Near Surface Disposal Facility

Deep River, Renfrew County, Ontario

ENVIRONMENTAL IMPACT STATEMENT

Volume 3: Appendices

Canadian Nuclear Laboratories

Laboratoires Nucléaires Canadiens

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APPENDIX 1.0-1

Concordance Tables

1.0 TABLE OF CONCORDANCE TO THE CNSC GENERIC EIS GUIDELINES

Section in Generic Guideline	Requirement	Section in the EIS
Part 1	**BACKGROUND**	
1.0	**Introduction**	
	The purpose of this document is to provide information to proponents on the requirements for the preparation of an environmental impact statement (EIS) for a designated project to be assessed pursuant to the Canadian Environmental Assessment Act, 2012 (CEAA 2012). This document specifies the nature, scope and extent of the information required. Part 1 of this document provides guidance and general instruction on the preparation of the EIS, and part 2 outlines the information that must be included in the EIS.	Not Applicable
	Section 5 of the CEAA 2012 requires an assessment of the proposed project's potential environmental effects: 5. (1) For the purposes of this Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are: a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament: i. fish and fish habitat as defined in subsection 2(1) of the *Fisheries Act* ii. aquatic species as defined in subsection 2(1) of the *Species at Risk Act* iii. migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act*, 1994 iv. any other component of the environment that is set out in Schedule 2 b) a change that may be caused to the environment that would occur: i. on federal lands ii. in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out iii. outside Canada c) with respect to Aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on: i. health and socio-economic conditions ii. physical and cultural heritage iii. the current use of lands and resources for traditional purposes iv. any structure, site or thing that is of historical, archaeological paleontological or architectural significance 5. (2) However, if the carrying out of the physical activity, the designated project or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than this Act, the following environmental effects are also to be taken into account: a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on: i. health and socio-economic conditions ii. physical and cultural heritage iii. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance	Not Applicable
	The Canadian Nuclear Safety Commission (CNSC) will use the proponent's EIS and other information received during the environmental assessment (EA) process to prepare an EA report that will inform the issuance of a decision statement by the Commission. Therefore, the EIS must include a full description of the changes the project will cause to the environment that may result in potential effects on areas of federal jurisdiction (i.e., section 5 of the CEAA 2012) – including changes that are directly linked or necessarily incidental to any federal decisions that would permit the project to be carried out. The EIS should also include a list of key mitigation measures that the proponent proposes to undertake in order to avoid or minimize any adverse environmental effects of the project. It is the proponent's responsibility to provide sufficient data and analysis on potential changes to the environment.	Not Applicable

Section in Generic Guideline	Requirement	Section in the EIS
2.0	**Guiding Principles**	
2.1	**Government of Canada Interim Measures**	
	On January 27, 2016, the Minister of Environment and Climate Change Canada and the Minister of Natural Resources Canada announced an interim approach that includes principles and plans for major projects. These principles are the first part of a broader strategy to review and restore confidence in Canada's EA processes. In particular, the Government of Canada has introduced the principle that direct and upstream greenhouse gas emissions linked to the projects under review will be assessed. The proponent is expected to take the necessary steps to provide sufficient information and evidence in accordance with this principle. For more information on assessing greenhouse gas emissions, refer to section 5.1 (part 2).	Section 5.2.2 Greenhouse Gases
2.2	**EA as a Planning Tool**	
	An EA is a planning tool used to ensure that projects are considered in a careful and precautionary manner in order to avoid or mitigate possible environmental effects and to encourage decision makers to take actions that promote sustainable development.	Not Applicable
2.3	**Public Participation**	
	One of the purposes identified in the CEAA 2012 is to ensure opportunities for meaningful public participation during an EA. The CNSC ensures that the public is provided with opportunities to participate in the EA. Meaningful public participation is best achieved when all parties have a clear understanding of the proposed project as early as possible in the review process. The proponent is required to provide current information about the project to the public and especially to the communities likely to be most affected by the project.	Section 4.0 Public and Stakeholder Engagement
2.4	**Aboriginal Engagement**	
	A key objective of the CEAA 2012 is to promote communication and cooperation with Aboriginal peoples, which include First Nations, Inuit and Métis. The proponent is expected to engage with Aboriginal groups that may be affected by the project, as early as possible in the project planning process. The proponent will provide Aboriginal groups with opportunities to learn about the project and its potential effects, to communicate their concerns about the project's potential effects, and to discuss measures to mitigate those effects. The proponent is strongly encouraged to work with Aboriginal groups in establishing an engagement approach that is reasonable to both parties. The proponent will make reasonable efforts to consider traditional Aboriginal knowledge into the assessment of environmental impacts. For more information on considering Aboriginal traditional knowledge, refer to section 3.3.2 (part 1). Information gathered through the EA process and associated engagement by the proponent with Aboriginal groups will be used to inform decisions under the CEAA 2012. In providing information to the CNSC, the proponent will ensure any confidential information shared with them by Aboriginal groups is treated in the appropriate manner. This information will also contribute to the Crown's understanding of any potential adverse impacts of the project on potential or established Aboriginal or Treaty rights and the effectiveness of measures proposed to avoid or minimize those impacts, and will assist the Crown in meeting its duty to consult obligations. The proponent is encouraged to consult the following resources: ▪ REGDOC-3.2.2, Aboriginal Engagement (CNSC); and ▪ Aboriginal and Treaty Rights Information System (Indigenous and Northern Affairs Canada).	Section 6.0 Indigenous Interests
2.5	**Application of the Precautionary Approach**	
	In documenting the analyses included in the EIS, the proponent will demonstrate that all aspects of the project have been examined and planned in a careful and precautionary manner in order to avoid significant adverse environmental effects. The Canadian Privy Council Office's *A Framework for the Application of Precaution in Science-based Decision Making About Risk* (refer to bibliography) sets out guiding principles for the application of precaution to science-based decision making.	All EIS Sections and Appendices

Section in Generic Guideline	Requirement	Section in the EIS
3.0	**Preparation and Presentation of the EIS**	
3.1	**Guidance**	
	The proponent is encouraged to consult the CNSC's draft REGDOC-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures for additional guidance on the preparation of the EIS. The proponent may also consider consulting the relevant EA policy and guidance documents provided on the Canadian Environmental Assessment Agency website. The proponent is further encouraged to consult with the CNSC and, if applicable, other federal authorities, during the planning and development of the EIS and supporting documentation.	All EIS sections and Appendices, see below
3.2	**Study Strategy and Methodology**	
	The proponent is expected to respect the intent of these guidelines and to consider the effects that are likely to arise from the project (including situations not explicitly identified in these guidelines), the technically and economically feasible mitigation measures that will be applied, and the significance of any residual effects. Except where specified by the CNSC, the proponent has the discretion to select the most appropriate methods to compile and present data, information and analysis in the EIS as long as the methods are transparent, justifiable and replicable. These guidelines may include matters that the proponent does not deem relevant or significant to the project. If such matters are omitted from the EIS, the proponent will clearly indicate it and provide a justification so that the CNSC, federal authorities, Aboriginal groups, the public and any other interested party will have an opportunity to comment on this decision. Where the CNSC disagrees with the proponent's decision, it will require the proponent to provide the specified information. The proponent must explain and justify methods used to predict impacts of the project on each valued component (VC) (see section 5.2.1 in part 2 of this document for the definition of valued component). VCs include biophysical and socio-economic components, the interactions among them, and their relationships within the environment. The information presented must be substantiated; in particular, the proponent must describe how the VCs were identified and what methods were used to predict and assess the project's potential adverse environmental effects on these components. The value of a component not only relates to its role in the ecosystem, but also to the value that humans place on it. The culture and way of life of the people using the area affected by the project may be considered VCs themselves. The EIS will also explain and justify methods used to identify mitigation measures and follow-up program elements. The EIS will document how scientific, engineering, traditional and local knowledge were used to reach conclusions. Assumptions will be clearly identified and justified. All data, models and studies will be documented such that the analyses are transparent and reproducible. All data collection methods will be specified. The uncertainty, reliability and sensitivity of models used to reach conclusions must be indicated. The sections in the EIS regarding the existing environment and the potential adverse environmental effects predictions and assessment must be prepared, using best available information and methods, to the highest standards in the relevant subject area. All conclusions must be substantiated. The EIS will identify all significant gaps in knowledge and understanding related to key conclusions, and the steps to be taken by the proponent to address these gaps. Where the conclusions drawn from scientific, engineering and technical knowledge are inconsistent with the conclusions drawn from traditional and local knowledge, the EIS will contain a balanced presentation of the issues and a statement of the proponent's conclusions.	Section 5.1 Environmental Assessment Approach Section 5.2 Atmospheric Environment Section 5.3 Geological and Hydrogeological Environment Section 5.4 Surface Water Section 5.5 Aquatic Environment Section 5.6 Terrestrial Environment Section 5.7 Ambient Radioactivity and Ecological Health Section 5.8 Human Health Section 5.9 Land and Resource Use Section 5.10 Socio-economic Environment Section 6.0 Indigenous Interests
3.3	**Use of Information**	
3.3.1	**Federal Coordination of Information or Knowledge**	
	Section 20 of the CEAA 2012 requires that every federal authority with specialist or expert information, or knowledge with respect to a project subject to an EA, make that information or knowledge available to the CNSC. The CNSC will coordinate the involvement, and notify the proponent, of federal departments and other jurisdictions with expert and specialist knowledge specific to the EA.	Not Applicable

Section in Generic Guideline	Requirement	Section in the EIS
3.3.2	**Community Knowledge and Aboriginal Traditional Knowledge**	
	Subsection 19(3) of the CEAA 2012 states that “the environmental assessment of a designated project may take into account community knowledge and Aboriginal traditional knowledge”. The proponent will consider community and Aboriginal traditional knowledge to which it has access or that is acquired through Aboriginal and public engagement activities, in keeping with appropriate ethical standards and obligations of confidentiality. Agreement should be obtained from Aboriginal groups regarding the use, management and protection of their existing traditional knowledge information during and after the EA. Where community and Aboriginal traditional knowledge has been considered by the proponent, the EIS will document the following: ▪ the traditional knowledge information gathered ▪ how the traditional knowledge information was gathered (e.g., interviews with key community leaders and elders, collaborative field research, Aboriginal traditional knowledge studies, etc.) ▪ the source of the traditional knowledge information ▪ how the traditional knowledge information gathered was taken into consideration by the proponent in the assessment, including both methodology (e.g., identifying VCs, establishing spatial and temporal boundaries, defining significance criteria) and analysis (e.g., baseline characterization, effects prediction, development of mitigation measures)	Section 6.0 Indigenous Interests
3.3.3	**Existing Information**	
	In preparing the EIS, the proponent is encouraged to make use of existing information relevant to the project. When relying on existing information to meet requirements of the EIS guidelines, the proponent will either include the information directly in the EIS or clearly direct the reader to where it may obtain the information (i.e., through cross-referencing). When relying on existing information, the proponent will also comment on how the data were applied to the project, separate factual lines of evidence from inference, and state any limitations on the inferences or conclusions that can be drawn from the existing information.	All EIS Sections and Appendices
3.3.4	**Confidential Information**	
	In implementing the CEAA 2012, the CNSC is committed to promoting public participation in the EA of projects and providing access to the information on which EAs are based. All documents prepared or submitted by the proponent or any other stakeholder in relation to the EA are posted or referenced on the Canadian Environmental Assessment Registry and/or the CNSC’s website and made available to the public upon request. For this reason, the EIS should not contain information that: ▪ is sensitive or confidential (i.e., financial, commercial, scientific, technical, personal, cultural or other nature) in accordance with the Privacy Act and the Access to Information Act, that is treated consistently as confidential, and the person affected has not consented to the disclosure ▪ may cause harm to a person or harm to the environment through its disclosure If the EIS contains information that should be treated as “confidential” or “protected” in accordance with the Privacy Act and the Access to Information Act, the proponent should identify and request to the CNSC that such information be treated accordingly.	All EIS Sections and Appendices

Section in Generic Guideline	Requirement	Section in the EIS
Part 2	**EIS CONTENT AND STRUCTURE** Part 2 of this document provides specific instructions for the content of each section in the EIS. The EIS as a whole must reflect the guiding principles in part 1 of this document.	
1.0	**Presentation and Organization of the EIS**	
	To facilitate the identification of the documents submitted, the title page of the EIS and its related documents will contain the following information: ▪ project name and location ▪ title of the document, including the term “environmental impact statement” ▪ subtitle of the document ▪ proponent name and contact information ▪ date	EIS Cover Page
	The EIS will be written in clear, precise language. A glossary of technical words, acronyms and abbreviations will be included. It will include charts, diagrams, tables, maps and photographs, where appropriate, to clarify the text. Perspective drawings that clearly convey the various components of the project will also be provided. Wherever possible, maps will be presented in common scales and datum to allow for comparison and overlay of mapped features. For purposes of brevity and to avoid repetition, cross-referencing within the EIS is preferred. The EIS may make reference to the information that has already been presented in other sections of the document, rather than repeating it. Detailed studies (including all relevant and supporting data and methodologies) will be provided in separate appendices and will be referenced by appendix, section and page in the text of the main document. The EIS will explain how information is organized in the document. This will include a list of all tables, figures, and photographs referenced in the text. A complete list of supporting literature and references will also be provided. A table of concordance, which cross references the information presented in the EIS with the information requirements identified in the EIS guidelines, will be provided. The proponent will provide copies of the EIS and its summary for distribution, as directed by the CNSC, including paper and electronic version in an unlocked, searchable PDF format.	All EIS Sections and Appendices Appendix 1.0-1 Concordance Tables Section 14.0 Glossary, Acronyms and Units
2.0	**Executive Summary**	
	For efficiency, the proponent may consider preparing a summary of the EIS in both of Canada’s official languages (French and English), which is to be provided to the CNSC at the same time as the EIS. The proponent is also encouraged to consider making the executive summary available in the language(s) spoken by Aboriginal communities in close proximity to the project (e.g., Cree, Dene). The summary will include the following: ▪ a concise description of all key components of the project and related activities ▪ a summary of the consultation conducted with Aboriginal groups, the public, and government agencies, including a summary of the issues raised and the proponent’s responses ▪ an overview of the key environmental effects of the project and proposed technically and economically feasible mitigation measures ▪ the proponent’s conclusions on the residual environmental effects of the project after taking mitigation measures into account and the significance of those effects The summary will be provided as a separate document and will have sufficient details for the reader to learn and understand the project, potential environmental effects, mitigation measures, the significance of the residual effects and follow-up program.	Executive Summary
3.0	**Introduction and Overview**	
3.1	**Project Overview**	
	The EIS will describe the project, key project components and associated activities, scheduling details, the timing of each phase of the project and other key features. If the project is a part of a larger sequence of projects, the EIS will outline the larger context. The overview is to identify the project’s key components, rather than providing a detailed description, which will follow in section 4 (part 2) of this document.	Section 1.1 Project Overview

Section in Generic Guideline	Requirement	Section in the EIS
3.2	**Project Location**	
	The EIS will contain a description of the geographical setting where the project will take place. This description should include those aspects of the project and its setting that are key to understanding the project's potential adverse environmental effects, including: ▪ geographical maps of the project location (at an appropriate scale) including project components, project boundaries of the proposed site with the Universal Transverse Mercator (UTM) coordinates – the lease boundary, site study area, local study area, regional study area, the major existing infrastructure, adjacent land uses and any important environmental features ▪ current land use in the area ▪ distance of the project facilities and components to any federal lands ▪ the environmental significance and value of the geographical setting in which the project will take place and the surrounding area ▪ environmentally sensitive areas, such as national, provincial and regional parks, ecological reserves, wetlands, estuaries, and habitats of federally (Schedule 1 of Species at Risk Act) or provincially listed species at risk and other sensitive areas ▪ description of local and Aboriginal communities ▪ traditional Aboriginal territories, treaty lands, and Indian reserve lands and Métis harvesting regions and/or settlements	Section 1.2 Project Location
3.3	**Regulatory Framework and the Role of Government**	
	The EIS should identify: ▪ the environmental and other regulatory approvals and legislation, including CEAA 2012, that are applicable to the project at the federal, provincial, regional and municipal levels ▪ government policies, resource management plans, planning or study initiatives pertinent to the project and/or EA and their implications ▪ any treaty or self-government agreements with Aboriginal groups that are pertinent to the project and/or EA ▪ any relevant land use plans, land zoning, or community plans ▪ regional, provincial and/or national objectives, standards or guidelines that have been used by the proponent to assist in the evaluation of any predicted environmental effects	Section 1.4 Regulatory Framework Section 5.1 Environmental Assessment Methodology Section 5.2 Atmospheric Environment Section 5.3 Geological and Hydrogeological Environment Section 5.4 Surface Water Section 5.5 Aquatic Environment Section 5.6 Terrestrial Environment Section 5.7 Ambient Radioactivity and Ecological Health Section 5.8 Human Health Section 5.9 Land and Resource Use Section 6.0 Indigenous Interests

Section in Generic Guideline	Requirement	Section in the EIS
4.0	**Project Description**	
4.1	**Purpose of the Project**	
	The EIS will describe the purpose of the project by providing the rationale for the project, explaining the background, the problems or opportunities that the project is intended to satisfy and the stated objectives from the perspective of the proponent. If the objectives of the project are related to broader private or public sector policies, plans or programs, this information should also be included.	Section 2.3 Purpose of the Project
4.2	**Alternative Means of Carrying out the Project**	
	The EIS will identify and consider the effects of alternative means of carrying out the project that are technically and economically feasible as described in appendix A, section A.3.2 Alternative means for carrying out the project, of the CNSC's draft REGDOC-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures. The proponent will complete the following procedural steps for addressing alternative means: ▪ Identify and describe in sufficient detail the alternative means to carry out the project: ▪ develop criteria to determine the technical and economic feasibility of the alternative means ▪ identify those alternative means that are technically and economically feasible ▪ Identify the effects of each technically and economically feasible alternative means: ▪ identify those elements of each alternative means that could produce effects in sufficient detail to allow a comparison with the effects of the project ▪ the effects referred to above include both environmental effects and potential adverse impacts on potential or established Aboriginal and Treaty rights and related interests ▪ Describe the methodology used for the analysis of alternative means and the conclusion reached (i.e., preferred means). For further information regarding the "purpose of" and "alternative means", please consult the Agency's operational policy statement, titled Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012". The CNSC recognizes that projects may be in the early planning stages when the EIS is being prepared. Proponents are strongly encouraged to conduct an environmental effects analysis where they have not made final decisions about the placement of project infrastructure, the technologies to be used, or if several options exist for various project components.	Section 2.5 Alternative Means for Carrying Out the Project
4.3	**Scope of Project**	
	The scope of project for the purposes of the EA includes all the phases, components, activities and federal decisions proposed by the proponent as described in the project description that has been determined to meet the requirements of the Prescribed Information for the Description of a Designated Project Regulations. The CNSC's Commission may also determine that other components and/or activities in relation to the project are to be included in the project scope. The proponent will consider all phases, components, activities and federal decisions identified in the scope of project as part of the effects assessment.	Section 3.0 Project Description
4.3.1	**Project Components**	
	The EIS will describe the project by presenting the project components, associated and ancillary works, and other characteristics that will assist in understanding the environmental effects.	Section 3.1.1 Project Overview
4.3.2	**Project Activities**	
	The EIS will include descriptions of each phase associated with the proposed project. This will include descriptions of the activities to be carried out during each phase, the location of each activity, expected outputs and an indication of the activity's magnitude and scale. Although a complete list of project activities should be provided, the emphasis will be on activities with the greatest potential to have environmental effects. Sufficient information will be included to predict environmental effects and address concerns identified by the public and Aboriginal groups. Highlight activities that involve periods of increased environmental disturbance or the release of materials into the environment. The EIS will include a summary of the changes that have been made to the project since originally proposed, including the benefits of these changes to the environment, Aboriginal peoples, and the public. The EIS will include a schedule including time of year, frequency, and duration for all project activities.	Section 3.1.4 Project Design Changes Section 3.2 Project Phases Section 3.3 Waste Strategy Section 3.4 Project Components and Activities

Section in Generic Guideline	Requirement	Section in the EIS
5.0	**Scope of the Environmental Assessment**	
5.1	**Factors to be Considered**	
	Scoping establishes the EA's parameters and focuses the assessment on relevant issues and concerns. The EA of the designated project must take into account the following factors, as listed in subsection 19(1) of the CEAA 2012: a) the section 5 environmental effects of the designated project (such as changes to fish and fish habitat, aquatic species, migratory birds), including the environmental effects of malfunctions or accidents that may occur in connection with the designated project, and any cumulative environmental effects likely to result from the designated project in combination with other physical activities that have been or will be carried out b) the significance of those environmental effects c) comments from the public that are received in accordance with the CEAA 2012 d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project e) the requirements of the follow-up program in respect of the designated project f) the purpose of the designated project g) alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means h) any changes to the designated project that may be caused by the environment i) the results of any relevant study conducted by a committee established under section 73 or 74 of the CEAA 2012 j) any other matter relevant to the EA that the CNSC requires to be taken into account, in accordance with the Nuclear Safety and Control Act Pursuant to subsection 19(2) of the CEAA 2012, the scope of the factors to be taken into account under paragraphs 19(1)(a), (b), (d), (e), (g), (h) and (j) is determined by the CNSC, as the responsible authority.	Section 2.0 Purpose and Alternative Means Section 3.0 Project Description Section 4.0 Public and Stakeholder Engagement Section 5.1 Environmental Assessment Approach Section 5.2 Atmospheric Environment Section 5.3 Geological and Hydrogeological Environment Section 5.4 Surface Water Section 5.5 Aquatic Environment Section 5.6 Terrestrial Environment Section 5.7 Ambient Radioactivity and Ecological Health Section 5.8 Human Health Section 5.9 Land and Resource Use Section 5.10 Socio-economic Environment Section 6.0 Indigenous Interests Section 7.0 Malfunctions and Accidents Section 8.0 Summary of Cumulative Effects Section 9.0 Summary of Significance of Residual Effects Section 10.0 Effects of the Environment on Project Section 11.0 Monitoring and Follow-up Programs
	To implement the Government of Canada interim measure with respect to upstream greenhouse gas emissions, the CNSC may require consideration of these types of emissions in the scope of the EA. On March 19, 2016, a definition of upstream GHG emissions was published by Environment Canada and Climate Change in the Canada Gazette. The proposed definition of upstream includes "*all industrial activities from the point of resource extraction to the project under review*." The processes that are to be considered as upstream activities will vary by the type of resource and the nature of the project under assessment. In general, upstream activities will include extraction, processing and handling as well as transportation. Where there is a reliable and feasible methodology for calculating upstream greenhouse gas emissions that are linked to the project, the proponent will be required to provide sufficient information to estimate these types of emissions. This information should be presented by individual pollutant and should be summarized in CO2 equivalent units per year. If upstream greenhouse gas emissions are not considered in the assessment, the proponent will provide a rationale in the EIS.	Section 5.2.2 Greenhouse Gases

Section in Generic Guideline	Requirement	Section in the EIS
5.2	**Scope of Factors**	
5.2.1	**Valued Components to be Examined**	
	Valued components (VCs) refer to environmental biophysical or human features that may be impacted by a project. The value of a component not only relates to its role in the ecosystem, but also to the value people place on it. For example, it may have scientific, social, cultural, economic, historical, archaeological or aesthetic importance. The EIS will identify the VCs linked to section 5 of the CEAA 2012, including the ones identified in section 9.2 (part 2) that may be affected by changes in the environment, as well as species at risk and their critical habitat as per the requirement outlined in section 79 of the Species at Risk Act (SARA). Under section 73 of SARA, the Minister of Environment and Climate Change Canada may grant permits authorizing an activity affecting a listed wildlife species or any part of its residence or critical habitat that would otherwise be prohibited. Should the proponent identify a listed wildlife species or any part of its residence or critical habitat that would be affected by the project activities, the proponent should consult directly with the Canadian Wildlife Service as early as possible in the process. The final list of VCs to be presented in the EIS will be completed according to the evolution and design of the project and reflect the knowledge on the environment acquired through public consultation and Aboriginal engagement. The EIS will describe what methods were used to predict and assess the potential adverse environmental effects of the project on these components. The VCs will be described in sufficient detail to allow the reviewer to understand their importance and to assess the potential for environmental effects arising from the project activities. The EIS will provide a rationale for selecting specific VCs and for excluding any VCs or information specified in these guidelines. Challenges with particular exclusions may arise, so it is important to document the information and criteria used to make each determination. Examples of justification include primary data collection, computer modelling, literature references, public consultation, expert input or professional judgement. The EIS will identify those VCs, processes, and interactions that were identified to be of concern during any workshops or meetings held by the proponent, or that the proponent considers likely to be affected by the project. In doing so, the EIS will indicate to whom these concerns are important and the reasons why, including environmental, Aboriginal, social, economic, recreational, and aesthetic considerations. If comments are received on a component that has not been included as a VC, these comments will be summarised and the rationale for excluding the VC will be provided.	Section 5.1.2 Valued Components Section 5.2.1.2 Valued Components – Air Quality Section 5.2.2.2 Valued Components – Greenhouse Gases Section 5.3.1.2 Valued Components – Geology Section 5.3.2.2 Valued Components – Hydrogeology Section 5.4.1.2 Valued Components – Hydrology Section 5.4.2.2 Valued Components – Surface Water Quality Section 5.5.2 Valued Components – Aquatic Environment Section 5.6.2 Valued Components – Terrestrial Environment Section 5.7.2 Valued Components – Ambient Radioactivity and Ecological Health Section 5.8.2 Valued components – Human Health Section 5.9.2 Valued Components – Land and Resource Use Section 5.10.2 Valued Components – Socio-economic Environment Section 6.3 Valued Components – Indigenous Interests

Section in Generic Guideline	Requirement	Section in the EIS
5.2.2	**Spatial and Temporal Boundaries**	
	The spatial and temporal boundaries used in the EA may vary depending on the VC and will be considered separately for each VC. The proponent is encouraged to consult with the CNSC, federal and provincial government departments and agencies, local government and Aboriginal groups, and take into account public comments when defining the spatial boundaries used in the EIS. The EIS will describe the spatial boundaries, including local and regional study areas, of each VC to be used in assessing the potential adverse environmental effects of the project and provide a rationale for each boundary. Spatial boundaries will be defined by taking into account, but not limited to, the following criteria: a) the physical extent of the proposed project, including any off-site facilities or activities b) the extent of aquatic and terrestrial ecosystems potentially affected by the project c) the extent of potential effects arising from noise, light and atmospheric emissions d) the extent to which traditional land use or treaty rights could potentially be affected by the project e) current land and resource use for residential, commercial, industrial, recreational, cultural and aesthetic purposes by communities whose areas include the physical extent of the project f) the size, nature and location of past, present and reasonably foreseeable projects and activities which could interact with items (b), (c), (d) and (e) g) community and Aboriginal traditional knowledge, ecological, and technical considerations The following geographic study areas should serve as the basis for developing project specific and effect-specific study areas: ▪ **Site study area:** The site study area is the project footprint (i.e., where project activities would be undertaken including the project's proposed facilities, buildings and infrastructure). ▪ **Local study area:** The local study area is defined as that area existing outside the site study area boundary, where measurable changes to the environment resulting from the proposed activities from any phase of the project, either through normal activities, or from possible accidents or malfunctions, may be anticipated. The boundaries must change if appropriate following an assessment of the spatial extent of potential effects. The geographic boundary will depend on the factor being considered (e.g., a local study area defined for the aquatic environment will differ from that defined for the atmospheric environment). ▪ **Regional study area:** The regional study area is defined as the area within which the potential effects of this project may interact with the effects of other projects, resulting in the potential for cumulative effects. The geographic boundary for the regional study areas are also specific to the factor being considered. Within the aforementioned study areas, the boundary of concern will extend to a depth that will include the full extent of the surface water and groundwater. The EA's temporal boundaries will span all phases of the project determined to be within the scope of the project as specified under section 4.3 above. If impacts are predicted after project decommissioning, this should be taken into consideration in defining boundaries. At a minimum, the assessment is expected to include the period of time during which the maximum impact is predicted to occur. Community and Aboriginal traditional knowledge should factor into decisions around temporal boundaries. If the temporal boundaries do not span all phases of the project, the EIS will identify the boundaries used and provide a rationale.	Section 5.2.1.3 Assessment Boundaries – Air Quality Section 5.2.2.3 Assessment Boundaries – Greenhouse Gases Section 5.3.1.3 Assessment Boundaries – Geology Section 5.3.2.3 Assessment Boundaries – Hydrogeology Section 5.4.1.3 Assessment Boundaries – Hydrology Section 5.4.2.3 Assessment Boundaries – Surface Water Quality Section 5.5.3 Assessment Boundaries – Aquatic Environment Section 5.6.3 Assessment Boundaries – Terrestrial Environment Section 5.7.3 Assessment Boundaries – Ambient Radioactivity and Ecological Health Section 5.8.3 Assessment Boundaries – Human Health Section 5.9.3 Assessment Boundaries – Land and Resource Use Section 5.10.3 Assessment Boundaries – Socio-economic Environment Section 6.4.3 Assessment Boundaries – Indigenous Traditional Land Use
6.0	**Public and Stakeholder Consultation**	
	In accordance with CNSC's REGDOC-3.2.1 (formerly REGDOC-99.3), Public Information and Disclosure, the EIS will describe the on-going and proposed participation activities that the proponent will undertake or that it has already conducted on the project. It will describe efforts made to distribute project information, as well information and materials that were distributed during the public consultation process. The EIS will indicate the methods used, where the consultation was held, the persons and organizations consulted, the concerns voiced and the extent to which this information was incorporated in the design of the project as well as in the EIS. The EIS will provide a summary of key issues raised related to the Project and its potential environmental effects, as well as describe any outstanding issues and ways to address them.	Section 4.0 Public and Stakeholder Engagement

