventional nuclear power plant technologies. Further mitigating actions, many of which are well established in the nuclear industry throughout the world, will be identified to off-set or minimize the potential harm to the environment associated with the operation of the facility.

The effects on the environment during the decommissioning activities are expected to be in many aspects less than those during the Project site preparation, construction and operation activities. For example, levels of dust, noise and reduced air quality are expected to be lower than during Project site preparation and construction, and levels of radiological effects are expected to be lower than during operation and maintenance. The potential effects of transporting the used fuel from the facility to the final repository will be assessed, and ample experience

exists with packaging and transportation of used fuel. As the design for NWMO final repository (APM-DGR) reaches finalization, the NWMO will confirm whether the design of the containers may require any optimization or adaptation to safely contain and isolate the MMR fuel while also meeting regulatory requirements.

Further information on the potential effects on the fish and fish habitat, on aquatic species at risk, and on migratory birds is provided in the following sub-sections.

6.2.1. Fish, Fish Habitat and Aquatic Species

No lakes or streams are found within any of the three Project candidate sites, therefore no fish habitat is present within each candidate site. The project could, however, impact fish or fish habitat in nearby waterbodies due to the release of effluents. The nearest water bodies to the three Project candidate sites are listed below:

- The nearest water body to Site A is “No Name” lake
- The nearest water body to Sites B and C is the Ottawa River

The Environmental Assessment under CEAA 2012 will assess the potential impacts on fish, fish habitat and aquatic species as the design of the facility evolves to identify potential releases and ensure these are within acceptable limits.

6.2.2. Migratory Birds

During Project 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 (April 8 to August 28).

6.2.3. Aquatic Species at Risk

A total of 25 species at risk listed in the *Species at Risk Act* or proposed under the Committee on the Status of Endangered Wildlife in Canada have been confirmed at CRL site including various turtle species (including the Blanding’s Turtle), several forest songbirds and mammals (including three bat species). Endangered means a wildlife species that is facing imminent extirpation or extinction. Threatened species are those likely to become endangered if limiting factors are not reversed. Species of Special Concern are those that have characteristics that make them particularly sensitive to human activities or natural events.

The species at risk in the Ottawa River include:

- River Redhorse and Brook Lamprey, which are listed under the Schedule 1 of the *Species at Risk Act* 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 threatened species by the Committee on the Status of Endangered Wildlife in Canada. Both species are listed on the *Endangered Species Act of Ontario* (American Eel as Endangered and the Lake Sturgeon as Threatened).

6.2.4. 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.

6.3. Effects on Indigenous Peoples

The Project is proposed at the CRL location currently managed by CNL, who identified in its Long-Term Strategy its vision of siting a new Small Modular Reactor (SMR) by 2026. In April 2018, CNL issued a public invitation seeking proponents of SMR demonstration projects to participate in the evaluation process for the construction and operation of an SMR at a CNL-managed site. CNL, as the organization leading the process, had initial accountability for all communications and engagement with Indigenous communities, stakeholders and the general public. Due to the nature of the selection process, GFP was not able to publicly discuss its involvement, except with stakeholders directly involved in the commercial review process.

On February 15, 2019, CNL announced that GFP's proposal had advanced to Stage 3 of the review process. That milestone, along with the submission of the Project Description, signaled the opportunity for GFP to begin fulsome Indigenous engagement. As such, GFP has begun Indigenous engagement activities that meet the requirements outlined in CNSC REGDOC-3.2.2 [5].

GFP will seek early and meaningful engagement with Indigenous communities including the sharing of expertise and information, discussion of potential design inputs, areas of concern and mitigation measures for any potential impact the

Project may have on the communities. The received inputs will help inform the Project.

GFP intends to coordinate engagement activities as much as possible with the CNSC and other government organizations, as applicable.

7. Summary

Global First Power (GFP), the Project proponent, is proposing a Small Modular Reactor (SMR) Project using MMR technology and having it sited on the Chalk River Laboratories (CRL) property. The CRL property is located in Renfrew County, Ontario, on the shore of the Ottawa River, approximately 200 km northwest of Ottawa. The CRL site has a total area of approximately 4,000 hectares and is situated within the boundaries of the Corporation of the Town of Deep River, Ontario.