Section in Generic Guideline	Requirement	Section in the EIS
7.0	**Aboriginal Engagement**	
	In accordance with the CNSC's REGDOC-3.2.2, Aboriginal Engagement, the EIS will describe the proponent's engagement activities with potentially affected Aboriginal groups. The EIS will include, and the proponent should consider engaging with potentially affected Aboriginal groups to obtain their views on, the following: ▪ the objectives of and the methods used for Aboriginal engagement activities ▪ each Aboriginal group's potential or established rights including geographical extent, nature, frequency, timing and maps and data sets (e.g., fish catch numbers) when this information is provided by a group to the proponent or available through public records ▪ comments, specific issues and concerns raised by Aboriginal groups and how the key concerns were responded to or addressed ▪ the potential adverse impacts of the project on potential or established Aboriginal or treaty rights effects of changes to the environment on Aboriginal peoples (health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes) pursuant to paragraph 5(1)(c) of the CEAA 2012 ▪ VCs suggested by Aboriginal groups for inclusion in the EIS, whether they were included, and the rationale for any exclusions ▪ measures identified to mitigate or accommodate potential adverse impacts of the project on the potential or established Aboriginal or treaty rights and effects of changes to the environment on Aboriginal peoples, including suggestions raised by Aboriginal groups A suggested format for providing the information above is the creation of a tracking table of key issues raised by each Aboriginal group, including the concerns raised related to the project, proposed mitigation options, and where appropriate, a reference to the proponent's analysis in the EIS.	Section 6.0 Indigenous Interests

Section in Generic Guideline	Requirement	Section in the EIS
8.0	**Description of the Environment**	
8.1	**Baseline Environment**	
	The EIS will include a description of the environment, including the components of the existing environment and environmental processes, their interrelations and interactions as well as the variability in these components, processes and interactions over time scales appropriate to the EIS. In characterizing the environmental effects of the project, the proponent will consider the current baseline environment and environmental trends within the project area. The description of the existing baseline and the environmental trends should include a consideration of past projects and activities carried out by the proponent and/or others within the project area. Based on the scope of project described in section 4.3 (part 2), the EIS will present baseline information in sufficient detail to enable the identification of how the project could affect the VCs and an analysis of those effects. Should other VCs be identified during the conduct of the EA, the baseline condition for these components will also be described in the EIS. The baseline description should include results from studies done prior to any physical disruption of the environment due to initial project activities (e.g., site preparation). The proponent will use the information in appendix B of the CNSC's draft REGDOC- 2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures to develop the characterization of the baseline environment. If a federal decision (as per section 5(2) of the CEAA 2012) in relation to the project may result in environmental changes such as changes on federal lands, outside the province or Canada, the proponent will use the information in appendix A, section A.3.7, Socio-economic environment, of the CNSC's draft REGDOC-2.9.1, Environmental Protection: *Environmental Policy, Assessments and Protection Measures*, to describe the baseline conditions in relation to these potential changes.	Section 5.1.4 Description of the Existing Environment Section 5.2.1.4 Description of the Environment – Air Quality Section 5.2.2.4 Description of the Environment – Greenhouse Gases Section 5.3.1.4 Description of the Environment – Geology Section 5.3.2.4 Description of the Environment – Hydrogeology Section 5.4.1.4 Description of the Environment – Hydrology Section 5.4.2.4 Description of the Environment – Surface Water Quality Section 5.5.4 Description of the Environment – Aquatic Environment Section 5.6.4 Description of the Environment – Terrestrial Environment Section 5.7.4 Description of the Environment – Ambient Radioactivity and Ecological Health Section 5.8.4 Description of the Environment – Human Health Section 5.9.4 Description of the Environment – Land and Resource Use Section 5.10.4 Description of the Environment – Socio-economic Environment Section 6.4.4 Description of the Environment – Traditional Land and Resource Use

Section in Generic Guideline	Requirement	Section in the EIS
9.0	**Effects Assessment**	
9.1	**Predicted Changes to the Physical Environment**	
	The assessment will include a consideration of the predicted changes to the environment as a result of the project being carried out or as a result of any powers, duties or functions that are to be exercised by the federal government in relation to the project. These predicted changes to the environment are to be considered in relation to each phase of the project (i.e., construction, operation, decommissioning) and are to be described in terms of the following: ▪ magnitude ▪ geographic extent ▪ timing ▪ frequency ▪ duration, ▪ reversibility As changes to various parts of the physical environment may be inter-related as part of an ecosystem, the EIS will explain and describe the connections between the changes described. The proponent will use the information in appendix C of the CNSC's draft REGDOC- 2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures*, to assess the environmental effects of the project.	Section 5.1.8 Residual Effects Analysis Classification and Determination of Significance Section 5.2.1.8 Residual Effects Classification and Determination of Significance – Air Quality Section 5.2.2.8 Residual Effects Classification and Determination of Significance – Greenhouse Gases Section 5.3.2.6 Residual Effects Analysis – Hydrogeology Section 5.4.1.6 Residual Effects Analysis – Hydrology Section 5.4.2.6 Residual Effects Analysis – Surface Water Quality Section 5.6.7 Residual Effects Assessment Results – Terrestrial Environment Section 5.7.8 Residual Effects Classification and Determination of Significance – Ambient Radioactivity and Ecological Health Section 5.8.8 Residual Effects Classification and Determination of Significance - Human Health Section 5.10.8 Residual Effects Classification and Determination of Significance - Socio-economic Environment
9.2	**Predicted Effects on Valued Components**	
	Based on the predicted changes to the environment identified in section 9.1 (part 2) above, the proponent is to assess the environmental effects of the project on the VCs identified as per section 5.2.1 (part 2). Based on the changes to the environment that have been identified in section 9.1 (part 2), additional VCs are to be selected based on the following: ▪ If there is the potential for the project to result in environmental changes on federal lands, another province, or another country, then VCs of importance not already identified above are to be listed in this section. ▪ If federal decisions about the project will lead to an environmental change, then these environmental changes are to be considered standalone VCs. All interconnections between VCs and between changes to multiple VCs will be described.	Section 5.1.6 Residual Effects Analysis Section 5.2.1.6 Residual Effects Analysis – Air Quality Section 5.2.2.6 Residual Effects Analysis – Greenhouse Gases Section 5.3.2.6 Residual Effects Analysis – Hydrogeology Section 5.4.1.6 Residual Effects Analysis – Hydrology Section 5.4.2.6 Residual Effects Analysis – Surface Water Quality Section 5.6.7 Residual Effects Assessment Results – Terrestrial Environment Section 5.7.6 Residual Effects Analysis – Ambient Radioactivity and Ecological Health Section 5.8.6 Residual Effects Analysis – Human Health Section 5.10.6 Residual Effects Analysis – Socio-economic Environment
9.3	**Accidents and Malfunctions**	
	The proponent will use the information in appendix A, section A.3.4, Malfunctions and accidents, of the CNSC's draft REGDOC-2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures*, to assess the potential health and environmental effects from postulated accident and malfunction scenarios.	Section 7.0 Malfunctions and Accidents

Section in Generic Guideline	Requirement	Section in the EIS
9.4	**Cumulative Effects**	
	The proponent will use the information in appendix A, section A.3, Cumulative effects, of the CNSC's draft REGDOC-2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures*, to assess the project's potential cumulative effects.	Section 8.0 Summary of Cumulative Effects
9.5	**Socio-economic Environment**	
	The proponent will use the information in appendix A, section A.3.7, Socio-economic environment, of the CNSC's draft REGDOC-2.9.1, Environmental Protection: *Environmental Policy, Assessments and Protection Measures*, to assess the project's indirect socio-economic effects.	Section 5.10 Socio-economic Environment
9.6	**Effects of the Environment on the Project**	
	The proponent will use the information in appendix A, section A.3.9, Assessment of effects of the environment on the project, of the CNSC's draft REGDOC-2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures*, to assess the effects of the environment on the project (i.e., severe weather events).	Section 10.0 Effects of the Environment on the Project
10.0	**Mitigation Measures**	
	Every EA conducted under the CEAA 2012 will consider measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project. Measures that are technically and economically feasible include application of best industry practices, pollution prevention principles such as best available technology and techniques economically achievable (BATEA), and radiation protection principles such as keeping radiation exposure and doses as low as reasonably achievable (ALARA). Under the CEAA 2012, mitigation includes measures to eliminate, reduce or control the adverse environmental effects of a project, as well as restitution for damages to the environment through replacement, restoration, compensation or other means. Each measure will be specific, achievable, measurable and verifiable, and described in a manner that avoids ambiguity in intent, interpretation and implementation. Mitigation measures may be considered for inclusion as conditions in the EA decision statement and/or in other compliance and enforcement mechanisms provided by other authorities' permitting or licensing processes. As a first step, the proponent is encouraged to use an approach based on the avoidance and reduction of the effect(s) at the source. Such an approach may include the modification of the design of the project or relocation of project components. The EIS will describe the standard mitigation practices, policies and commitments that constitute technically and economically feasible mitigation measures and that will be applied as part of standard practice regardless of location (including the measures directed at mitigating adverse socio-economic effects). The EIS will then describe the project's environmental protection plan and its environmental management system, through which the proponent will deliver this plan. The plan will provide an overall perspective on how potentially adverse effects would be minimized and managed over time. The EIS will further discuss the mechanisms the proponent would use to require its contractors and sub-contractors to comply with these commitments and policies and with auditing and enforcement programs. The EIS will then describe mitigation measures that are specific to each environmental effect identified. Measures will be written as specific commitments that clearly describe how the proponent intends to implement them and the environmental outcome the mitigation is designed to address. The EIS will describe mitigation measures in relation to species and/or critical habitat listed under the Species at Risk Act (SARA). These mitigation measures will be consistent with any SARA permit, applicable recovery strategy and/or action plan. The EIS will specify the actions, works, minimal disturbance footprint techniques, best available technology, corrective measures or additions planned during the project's various phases to eliminate or reduce the significance of potential adverse effects. The impact statement will also present an assessment of the effectiveness of the proposed technically and economically feasible mitigation measures. The reason(s) for determining if the mitigation measure reduces the significance of a potential adverse effect will be made explicit. The proponent is also encouraged to identify mitigation measures for effects that are adverse although not significant. The EIS will indicate what other technically and economically feasible mitigation measures were considered, and explain why they were rejected. Trade-offs between cost savings and effectiveness of the various forms of mitigation will be justified. The EIS will identify who is responsible for the implementation of these measures and the system of accountability. For proposed mitigation measures for which there is little experience or that have questionable effectiveness, the potential environmental risks and effects – should those measures not be effective –will be clearly and concisely described. In addition, the EIS will identify the extent to which technological innovations will help mitigate environmental effects. Where possible, it will provide detailed information on the nature of these measures, their implementation and management and how these are integrated in the follow-up program.	Section 5.1.5 Project Interactions and Mitigation Section 5.2.1.5 Project Interactions and Mitigation – Air Quality Section 5.2.2.5 Project Interactions and Mitigation – Greenhouse Gases Section 5.3.1.5 Project Interactions and Mitigation – Geology Section 5.3.2.5 Project Interactions and Mitigation – Hydrogeology Section 5.4.1.5 Project Interactions and Mitigation – Hydrology Section 5.4.2.5 Project Interactions and Mitigation – Surface Water Quality Section 5.5.5 Project Interactions and Mitigation – Aquatic Environment Section 5.6.5 Project Interactions and Mitigation – Terrestrial Environment Section 5.7.5 Project Interactions and Mitigation – Ambient Radioactivity and Ecological Health Section 5.8.5 Project Interactions and Mitigation – Human Health Section 5.9.5 Project Interactions and Mitigation – Land and Resource Use Section 5.10.5 Project Interactions and Mitigation – Socio-economic Environment Section 6.4.5 Project Interactions and Mitigation – Traditional Land and Resource Use

Section in Generic Guideline	Requirement	Section in the EIS
11.0	**Conclusion on Significance**	
	The proponent will use the guidance and information in appendix A, section A.3.6, Significance of residual effects, of the CNSC's draft REGDOC-2.9.1, *Environmental Protection: Environmental Policy, Assessments and Protection Measures*, for the preparation of this section of the EIS.	Section 9.0 Summary of Significance of Residual Effects
12.0	**Follow-up Program**	
	The proponent will use the guidance and information in appendix A, section A.3.10 EA follow-up program, of CNSC's draft REGDOC-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures for the preparation of this section of the EIS. Where applicable, the proponent will describe how the follow-up program relates to the project's environmental protection plan and environmental management system as mentioned in section 10 above. Environmental assessment effects predictions, assumptions and mitigation actions that are to be tested in the follow-up program must be converted into field-testable monitoring objectives. The monitoring design must include a statistical evaluation of the adequacy of existing baseline data to provide a benchmark for testing project effects, and the need for any additional pre-construction or pre-operational monitoring to establish a firmer project baseline. The proponent will propose a schedule for the follow-up program. The schedule should indicate the timing, frequency and duration of effect monitoring. This schedule would be developed after statistical evaluation of the length of time needed to detect effects given estimated baseline variability, probable environmental effect size and desired level of statistical confidence in the results (type 1 and type 2 errors). The description of the follow-up program will include any contingency procedures or plans or other adaptive management provisions as a means of addressing unforeseen effects, or for correcting exceedances, as required, so as to comply with benchmarks, regulatory standards or guidelines. The follow-up program will describe roles and responsibilities for the program and its review process, by both peers and the public. The EIS should provide discussion on the follow-up program's requirements, and include: ▪ objectives and structure of the follow-up program and the VCs targeted by the program ▪ tabular summary and explanatory text of the main components of the program including: ▪ a description of each monitoring activity under that component ▪ which of the two generic program objectives the activity is relevant to (e.g., verify EA predictions, determine effectiveness of mitigation measures) ▪ the specific statement from the EA that goes along with that generic objective and will be the focus for that activity (e.g., program objective: verify predicted effects; environmental assessment effect: no potential adverse effects) ▪ the specific monitoring objective for that activity ▪ planned schedule ▪ roles and responsibilities to be played by the proponent, regulatory agencies, Aboriginal people, local and regional organizations and others in the design, implementation and evaluation of the program results ▪ possible involvement of independent researchers ▪ program funding sources ▪ information management and reporting (reporting frequency, methods and format) ▪ possible opportunities for the proponent to include the participation of the public and Aboriginal groups, during the development and implementation of the program The follow-up program plan should be sufficiently described in the EIS to allow independent judgment as to the likelihood that it will deliver the type, quantity and quality of information required to reliably verify predicted effects (or absence of them) and confirm the effectiveness of mitigation measures.	Section 5.1.9 Monitoring and Follow-up Section 5.2.1.9 Monitoring and Follow-up – Air Quality Section 5.2.2.9 Monitoring and Follow-up – Greenhouse Gases Section 5.3.1.6 Monitoring and Follow-up – Geology Section 5.3.2.8 Monitoring and Follow-up – Hydrogeology Section 5.4.1.8 Monitoring and Follow-up – Hydrology Section 5.4.2.9 Monitoring and Follow-up – Surface Water Quality Section 5.5.6 Monitoring and Follow-up – Aquatic Environment Section 5.6.8 Monitoring and Follow-up – Terrestrial Environment Section 5.7.9 Monitoring and Follow-up – Ambient Radioactivity and Ecological Health Section 5.8.9 Monitoring and Follow-up – Human Health Section 5.9.6 Monitoring and Follow-up – Land and Resource Use Section 5.10.9 Monitoring and Follow-up – Socio-economic Environment Section 6.4.6 Monitoring and Follow-up – Traditional Land and Resource Use Section 11.0 Monitoring and Follow-up Programs

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2.0 TABLE OF CONCORDANCE TO THE CNSC REGDOC 2.9.1 ENVIRONMENTAL POLICY, ASSESSMENTS, AND PROTECTION MEASURES

Section in REGDOC 2.9.1	Requirement	Section in the EIS
Appendix A	**Environmental Assessments under the Canadian Environmental Assessment Act, 2012**	
A.3	**Specific CEAA 2012 Environmental Assessment Requirements**	
	Where the information is common to both the EIS and the licence application, the applicant may provide the information in either the application or the EIS, with appropriate cross-referencing between the submissions. The applicant shall clearly indicate where the requirements of both the NSCA and CEAA 2012 are addressed. The EA of a designated project shall take into account the following factors as listed in subsection 19(1) of CEAA 2012: ▪ the environmental effects of the designated project, including the environmental effects of malfunctions or accidents that may occur in connection with the designated project and any cumulative environmental effects that are likely results from the designated project in combination with other physical activities that have been or will be carried out ▪ the significance of those environmental effects ▪ comments from the public that are received in accordance with CEAA 2012 ▪ mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project ▪ the requirements of the follow-up program in respect of the designated project ▪ the purpose of the designated project ▪ alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means ▪ any changes to the designated project that may be caused by the environment ▪ the results of any relevant study conducted by a committee established under section 73 or 74 of CEAA 2012 ▪ any other matter relevant to the EA that the responsible authority requires to be taken into account The EIS and supporting technical studies are completed to meet the requirements of CEAA 2012, paragraphs 19(1)(*a*), (*b*), (*d*), (*e*), (*f*), (*g*), (*h*) and, if appropriate, (*i*) and (*j*) in accordance with the scope of these factors as determined by the CNSC. The completion of the EIS and, as necessary, supporting technical studies is typically delegated to the applicant in accordance with section 23 of CEAA 2012. This regulatory document provides requirements and guidance to support project planning and early development of these documents by the applicant. These requirements and guidance do not negate the importance of pre-project consultation or the potential for project-specific EA guidelines.	All EIS Sections and Appendices
A.3.1	**Purpose of the Project**	
	Paragraph 19(1)(*f*) of CEAA 2012 states that the EIS shall identify the purpose of the project (defined as what is to be achieved by carrying out the project). For additional information, see Addressing “Purpose of” and “Alternative Means” under the Canadian Environmental Assessment Act, 2012 [17].	Section 2.3 Purpose of the Project
A.3.2	**Alternative Means for Carrying out the Project**	
	Paragraph 19(1)(*g*) of CEAA 2012 states that the EIS shall identify and describe alternative means to carry out the project that are, from the perspective of the applicant, technically and economically feasible. As identified by the proponent, the alternative means include options for locations, development, and implementation methods, routes, designs, technologies, mitigation measures, and so on. Alternative means may also be related to the construction, operation, expansion, decommissioning and abandonment of a physical work. The approach and level of effort applied to addressing alternative means is established on a project-by-project basis taking into consideration: ▪ the characteristics of the project ▪ the environmental effects associated with the potential alternative means ▪ the health or status of valued components (VCs) that may be impacted by the alternative means ▪ the potential for mitigation and the extent to which mitigation measures may address potential environmental effects ▪ the level of concern expressed by the public and Aboriginal groups The EIS should also describe the environmental effects of each alternative means. The criteria used to identify alternative means as unacceptable, and how these criteria were applied, should be described, as should the criteria used to examine the environmental effects of each remaining alternative means to identify the preferred alternative. For further guidance, consult *Addressing* *“Purpose of” and “Alternative Means” under the Canadian Environmental Assessment Act, 2012* [17].	Section 2.5 Alternative Means for Carrying Out the Project

Section in REGDOC 2.9.1	Requirement	Section in the EIS
A.3.3	**Environmental Effects**	
	Paragraph 19(1)(a) of CEAA 2012 states that the EA must take into account the environmental effects of the designated project. The environmental effects that must be considered in an EA under CEAA 2012 are also requirements under the NSCA. As described in section 4, the applicant should conduct an ERA in accordance with CSA 288.6, Environmental risk assessment at Class I nuclear facilities and uranium mines and mills [6].	Section 5.1 Environmental Assessment Approach Section 5.2 Atmospheric Environment Section 5.3 Geological and Hydrogeological Environment Section 5.4 Surface Water Section 5.5 Aquatic Environment Section 5.6 Terrestrial Environment Section 5.7 Ambient Radioactivity and Ecological Health Section 5.8 Human Health Section 5.9 Land and Resource Use Section 5.10 Socio-economic Environment Section 6.0 Indigenous Interests
A.3.4	**Malfunctions and Accidents**	
	Paragraph 19(1)(*a*) of CEAA 2012 states that malfunctions and accidents shall be assessed in the EA. Malfunctions and accidents should be separated into radiological and non-radiological (conventional). The applicant should provide an assessment of potential health and environmental effects resulting from postulated radiological and conventional malfunctions or accidents. The EIS should also include any mitigation measures such as monitoring, contingency, clean-up or restoration work in the surrounding environment that would be required during or immediately following the postulated malfunction and accident scenarios. The EIS should provide a description of postulated malfunction and accident sequences leading to a radiological or non-radiological release considering, as appropriate, internal events, external events and human-induced events, including their frequency and an explanation of how these events were identified, and any modeling that was performed. The applicant can use a bounding approach or use facility- or activity-specific information (for example, design, operation, projected environmental releases) in the assessment of radiological accidents and malfunctions. If a bounding approach is used, the applicant should provide a detailed rationale for the selection of each bounding scenario. The EIS should include the source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the postulated malfunctions and accidents. **Note:** Malfunctions and accidents are reviewed in depth under the NSCA for licensing purposes (for example, under REGDOC-2.4.1, *Deterministic Safety Analysis* [18], REGDOC-2.4.2, *Probabilistic Safety Assessments for Nuclear Power Plants* [19] and RD-346, *Site Evaluation for New Nuclear Power Plants* [20]). These scenarios should be taken into consideration by the applicant when designing environmental protection measures (see section 4). If applicable, the applicant should use operating experience (OPEX) to identify any past abnormal operations, accidents and spills to the extent that they are relevant to the current assessment for the purposes of identifying malfunction and accident scenarios to be assessed.	Section 7.2 General Approach – Malfunctions and Accidents Section 7.3 Project Overview and Identification of Hazards – Malfunctions and Accidents Section 7.4 Radiological Malfunctions and Accidents Section 7.5 Conventional (Non-radiological) Malfunctions and Accidents
A.3.5	**Cumulative Effects**	
	Paragraph 19(1)(*a*) of CEAA 2012 states that the applicant shall assess any residual adverse environmental effects of the project in combination with other past, present or reasonably foreseeable projects and/or activities within the study area. The applicant should explain the approach and methods used to identify and assess cumulative effects. The approach and methods should be consistent with *Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* [21].	Section 8.0 Summary of Cumulative Effects

Section in REGDOC 2.9.1	Requirement	Section in the EIS
A.3.6	**Significance of Residual Effects**	
	Paragraph 19(1)(*b*) of CEAA 2012 states that the applicant shall assess the significance of any residual effects that persist, taking into consideration the proposed mitigation measures. These residual effects are identified during the ERA or a characterization of the environmental effects. In the EIS, the applicant should include a detailed analysis of the significance of each residual effect. The applicant should clearly explain the method and definitions used to describe the level of the residual adverse effect (for example, low, medium, or high) for each of the issues. The applicant should also describe any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried on and how these levels were combined to reach an overall conclusion on the significance of the adverse effects for each valued component (VC). **Guidance** Some specific issues to be assessed are: ▪ magnitude of the effect ▪ spatial extent of the effect ▪ duration and frequency of the effect ▪ degree to which the effect can be reversed or mitigated ▪ ecological importance The method used to describe the level of the adverse effect should be transparent and reproducible. The EIS should identify additional criteria used to assign significance ratings to any predicted adverse effects. It should contain clear and sufficient information to enable the CNSC and the public to understand and review the applicant's judgement of the significance of effects. The applicant should define the terms used to describe the level of significance. In assessing significance against the criteria, the EIS should, where possible, employ relevant existing regulatory documents, environmental standards, guidelines or objectives such as prescribed maximum levels of emissions or discharges of specific hazardous substances into the environment or maximum acceptable levels of specific hazardous substances in the environment.	Section 9.0 Summary of Significance of Residual Effects
A.3.7	**Socio-economic Environment**	
	The applicant should characterize the socio-economic environment and identify all indirect socio-economic effects. An indirect effect is a secondary environmental effect that occurs as a result of a change that a project may cause to the environment. Paragraph 5(2)(b) of CEAA 2012 refers to any change to the environment caused by the project on health and socio-economic conditions, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. For additional guidance, refer to *Technical Guidance for Assessing Physical and Cultural Heritage or any Structure, Site or Thing that is of Historical, Archeological, Paleontological or Architectural Significance under the Canadian Environment Assessment Act, 2012* [22].	Section 5.10 Socio-economic Environment
A.3.8	**Community and Aboriginal Traditional Knowledge**	
	Subsection 19(3) of CEAA 2012 states that community and Aboriginal traditional knowledge may be considered in the EA. CNSC staff will provide guidance to the applicant at the earliest possible stage in the EA process concerning the extent to which community and Aboriginal traditional knowledge shall be considered in the EA. For additional information, refer to: ▪ Considering Aboriginal traditional knowledge in environmental assessments conducted under the Canadian Environmental Assessment Act, 2012 [23] ▪ REGDOC-3.2.2, Aboriginal Engagement [10] (for further information on the CNSC's expectations of applicants for Aboriginal engagement)	Section 6.4 Traditional Land and Resource Use
A.3.9	**Assessment of Effects of the Environment on the Project**	
	Paragraph 19(1)(*h*) of CEAA 2012 states that the EIS shall take into account how the environment could adversely affect the project. The applicant shall also take into account any potential effects of climate change on the project, including an assessment of whether the project might be sensitive to changes in climate conditions during its lifecycle. Some adverse environmental conditions are flooding, severe weather, biophysical hazards (such as algae), geotechnical hazards and seismic events.	Section 10.0 Effects of the Environment on the Project

Section in REGDOC 2.9.1	Requirement	Section in the EIS
A.3.10	**EA Follow-up Program**	
	Paragraph 19(1)(e) of CEAA 2012 states that the EIS shall include a framework or preliminary program upon which EA follow-up actions will be managed throughout the life of the project. The applicant should design the follow-up program to verify the accuracy of the EA predictions and to determine the effectiveness of the measures implemented to mitigate the potential adverse environmental effects of the project. The applicant should also design the follow-up program to incorporate pre-project information that would provide the baseline data; compliance data such as established environmental quality criteria; regulatory documents, standards or guidelines; and real-time data consisting of observed data gathered in the field. As part of the follow-up program, the applicant should describe the compliance reporting methods to be used, including reporting frequency, methods and format. **Note:** The CNSC, in collaboration with other federal authorities (where applicable), verifies and monitors all EA follow-up activities through the CNSC licensing and compliance process. EA follow-up monitoring activities may be integrated within the applicant's environmental protection measures.	Section 5.1.9 Monitoring and Follow-up Section 5.2.1.9 Monitoring and Follow-up – Air Quality Section 5.2.2.9 Monitoring and Follow-up – Greenhouse Gases Section 5.3.1.6 Monitoring and Follow-up – Geology Section 5.3.2.8 Monitoring and Follow-up – Hydrogeology Section 5.4.1.8 Monitoring and Follow-up – Hydrology Section 5.4.2.9 Monitoring and Follow-up – Surface Water Quality Section 5.5.6 Monitoring and Follow-up – Aquatic Environment Section 5.6.8 Monitoring and Follow-up – Terrestrial Environment Section 5.7.9 Monitoring and Follow-up – Ambient Radioactivity and Ecological Health Section 5.8.9 Monitoring and Follow-up – Human Health Section 5.9.6 Monitoring and Follow-up – Land and Resource Use Section 5.10.9 Monitoring and Follow-up – Socio-economic Environment Section 6.4.6 Monitoring and Follow-up – Traditional Land and Resource Use Section 11.0 Monitoring and Follow-up Programs
Appendix B	**Characterization of the Baseline Environment for an Environmental Assessment under CEAA 2012**	
B.1	**Atmospheric Environment**	
	The atmospheric environment includes the climate conditions at the site and in the local and regional study areas. It includes the seasonal variations in weather conditions within the study areas, to allow the assessment of effects on the facility or activity. The applicant or licensee should provide a description of the existing ambient air quality in the study areas, with emphasis on characterizing radiological and non-radiological analytes. The description should include meteorological information such as air temperature, relative humidity, precipitation, wind speed and direction, atmospheric pressure, and solar radiation. It should also include the occurrence of weather phenomena (for example, lightning, temperature inversions and fog). Special consideration should be given to the analysis of extreme and rare meteorological phenomena (for example, tornadoes). Uncertainties should be described and taken into account when discussing the reliability of the information presented. The description should also include current ambient daytime and nighttime noise levels at the site and local study areas, and include information on its source(s), geographic extent and temporal variations. The description should provide ambient noise levels for other areas that could be affected by the facility or activity. Some examples are: ▪ increased traffic along transportation corridors to and from the site during construction ▪ receptors at residences and sensitive sites (such as hospitals, schools, daycare facilities, seniors' residences, and places of worship) The applicant or licensee should describe the influence of regional topography or other features that could affect weather conditions in the study areas. The baseline information should be sufficient to support the use of an atmospheric dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the project (for example, tornadoes).	Section 5.2.1.4 Description of the Environment – Air Quality Section 5.2.2.4 Description of the Environment – Greenhouse Gases

Section in REGDOC 2.9.1	Requirement	Section in the EIS
B.2	**Surface Water Environment**	
	The surface water environment includes all surface water features and hydrology that affect surface water at the site or in the local and regional study areas. The applicant or licensee should include delineation of drainage basins at appropriate scales. When documenting the water quality of all surface water, the applicant or licensee should demonstrate the use of appropriate sampling and analytical protocols, for the range of analytical parameters with the potential to be influenced by the facility or activity. This information should be presented using tables, maps and figures to provide an understanding of surface water characteristics and conditions at the site and in the local and regional study areas. The applicant or licensee should describe hydrological regimes within the drainage basin, including seasonal fluctuations and year-to-year variability of all surface waters. The applicant or licensee should assess normal flow, flooding and drought properties of water bodies as well as the interactions between surface water and groundwater flow systems. The applicant or licensee should describe all water sources used for drinking water in the area, including source water intakes for drinking water treatment facilities. The baseline information should be sufficient to support the use of an aquatic dispersion model to conduct the site-specific ERA and to support an assessment of the effects of the environment on the facility or activity (for example, flooding). The applicant or licensee should document the sediment quality of all water bodies to be affected by the facility or activity, demonstrating the use of appropriate sampling and analytical protocols, for the range of analytical parameters with the potential to be influenced by the facility or activity. This information should provide an appropriate understanding of sediment characteristics and conditions on the site and in the local and regional study areas. The study design should be fully described, including the allocation of samples in space and time, measurement methods and results. The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.	Section 5.4.1.4 Description of the Environment – Hydrology Section 5.4.2.4 Description of the Environment – Surface Water Quality
B.3	**Aquatic Environment**	
	The aquatic environment includes the aquatic and wetland species at the site and within the local and regional study areas, including the flora, fauna and their habitats. The applicant or licensee should seek information from relevant authorities (such as Environment and Climate Change Canada (ECCC), Fisheries and Oceans Canada (DFO) and provincial or territorial authorities) on aquatic and wetland species and habitat for the local and regional study areas. The applicant or licensee should also undertake independent studies to gather the necessary information. The applicant or licensee should include a description of the food chain and food web dynamics as a habitat component as this relates to fish populations, and potential effects resulting from the facility or activity (such as impingement and entrainment). The applicant or licensee should provide detailed habitat mapping that demonstrates habitat usage by fish within the study areas. This information should include depth profiles, substrate mapping, water temperature profiles, and a description of known and potential habitat usage (such as spawning, nursery, rearing, feeding and migratory) by fish that occur in the study areas. The applicant or licensee should identify any biological species of natural conservation status (that is, rare, vulnerable, endangered, threatened or uncommon at a federal, provincial or municipal level) and their critical habitats, if identified. The applicant or licensee should provide baseline characterization of radionuclide and hazardous substance levels in aquatic biota to support human and ecological risk assessment. The applicant or licensee should fully describe the study design, including the allocation of samples in space and time, measurement methods and results. The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline date and methods, as well as the method(s) by which they have been addressed.	Section 5.5.4 Description of the Environment – Aquatic Environment
B.4	**Geological and Hydrogeological Environment**	
	The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.	

Section in REGDOC 2.9.1	Requirement	Section in the EIS
B.4.1	**Geology**	
	The applicant or licensee should characterize the geomorphology, topography, quaternary geology and soil characteristics, structural geology, petrology, geochemistry, economic geology and hydrogeology. The applicant or licensee should also describe the geomechanical properties that apply to the region and at the site that will be disturbed. The applicant or licensee should provide the geotechnical properties of the overburden, including shear strength and liquefaction potential, to allow for the assessment of slope stability and bearing capacity of foundations under both static and dynamic conditions. The description of the structural geology should include regional, local and site-specific documentation of fractures and faults. It should include a description of primary geological features and deformation fabrics both at the site and within the local and regional study areas. If applicable, the applicant or licensee should describe the coastal geomorphology and should include the characteristics of any lakefront or ocean bluffs, shoreline, and both near-shore zone and offshore zones. The baseline characterization should be sufficient to assess effects of the environment on the facility or activity (for example, seismic effects). The applicant or licensee should present a geological model that incorporates all overburden and bedrock information. If extrapolation is required to derive the stratigraphy, the applicant or licensee should explicitly discuss the uncertainties and the need for additional field investigations to reduce those uncertainties. The applicant or licensee should describe the geotechnical and geophysical hazards including the consideration of subsidence, uplift, seismicity (and active faulting), and consider the potential for movement at the ground surface (including co-seismic rupture) and earthquake ground motions. A seismic hazard assessment should be provided. Where appropriate, the narrative descriptions should be supplemented by geological maps, figures, cross-sections, borehole logs and photographs (with specific location information).	Section 5.3.1.4 Description of the Environment – Geology
B.4.2	**Hydrogeology**	
	The applicant or licensee should describe the hydrogeology at the site and in the local and regional study areas. The description should characterize the physical and geochemical properties of all overburden and bedrock hydrogeological units (from the ground surface to the uppermost basement unit, which is site dependent). Units may be characterized as aquifers or aquitards, and unit descriptions should include their geochemical characteristics, vertical and lateral permeabilities, transport mechanism (diffusion versus advection) and directions of groundwater flow. The applicant or licensee should identify the groundwater recharge and discharge areas, and describe in detail the groundwater interactions with surface waters. The applicant or licensee should present a conceptual and numerical hydrogeological model that discusses the hydrostratigraphy and groundwater flow systems. The applicant or licensee should provide a description of baseline groundwater quality at the site and in the local study area. The applicant or licensee should also describe local and regional potable groundwater supplies, including their current use and potential for future use.	Section 5.3.2.4 Description of the Environment – Hydrogeology
B.5	**Terrestrial Environment**	
	The terrestrial environment includes flora and fauna, their habitats, any wildlife corridors and the soil. The applicant or licensee should describe the terrestrial species at the site and within the local and regional study areas, including flora, fauna and their habitat. The applicant or licensee should identify all biological species risk (that is, endangered, threatened, special concern, extirpated at a federal, provincial or municipal level) known to occur in the area or where the site is within the range of the species. The applicant or licensee should describe the presence and importance of wildlife habitat within the study areas, including critical habitats for listed species (if identified). The applicant or licensee should also describe any wildlife corridors and physical barriers to movement. The applicant or licensee should identify all protected and conservation areas established by federal, provincial and municipal jurisdictions (for example, wilderness areas, parks, sites of historical or ecological significance, nature reserves, federal migratory bird sanctuaries and wildlife management areas). The applicant or licensee should describe the existing soil quality (including hazardous and radiological substance concentrations) for all study areas, as well as any additional soil quality parameters potentially relevant for modelling purposes (such as transport and bioavailability of contaminants of potential concern). The applicant or licensee should provide baseline characterization of radionuclide and hazardous substance levels in vegetation and other non-human biota to support human and ecological risk assessment. The characterization should also take into consideration the baseline conditions of other applicable environmental components (such as the atmospheric environment). The applicant or licensee should undertake independent studies to gather the necessary information as appropriate. The applicant or licensee should describe field studies in terms of representativeness of the target populations where possible. The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results. The applicant or licensee should include an assessment of any limitations or gaps in the quality and extent of baseline data and methods, as well as the method(s) by which they have been addressed.	Section 5. 6.4 Description of the Environment – Terrestrial Environment

Section in REGDOC 2.9.1	Requirement	Section in the EIS
B.6	**Ambient Radioactivity**	
	The ambient radioactivity arises from the sources, their activity levels and their origin, for all applicable environmental media (including air, soil, food, water, aquatic sediments and plant or animal tissue). The applicant or licensee should describe the ambient radiological conditions at the site and in the local and regional study areas. The applicant or licensee should include information on the existing conditions, including an inventory of sources, their activity levels and their origin (natural or anthropogenic), for all applicable environmental media. The applicant or licensee should fully describe the design of the study, including the allocation of samples in space and time, measurement methods and results. The description should include an assessment of any limitations or gaps in the quality and extent of the baseline data and methods, as well as the method(s) by which they have been addressed.	Section 5.7.4 Description of the Environment – Ambient Radioactivity and Ecological Health
B.7	**Human Health**	
	The potential effects of the facility or activity on human health include both radiological sources and non-radiological contaminants. The applicant or licensee should describe the current health profiles of the communities likely to be affected by the facility or activity, including information on population health of the communities in the local and regional study areas. The applicant or licensee should provide, to the extent available, information on current consumption of locally grown harvests and country foods, and the quality by food type, amounts consumed, parts consumed (whole body or specific organs).	Section 5.8.4 Description of the Environment – Human Health
B.8	**Aboriginal Land Use**	
	Aboriginal land and resource use includes lands, waters and resources of specific value; traditional activities and lifestyle; and traditional dietary habits. Traditional land use may include areas where traditional activities such as establishing seasonal camps, camping, travel on traditional routes, gathering of country foods and medicines (hunting, fishing, trapping, planting and harvesting) are being carried out. Traditional land use also includes spiritual sites of significance to Aboriginal people. The applicant or licensee should identify the lands, water and resources of specific social, economic, archaeological, cultural or spiritual value to Aboriginal people, including established and asserted Aboriginal or treaty rights that may be affected by the facility or activity. The applicant or licensee should describe Aboriginal land and resource use at the site and in the local and regional study areas. The applicant or licensee should identify traditional activities, including activities for food, social, ceremonial and other cultural purposes, in relation to such lands, waters and resources with a focus on the current use of lands, waters and resources for traditional purposes. The applicant or licensee should describe the traditional dietary habits and dependence on country foods and harvesting for other purposes, including harvesting of plants for medicinal purposes. The analysis should focus on the identification of potential adverse effects of the facility or activity on the ability of future generations of Aboriginal people to pursue traditional activities or lifestyle.	Section 6.4.4 Description of the Environment - Traditional Land and Resource Use
Appendix C	**Environmental Effects for an Environmental Assessment under CEAA 2012**	
C.1	**Atmospheric Environment**	
	The licensee should characterize the effects of the facility or activity on the atmospheric environment during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios. The licensee should identify and characterize all atmospheric emissions (radiological and non-radiological) expected to be generated during all phases of the lifecycle for the facility or activity, including postulated accident and malfunction scenarios. This information should include average and maximum emissions from planned discharges, point sources and fugitive (non-point source) releases (including greenhouse gases). The licensee should complete modelling that incorporates baseline (or existing ambient) air quality in combination with the predicted site-specific atmospheric characteristics (such as shoreline fumigation) to assess potential effects on air quality, the transport of atmospheric contaminants and any associated exposure to humans and non-human biota receptors. The licensee should describe predicted effects of noise on terrestrial and aquatic species as well as on nearby residents and communities. The description should include both daytime and nighttime noise levels and tonal noise. The predicted sound levels should be compared against baseline levels and any guidelines published by recognized organizations.	Section 5.2.1.6 Residual Effects Analysis – Air Quality Section 5.2.2.6 Residual Effects Analysis – Greenhouse Gases

Section in REGDOC 2.9.1	Requirement	Section in the EIS
C.2	**Surface Water Environment**	
	The licensee should describe the effects of the facility or activity on the surface water environment during all phases of the lifecycle for the facility or activity, including accident and malfunction scenarios. The licensee should identify and characterize all liquid effluents that could be generated during all phases of the facility or activity. Some examples are: ▪ average and maximum emissions from point sources (concentrations/activity levels and volumes) ▪ planned discharges ▪ fugitive releases ▪ deposition from airborne particulates ▪ surface runoff	Section 5.4.1.6 Residual Effects Analysis – Hydrology Section 5.4.2.6 Residual Effects Analysis – Surface Water Quality
C.3	**Aquatic Environment**	
	For all phases of the lifecycle for the facility or activity, the licensee should describe the effects of the facility or activity on aquatic flora and fauna, and include a full accounting of effects on species of natural conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment. The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected reference condition for unexposed biota on a biological population basis, taking natural variation into account. Predictions of effects should include sufficient detail to allow follow-up verification. Some potential effects are: ▪ effects on habitat, including aquatic vegetation and sensitive areas such as spawning grounds, nursery areas, winter refuges and migration corridors ▪ effects on aquatic species, including rare or sensitive species ▪ effects of blasting on fish and fish habitat on local aquatic systems ▪ contaminant exposures through environmental and food-chain transport ▪ effects on aquatic biota due to impingement and entrainment ▪ effects of infilling on loss of fish habitat and changes to productive capacity ▪ effects of thermal plume(s) on fish and fish habitat ▪ effects on wetlands Under the NSCA, the CNSC assesses the on-going operation of nuclear facilities and activities to ensure protection of the environment and the health and safety of persons. Under the Memorandum of Understanding between CNSC and Fisheries and Oceans Canada (DFO), the CNSC is responsible for conducting reviews of licence applications to assess the potential effects on fish and fish habitat, and to ensure that the assessment process considers the intent and requirements of the *Fisheries Act*, the *Species at Risk Act* and their associated regulatory and policy frameworks.	5.5.5 Project Interactions and Mitigations – Aquatic Environment
C.4	**Geological and Hydrogeological Environment**	
	The geological and hydrogeological environment includes the bedrock and overburden geology at both the local and regional scales.	
C.4.1	**Geology**	
	The licensee should fully describe any changes to the geology and geomorphology resulting from the facility or activity, including any interrelationships with the groundwater regime. The licensee should describe any changes to the environment resulting from the removal of bedrock and/or unconsolidated deposits. The licensee should also describe the disturbance of soils or sediments that may be stockpile, used for construction purposes or otherwise perturbed. The licensee should include an assessment of changes made that would affect coastal processes and features (such as changes to the shoreline morphology due to construction, erosion or sediment transport).	5.3.1.5 Project Interactions and Mitigations – Geology
C.4.2	**Hydrogeology**	
	The licensee should describe and assess any effects the facility or activity may have on the groundwater regime including the quantity and quality of groundwater and how these effects may influence surface waters. The licensee should carry out modelling as needed to develop and test the predicted effects.	Section 5.3.2.6 Residual Effects Analysis – Hydrogeology

Section in REGDOC 2.9.1	Requirement	Section in the EIS
C.5	**Terrestrial Environmental**	
	The licensee should describe the effects of the facility or activity on terrestrial fauna and flora and include a full accounting of effects on species with elevated conservation status and their habitat. This evaluation should be based on results of field monitoring studies or predictions from an ecological risk assessment. The description should be clear on how predicted effects to the biota exposed to the stressor compare to the expected "reference condition" for unexposed biota on a biological population basis taking into account natural variation. Predictions of the effects should include sufficient detail to allow follow-up verification. Some potential effects that should be considered are: ▪ loss of terrestrial habitat and the quality of lost habitat for relevant species ▪ disturbance of feeding, nesting or breeding habitats ▪ physical barriers to wildlife ▪ disruption, blockage, impediment and sensory disturbance (such as light effects, noise and vibration) of daily or seasonal wildlife movements (such as migration or home ranges) ▪ direct and indirect wildlife mortality ▪ reduction in wildlife productivity ▪ contaminant exposures through environmental and food-chain transport ▪ effects on biodiversity	Section 5.6.7 Residual Effects Assessment Results – Terrestrial Environment
C.6	**Ambient Radioactivity**	
	The licensee should describe the effects of the facility or activity on ambient radioactivity. Humans and non-human biota exposed to ambient radioactivity should be assessed for all relevant routes of exposure (both internal and external exposure scenarios). To support the assessment of human health (see section 3.2.7), the licensee should provide information on radiation levels to which members of the public may be exposed, including consideration of consumers of country food whose exposure pathways may differ due to cultural norms; for example, any dietary characteristics of Aboriginal peoples.	Section 5.7.6 Residual Effects Analysis – Ambient Radioactivity and Ecological Health
C.7	**Human Health**	
	The licensee should describe the potential effects of the facility or activity on the physical well-being of Aboriginal groups and other people resulting from biophysical effects, including the effects of the facility or activity on all environmental components (for example, atmospheric environment) and the resulting effects on human health. Some examples are: ▪ an analysis of the effects of the facility or activity on the health and safety of the public, including the possible effects from malfunctions and accidents (radiological and conventional) ▪ the predicted radiation doses to members of the public resulting from activities within the scope of the facility or activity and any resulting health effects ▪ a description of quantitative risk assessment modeling conducted, where necessary, for any malfunctions and accidents ▪ an assessment of the potential effects on human health from all non-radiological contaminants released from the facility or activity, through all potential exposure pathways ▪ potential effects of noise generated from the facility or activity on human receptors within the study area(s)	Section 5.8.6 Residual Effects Analysis – Human Health
C.8	**Aboriginal Land and Resource Use**	
	The licensee should identify any change that the facility or activity is likely to cause in the environment and any effect of any such change on the health and socio-economic conditions, physical and cultural heritage and on the current use of lands and resources for traditional purposes by any Aboriginal group including effects on hunting, trapping, fishing and gathering. The licensee should identify any concerns raised by Aboriginal people about the facility or activity in relation to any Aboriginal or treaty rights. For further information on the CNSC's expectations of licensees for Aboriginal engagement, see REGDOC-3.2.2, Aboriginal Engagement. [10]	6.4.5 Project Interactions and Mitigations – Traditional Land and Resource Use

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APPENDIX 5.1-1

Project Environment Interactions Matrix

Table 5.1-1-1: Project Interactions with Valued Components – Biophysical Environment and Human Health

Project Phase	Key Project Component/Activity[a]	Atmospheric Environment		Geologic and Hydrogeologic Environment		Surface Water Environment		Aquatic Environment		Terrestrial Environment	Ambient Radioactivity and Ecological Health	Human Health	
		Air Quality	Greenhouse Gases	Geology	Groundwater Quantity and Quality	Hydrology	Surface Water Quality	Fish	Fish Habitat	All VCs	All VCs	Worker	Public
Construction	Site preparation and construction, including for the ECM, WWTP, operations support facilities, and site infrastructure.	■	■	●	■	■	●	●	●	■ ●(a)			
	Blasting			●			●	●	●	●			
	Vehicle traffic on-site (CRL and NSDF)	■	■	●			●	●	●	■ ●(a)			
	Domestic waste (solid and liquid) management				●	●	●	●	●	●			
	Surface water management			●	●	●	●	●	●	●			
Operations	Staged development, placement of waste in the ECM, and progressive closure of disposal cells and installation of interim cover	■	■			■					■	■	■
	Vehicle traffic and equipment use on-site (CRL and NSDF)	■	■	●			●	●		●			
	Operation of the WWTP	■	■	●						●	■	■	■
	Discharge of treated effluent				■	●	■ ●(a)	●	●	●	■	■	■
	Domestic waste (solid and liquid) management									●			
	Surface water management			●			●	●	●	●			
	Leachate generation and collection			●	●		●	●	●	●	■	■	■
	Sewage management					●	●	●	●	●			
Closure	Surface water management			●		●	●	●	●	●			
	Operation of the WWTP					●				●			
	Discharge of treated effluent				■	●	■ ●(a)	●	●	●	■	■	■
	Leachate generation and collection			●	●		●	●	●	●	●	●	●
	Installation of the final cover system, restoration and grading of the site			●		■	●	●	●	●			
Post-closure	Leachate generation				■		■	●	●	●	■	■	■
	Landfill gas generation	■	■							●	■	■	■

Notes:

(a) Some project activities have more than one effects pathway; consequently, there can be more than one type of project interaction.

■ – Primary Pathway; ● – Secondary Pathway or No Linkage; Blank cell – No interaction anticipated.

Table 5.1-1-2: Project Interactions with Valued Components - Land and Resource Use and Socio-Economic Environment

Project Phase	Key Project Component/Activity	Land and Resource Use				Socio-economic Environment						
		Land and Resource Tenures	Outdoor Tourism and Recreation	Archaeological Sites	Traditional Land and Resource Use	Labour Market	Economic Development	Government Finances	Housing and Accommodations	Services and Infrastructure	Quality of Life	Public Safety
Construction	Ground disturbance			●								
All phases	General construction, operations and post-closure activities	●	●		●							
All phases	Employment of personnel, procurement of goods and services, and expenditures from the NSDF Project					■	■					
	Use of services and infrastructure, and commercial accommodations for NSDF Project								■ ●	■ ●	●	
	Contributions to government finances through the payment of property taxes							●				
	Physical hazards associated with the NSDF Project											●

Notes:

■ – Primary Pathway; ● – Secondary Pathway or No Linkage; Blank cell – No interaction anticipated.

Table 5.1-1-3: Project Interactions with Valued Components - Indigenous Traditional Land and Resource Use and Socio-Economic Environment

Project Phase	Key Project Component/Activity	Traditional Land and Resource Use	Indigenous Socio-economic Environment			
			Decision-making	Economy and employment	Housing and infrastructure	Indigenous resident – use and enjoyment of private property
Construction and Operations	General construction and operations activities	●				
All phases	Employment of personnel, procurement of goods and services, and expenditures from the NSDF Project		●	●	●	
	Physical hazards associated with the NSDF Project					●

Notes:

■ – Primary Pathway; ● – Secondary Pathway or No Linkage; Blank cell – No interaction anticipated.

APPENDIX 5.3-1

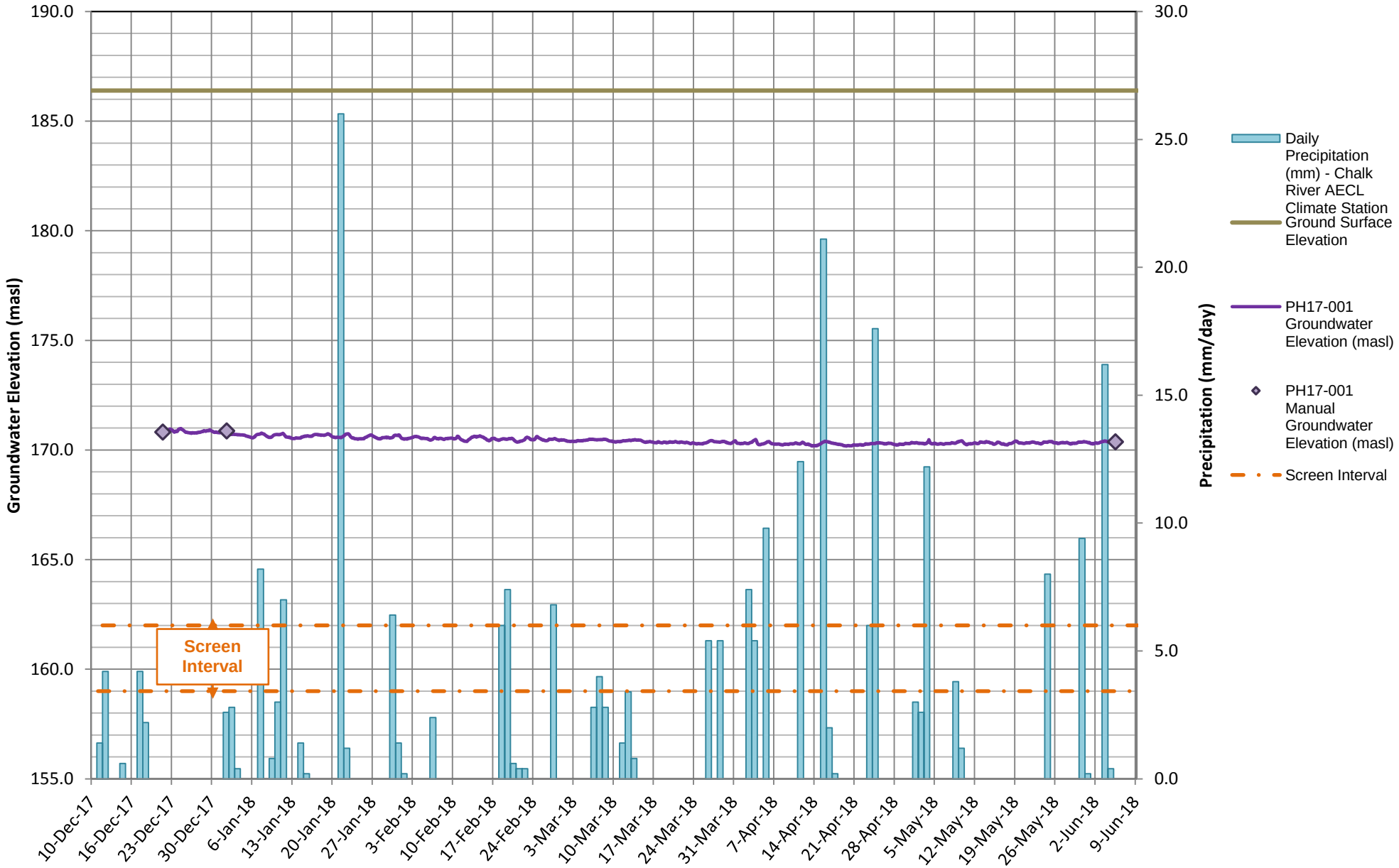
Groundwater Level Hydrographs (from AMEC 2018b)