The proposed Project will involve site preparation, construction, operation, and decommissioning of one MMR nuclear reactor and supporting infrastructure on a Project site within the CRL property. The main physical works related to the Project are a Nuclear Plant, which includes an MMR High Temperature Gas-cooled Reactor (HTGR) that will provide approximately 15 MWt of process heat to a (non-nuclear) Adjacent Plant via molten salt, as well as all the equipment required to transport the heat from the reactor, support the operation of the plant and ensure the safety of the facility. The process heat will be used in the Adjacent Plant to generate electrical power and/or heat that could be used by CRL, or electrical power to the area grid, over an anticipated life span of 20 years.

If an agreement with Atomic Energy of Canada (AECL) and Canadian Nuclear Laboratories (CNL) can be reached, it is envisaged that the Project could replace most of the greenhouse gas emitting heat and power sources currently employed on the CRL site with the new MMR technology clean and reliable energy source. It would also enhance the power and heat source reliability at the CRL site during interruptions in grid power supply due to failures induced by local harsh weather conditions.

The Project will support and have access to the strong local research community. It will enhance the research and skilled workers community locally and will contribute to CNL's Long-Term Strategy for siting an SMR by 2026 and position itself as a global hub in SMR technology development support.

A Project site selection process was initiated through a feasibility study and three candidate sites have been identified amongst ten suitable sites on the CRL property. At the conclusion of the Project site selection process, one site will be selected for the Project's implementation.

No lakes or streams are found within any of the three Project candidate sites, therefore no fish habitat is present within each site. The Environmental Assessment under the *Canadian Environmental Assessment Act*, 2012, (CEAA 2012) will assess

the potential impacts on fish, fish habitat and aquatic species as the design of the facility evolves to identify potential releases and ensure these are within acceptable limits. During Project 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 (April 8 to August 28).

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.

The Project will be undertaken on Federal lands (CRL property). GFP will enter into a formal agreement with AECL, the Crown corporation that owns the property, to use a suitable parcel of the CRL site for the Project, as the Project's site.

The proposed Project qualifies as a Designated Project per section 35 of the CEAA 2012 Regulations Designating Physical Activities (SOR/2012-147 [3]), specifically as it relates to "The construction, operation and decommissioning of a new nuclear fission or fusion reactor". These Regulations identify the Canadian Nuclear Safety Commission (CNSC) as the Responsible Authority for projects of this type.

8. References

[1] *Canadian Environmental Assessment Act*, 2012, S.C. 2012, c. 19, s. 52.

[2] CEAA 2012 Regulations, "Prescribed Information for the Description of a Designated Project", SOR/2012-148.

[3] CNSC, REGDOC-3.2.1. "Public Information and Disclosure", May 2018.

[4] CEAA 2012 Regulations, "Designating Physical Activities", SOR/2012-147.

[5] CNSC, REGDOC-3.2.2, "Aboriginal Engagement", February 2016.

9. Appendices

9.1. Appendix A: Ontario Land Registry Proof of Land Ownership

Ontario ServiceOntario

LAND REGISTRY OFFICE #49

PARCEL REGISTER (ABBREVIATED) FOR PROPERTY IDENTIFIER

57074-0021 (LT)

PAGE 1 OF 2
PREPARED FOR Vetta123
ON 2019/05/21 AT 16:10:13

* CERTIFIED IN ACCORDANCE WITH THE LAND TITLES ACT * SUBJECT TO RESERVATIONS IN CROWN GRANT *

PROPERTY DESCRIPTION: LTS 21 TO 38 RANGE A BUCHANAN; LTS 21 TO 38 RANGE B BUCHANAN; LTS 6 TO 16 CON 9 BUCHANAN; LTS 6 TO 8 & 10 TO 13 CON 10 BUCHANAN; LTS 6 TO 12 CON 11 BUCHANAN; LTS 6 TO 9 CON 12 BUCHANAN; LTS 6 TO 8 CON 13 BUCHANAN; SHORE RDAL ALONG THE OTTAWA RIVER BUCHANAN; SHORE RDAL ALONG LOWER BASS LAKE BUCHANAN; SHORE RDAL ALONG CLEAR LAKE BUCHANAN; SHORE RDAL ALONG MASCULONGE LAKE BUCHANAN AKA MASKINONGE LAKE; MASCULONGE LAKE BUCHANAN AKA MASKINONGE LAKE; CLEAR LAKE BUCHANAN; LOWER BASS LAKE BUC HANAN; RDAL BTN CON 8&9 BUCHANAN; RDAL BTN CON 10&11 BUCHANAN; RDAL BTN CON 12&13 BUCHANAN; RDAL BTN RANGE A&B BUCHANAN AKA PEMBROKE AND MATTAWA RD; RDAL BTN LT 10&11 BUCHANAN CON 10&11; RDAL BTN LT 20&21 BUC HANAN RANGE A&B; RDAL BTN LT 22&23 BUCHANAN RANGE A&B; RDAL BTN LT 27&28 BUCHANAN RANGE A&B; RDAL BTN LT 32&33 BUCHANAN RANGE A&B; RDAL BTN LT 37&38 BUCHANAN RANGE A&B; RDAL FROM CON 8 TO 15 AND ALONG S/S OF LT 23 TO 38, RANGE A BUCHANAN, ALL BEING AS IN BC1853 (FIRSTLY) & BC1872 (FIRSTLY) LYING N OF THE SLY LIMIT OF THE RDAL BTN CON 8&9; TOWN OF DEEP RIVER