PH17-001 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

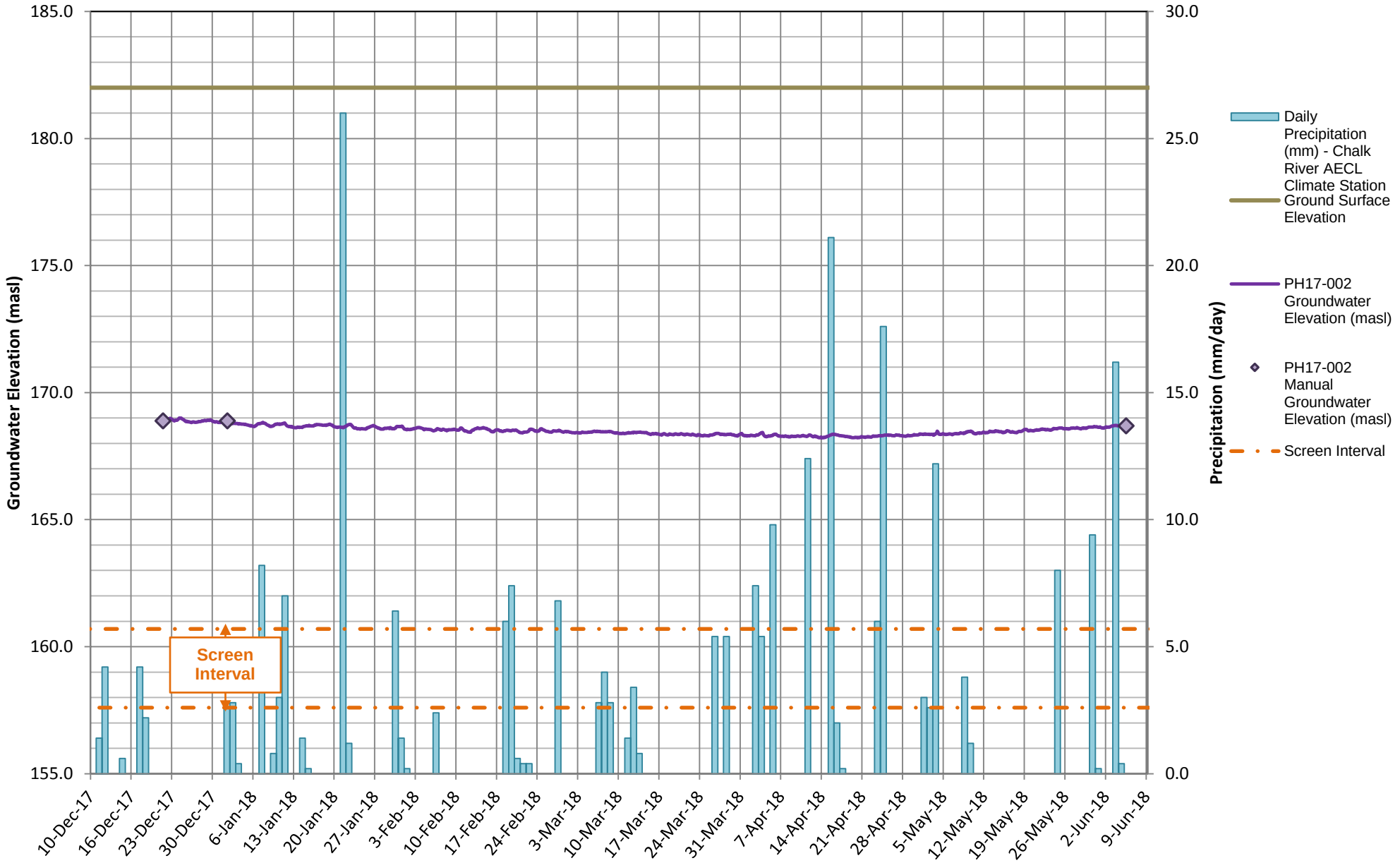


PH17-002 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

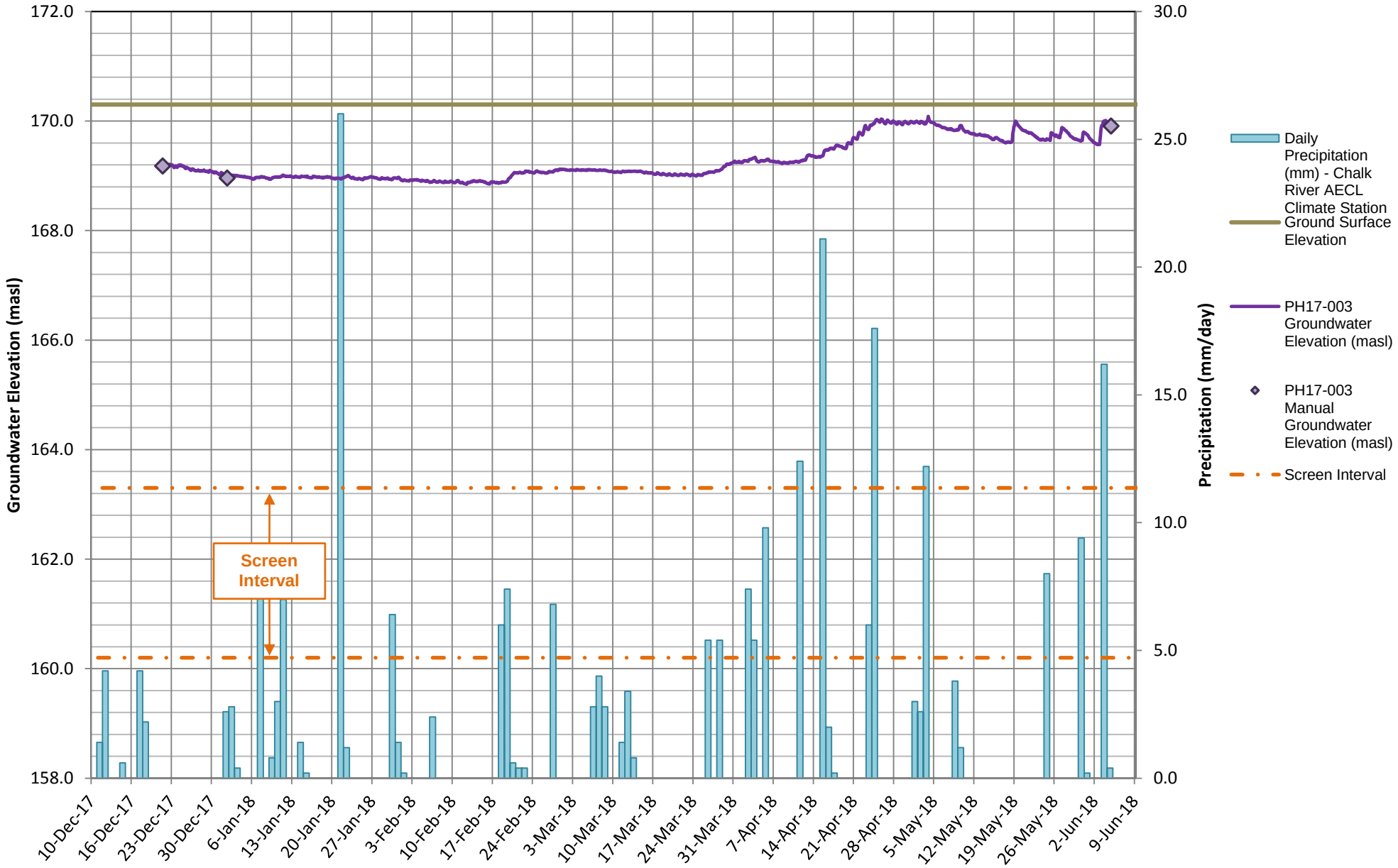


PH17-003 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

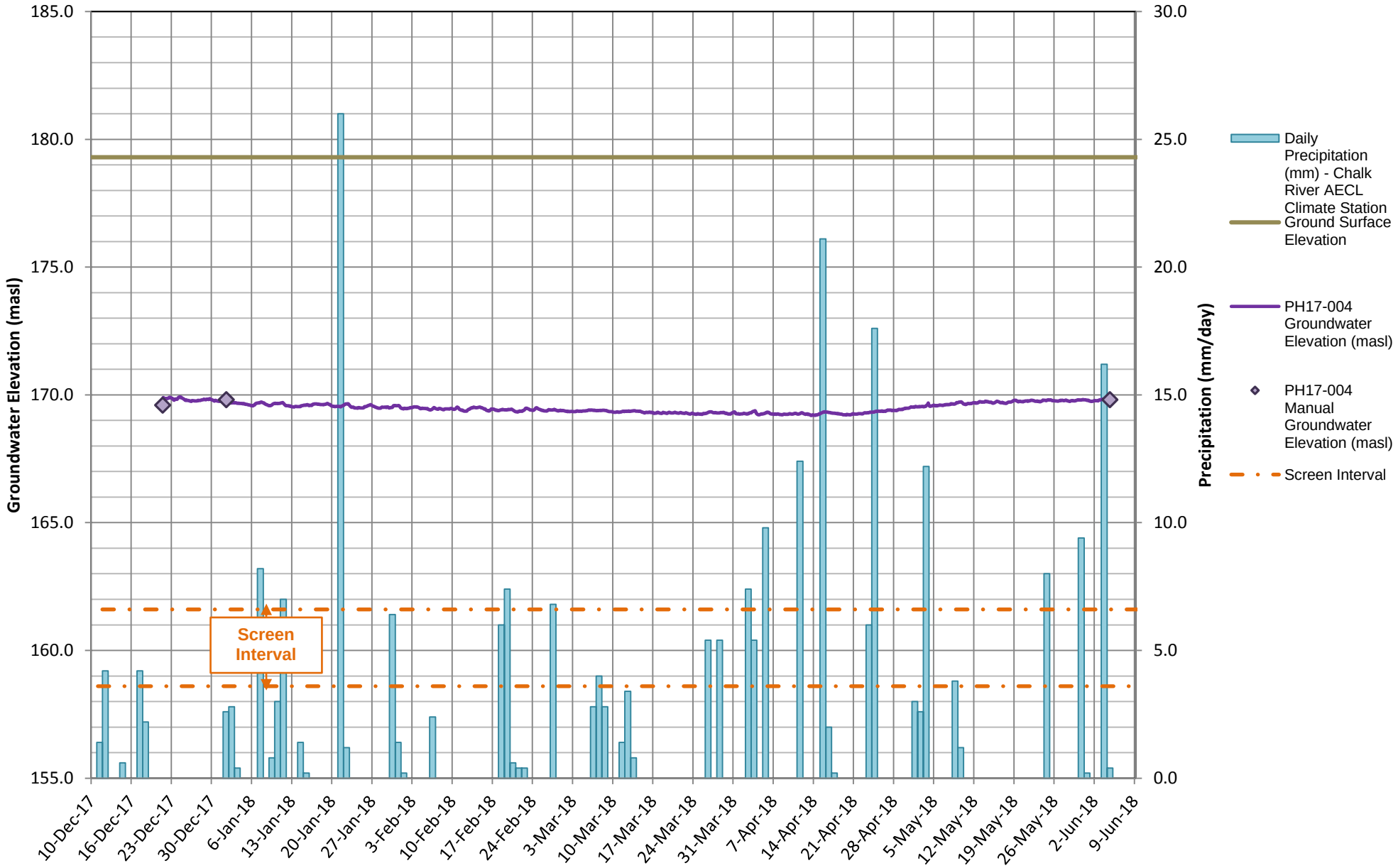


PH17-004 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

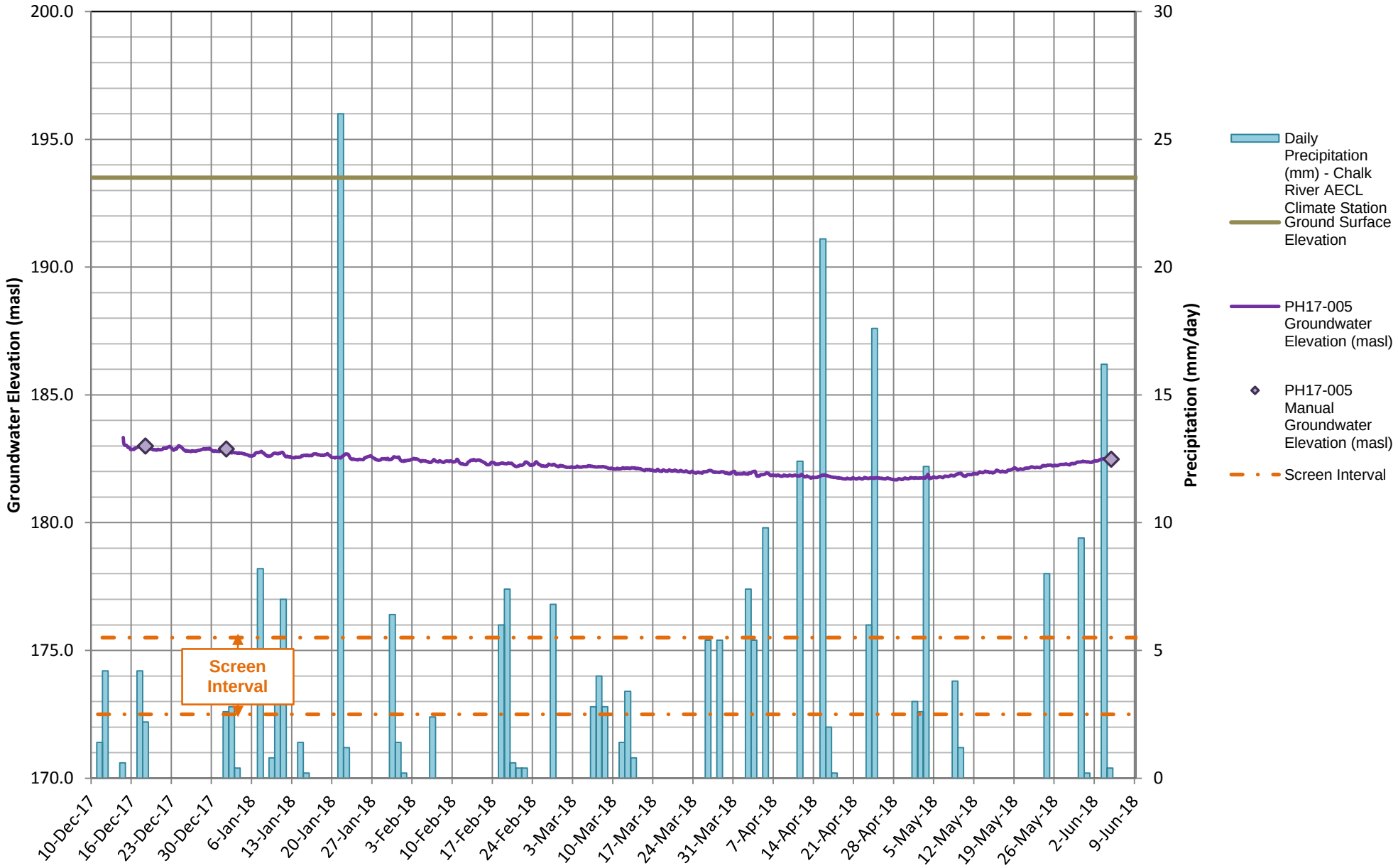


PH17-005 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

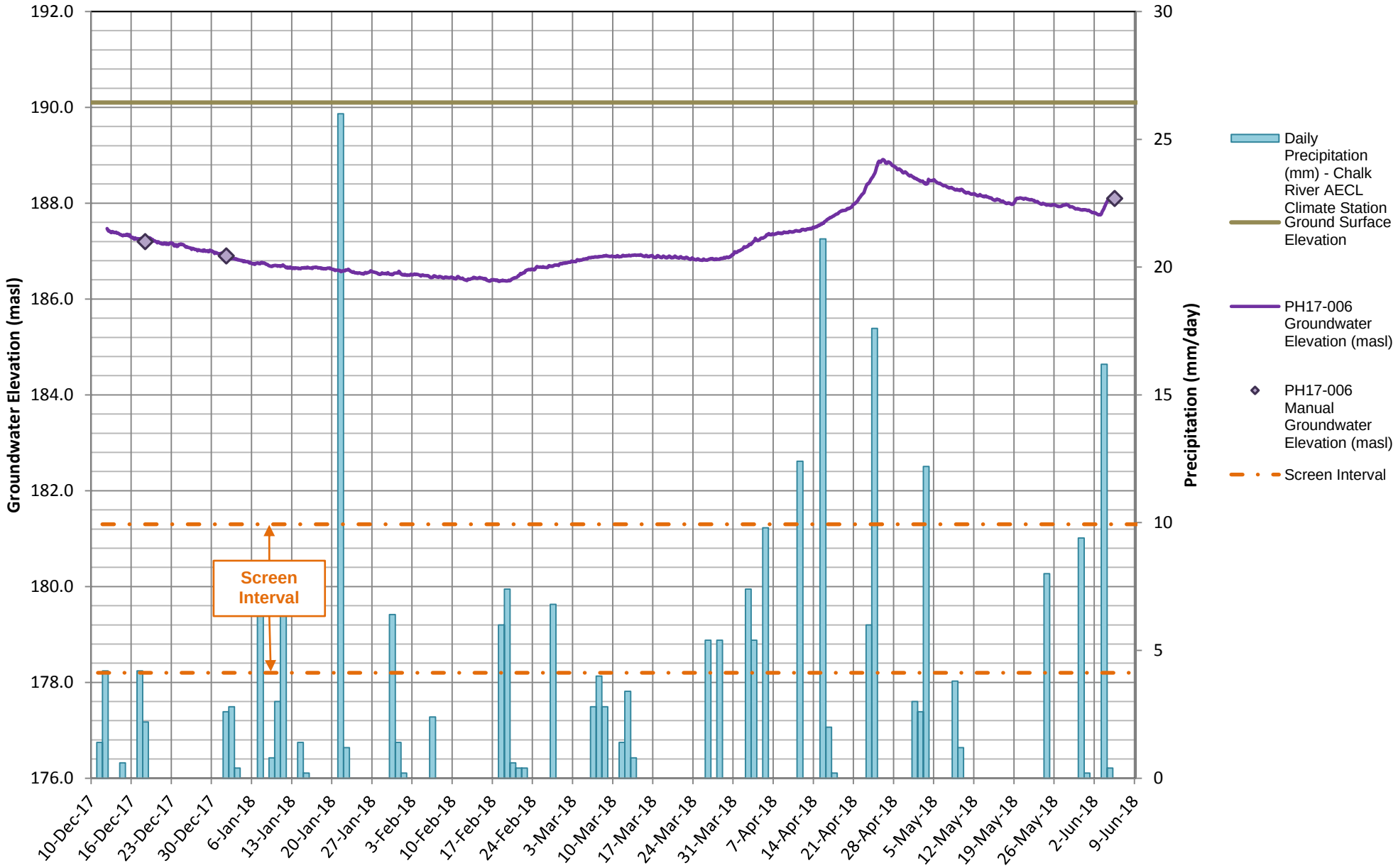


PH17-006 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

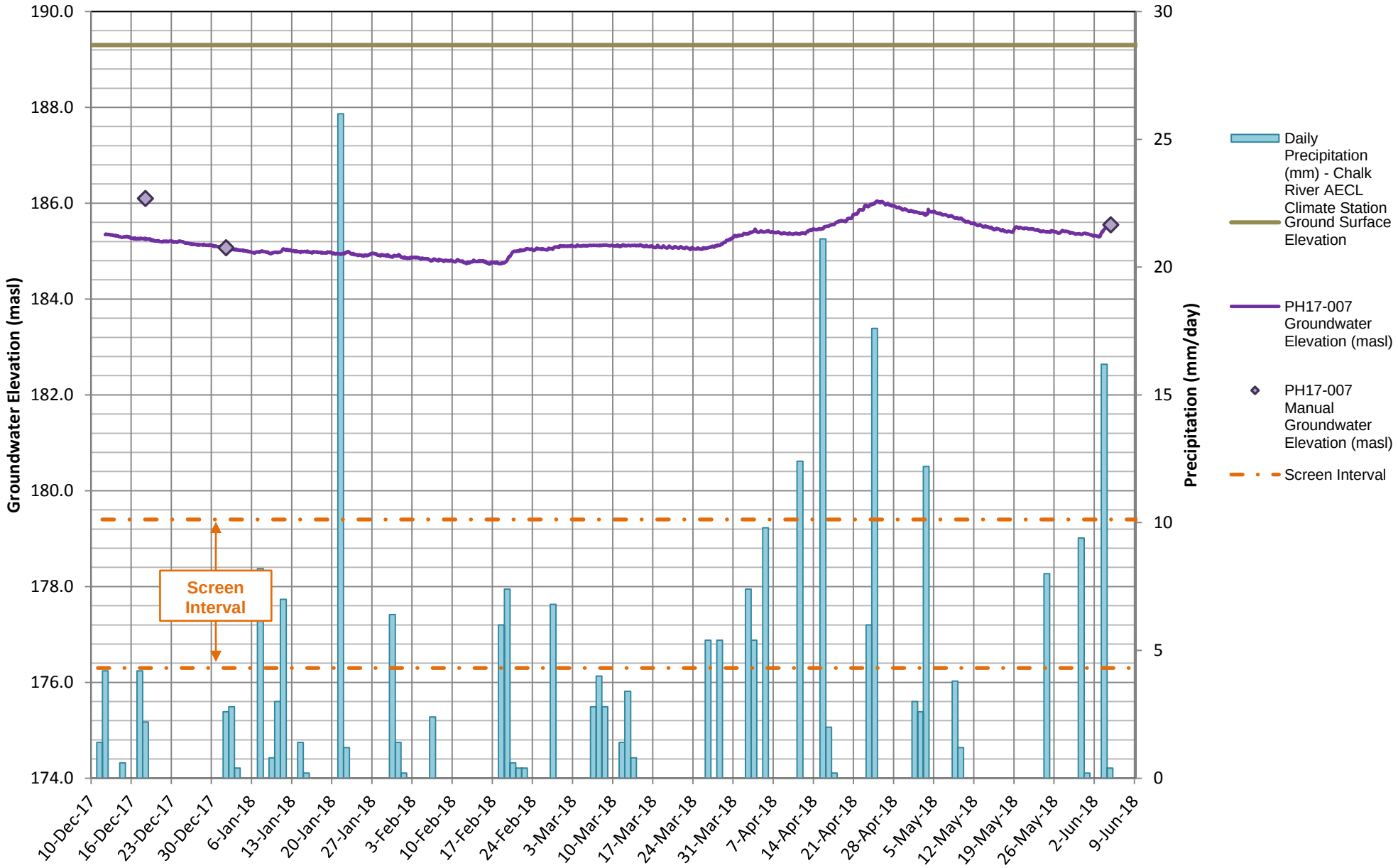


PH17-007 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

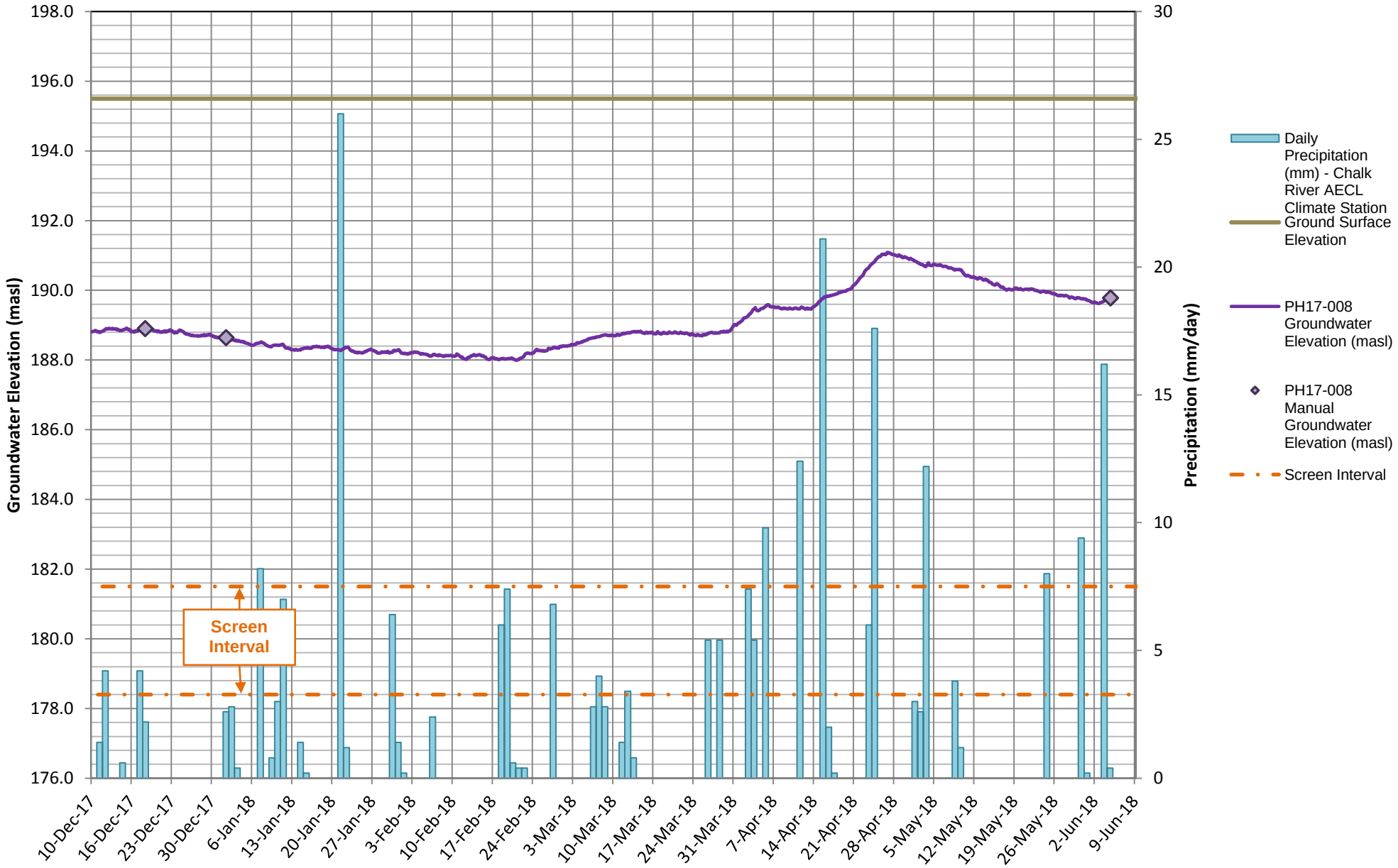


PH17-008 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

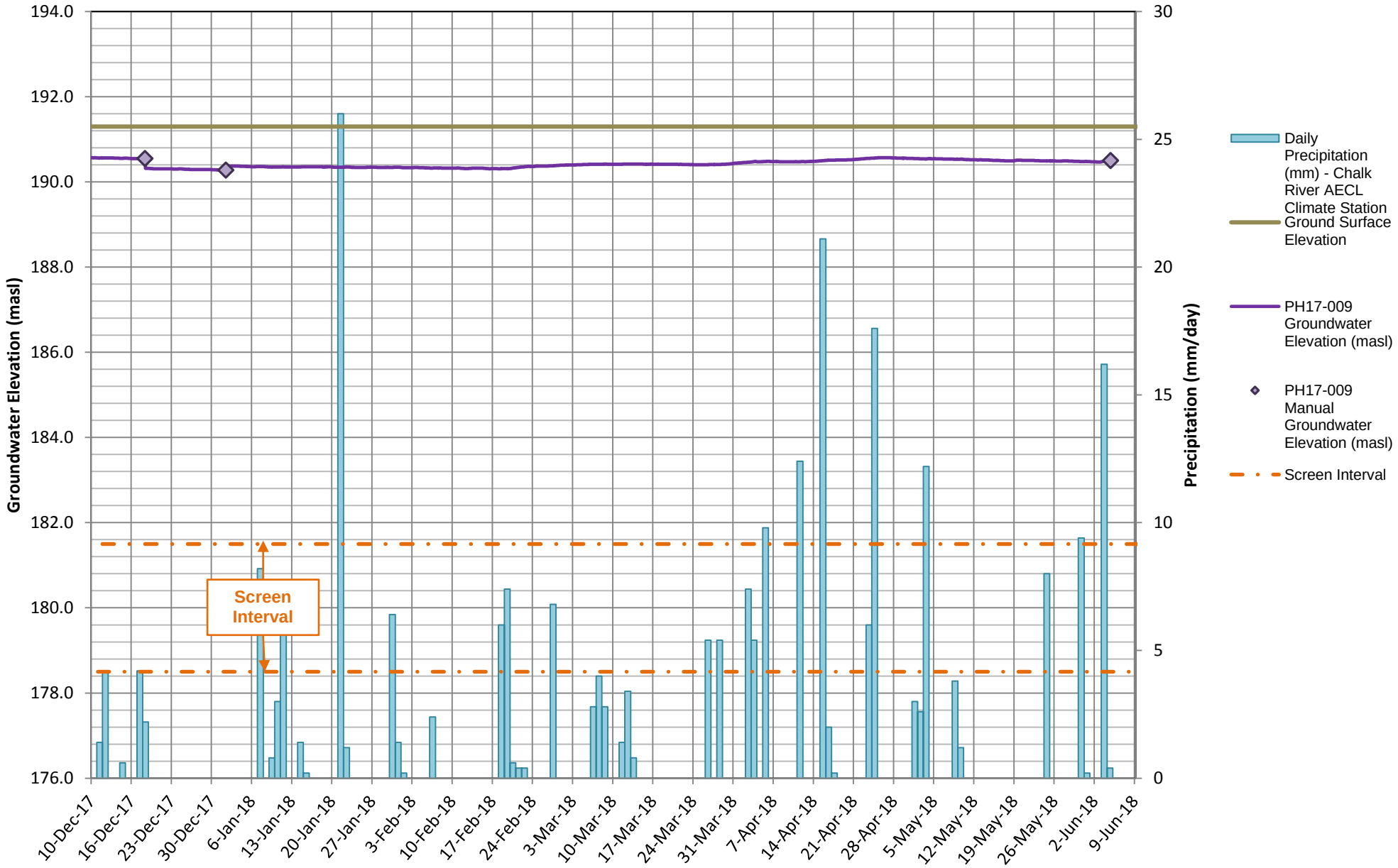


PH17-009 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

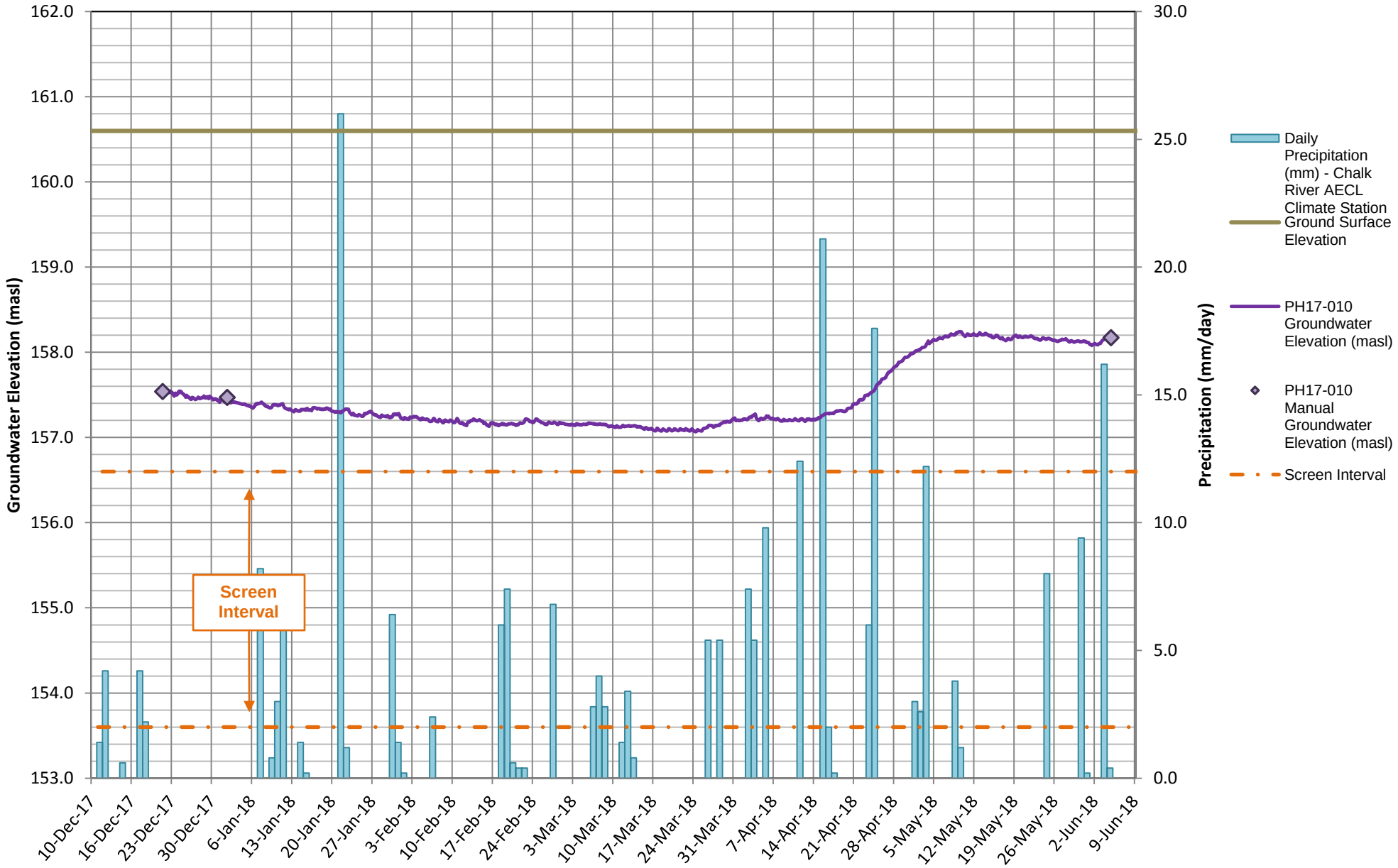


PH17-010 Hydrograph - December 2017 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

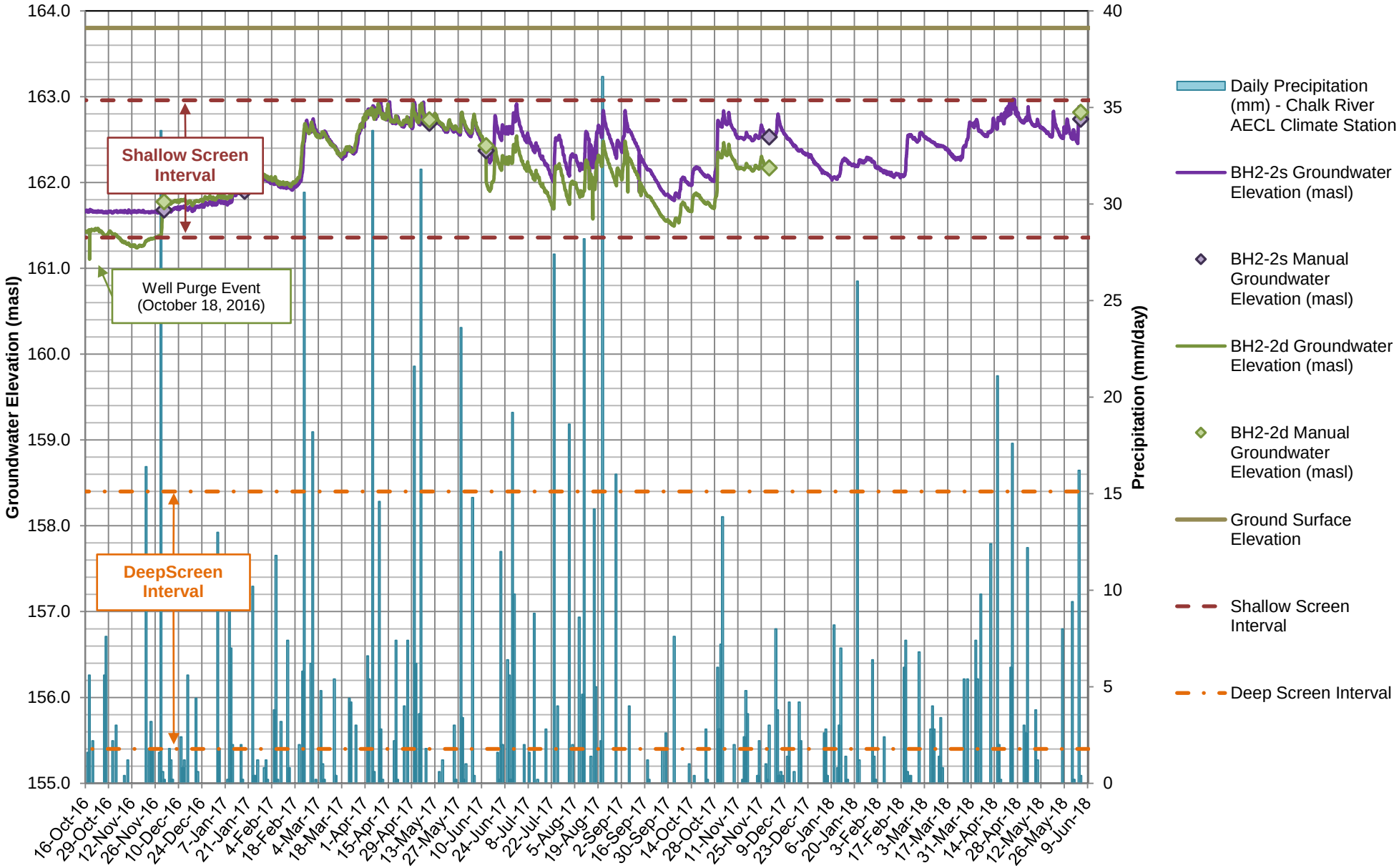


BH2-2d/s Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

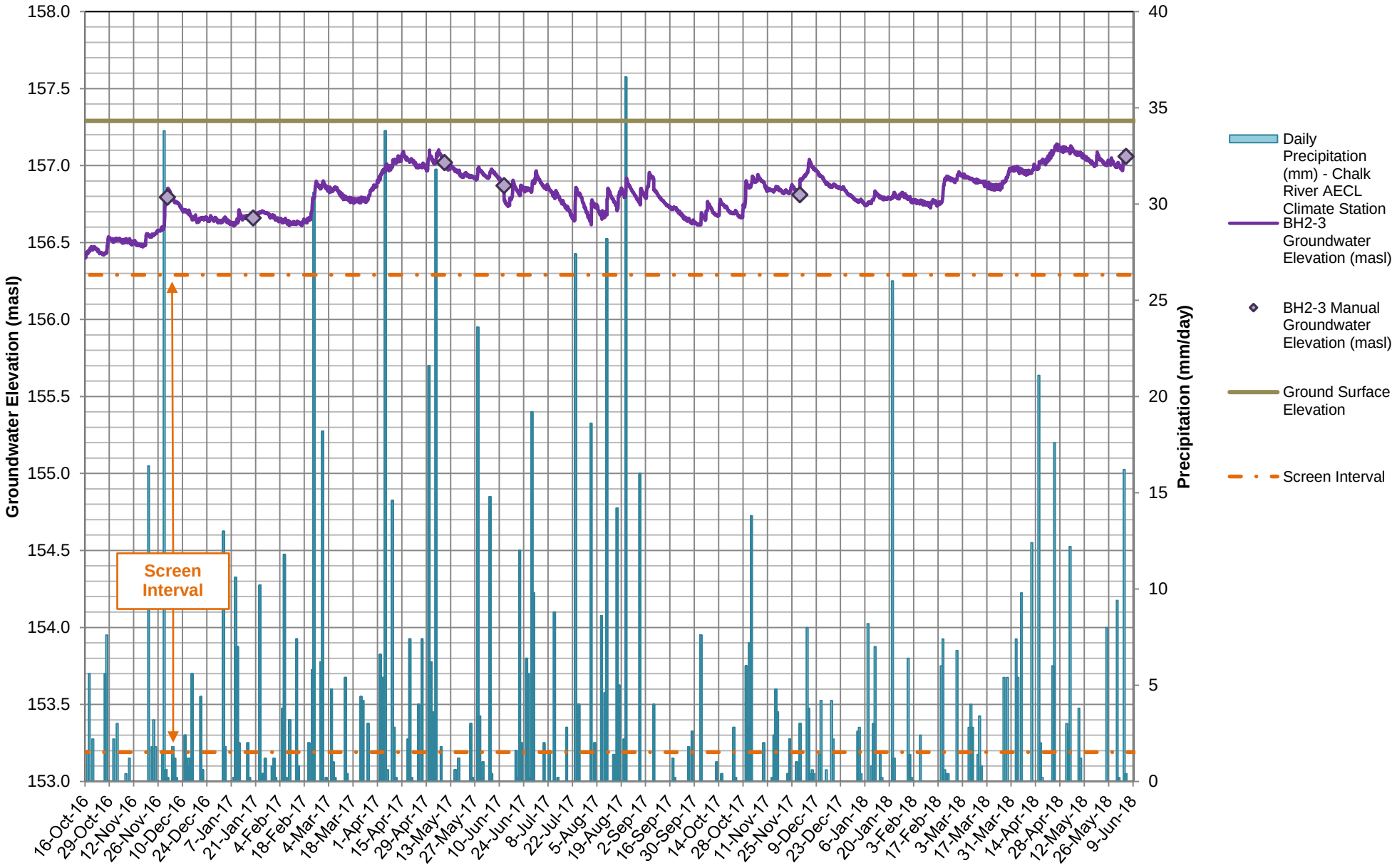


BH2-3 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

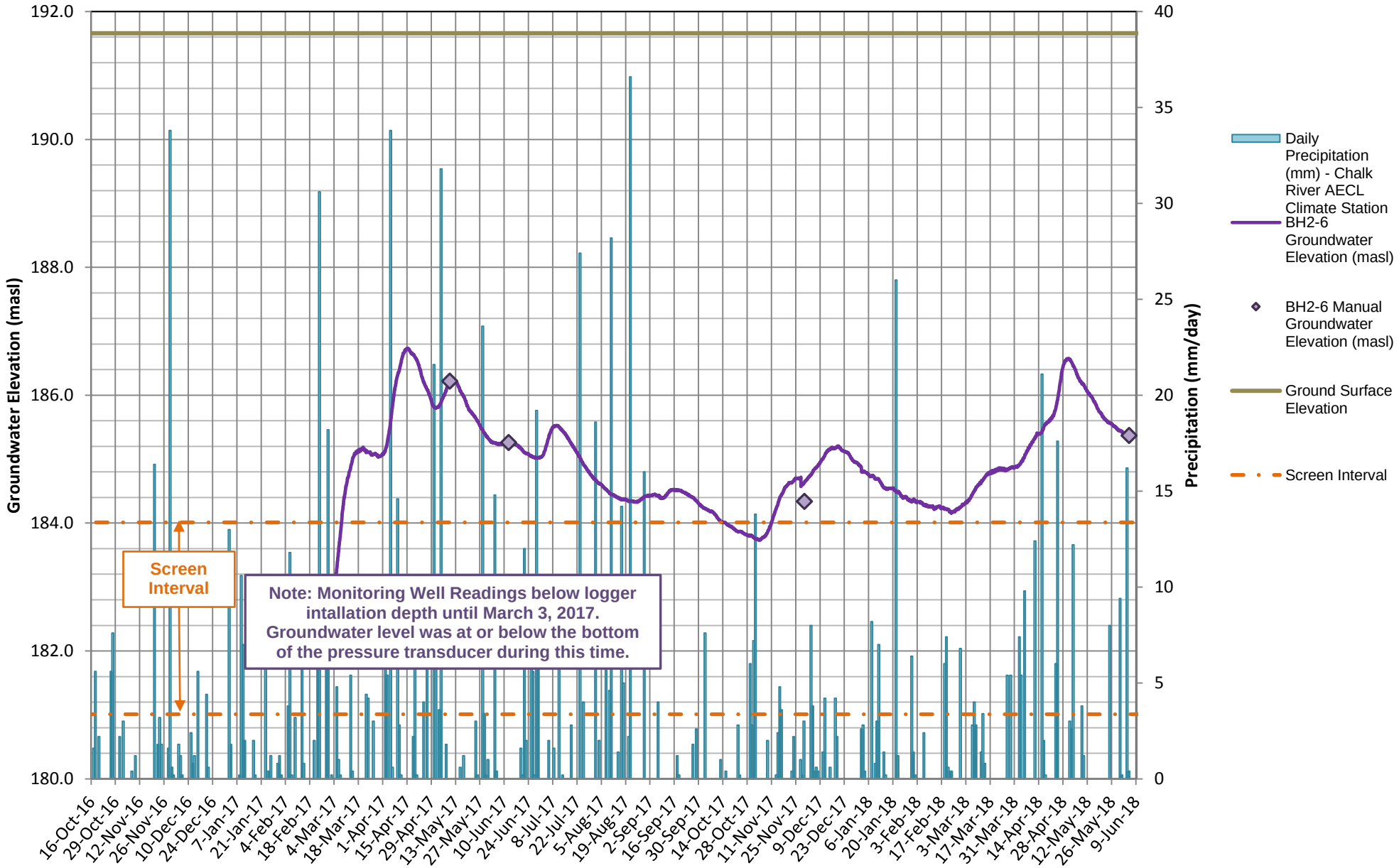
Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018



BH2-6 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation
Chalk River, Ontario
Amec Foster Wheeler Reference No.: TZ16018

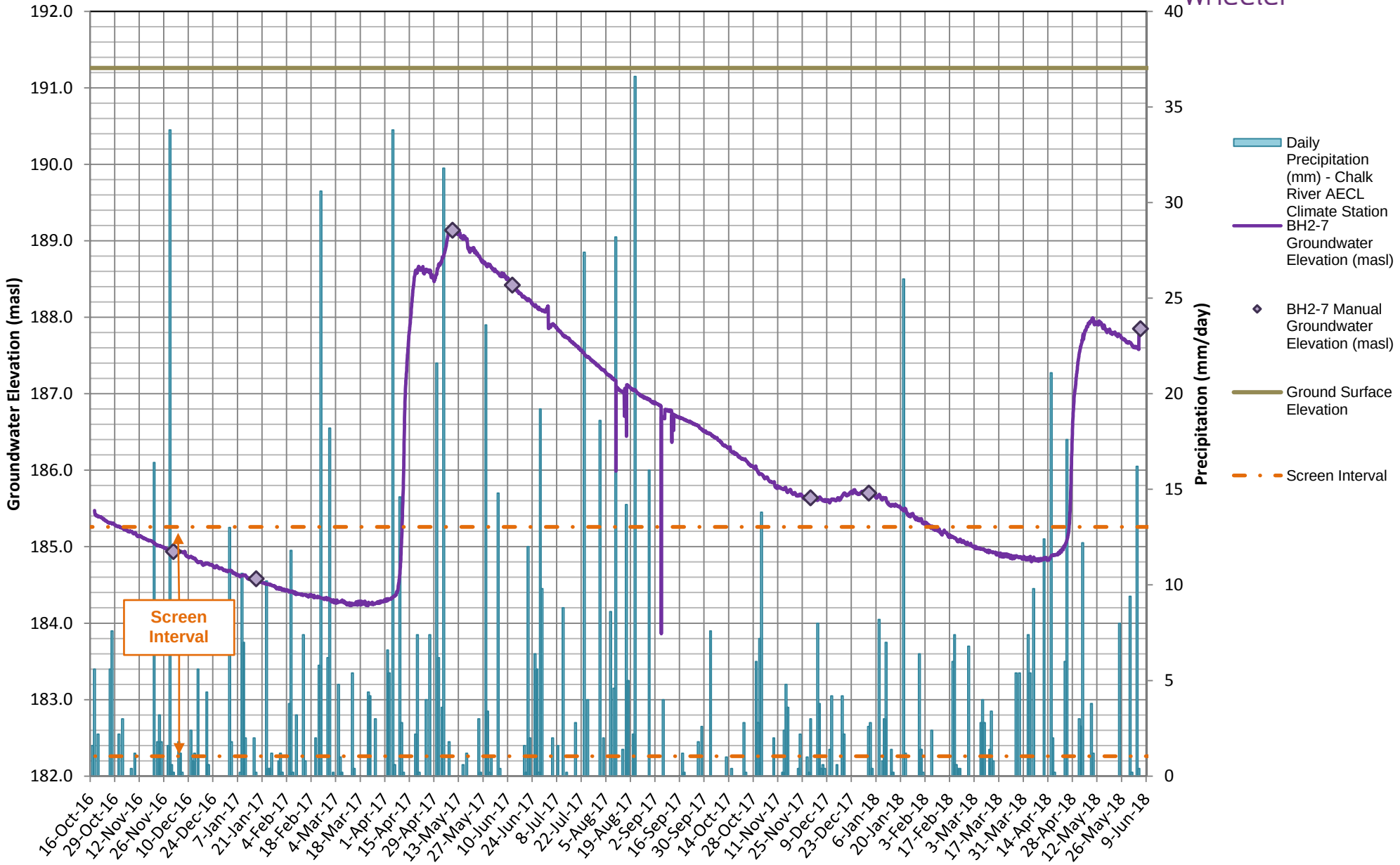


BH2-7 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

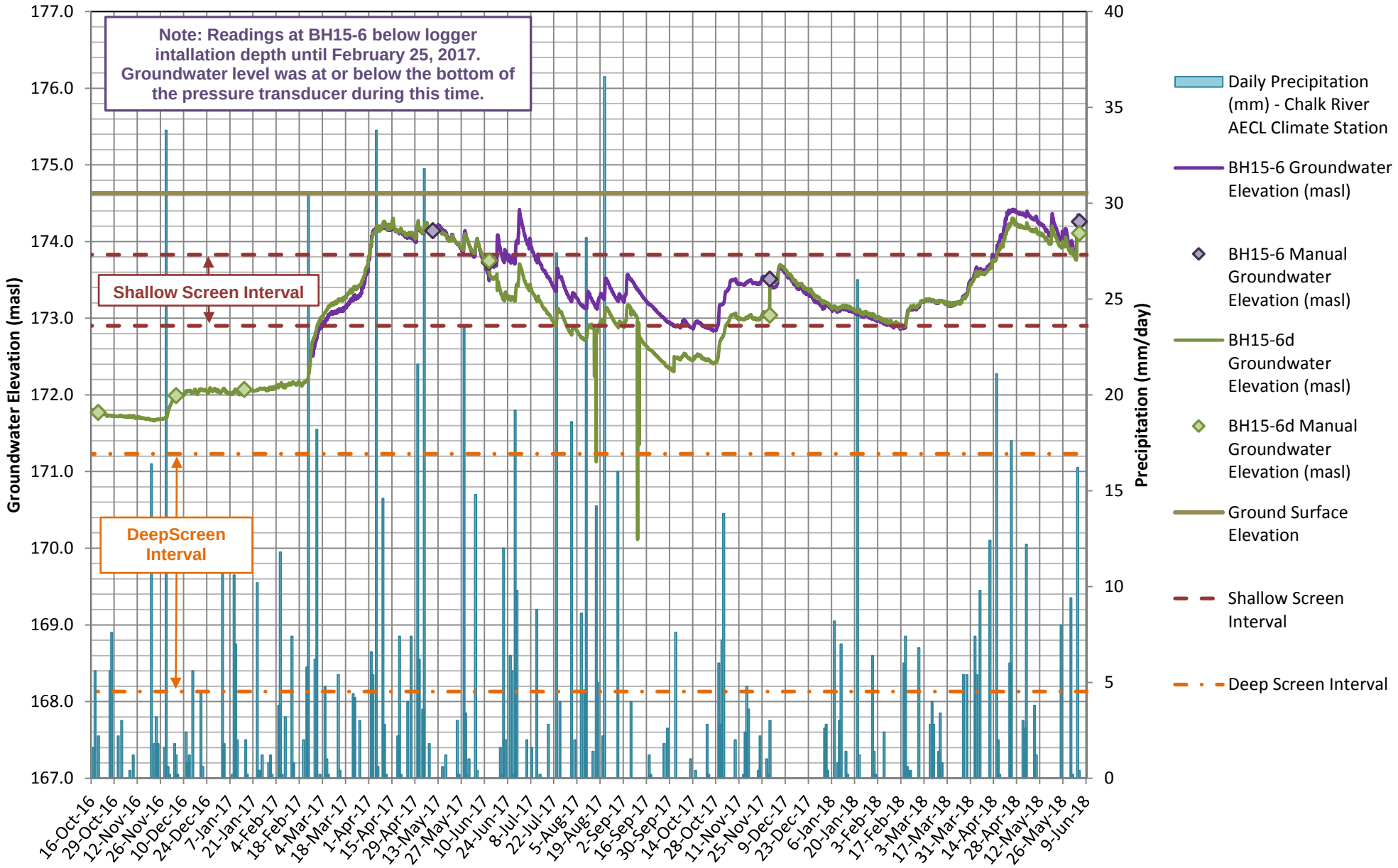


BH15-6d & BH15-6 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

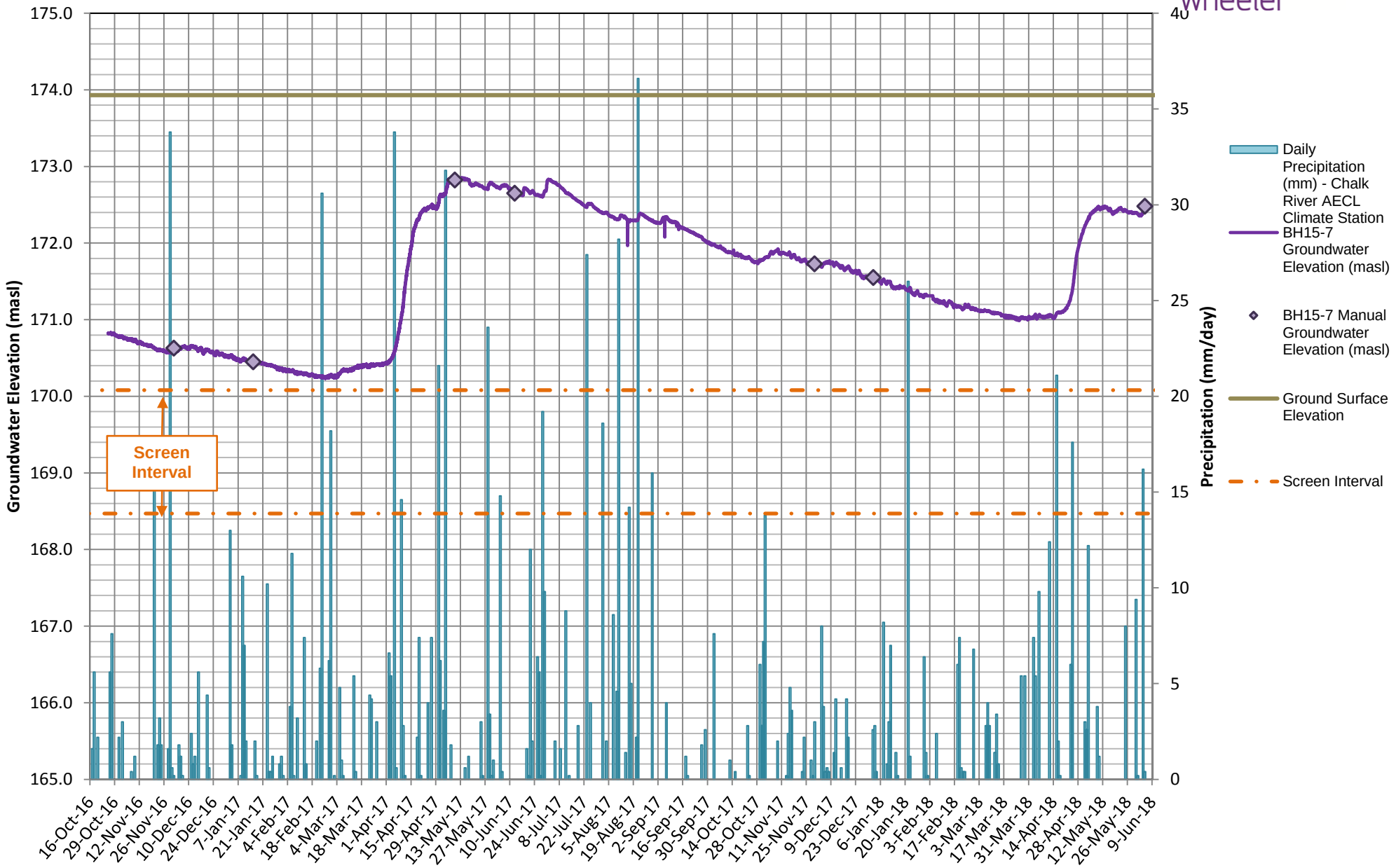


BH15-7 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

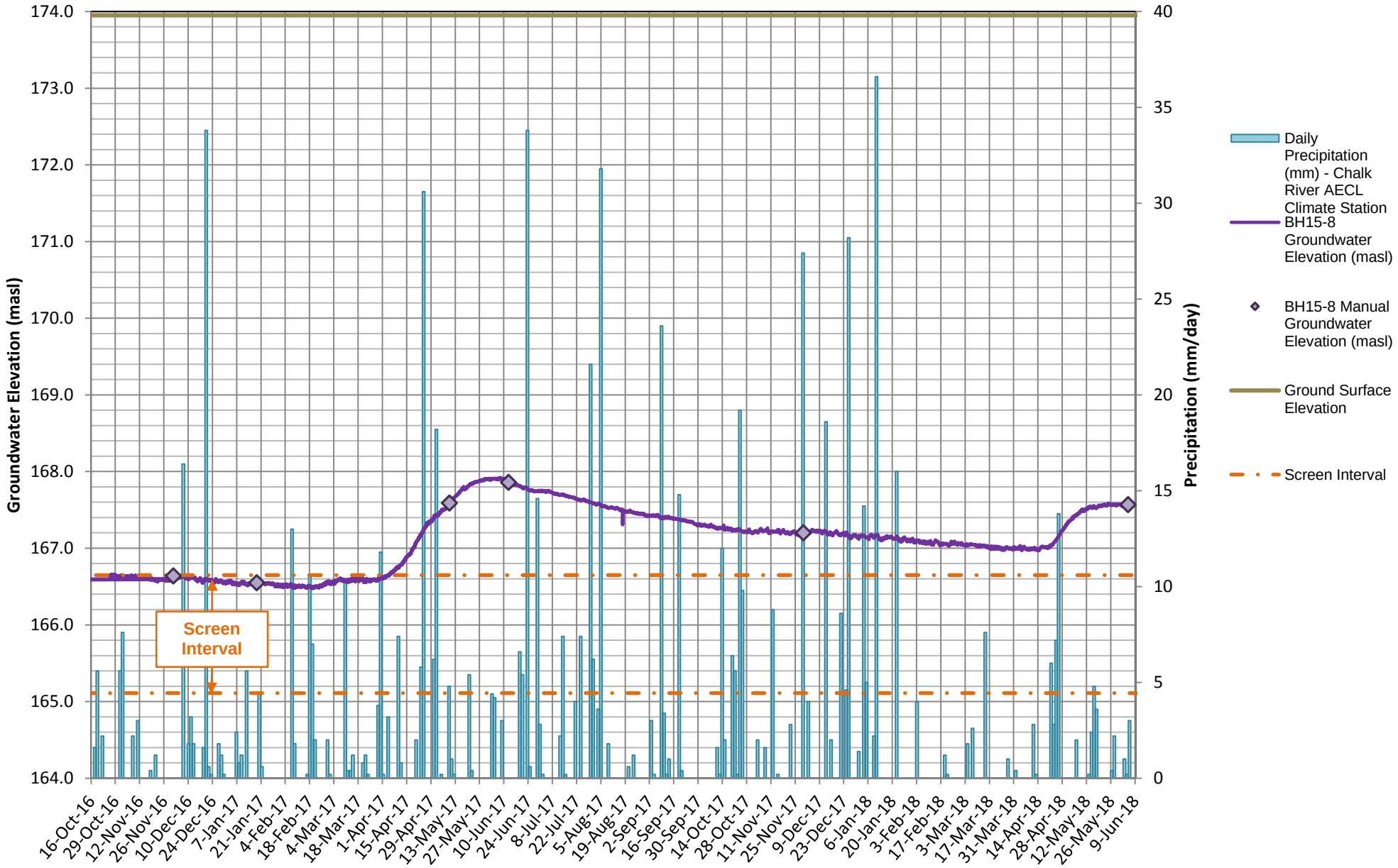
Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018