PROPERTY REMARKS: CORRECTION: INSTRUMENT NUMBER BC1853 WAS OMITTED FROM THIS PROPERTY IN ERROR AND WAS ADDED AND CERTIFIED ON 1999/08/13 BY LAND REGISTRY OFFICE.
CORRECTION: INSTRUMENT NUMBER BC1872 WAS OMITTED FROM THIS PROPERTY IN ERROR AND WAS ADDED AND CERTIFIED ON 1999/08/13 BY LAND REGISTRY OFFICE.

ESTATE/QUALIFIER: FEE SIMPLE LT CONVERSION QUALIFIED

RECENTLY: FIRST CONVERSION FROM BOOK

PIN CREATION DATE: 1999/08/09

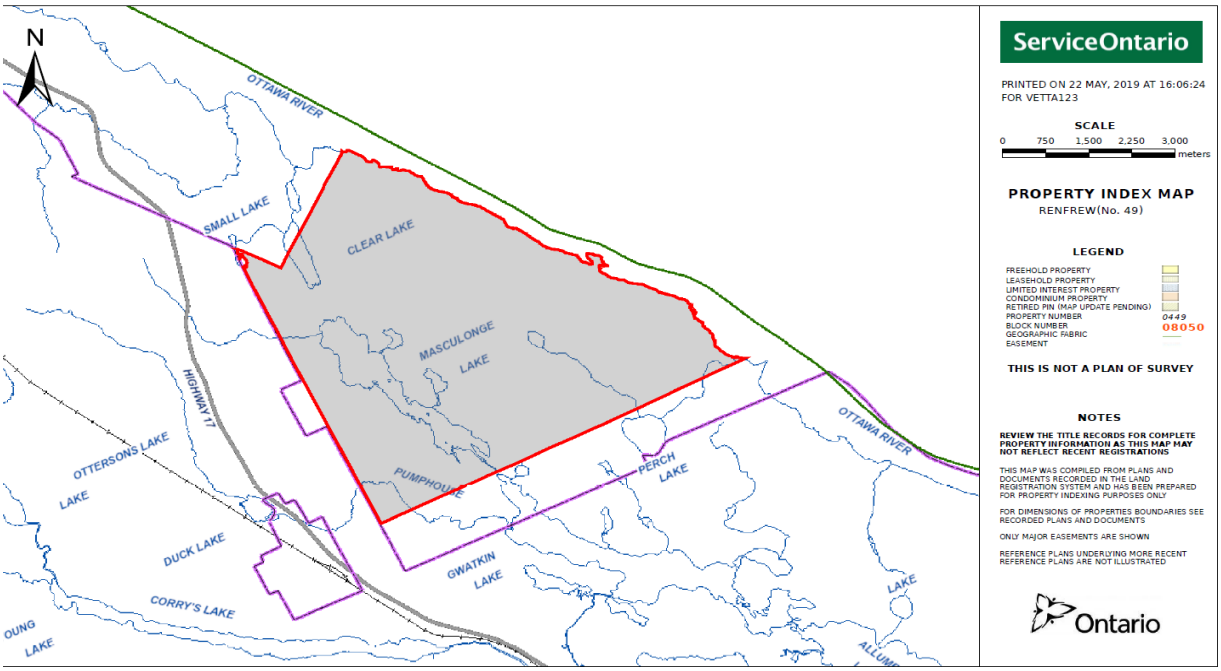
OWNERS' NAMES: ATOMIC ENERGY OF CANADA LIMITED

CAPACITY: BENO

SHARE:

REG. NUM.	DATE	INSTRUMENT TYPE	AMOUNT	PARTIES FROM	PARTIES TO	CERT/ CHKD
EFFECTIVE 2000/07/29 THE NOTATION OF THE "BLOCK IMPLEMENTATION DATE" OF 1999/08/09 ON THIS PIN						
WAS REPLACED WITH THE "PIN CREATION DATE" OF 1999/08/09						
** PRINTOUT INCLUDES ALL DOCUMENT TYPES (DELETED INSTRUMENTS NOT INCLUDED) **						
**SUBJECT, ON FIRST REGISTRATION UNDER THE LAND TITLES ACT, TO:						
**	SUBSECTION 44(1) OF THE LAND TITLES ACT, EXCEPT PARAGRAPH 11, PARAGRAPH 14, PROVINCIAL SUCCESSION DUTIES *					
**	AND ESCHEATS OR FORFEITURE TO THE CROWN.					
**	THE RIGHTS OF ANY PERSON WHO WOULD, BUT FOR THE LAND TITLES ACT, BE ENTITLED TO THE LAND OR ANY PART OF					
**	IT THROUGH LENGTH OF ADVERSE POSSESSION, PRESCRIPTION, MISDESCRIPTION OR BOUNDARIES SETTLED BY					
**	CONVENTION.					
**	ANY LEASE TO WHICH THE SUBSECTION 70(2) OF THE REGISTRY ACT APPLIES.					
**DATE OF CONVERSION TO LAND TITLES: 1999/08/09 **						
BC1853	1955/05/18	TRANSFER			ATOMIC ENERGY OF CANADA LIMITED	C
BC1872	1955/08/17	TRANSFER			ATOMIC ENERGY OF CANADA LIMITED	C
R46063	1960/06/02	LIEN		MARKUS AND SON LIMITED	ATOMIC ENERGY OF CANADA LIMITED	C
	REMARKS: MECHANICS'					
R203784	1980/05/08	CERTIFICATE		CORPORATION OF THE TOWN OF DEEP RIVER		C
	REMARKS: SKETCH ATTACHED					

NOTE: ADJOINING PROPERTIES SHOULD BE INVESTIGATED TO ASCERTAIN DESCRIPTIVE INCONSISTENCIES, IF ANY, WITH DESCRIPTION REPRESENTED FOR THIS PROPERTY.
NOTE: ENSURE THAT YOUR PRINTOUT STATES THE TOTAL NUMBER OF PAGES AND THAT YOU HAVE PICKED THEM ALL UP.



Ontario ServiceOntario

PARCEL REGISTER (ABBREVIATED) FOR PROPERTY IDENTIFIER

LAND REGISTRY OFFICE #49 — 57075-0003 (LT)

PAGE 1 OF 1
PREPARED FOR Vetta123
ON 2019/05/21 AT 16:01:31

* CERTIFIED IN ACCORDANCE WITH THE LAND TITLES ACT * SUBJECT TO RESERVATIONS IN CROWN GRANT *

PROPERTY DESCRIPTION: LT 6 CON 8 BUCHANAN; LT 7 CON 8 BUCHANAN; LT 8 CON 8 BUCHANAN; LT 9 CON 8 BUCHANAN; LT 10 CON 8 BUCHANAN; LT 11 CON 8 BUCHANAN; LT 12 CON 8 BUCHANAN; LT 13 CON 8 BUCHANAN; LT 14 CON 8 BUCHANAN; LT 15 CON 8 BUCHANAN; LT 16 CON 8 BUCHANAN; PT LT 17 CON 7 BUCHANAN AS IN BC1853; LT 19 RANGE A BUCHANAN; LT 20 RANGE A BUCHANAN; LT 19 RANGE B BUCHANAN; LT 20 RANGE B BUCHANAN; PERCH LAKE BUCHANAN; STURGEON LAKE BUCHANAN AKA CHALK LAKE LYING N OF THE ELY EXT OF THE SLY LIMIT OF LT 10 CON 8; SHORE RDAL ALONG THE OTTAWA RIVER AND/OR CHALK BAY BUCHANAN LYING S OF THE ELY EXT OF THE SLY LIMIT OF THE RDAL BTN LT 20&21 RANGE B & N OF THE ELY EXT OF THE SLY LIMIT OF LT 19 RANGE B; RDAL BTN LT 10&11 BUCHANAN LYING S OF THE ELY EXT OF SLY LIMIT OF THE RDAL BTN CON 8 & 9 & N OF THE ELY EXT OF THE SLY LIMIT OF LT 10, CON 8; RDAL BTN LT 15&16 BUCHANAN LYING S OF THE ELY EXT OF THE SLY LIMIT OF THE RDAL BTN CON 8 & 9 & N OF THE ELY EXT OF THE SLY LIMIT OF LT 15 CON 8; RDAL BTN RANGE A&B BUCHANAN LYING S OF THE ELY EXT OF THE SLY LIMIT OF THE RDAL BTN CON 8 & 9 & N OF THE ELY EXT OF THE SLY LIMIT OF LT 19 RANGE A; SHORE RDAL ALONG S SHORE OF STURGEON LAKE BUCHANAN; SHORE RDAL ALONG N SHORE OF STURGEON LAKE BUCHANAN ALL LYING N OF THE SLY LIMIT OF LT 11&12 CON 8 ; TOWN OF DEEP RIVER