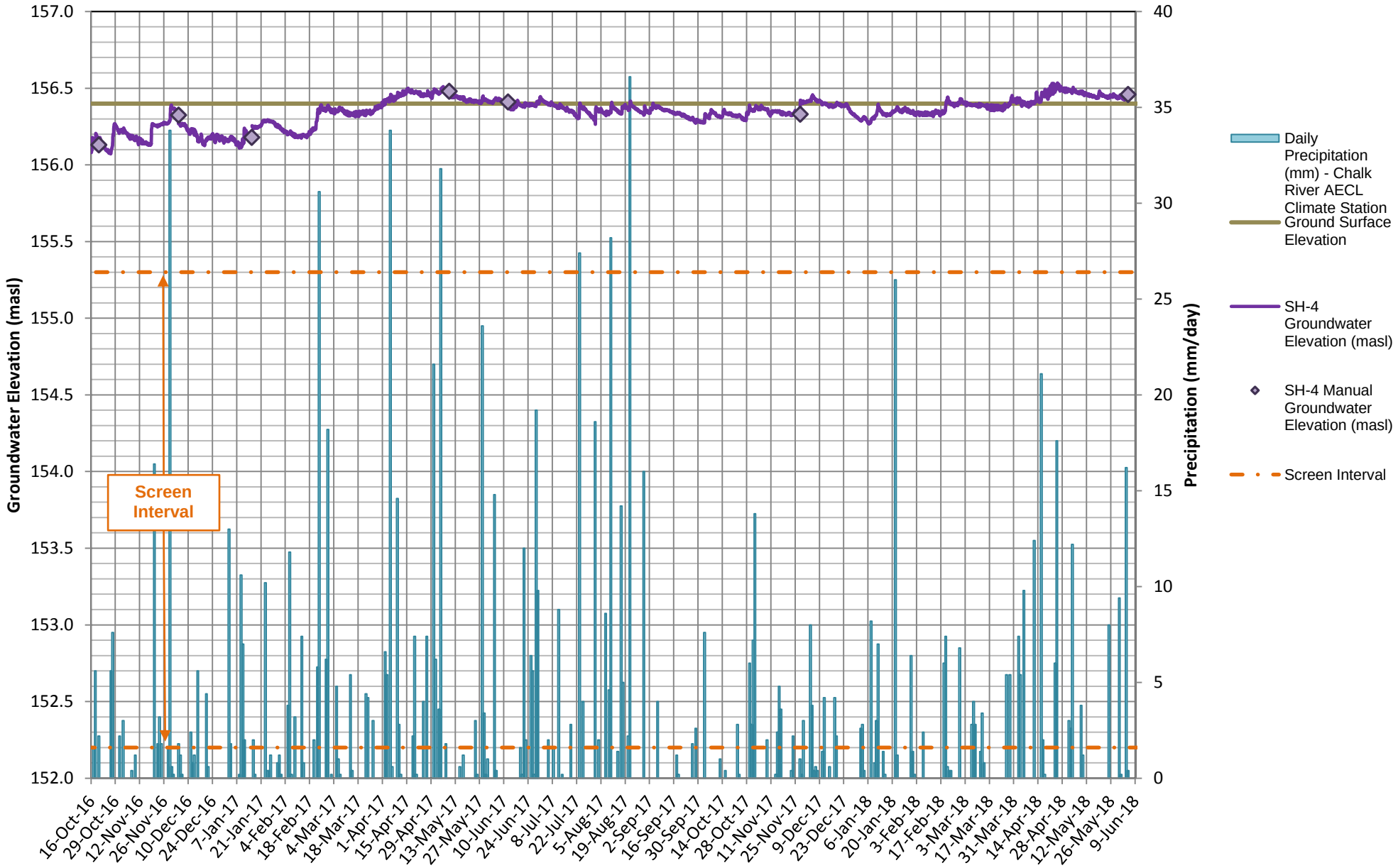
BH15-8 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation
Chalk River, Ontario
Amec Foster Wheeler Reference No.: TZ16018



SH-4 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation
Chalk River, Ontario
Amec Foster Wheeler Reference No.: TZ16018

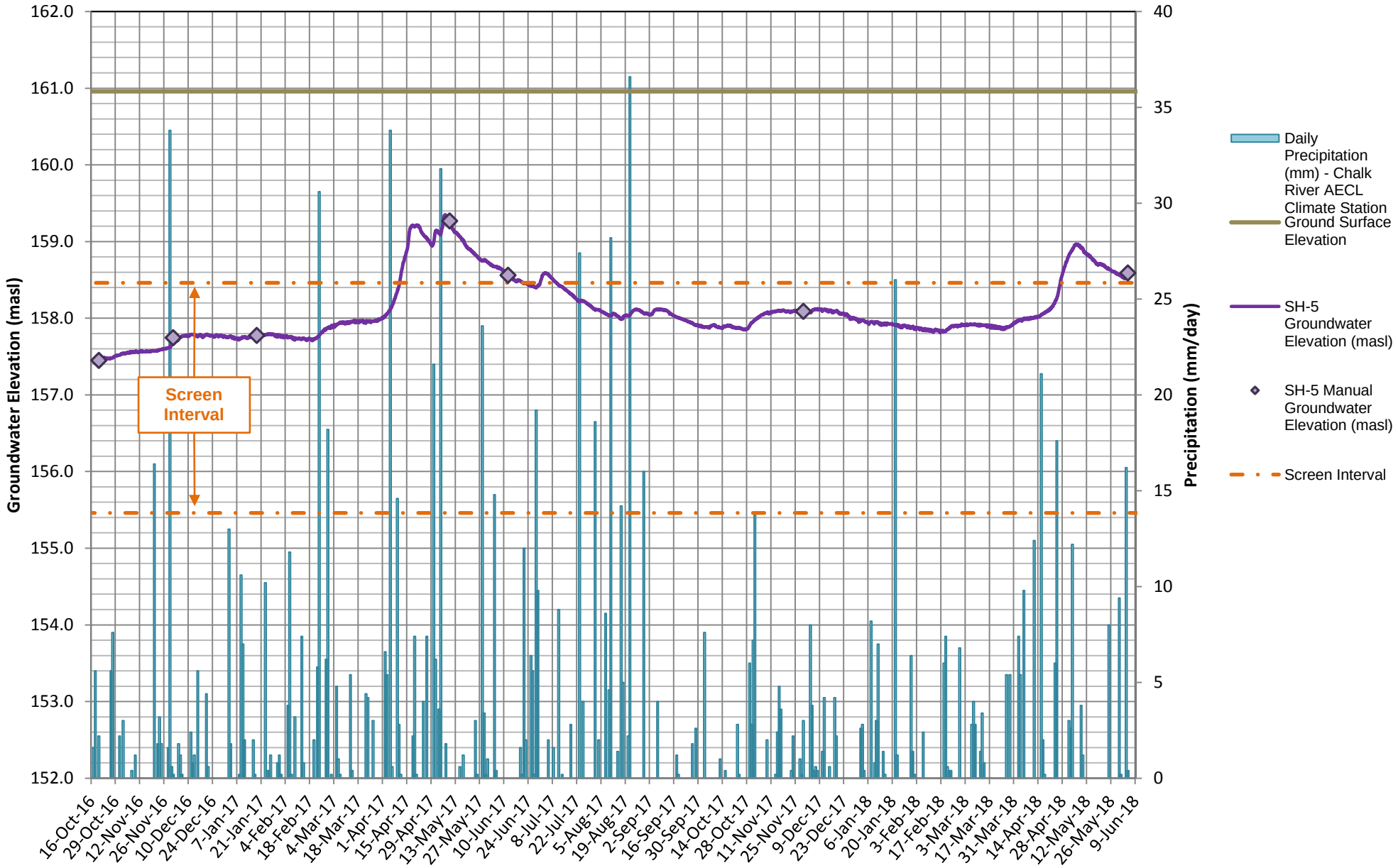


SH-5 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

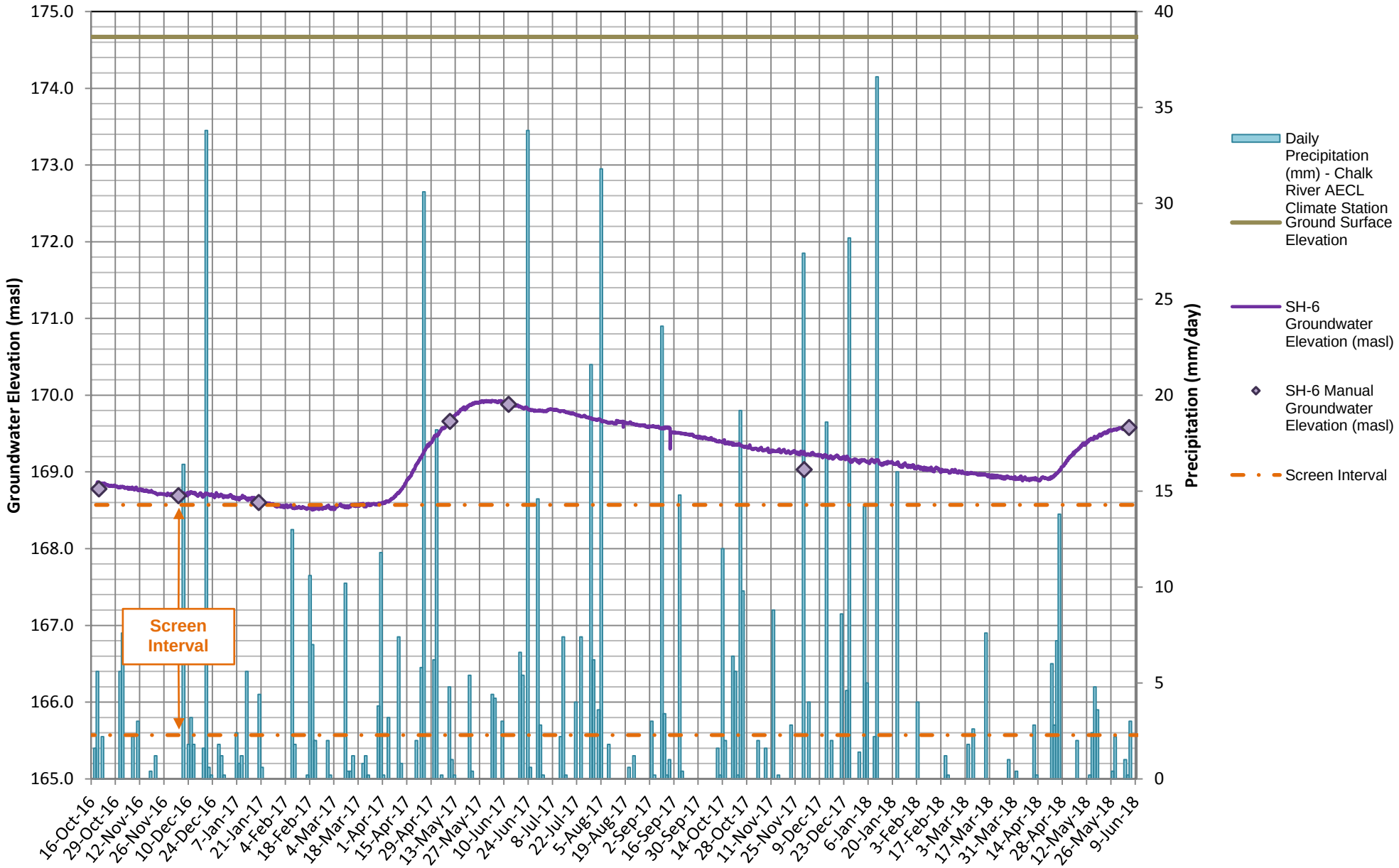


SH-6 Hydrograph - October 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

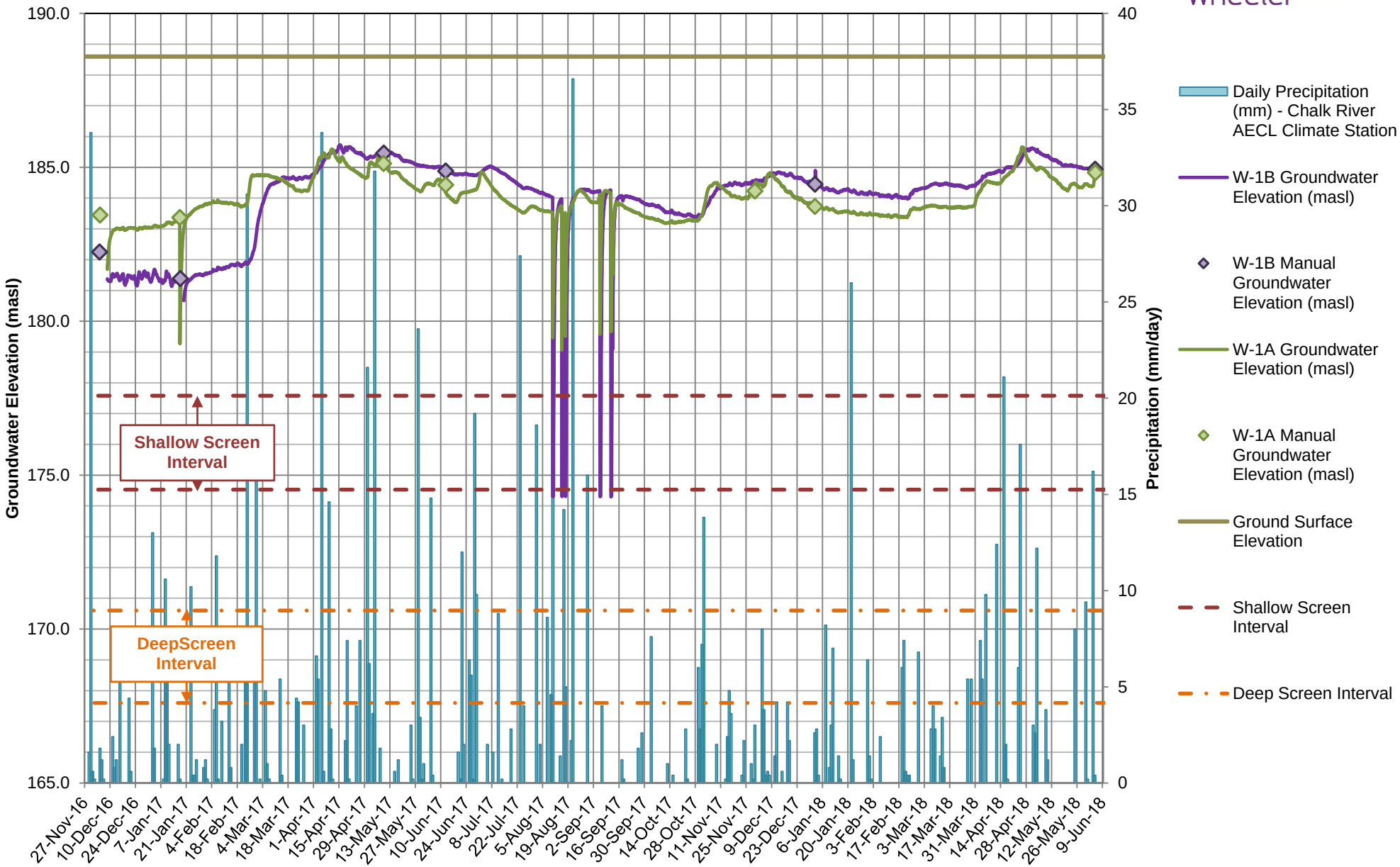


W-1 A/B Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

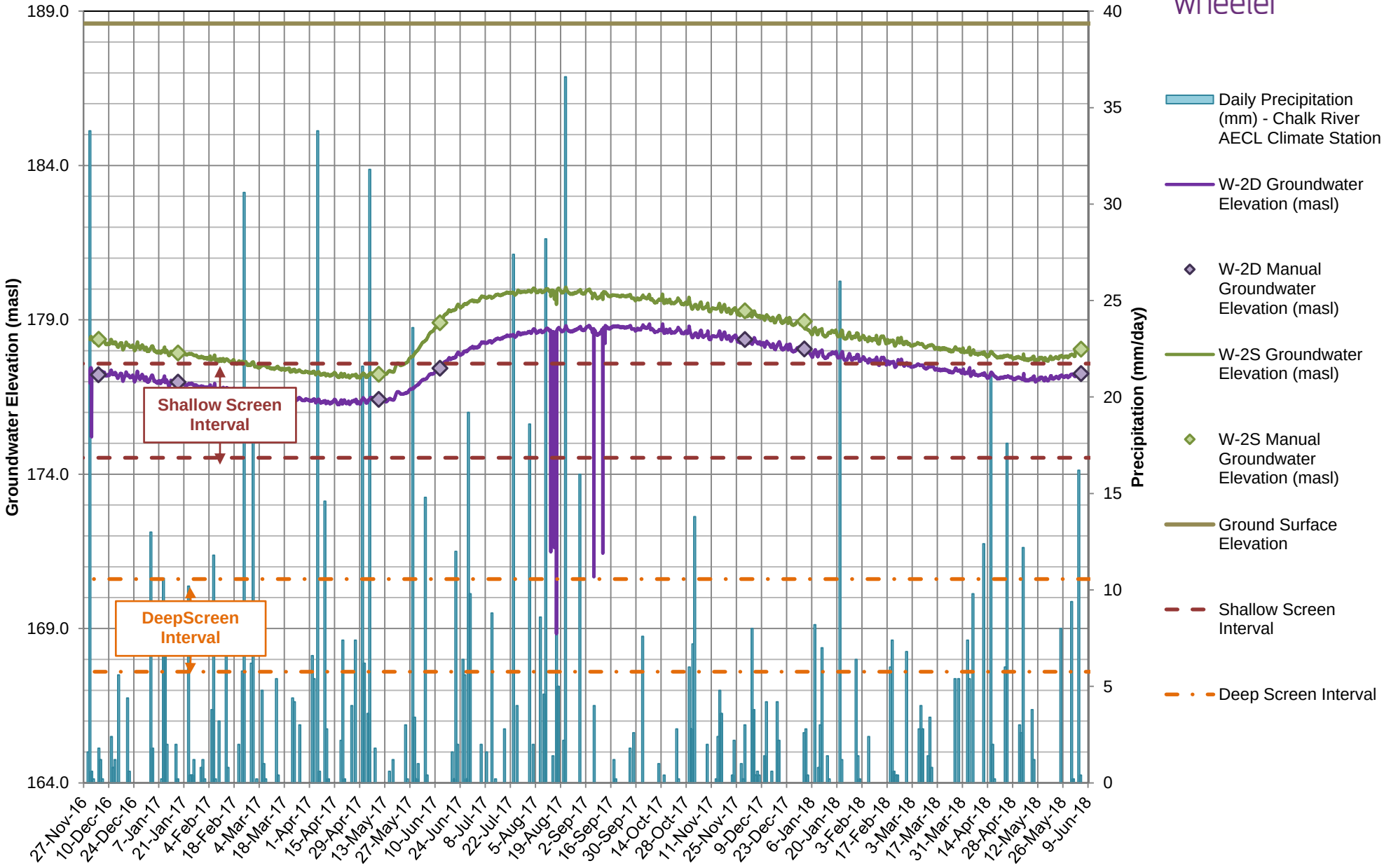


W-2 S/D Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

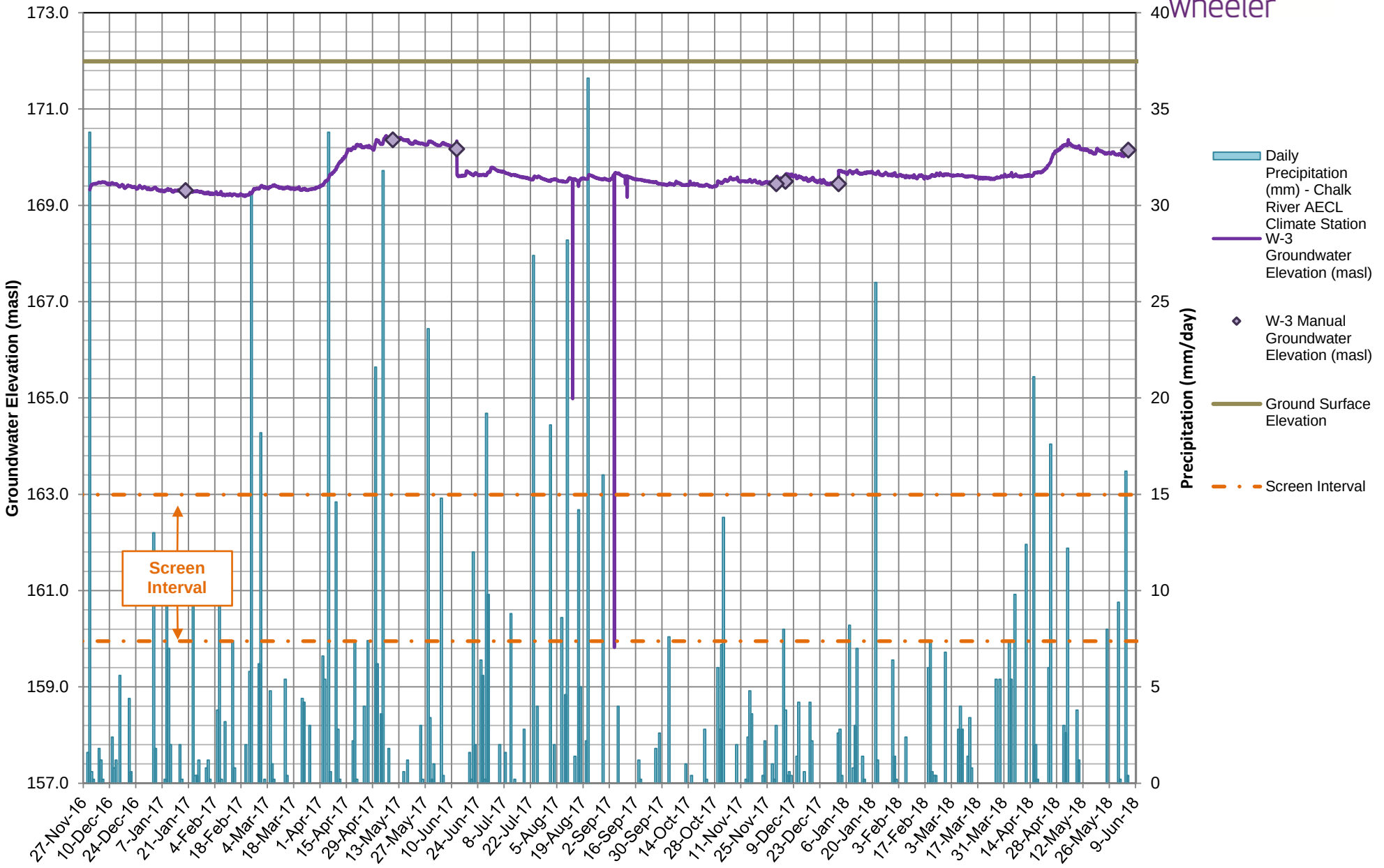


W-3 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

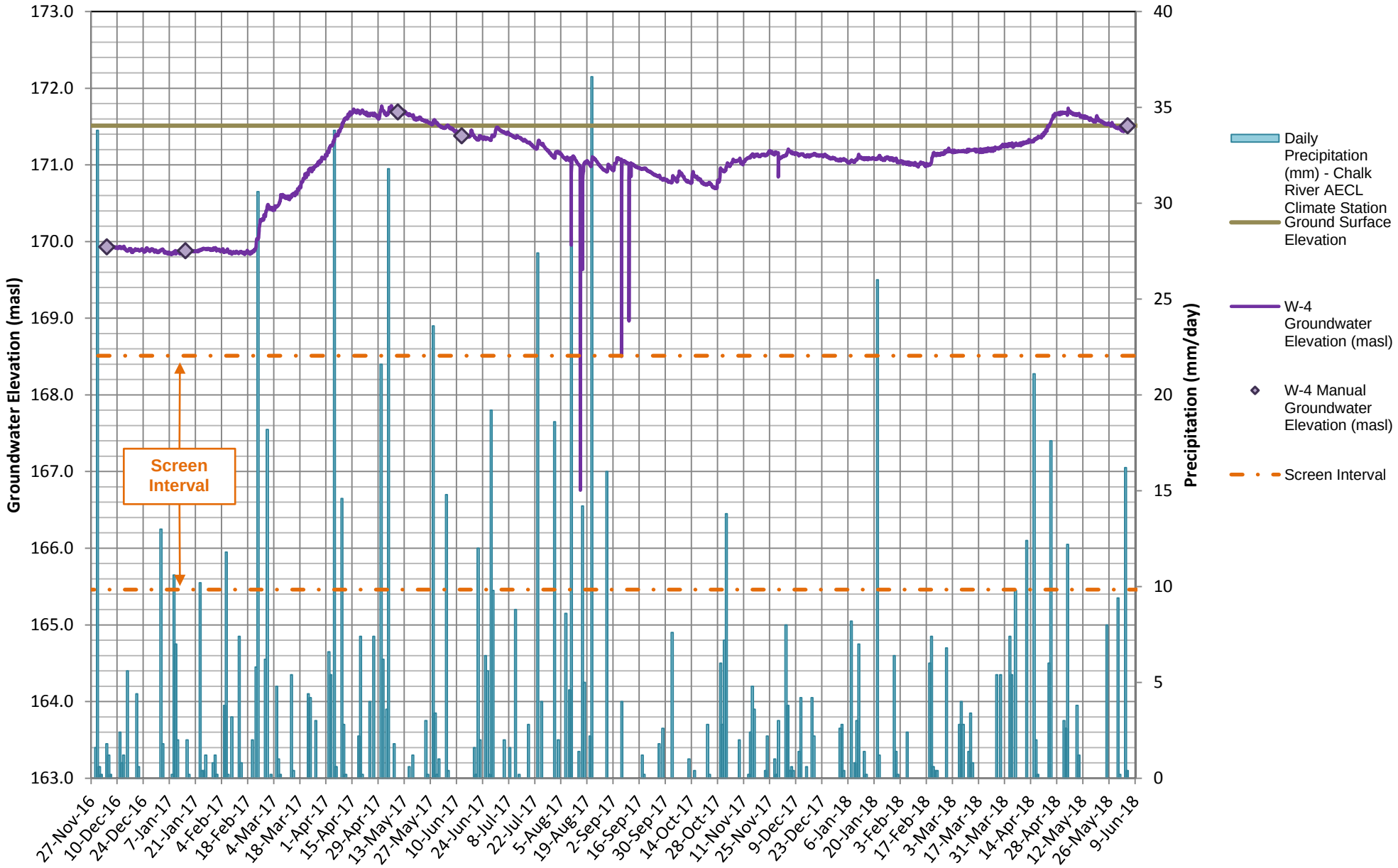


W-4 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

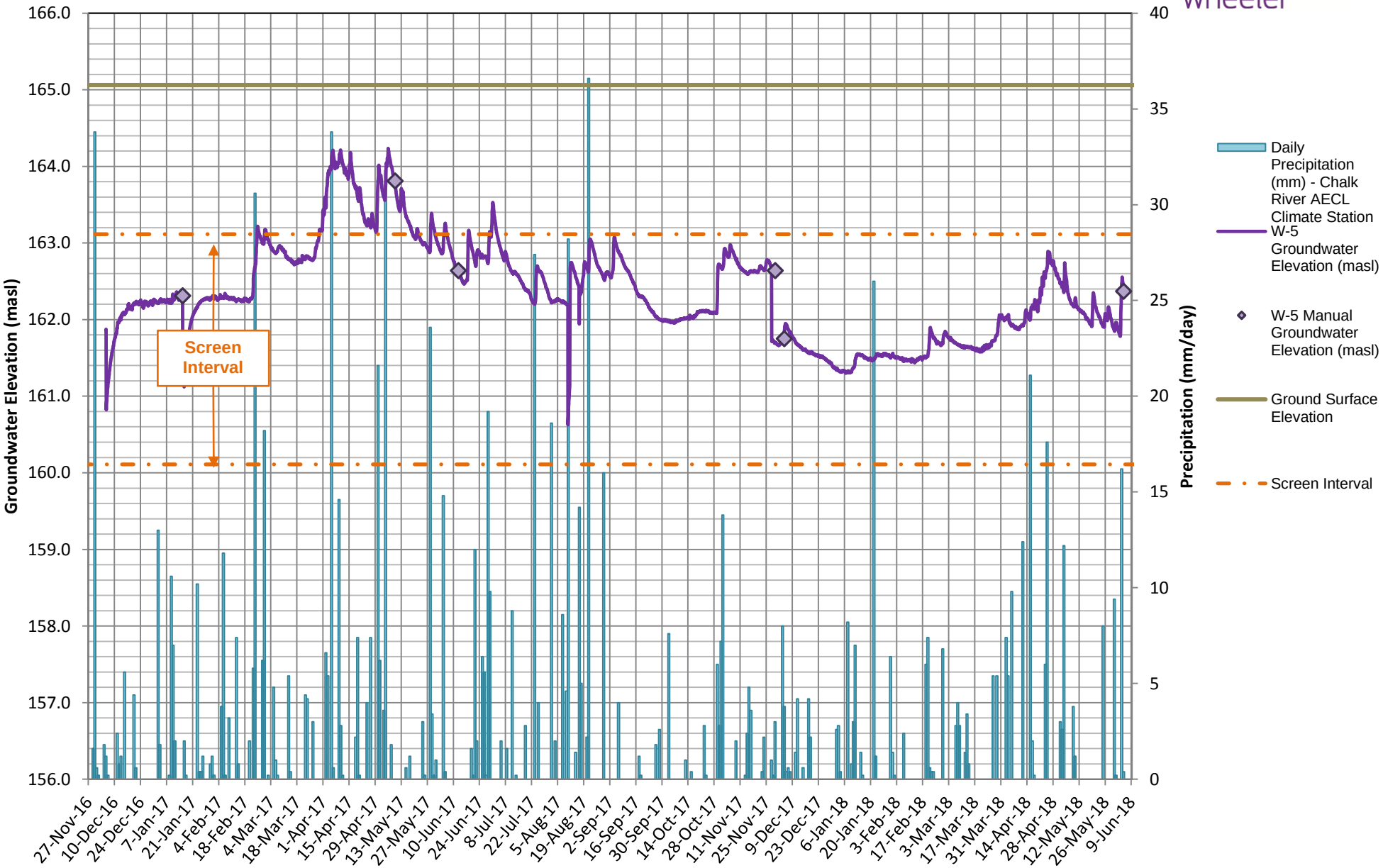


W-5 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

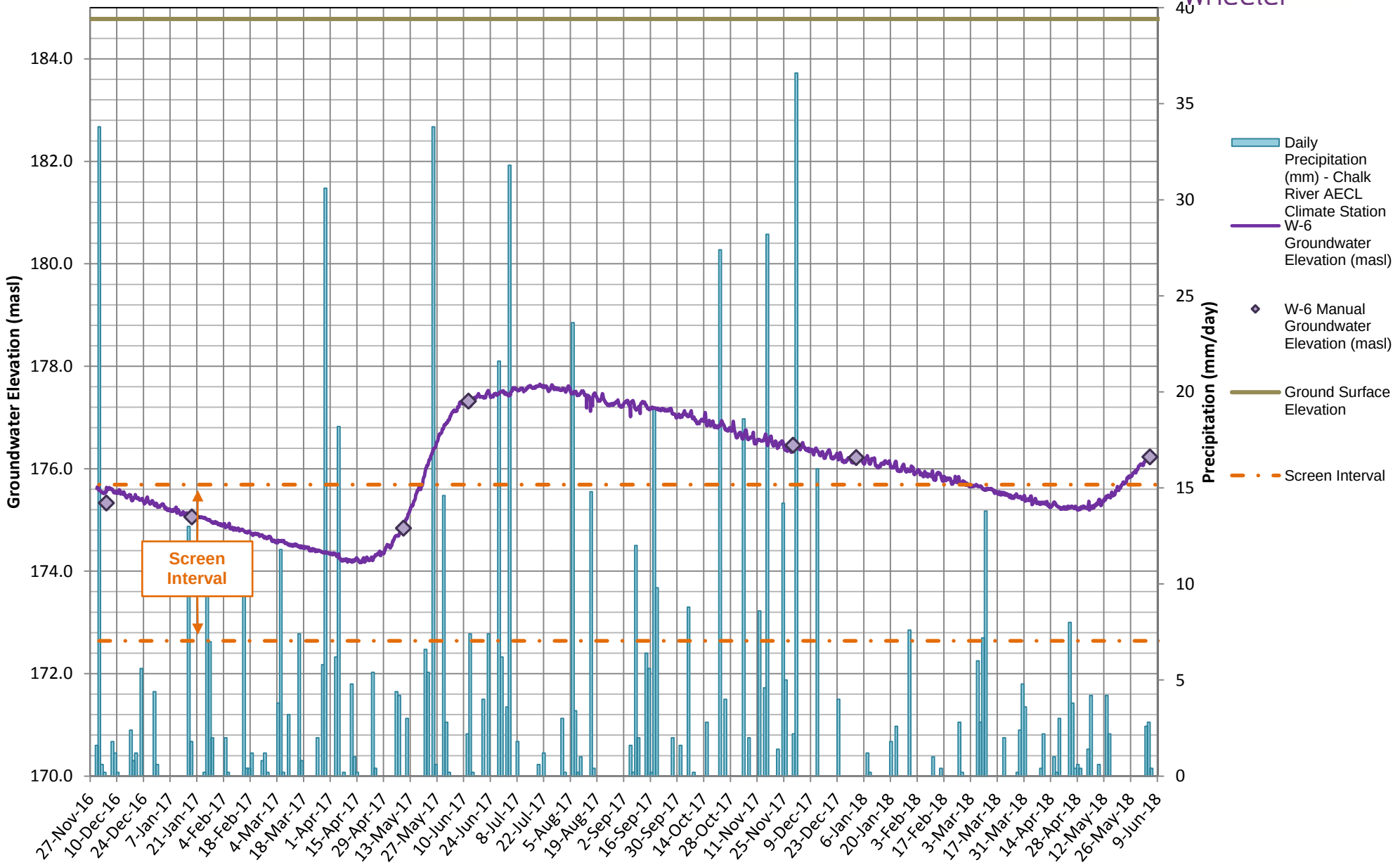


W-6 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

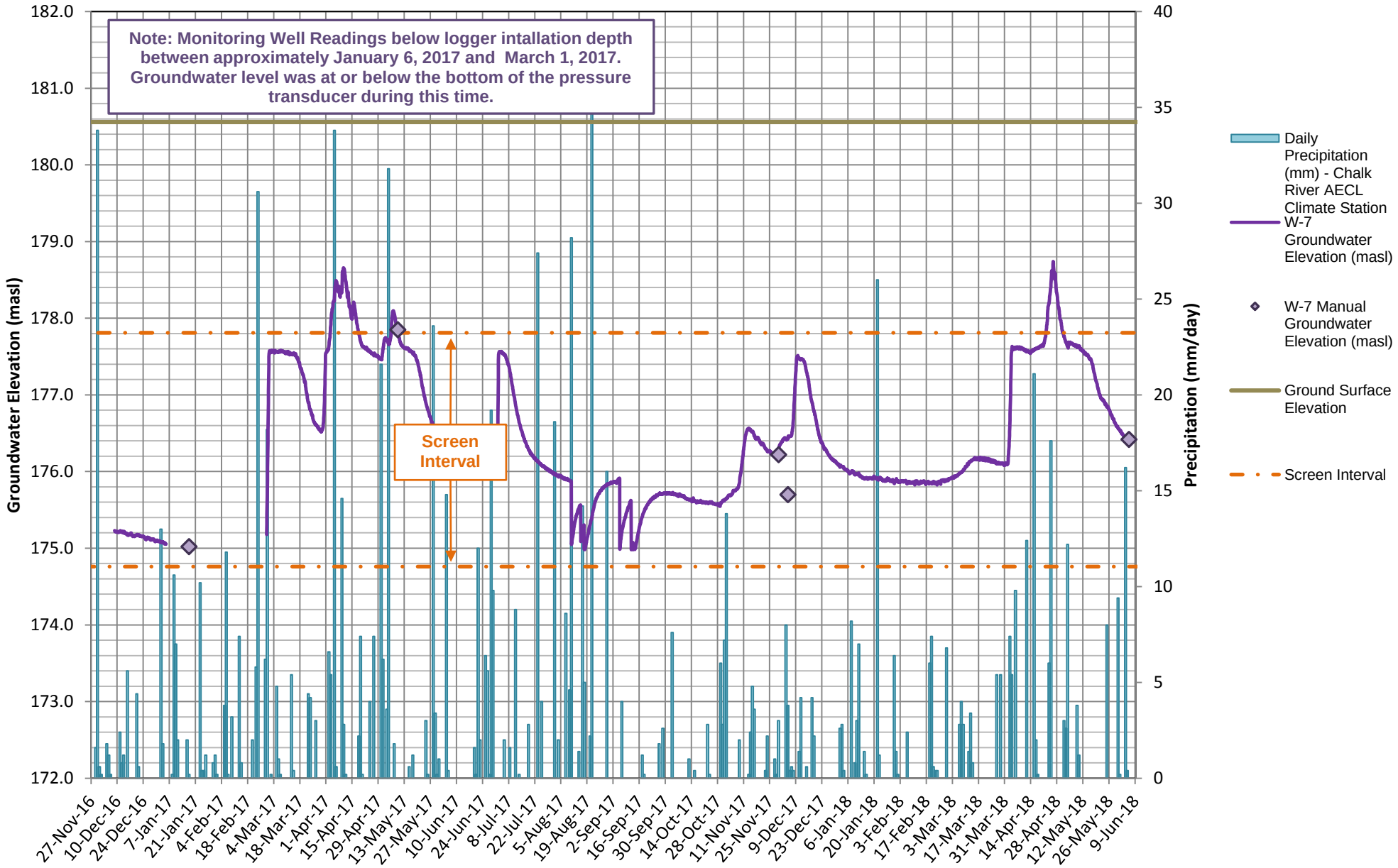


W-7 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018

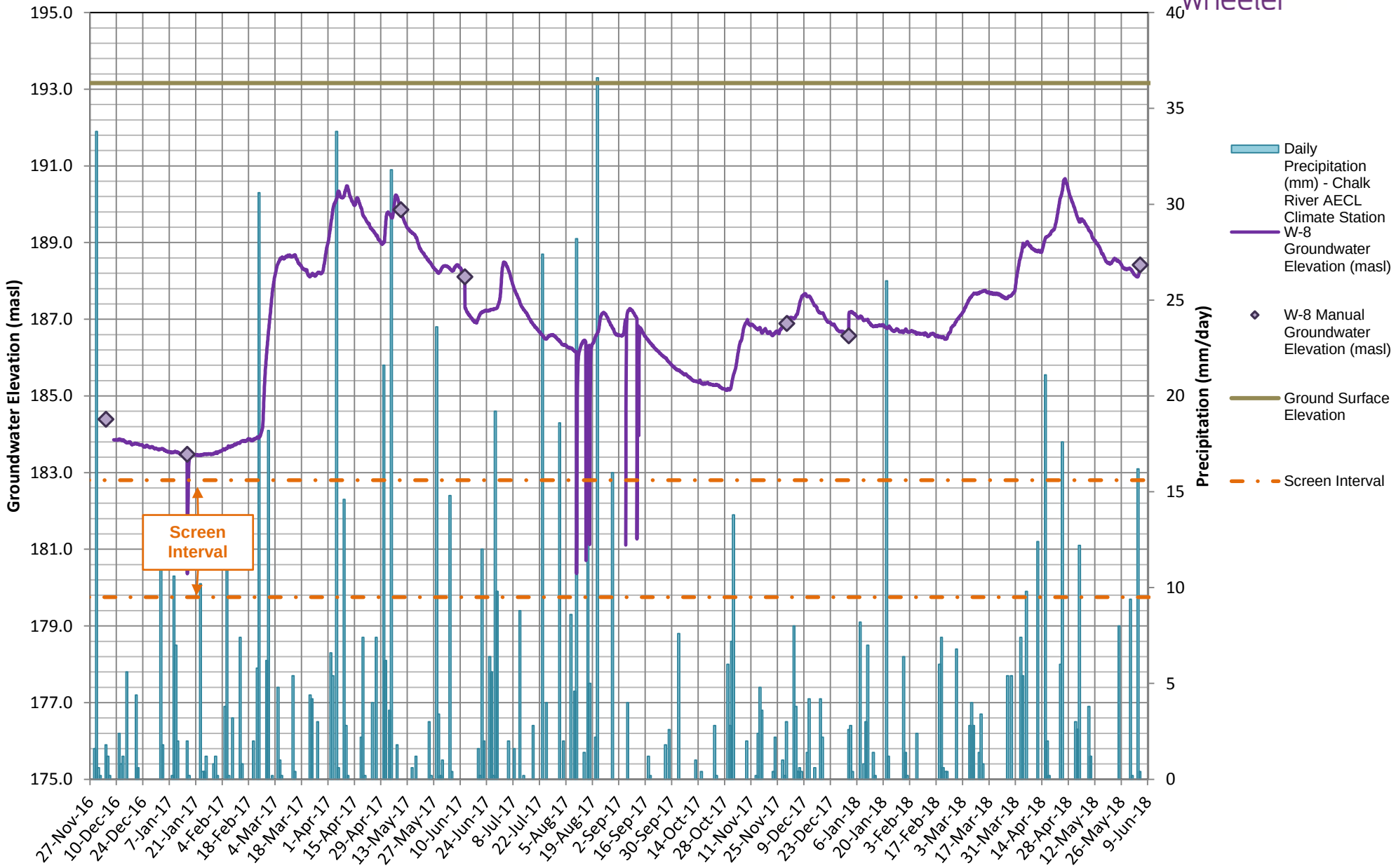


W-8 Hydrograph - December 2016 to June 2018

Chalk River NSDF Investigation

Chalk River, Ontario

Amec Foster Wheeler Reference No.: TZ16018



APPENDIX 5.4-1

Ottawa River Elevations Recorded at Pembroke Station between 1950 and 2019

Table 1: Ottawa River Elevations Recorded at Pembroke Station between 1950 and 2019

Average Daily Surface Elevation (masl) per Month													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
1950	111.16	111.19	111.15	111.41	112.05	111.57	111.32	111.17	111.17	111.16	111.32	111.38	111.34
1951	111.33	111.35	111.49	112.67	112.01	111.44	111.52	111.30	111.29	111.74	112.10	111.81	111.67
1952	111.64	111.54	111.56	111.96	112.07	111.76	111.33	111.32	111.32	111.32	111.27	111.43	111.54
1953	111.50	111.58	111.81	112.38	111.72	111.37	111.24	111.14	110.98	111.14	111.10	111.18	111.43
1954	111.23	111.21	111.46	111.79	111.74	111.93	111.64	111.36	111.38	111.99	111.87	111.73	111.61
1955	111.62	111.55	111.49	112.00	111.66	111.36	111.16	111.05	111.03	111.20	111.73	111.59	111.45
1956	111.37	111.31	111.32	111.64	112.03	111.81	111.59	111.49	111.63	111.83	111.54	111.49	111.59
1957	111.44	111.47	111.52	111.61	111.69	111.47	112.17	111.39	111.43	111.56	111.79	111.81	111.61
1958	111.67	111.67	111.66	111.77	111.34	111.39	111.39	111.22	111.25	111.39	111.64	111.58	111.50
1959	111.45	111.40	111.34	111.67	111.98	111.52	111.25	111.16	111.25	111.37	111.77	111.74	111.49
1960	111.61	111.57	111.55	112.09	113.12	111.87	112.10	111.69	111.37	111.34	111.40	111.44	111.76
1961	111.40	111.29	111.29	111.56	111.73	111.57	111.43	111.33	111.39	111.50	111.42	111.50	111.45
1962	111.56	111.62	111.43	111.81	112.06	111.49	111.12	111.03	111.06	111.08	111.07	111.02	111.36
1963	111.02	111.08	111.14	111.72	111.58	111.43	111.15	111.07	111.16	111.11	111.14	111.41	111.25
1964	111.41	111.39	111.43	111.64	111.74	111.66	111.37	111.12	111.03	111.14	111.16	111.24	111.36
1965	111.33	111.34	111.34	111.41	111.98	111.44	111.16	111.29	111.73	112.05	111.76	111.66	111.54
1966	111.69	111.62	111.66	111.99	111.81	111.73	111.29	111.46	111.32	111.49	111.75	112.33	111.68
1967	111.73	111.36	111.20	112.19	112.34	112.03	111.46	111.23	111.21	111.34	111.84	111.68	111.63
1968	—	—	—	—	—	—	—	—	—	—	—	—	—
1969	—	—	—	—	—	—	111.40	111.40	111.23	111.33	111.86	111.69	—
1970	111.52	111.44	111.47	111.55	112.05	112.00	111.94	111.60	111.34	111.41	111.43	111.44	111.60
1971	111.40	111.39		111.77	112.00	111.42	111.00	111.09	110.87	110.90	111.03	111.19	111.29
1972	111.34	111.38	111.43	111.54	112.26	—	111.41	111.48	111.49	111.40	111.56	111.60	111.55
1973	111.48	111.55	111.67	112.13	112.16	111.88	111.58	111.27	111.27	111.43	111.52	111.55	111.62
1974	111.44	111.39	111.57	111.84	112.63	112.20	111.66	—	111.18	111.32	111.66	—	111.66

Table 1: Ottawa River Elevations Recorded at Pembroke Station between 1950 and 2019

Average Daily Surface Elevation (masl) per Month													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Monthly Average
1975	111.53	111.59	111.54	—	111.77	111.63	111.18	111.02	110.94	110.99	111.07	—	—
1976	111.40	111.40	111.49	112.31	112.22	111.56	111.36	111.21	111.12	111.20	111.21	111.37	111.50
1977	111.35	111.34	111.56	112.09	111.69	111.22	111.24	111.10	111.13	111.21	111.41	111.59	111.41
1978	111.52	111.55	111.41	111.44	111.82	111.47	111.18	111.07	111.04	111.39	111.38	111.40	111.39
1979	111.48	111.48	111.58	112.20	112.69	111.85	111.46	111.39	111.34	111.64	111.92	111.94	111.75
1980	111.77	111.60	111.55	112.09	112.03	111.34	111.34	111.28	111.27	111.66	111.68	111.56	111.60
1981	111.44	111.52	111.83	112.38	111.87	111.79	111.36	111.13	111.36	111.46	111.57	111.43	111.59
1982	111.38	111.41	111.43	111.59	111.56	111.31	111.15	111.01	111.01	111.16	111.48	111.69	111.35
1983	111.73	111.64	111.71	111.74	112.26	112.02	111.25	111.14	111.02	111.18	111.42	111.51	111.55
1984	111.56	111.58	111.57	111.93	111.79	111.91	111.67	111.28	111.21	111.25	111.68	111.74	111.59
1985	111.72	111.63	111.62	111.90	112.27	111.43	111.45	111.47	111.20	111.19	111.32	111.51	111.56
1986	111.47	111.57	111.36	112.04	111.87	111.57	111.22	111.19	111.17	111.42	111.63	111.47	111.50
1987	111.47	111.44	111.36	111.72	111.11	111.01	111.01	111.01	110.89	110.90	111.11	111.36	111.20
1988	111.50	111.54	111.31	112.08	111.92	111.27	111.05	111.21	111.34	111.80	112.08	111.77	111.56
1989	111.70	111.73	111.40	—	112.03	112.02	111.30	111.09	—	—	111.17	111.51	—
1990	111.52	111.59	111.57	111.84	111.87	111.45	111.43	111.12	111.11	111.69	111.78	111.99	111.58
1991	111.70	111.74	111.52	112.20	111.70	111.32	111.10	111.01	111.05	111.17	111.39	111.64	111.46
1992	111.57	111.62	111.40	111.49	111.81	111.22	111.16	111.06	111.33	111.52	111.83	111.68	111.47
1993	111.60	111.61	111.31	111.53	111.31	111.49	111.08	110.97	111.02	111.45	111.72	111.54	111.38
1994	111.46	111.64	111.49	111.41	111.57	111.56	111.62	111.33	111.15	111.20	111.49	111.50	111.45
1995	111.60	111.57	111.54	111.41	111.93	111.74	111.13	111.10	110.95	111.00	111.51	111.58	111.42
1996	111.51	111.54	111.43	111.62	112.45	111.65	111.56	111.41	111.12	111.15	111.43	111.46	111.53
1997	111.56	111.71	111.60	111.94	112.39	111.61	111.40	111.08	111.16	111.23	111.25	111.25	111.52
1998	111.32	111.49	111.42	112.24	111.23	111.17	111.11	110.97	110.96	110.99	111.06	111.34	111.27
1999	111.47	111.59	111.46	111.52	110.97	111.37	111.33	111.09	111.04	111.57	111.88	111.95	111.44

Table 1: Ottawa River Elevations Recorded at Pembroke Station between 1950 and 2019

Average Daily Surface Elevation (masl) per Month													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Monthly Average**
2000	111.69	111.67	111.75	111.73	111.60	111.42	111.27	111.32	111.20	111.16	111.30	111.45	111.46
2001	111.45	111.50	111.49	111.79	111.67	111.45	111.13	110.97	111.07	111.85	112.02	112.02	111.53
2002	111.79	111.67	111.68	112.19	112.15	111.97	111.45	111.12	111.03	111.08	111.13	111.15	111.53
2003	111.27	111.27	111.26	111.68	111.44	111.51	111.37	111.40	111.19	111.50	111.96	111.88	111.48
2004	111.77	111.67	111.57	112.04	112.23	111.65	111.83	111.17	111.14	111.00	111.22	111.45	111.56
2005	111.57	111.54	111.39	111.99	111.59	111.32	111.06	110.84	110.87	111.13	111.41	—	111.36
2006	111.68	111.67	111.65	112.30	111.68	111.42	111.19	111.19	111.14	111.70	111.95	112.02	111.64
2007	111.93	111.77	111.61	111.65	111.41	111.71	111.41	111.06	110.98	110.94	111.13	111.32	111.41
2008	111.63	111.71	111.60	111.99	112.16	111.77	111.82	111.60	111.41	111.35	111.53	111.62	111.68
2009	111.76	111.74	111.69	112.22	112.27	111.79	111.48	111.57	111.26	111.44	111.77	111.68	111.72
2010	111.60	111.64	111.58	111.23	111.09	111.01	110.89	110.86	111.13	111.50	111.42	111.69	111.30
2011	111.71	111.71	111.55	111.85	112.11	111.62	111.41	111.12	110.98	111.09	111.42	111.59	111.51
2012	111.67	111.63	111.89	111.81	111.45	111.18	110.93	110.94	111.01	111.37	111.87	111.62	111.45
2013	111.66	111.75	111.60	111.98	112.57	112.01	111.20	111.16	111.22	111.37	111.98	111.65	111.68
2014	111.65	111.68	111.40	111.69	112.53	111.69	111.33	111.21	111.57	111.93	112.00	111.82	111.71
2015	111.83	111.77	111.53	111.77	111.92	111.56	111.12	111.06	111.08	111.02	111.40	111.88	111.49
2016	111.96	111.83	112.01	112.21	111.94	111.57	111.12	111.08	111.05	111.07	111.13	111.30	111.52
2017	111.49	111.61	111.76	112.22	112.56	111.91	111.54	111.34	111.43	111.23	111.46	111.67	111.68
2018	111.69	111.66	111.45	111.28	112.29	111.65	111.08	111.14	111.48	111.91	111.84	111.63	111.59
2019	111.67	111.72	111.52	112.02	—	—	—	—	—	—	—	—	—
Average	111.55	111.54	111.51	111.86	111.92	111.58	111.34	111.20	111.19	111.35	111.53	111.58	111.51
Max	111.96	111.83	112.01	112.67	113.12	112.20	112.17	111.69	111.73	112.05	112.10	112.33	—
Min	111.02	111.08	111.14	111.23	110.97	111.01	110.89	110.84	110.87	110.90	111.03	111.02	—

m = metres above sea level; '-' = no data.

APPENDIX 5.6-1

Valued Component Selection

Scientific Name	Common Name	Confirmed at CRL	Confirmed in LSA	Likelihood of Presence at CRL	Likelihood of Presence in LSA	Justification for Likelihood of Presence in LSA	Included as VC in EIS	Justification for Inclusion/Exclusion	COSEWIC[1]	SARA[2]	ESA[3]	G-Rank, S-Rank[4]
Mammals												
Canis lupus Lycaon	Eastern Wolf	Yes	No	Confirmed	Likely	Species present on-site; suitable habitat	No	Small footprint relative to home range; no evidence of dens reported by CNL in LSA; Project unlikely to have substantial effect	THR	SC	THR	G4G5TNR, S4
Myotis leibii	Eastern Small-footed Myotis	Yes	Yes	Confirmed	Confirmed	Species present on-site; suitable habitat	No	Not SARA-listed; bat VC covers many pathways	—	—	END	G4, S2S3
Myotis lucifugus	Little Brown Myotis	Yes	Yes	Confirmed	Confirmed	Species present on-site; suitable habitat	Yes	SARA-listed; included in bat VC	END	END	END	G3, S4
Myotis septentrionalis	Northern Myotis	Yes	Yes	Confirmed	Confirmed	Species present on-site; suitable habitat	Yes	SARA-listed; included in bat VC	END	END	END	G1G2, S3
Perimyotis subflavus	Tricolored Bat	Yes	Yes	Confirmed	Confirmed	Species present on-site; suitable habitat	Yes	SARA-listed; included in bat VC	END	END	END	G2G3, S3?
Puma concolor couguar	Eastern Cougar	No	No	Unlikely	Unlikely	Believed to occur primarily in remote northern parts of Ontario	No	Presence unlikely	—	—	END	G5, SU
Birds												
Ammodramus savannarum	Grasshopper Sparrow	No	No	Unlikely	Unlikely	No habitat available	No	Presence unlikely	SC	SC	SC	G5, S4B
Antrostomus vociferus	Eastern Whip-poor-will	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed	THR	THR	THR	G5, S4B
Asio flammeus	Short-eared Owl	No	No	Likely	Unlikely	Little potential habitat	No	Little open habitat to support this species; low chance of important interaction with the Project	SC	SC	SC	G5, S2N, S4B
Cardellina canadensis	Canada Warbler	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed	THR	THR	SC	G5, S4B
Chaetura pelagica	Chimney Swift	Yes	No	Confirmed	Unlikely	No man made structure; large-diameter cavity trees are identified as the natural habitat for the species, but only 59 of them have been recorded in the literature since 1840	No	Presence unlikely; suitable cavity trees uncommon in most forests within the species' breeding range.	THR	THR	THR	G5, S4B, S4N
Chlidonias niger	Black Tern	No	No	Unlikely	Unlikely	No breeding evidence in the area (OBBA)	No	Presence unlikely	NAR	—	SC	G4, S3B
Chordeiles minor	Common Nighthawk	Yes	No	Confirmed	Unlikely	Usually breeds on flat roofs	No	Presence unlikely	SC	THR	SC	G5, S4B
Coccothraustes vespertinus	Evening Grosbeak	Yes	No	Confirmed	Likely	Observed in the area during previous Christmas Bird Counts	No	Project not expected to have important interaction with the coniferous forest habitat of this species; represented by migratory birds VC	SC	SC	SC	G5, S4B
Contopus cooperi	Olive-sided Flycatcher	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Very rarely detected in RSA. Not likely present in LSA. Despite substantial survey effort, this species was undetected.	SC	THR	SC	G4, S4B
Contopus virens	Eastern Wood-pewee	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed	SC	SC	SC	G5, S4B
Dolichonyx oryzivorus	Bobolink	No	No	Unlikely	Unlikely	No habitat available	No	Presence unlikely	THR	THR	THR	G5, S4B
Euphagus carolinus	Rusty Blackbird	No	No	Likely	Likely	Suitable habitat; analysis underway to detect the species in surrounding wetland	No	Project not expected to have important interaction with the aquatic habitat or food of this species; represented by migratory birds VC	SC	SC	SC	G4, S4B
Falco peregrinus	Peregrine Falcon	No	No	Unlikely	Unlikely	No suitable habitat for breeding. Using the site to feed	No	Presence unlikely	NAR	SC	SC	G4, S3B
Haliaeetus leucocephalus	Bald Eagle	Yes	No	Confirmed	Unlikely	No breeding or nest in LSA. No pine component.	No	Presence unlikely	NAR	—	SC	G5, S2N, S4B
Hirundo rustica	Barn Swallow	Yes	No	Confirmed	Unlikely	No anthropogenic structure in LSA	No	Presence unlikely	THR	THR	THR	G5, S4B
Hylocichla mustelina	Wood Thrush	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed	THR	THR	SC	G4, S4B
Ixobrychus exilis	Least Bittern	No	No	Likely	Likely	Suitable habitat; analysis underway to detect the species in surrounding wetland	No	Project not expected to have important interaction with the aquatic habitat or food of this species; represented by migratory birds VC	THR	THR	THR	G5, S4B

Scientific Name	Common Name	Confirmed at CRL	Confirmed in LSA	Likelihood of Presence at CRL	Likelihood of Presence in LSA	Justification for Likelihood of Presence in LSA	Included as VC in EIS	Justification for Inclusion/Exclusion	COSEWIC[1]	SARA[2]	ESA[3]	G-Rank, S-Rank[4]
Birds (cont'd)												
Lanius ludovicianus	Loggerhead Shrike	No	No	Unlikely	Unlikely	No breeding evidence in the area (OBBA)	No	Presence unlikely	END	No Status	END	G4, S2B
Melanerpes erythrocephalus	Red-headed Woodpecker	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Not likely present in LSA. Despite substantial survey effort, this species was undetected.	END	THR	SC	G5, S4B
Riparia riparia	Bank Swallow	No	No	Likely	Likely	Suitable habitat	No	Represented by migratory birds VC	THR	THR	THR	G5, S4B
Setophaga cerulea	Cerulean Warbler	No	No	Unlikely	Unlikely	No breeding evidence in the area (OBBA)	No	Presence unlikely	END	END	THR	G4, S3B
Setophaga kirtlandii	Kirtland's Warbler	No	No	Unlikely	Unlikely	No habitat available	No	Presence unlikely	END	END	END	G3G4, S1B
Sturnella magna	Eastern Meadowlark	No	No	Unlikely	Unlikely	No habitat available	No	Presence unlikely	THR	THR	THR	G5, S4B
Vermivora chrysoptera	Golden-winged Warbler	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed	THR	THR	SC	G4, S4B
Reptiles												
Apalone spinifera	Spiny Softshell	No	No	Unlikely	Unlikely	No sightings past Ottawa; surveys since 2009 have never found the species	No	Presence unlikely	END	END	END	G5, S2
Chelydra serpentina	Snapping Turtle	Yes	Yes	Confirmed	Confirmed	In Perch Lake	No	No water quality or Project effects in Perch Lake anticipated (i.e., no upstream effects); Blanding's turtle VC covers many pathways	SC	SC	SC	G5, S3
Chrysemys picta marginata	Midland Painted Turtle	Yes	Yes	Confirmed	Confirmed	In Perch lake	No	No water quality or Project effects in Perch Lake anticipated (i.e., no upstream effects); Blanding's turtle VC covers many pathways	SC	-	-	G5T5, S4
Emydoidea blandingii	Blanding's Turtle	Yes	Yes	Confirmed	Confirmed	Observed in LSA	Yes	Present in LSA; SARA-listed; critical habitat in region; uses terrestrial habitat for nesting	END	THR	THR	G4, S3
Glyptemys insculpta	Wood Turtle	No	No	Unlikely	Unlikely	Survey did not detect the species; no suitable habitat	No	Presence unlikely	THR	THR	END	G3, S2
Graptemys geographica	Northern Map Turtle	Yes	No	Confirmed	Likely	In Perch Lake	No	No water quality or Project effects in Perch Lake anticipated (i.e., no upstream effects); Blanding's turtle VC covers many pathways	SC	SC	SC	G5, S3
Heterodon platirhinos	Eastern Hog-nosed Snake	No	No	Unlikely	Unlikely	Outside of range; no known sightings in Renfrew County	No	Presence unlikely	THR	THR	THR	G5, S3
Lampropeltis triangulum	Eastern Milksnake	Yes	No	Confirmed	Likely	Milksnake present throughout the site	Yes	Likely present in LSA; SARA-listed. Milksnakes are habitat generalists and rely on microsite habitat features for egg laying, thermoregulation and hibernation.	SC	SC	—	G5, S4
Sternotherus odoratus	Eastern Musk Turtle	Yes	Yes	Confirmed	Confirmed	In Perch Lake	No	No water quality or Project effects in Perch Lake anticipated (i.e., no upstream effects); Blanding's turtle VC covers many pathways	SC	SC	SC	G5, S3
Thamnophis sauritus sauritus (Great Lakes/St. Lawrence Populations)	Eastern Ribbonsnake	No	No	Unlikely	Unlikely	Never observed on-site and CNL are providing Species at Risk training and awareness and field guide to employees since 2009	No	Presence unlikely	SC	SC	SC	G5, S4
Amphibians												
Pseudacris triseriata	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population)	Yes	No	Confirmed	Unlikely	Amphibian survey did not detect the species	No	Presence unlikely	THR	THR	—	G5TNR, S3