PROPERTY REMARKS:

ESTATE/QUALIFIER: FEE SIMPLE
LT CONVERSION QUALIFIED

RECENTLY: FIRST CONVERSION FROM BOOK

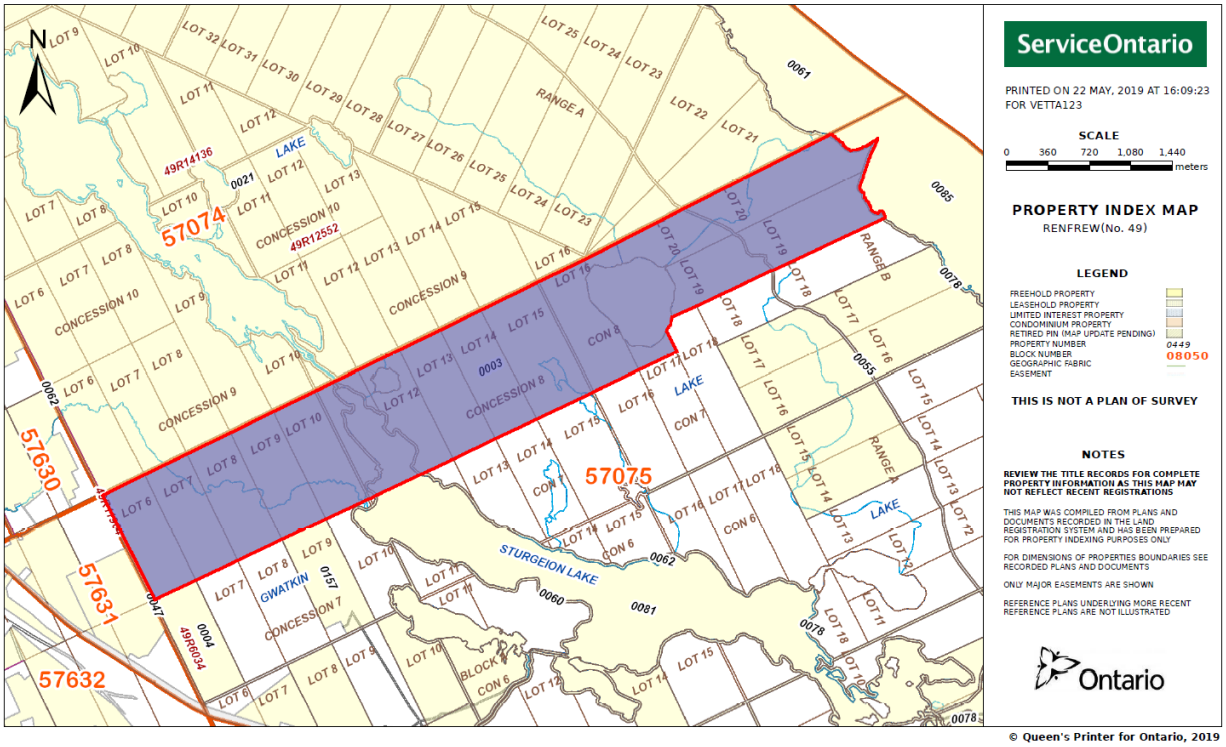
PIN CREATION DATE: 1999/08/09

OWNERS' NAMES: ATOMIC ENERGY OF CANADA LIMITED

CAPACITY: BENO — SHARE

REG. NUM.	DATE	INSTRUMENT TYPE	AMOUNT	PARTIES FROM	PARTIES TO	CERT/ CHKD
EFFECTIVE 2000/07/28 THE NOTATION OF THE "BLOCK IMPLEMENTATION DATE" OF 1999/08/09 ON THIS PIN						
WAS REPLACED WITH THE "PIN CREATION DATE" OF 1999/08/09						
** PRINTOUT INCLUDES ALL DOCUMENT TYPES (DELETED INSTRUMENTS NOT INCLUDED) **						
**SUBJECT, ON FIRST REGISTRATION UNDER THE LAND TITLES ACT, TO						
**	SUBSECTION 44(1) OF THE LAND TITLES ACT, EXCEPT PARAGRAPH 11, PARAGRAPH 14, PROVINCIAL SUCCESSION DUTIES *					
**	AND ESCHEATS OR FORFEITURE TO THE CROWN.					
**	THE RIGHTS OF ANY PERSON WHO WOULD, BUT FOR THE LAND TITLES ACT, BE ENTITLED TO THE LAND OR ANY PART OF					
**	IT THROUGH LENGTH OF ADVERSE POSSESSION, PRESCRIPTION, MISDESCRIPTION OR BOUNDARIES SETTLED BY					
**	CONVENTION.					
**	ANY LEASE TO WHICH THE SUBSECTION 70(2) OF THE REGISTRY ACT APPLIES.					
**DATE OF CONVERSION TO LAND TITLES: 1999/08/09 **						
BC1853	1955/05/18	TRANSFER			ATOMIC ENERGY OF CANADA LIMITED	C
BC1872	1955/08/17	TRANSFER			ATOMIC ENERGY OF CANADA LIMITED	C

NOTE: ADJOINING PROPERTIES SHOULD BE INVESTIGATED TO ASCERTAIN DESCRIPTIVE INCONSISTENCIES, IF ANY, WITH DESCRIPTION REPRESENTED FOR THIS PROPERTY.
NOTE: ENSURE THAT YOUR PRINTOUT STATES THE TOTAL NUMBER OF PAGES AND THAT YOU HAVE PICKED THEM ALL UP.



9.2. Appendix B: Treasury Board of Canada Proof of Land Ownership

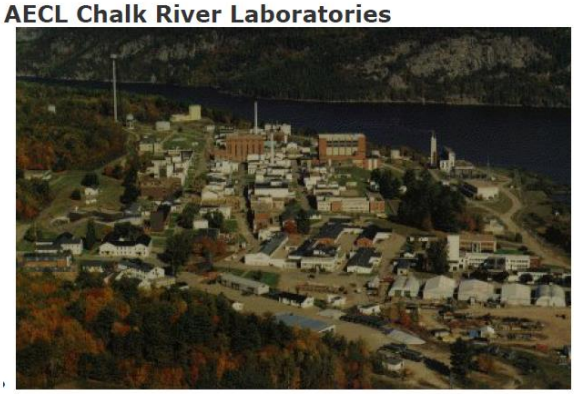
Government of Canada / Gouvernement du Canada

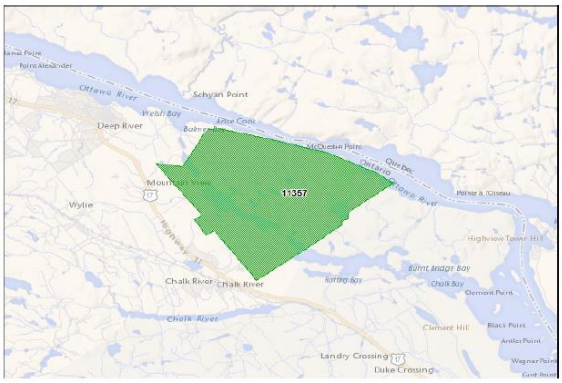
Canada

Treasury Board of Canada Secretariat

Home > OCG > RPM > DFRP > Query #24254553

AECL Chalk River Laboratories





Go to photo album

Summary | Parcels (2) | Buildings (227) | Contaminated Sites (1)

Summary

Property Number:	11357
Custodian:	Atomic Energy of Canada Limited
Official Contact:	Melanie Scheer - 613.584.8811 x 44998
Interest	Crown Owned
Restriction:	No Restriction
Primary Use:	Research and Technological Development
Address:	Chalk River Laboratories
Place Name:	Chalk River
Municipality:	Deep River
Province/Territory:	Ontario
Federal Electoral District:	Renfrew--Nipissing--Pembroke
Coordinates	46.045573, -77.408315, Accurate within ± 200m
Census Classification	Rural
Land Area:	3,778.2500 ha
Building Count:	227
Floor Area:	144,967 sq. m.
Record Created On	July 18th, 1990
Record Last Modified On	May 30th, 2019