Scientific Name	Common Name	Confirmed at CRL	Confirmed in LSA	Likelihood of Presence at CRL	Likelihood of Presence in LSA	Justification for Likelihood of Presence in LSA	Included as VC in EIS	Justification for Inclusion/Exclusion	COSEWIC[1]	SARA[2]	ESA[3]	G-Rank, S-Rank[4]
Insects												
Bombus affinis	Rusty-patched Bumble Bee	No	No	Unlikely	Unlikely	Only a handful of individuals identify in Ontario, well outside region	No	Presence unlikely	END	END	END	G1, S1
Bombus pensylvanicus	American Bumblebee	No	No	Unlikely	Unlikely	The species have not been recorded in Renfrew County but its habitat range overlaps CRL	No	Presence unlikely	SC	-	-	G3G4, S3S4
Cicindela patruela	Northern Barrens Tiger Beetle	No	No	Unlikely	Unlikely	Only one known population at Allumette Island, QC; summer 2016 surveys by CWS found no individuals	No	Presence unlikely	END	END	END	G3, S1
Danaus plexippus	Monarch	Yes	No	Confirmed	Likely	Species present across the site	Yes	Likely present in LSA; SARA-listed	END	SC	SC	G4, S2N, S4B
Plants												
Ceratophyllum echinatum	Prickly Hornwort	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G4?, S3?
Cyperus houghtonii	Houghton's Flatsedge	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G4?, S3
Cyperus schweinitzii	Schweinitz's Flatsedge	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G5, S3
Faxinus nigra	Black Ash	Yes	Yes	Confirmed	Confirmed	Confirmed during stand assessment survey.	No	Threat for this species is covered under the Vegetation VC.	END	-	-	G5, S4
Hudsonia tomentosa	Woolly Beach-heath	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G5, S3
Juglans cinerea	Butternut	Yes	No	Confirmed	Unlikely	Butternut presence at CRL is at an old homestead; north of the known range for the species	No	Presence unlikely	END	END	END	G4, S2?
Panax quinquefolius	American Ginseng	No	No	Unlikely	Unlikely	No known records past Pembroke	No	Presence unlikely	END	END	END	G3G4, S2
Picea rubens	Red Spruce	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G5, S3
Polygonum arifolium	Halberd-leaved Tear-thumb	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G5, S3
Sagittaria cristata	Crested Arrowhead	Yes	No	Confirmed	Unlikely	Not detected in any previous studies	No	Presence unlikely	—	—	—	G4?, S3

Note:

1) COSEWIC = Committee on the Status of Endangered Wildlife in Canada, END = Endangered; THR = Threatened; SC = Special Concern; NAR = Not at Risk.
2) SARA = *Species at Risk Act* Schedule 1. Part 1 (Extirpated - EXP), Part 2 (Endangered - END), Part 3 (Threatened - THR), Part 4 (Special Concern - SC).
3) ESA = Ontario *Endangered Species Act, 2007* and *O. Reg. 230/08 Species at Risk in Ontario List.* Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC)
4) Global Ranks (G-Rank) and Provincial Ranks (S-Rank) are rarity ranks assigned to a species or ecological communities by the Natural Heritage Information Centre (NHIC). These ranks are not legal designations. Rarity ranks are evaluated by NHIC on a continual basis and updated lists are produced periodically. Rank definitions: G1 or S1 (Critically Imperiled); G2 or S2 (Imperiled); G3 or S3 (Vulnerable); G4 or S4 (Apparently Secure); G5 or S5 (Secure); G#G# or S#S# (Range Rank); GNR or SNR (Not Ranked); GU or SU (Unrankable – Data Deficient); GX or SX (Presumed Extinct or Extirpated); GH or SH (Possibly Extinct or Extirpated – Historical); SNA (Not Applicable). Qualifiers: B = Breeding; N = Non-breeding; M = Migrant; ? = Inexact or uncertain numeric rank

CRL = Chalk River Laboratories; EIS = Environmental Impact Statement; LSA = local study area; VC = valued component; - = not listed/no status.

APPENDIX 5.6-2

Detailed Vegetation Community Forest Composition Summary

Table 1: Detailed Composition of Vegetation Communities within the Regional Study Area and Local Study Area

Forest Unit	Age Ranges (years)	Structural Stage	Total Area in RSA		Total Area in LSA	
			Hectares	%	Hectares	%
Mixed Forest						
Tolerant Hardwoods Selection (HDSEL)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	—	—	—	—
	75-129	Mature	12	0.3	—	—
	130+	Old	—	—	—	—
Intolerant Hardwoods Clearcut (INTCC)	0-9	Pre-sapling	—	—	—	—
	10-24	Sapling	—	—	—	—
	25-64	Immature	39	1.0	—	—
	65-99	Mature	64	1.7	—	—
	100+	Old	—	—	—	—
Mixed Uniform Shelterwood (MWus)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	9	0.2	—	—
	35-74	Immature	969	25.1	6	2.9
	75-129	Mature	377	9.8	9	4.1
	130+	Old	—	—	—	—
Red Oak Shelterwood (OrUS)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-69	Immature	2	—	—	—
	70-119	Mature	127	3.3	40	19.1
	120+	Old	—	—	—	—
Jack Pine (PJ1)	0-9	Pre-sapling	—	—	—	—
	10-24	Sapling	—	—	—	—
	25-59	Immature	—	—	—	—
	60-99	Mature	8	0.2	—	—
	100+	Old	—	—	—	—
Red Pine Clearcut (PrCC)	0-14	Pre-sapling	—	—	—	—
	15-39	Sapling	—	—	—	—
	40-79	Immature	3	0.1	—	—
	80-139	Mature	—	—	—	—
	140+	Old	—	—	—	—

Table 1: Detailed Composition of Vegetation Communities within the Regional Study Area and Local Study Area

Forest Unit	Age Ranges (years)	Structural Stage	Total Area in RSA		Total Area in LSA	
			Hectares	%	Hectares	%
Mixed Forest (cont'd)						
White Pine 4 Cut Shelterwood (PWUS4)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	208	5.4	—	—
	75-119	Mature	91	2.4	15	7.2
	120+	Old	—	—	—	—
Spruce-Fir Uniform Shelterwood (SFUS)	0-14	Pre-sapling	4	0.1	—	—
	15-29	Sapling	—	—	—	—
	30-69	Immature	12	0.3	—	—
	70-114	Mature	6	0.2	1	0.5
	115+	Old	—	—	—	—
Combined - Mixed Forest		**Pre-sapling**	**4**	**0.1**	**—**	**—**
		Sapling	**9**	**0.2**	**—**	**—**
		Immature	**1,232**	**32.0**	**6**	**2.9**
		Mature	**684**	**17.8**	**65**	**30.9**
		Old	**—**	**—**	**—**	**—**
Sub-Total for Mixed Forest:			**1,929**	**50.1**	**71**	**33.8**
Deciduous Forest						
Tolerant Hardwoods Selection (HDSEL)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	—	—	—	—
	75-129	Mature	72	1.9	—	—
	130+	Old	—	—	—	—
Hardwood Uniform Shelterwood (HDUS)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	9	0.2	—	—
	75-129	Mature	35	0.9	—	—
	130+	Old	—	—	—	—
Intolerant Hardwoods Clearcut (INTCC)	0-9	Pre-sapling	13	0.3	—	—
	10-24	Sapling	15	0.4	—	—
	25-64	Immature	3	0.1	—	—
	65-99	Mature	5	0.1	—	—
	100+	Old	—	—	—	—

Table 1: Detailed Composition of Vegetation Communities within the Regional Study Area and Local Study Area

Forest Unit	Age Ranges (years)	Structural Stage	Total Area in RSA		Total Area in LSA	
			Hectares	%	Hectares	%
Deciduous Forest (cont'd)						
Mixed Uniform Shelterwood (MWus)	0-14	Pre-sapling	7	0.2	—	—
	15-34	Sapling	15	0.4	—	—
	35-74	Immature	272	7.0	3	1.3
	75-129	Mature	172	4.5	3	1.5
	130+	Old	—	—	—	—
Red Oak Shelterwood (OrUS)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-69	Immature	—	—	—	—
	70-119	Mature	8	0.2	—	—
	120+	Old	—	—	—	—
White Pine 4 Cut Shelterwood (PWUS4)	0-14	Pre-sapling	4	0.1	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	6	0.1	—	—
	75-119	Mature	7	0.2	—	—
	120+	Old	—	—	—	—
Spruce-Fir Uniform Shelterwood (SFUS)	0-14	Pre-sapling	—	—	—	—
	15-29	Sapling	—	—	—	—
	30-69	Immature	—	—	—	—
	70-114	Mature	—	—	—	—
	115+	Old	—	—	—	—
Combined - Deciduous Forest		**Pre-sapling**	**25**	**0.7**	**—**	**—**
		Sapling	**30**	**0.8**	**—**	**—**
		Immature	**289**	**7.5**	**3**	**1.3**
		Mature	**299**	**7.8**	**3**	**1.5**
		Old	**—**	**—**	**—**	**—**
Sub-Total for Deciduous Forest:			**643**	**16.7**	**6**	**2.8**

Table 1: Detailed Composition of Vegetation Communities within the Regional Study Area and Local Study Area

Forest Unit	Age Ranges (years)	Structural Stage	Total Area in RSA		Total Area in LSA	
			Hectares	%	Hectares	%
Coniferous Forest						
Mixed Uniform Shelterwood (MWus)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	25	0.7	—	—
	75-129	Mature	—	—	—	—
	130+	Old	—	—	—	—
Red Pine Clearcut (PrCC)	0-14	Pre-sapling	2	0.0	—	—
	15-39	Sapling	3	0.1	—	—
	40-79	Immature	51	1.3	—	—
	80-139	Mature	12	0.3	—	—
	140+	Old	—	—	—	—
White Pine 4 Cut Shelterwood (PWUS4)	0-14	Pre-sapling	—	—	—	—
	15-34	Sapling	—	—	—	—
	35-74	Immature	—	—	—	—
	75-119	Mature	5	0.1	—	—
	120+	Old	—	—	—	—
Spruce-Fir Uniform Shelterwood (SFUS)	0-14	Pre-sapling	—	—	—	—
	15-29	Sapling	11	0.5	—	—
	30-69	Immature	18	1.8	2	1.1
	70-114	Mature	69	1.8	—	—
	115+	Old	—	—	—	—
Jack Pine Clearcut (PJCC)	0-9	Pre-sapling	—	—	—	—
	10-24	Sapling	—	—	—	—
	25-59	Immature	3	0.1	—	—
	60-99	Mature	—	—	—	—
	100+	Old	—	—	—	—
Combined - Coniferous Forest		**Pre-sapling**	**2**	**0.0**	**—**	**—**
		Sapling	**14**	**0.4**	**—**	**—**
		Immature	**97**	**2.5**	**2**	**1.1**
		Mature	**87**	**2.3**	**—**	**—**
		Old	**—**	**—**	**—**	**—**
Sub-Total for Coniferous Forest:			**199**	**5.2**	**2**	**1.1**

Table 1: Detailed Composition of Vegetation Communities within the Regional Study Area and Local Study Area

Forest Unit	Age Ranges (years)	Structural Stage	Total Area in RSA		Total Area in LSA	
			Hectares	%	Hectares	%
Total Forest Cover:			**2,772**	**71.9**	**82**	**38.9**
Total Wetland Cover:			**522**	**13.5**	**61**	**29.0**
Total Flooded Area Cover:			**1**	**<0.1**	**—**	**—**
Total Unclassified (cleared) Area Cover:			**268**	**7.0**	**27**	**12.8**
Total Aquatic Habitat Cover:			**274**	**7.1**	**41**	**19.6**
Gaps and Slivers in GIS data:			**16**	**0.4**	**—**	**—**
Total Area:			**3,853**	**100.0**	**210**	**100.0**

Note: RSA = regional study area; LSA = local study area. Structural class for each polygon were assigned to Forest Units primarily using age ranges from the Forest Management Plan for the Ottawa Valley Forest (Van Dyke 2011). In cases of polygons with poplar, jack pine, or white pine dominant stands, the Forest Management Guide for Great Lakes-St. Lawrence Landscapes (OMNR 2010) was used because it more accurately assigned stands as “mature” – at a younger age (poplar at 65+ years, jack pine at 60+ years, white pine at 75+ years) to be protective / err on side of conservatism for quantifying “mature” forest stand coverage within RSA and LSA).

Some numbers are rounded for presentation purposes. Therefore, it may appear that the totals do not equal the sum of the individual values.

The following sections provide more detailed information on tree species composition and wildlife habitat value for the forest units within the Regional Study Area (RSA).

Hardwood Uniform Shelterwood (HDUS); Mixed Uniform – Shelterwood (MWUS)

The hardwood uniform shelterwood forest unit is comprised of the Great Lakes Landscape Guide forest units of hardwood uniform shelterwood (HWUS) and mixed uniform shelterwood (MWUS). This forest unit is a relatively minor unit in the Ottawa Valley Forest that is made up of mixed forests dominated by poplar species. Within the Management Unit, it also includes the following coniferous species: eastern white pine, balsam fir, red pine, and white spruce, and the following deciduous species: red maple, white birch, and red oak (Van Dyke 2011). Mature and old stands are considered to provide good habitat for cavity nesting species and depending on relative conifer content, can provide high mast food value (i.e., from red oak acorns, if a dominant species). The three stands of forest categorized as HDUS within the RSA have only deciduous tree species recorded; therefore, it is considered a deciduous forest type. All three stands are mature. The MWUS forest unit has the largest coverage of all units within the RSA (47.9% of total area) and individual stands of MWUS consist of all 3 forest types (coniferous, mixed, and deciduous). Many have almost exclusively poplar as the leading tree species. They also contain all successional stages present in the RSA (pre-sapling to mature). Within the LSA, MWUS stands comprise 21.7% of the total area, and all of the deciduous and mixed stands are between 60-80 years old (those over 80 years old are considered mature). All stands are dominated by poplar species, and some have relatively high red oak content (with attendant wildlife food value).

White Pine – Shelterwood (PWUS4)

This forest unit has the largest coverage and widest distribution in the Ottawa Valley Forest (Van Dyke 2011). It generally consists of eastern white pine dominated stands with sub-dominant eastern white and red pine. Poplar also occurs in this unit. Habitat value of this forest unit is high in mature and old stands with supercanopy eastern white pine which provide important raptor nesting habitat. Most of the stands of PWUS4 in the RSA are mixed stands with high poplar content. Most are also mature (80-100 years old), with the associated high wildlife

habitat value associated with supercanopy eastern white pine as well as mature poplar trees providing nesting and roosting habitat for secondary cavity nesting species. Within the LSA, the five stands are dominated by white pine but have high poplar content. They are all 100 years old, which makes them mature because they are white pine-leading stands; however, it should be noted if these forest stands were poplar species leading, they would be considered old growth, because poplar trees are considered old at 95 years of age. These forest stands therefore provide high quality nesting and roosting habitat for secondary cavity nesting (and roosting) species.

Intolerant Hardwoods – Clearcut (INTCC); Poplar (PO)

This forest unit is characterized by the dominance of shade-intolerant hardwood species and is an aggregate of the two single-species forest units of PO (poplar) and BW (white birch) from the Forest Management Guide for Great Lakes – St. Lawrence Landscapes (OMNR 2010). This unit includes forests dominated by all poplar species: trembling aspen (*Populus tremuloides*), large-toothed aspen (*P. grandidentata*), balsam poplar (*P. balsamifera*), as well as dwarf white birch (*Betula minor*). It comprises the second largest forest unit in the Ottawa Valley Forest and occurs throughout the Management Unit, but is more frequent in the northern half (Van Dyke 2011). It is considered to provide an important source of early successional habitat for wildlife with abundant forage during the pre-sapling to sapling stage, and important nesting habitat for cavity nesters (e.g., bats and various bird species) provided during the mature and old stages (Van Dyke 2011). Within the RSA, the stands of intolerant hardwoods and poplar range from pre-sapling to mature, with the majority of stands aged 60 to 80 years (immature to mature).

Tolerant Hardwoods – Selection (HDSEL)

This forest unit is relatively uncommon in the Ottawa Valley Forest and consists of mixed and deciduous stands dominated by sugar maple, other hardwood species, yellow birch, poplar, as well as spruce species and balsam fir. Mature stands provide valuable habitat for wildlife species that prefer the interior of mature, closed canopy forests (Van Dyke 2011). Within the RSA, there are only four stands (three deciduous and one mixed), and all are mature (80 years old).

Red Oak – Shelterwood (OrUS)

This forest unit is the third most prevalent in the Ottawa Valley Forest and contains a minimum of 30% oak (primarily red oak) (Van Dyke 2011). Other dominant species are deciduous (poplar, red maple) or coniferous (white pine, balsam fir), making stands of this unit deciduous or mixed, depending on individual stand composition. Acorns (mast) are a preferred game and non-game food source, and mature to old stands provide cavity nesting habitat (Van Dyke 2011). Within the RSA, there are deciduous and mixed stands of Red Oak Shelterwood, most of which are mature (80 years old). Within the LSA, there are two mixed stands of Red Oak Shelterwood bisected by the Perch Lake Swamp; both are mature (80 years old) and contain an even mix of poplar and red oak with some balsam fir.

Jack Pine – Clearcut (PJ1); Spruce-Fir Uniform Shelterwood (SFUS) (Mixed Upland Conifers – Clearcut)

Likely as a result of the age of the original FRI dataset for the RSA (1987 original source), the Ottawa Valley Forest Management Plan (Van Dyke 2011) describes the Mixed Upland Conifers – Clearcut forest unit, and not the Jack Pine and Spruce-Fir units in the FRI dataset. The Mixed Upland Conifers – Clearcut forest unit represents conifer-dominated stands typical of the boreal forest. Early successional stands provide important habitat and forage for wildlife and mature to old stands provide important habitat for species dependent on

old-growth conifer habitat (Van Dyke 2011). Within the RSA, most are coniferous stands, dominated by spruce species, red and white pine, and Jack pine. Some are mixed with sub-dominant poplar or white birch. Within the RSA, numerous stands of these two forest unit are plantations. Stand ages range from pre-sapling to mature. Within the LSA, this forest type makes up 7.1% of the total area. Some are immature coniferous stands dominated by spruce species (including Norway spruce), balsam fir and larch, others are mature mixed stands containing spruce and poplar species.

Red Pine – Clearcut (PrCC)

This forest unit is comprised of forests with minimum red pine composition of 70% and has relatively low coverage in the Ottawa Valley Forest. Natural stands with sufficiently high red pine composition are rare and the majority of these forest units in the Management Unit are plantations between 21-60 years old (sapling or immature) that were established on old field or relatively barren sites. The wildlife habitat value of these immature, largely mono-culture plantations is considered low, but improves over time as thinning and natural succession modifies the structure and composition of the stand (Van Dyke 2011). Within the RSA, these red pine stands are primarily mono-culture and plantations, ranging pre-sapling to mature, with most stands in the immature stage (40 to 70 years old).

References

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APPENDIX 5.6-3

Migratory Birds

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Alder Flycatcher	*Empidonax alnorum*	Confirmed	no	no	Likely	Likely	—	—	—
American Bittern	*Botaurus lentiginosus*	Probable	yes	no	Confirmed	Likely	—	—	—
American Black Duck	*Anas rubripes*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
American Goldfinch	*Carduelis tristis*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
American Redstart	*Setophaga ruticilla*	Probable	no	no	Likely	Likely	—	—	—
American Robin	*Turdus migratorius*	Confirmed	no	no	Likely	Likely	—	—	—
American Woodcock	*Scolopax minor*	Probable	yes	yes	Confirmed	Confirmed	—	—	—
Baltimore Oriole	*Icterus galbula*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Bank Swallow	*Riparia riparia*	Confirmed	no	no	Likely	Possible	THR	THR	THR
Barn Swallow	*Hirundo rustica*	Confirmed	yes	no	Confirmed	Unlikely	THR	THR	THR
Bay-breasted Warbler	*Setophaga castanea*	Possible	no	no	Likely	Likely	—	—	—
Black-and-white Warbler	*Mniotilta varia*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Black-backed Woodpecker	*Picoides arcticus*	Confirmed	no	no	Likely	Likely	—	—	—
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Probable	no	no	Likely	Likely	—	—	—
Blackburnian Warbler	*Dendroica fusca*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Black-capped Chickadee	*Poecile atricapillus*	Confirmed	no	no	Likely	Likely	—	—	—
Black-throated Blue Warbler	*Dendroica caerulescens*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Black-throated Green Warbler	*Dendroica virens*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Blue-headed Vireo	*Vireo solitarius*	Probable	no	no	Likely	Likely	—	—	—
Blue-winged Teal	*Anas discors*	Possible	no	no	Likely	Likely	—	—	—
Bobolink	*Dolichonyx oryzivorus*	Confirmed	no	no	Unlikely	Unlikely	THR	THR	THR
Brown Creeper	*Certhia americana*	Probable	no	no	Likely	Likely	—	—	—
Brown Thrasher	*Toxostoma rufum*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Canada Goose	*Branta canadensis*	Confirmed	no	no	Likely	Likely	—	—	—

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Canada Warbler	*Wilsonia canadensis*	Confirmed	yes	yes	Confirmed	Confirmed	THR	THR	SC
Cape May Warbler	*Setophaga tigrina*	Possible	no	no	Possible	Possible	—	—	—
Cedar Waxwing	*Bombycilla cedrorum*	Confirmed	no	no	Possible	Possible	—	—	—
Cerulean Warbler	*Setophaga cerulea*	N/A	no	no	Unlikely	Unlikely	END	END	THR
Chestnut-sided Warbler	*Dendroica pensylvanica*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Chimney Swift	*Chaetura pelagica*	N/A	yes	no	Confirmed	Unlikely	THR	THR	THR
Chipping Sparrow	*Spizella passerina*	Confirmed	no	no	Likely	Likely	—	—	—
Clay-colored Sparrow	*Spizella pallida*	Possible	no	no	Likely	Likely	—	—	—
Cliff Swallow	*Petrochelidon pyrrhonota*	Confirmed	no	no	Likely	Possible	—	—	—
Common Goldeneye	*Bucephala clangula*	Confirmed	no	no	Likely	Likely	—	—	—
Common Loon	*Gavia immer*	Confirmed	yes	no	Confirmed	Likely	NAR	—	—
Common Merganser	*Mergus merganser*	Confirmed	no	no	Likely	Likely	—	—	—
Common Nighthawk	*Chordeiles minor*	Possible	yes	no	Confirmed	Unlikely	SC	THR	SC
Common Tern	*Sterna hirundo*	Possible	no	no	Possible	Possible	NAR	—	—
Common Yellowthroat	*Geothlypis trichas*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Dark-eyed Junco	*Junco hyemalis*	Possible	no	no	Likely	Likely	—	—	—
Downy Woodpecker	*Picoides pubescens*	Confirmed	no	no	Likely	Likely	—	—	—
Eastern Bluebird	*Sialia sialis*	Confirmed	yes	no	Confirmed	Likely	NAR	—	—
Eastern Kingbird	*Tyrannus tyrannus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Eastern Meadowlark	*Sturnella magna*	Possible	no	no	Possible	Unlikely	THR	THR	THR
Eastern Phoebe	*Sayornis phoebe*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Eastern Towhee	*Pipilo erythrophthalmus*	Possible	no	no	Possible	Possible	—	—	—
Eastern Whip-poor-will	*Caprimulgus vociferus*	Confirmed	yes	yes	Confirmed	Confirmed	THR	THR	THR
Eastern Wood-pewee	*Contopus virens*	Confirmed	yes	yes	Confirmed	Confirmed	SC	SC	SC

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Evening Grosbeak	*Coccothraustes vespertinus*	Confirmed	yes	yes	Confirmed	Confirmed	SC	SC	SC
Field Sparrow	*Spizella pusilla*	Possible	no	no	Likely	Unlikely	—	—	—
Golden-crowned Kinglet	*Regulus satrapa*	Possible	no	no	Likely	Likely	—	—	—
Golden-winged Warbler	*Vermivora chrysoptera*	Confirmed	yes	yes	Confirmed	Confirmed	THR	THR	SC
Grasshopper Sparrow	*Ammodramus savannarum*	Possible	no	no	Possible	Unlikely	SC	SC	SC
Gray Catbird	*Dumetella carolinensis*	Probable	yes	yes	Confirmed	Confirmed	—	—	—
Great Blue Heron	*Ardea herodias*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Great Crested Flycatcher	*Myiarchus crinitus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Green Heron	*Butorides virescens*	Possible	no	no	Likely	Likely	—	—	—
Green-winged Teal	*Anas crecca*	Probable	yes	yes	Confirmed	Confirmed	—	—	—
Hairy Woodpecker	*Leuconotopicus villosus*	Confirmed	no	no	Likely	Likely	—	—	—
Hermit Thrush	*Catharus guttatus*	Confirmed	no	no	Likely	Likely	—	—	—
Herring Gull	*Larus argentatus*	Confirmed	no	no	Likely	Likely	—	—	—
Hooded Merganser	*Lophodytes cucullatus*	Confirmed	no	no	Likely	Likely	—	—	—
House Wren	*Troglodytes aedon*	Confirmed	no	no	Likely	Likely	—	—	—
Indigo Bunting	*Passerina cyanea*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Killdeer	*Charadrius vociferus*	Confirmed	no	no	Likely	Likely	—	—	—
Least Bittern	*Ixobrychus exilis*	Possible	no	no	Likely	Likely	THR	THR	THR
Least Flycatcher	*Empidonax minimus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Lesser Scaup	*Aythya affinis*	N/A	no	no	Likely	Likely	—	—	—
Lincoln's Sparrow	*Melospiza lincolnii*	Possible	no	no	Likely	Likely	—	—	—
Magnolia Warbler	*Setophaga magnolia*	Confirmed	no	no	Likely	Likely	—	—	—
Mallard	*Anas platyrhynchos*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Mourning Dove	*Zenaida macroura*	Confirmed	no	no	Likely	Likely	—	—	—

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Mourning Warbler	*Oporornis philadelphia*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Nashville Warbler	*Vermivora ruficapilla*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Northern Flicker	*Colaptes auratus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Northern Mockingbird	*Mimus polyglottos*	Possible	no	no	Likely	Likely	—	—	—
Northern Parula	*Setophaga americana*	Confirmed	no	no	Likely	Likely	—	—	—
Northern Pintail	*Anas acuta*	N/A	no	no	Likely	Likely	—	—	—
Northern Waterthrush	*Parkesia noveboracensis*	Possible	no	no	Likely	Likely	—	—	—
Olive-sided Flycatcher	*Contopus cooperi*	Confirmed	yes	no	Confirmed	Likely	SC	THR	SC
Ovenbird	*Seiurus aurocapilla*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Pied-billed Grebe	*Podilymbus podiceps*	Probable	no	no	Likely	Likely	—	—	—
Pileated Woodpecker	*Hylatomus pileatus*	Confirmed	no	no	Likely	Likely	—	—	—
Pine Grosbeak	*Pinicola enucleator*	N/A	yes	no	Confirmed	Likely	—	—	—
Pine Siskin	*Carduelis pinus*	Possible	no	no	Likely	Likely	—	—	—
Pine Warbler	*Setophaga pinus*	Confirmed	no	no	Likely	Likely	—	—	—
Purple Finch	*Carpodacus purpureus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Red Crossbill	*Loxia curvirostra*	Possible	yes	no	Confirmed	Likely	—	—	—
Red-breasted Nuthatch	*Sitta canadensis*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Red-eyed Vireo	*Vireo olivaceus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Confirmed	yes	no	Confirmed	Likely	END	THR	SC
Ring-billed Gull	*Larus delawarensis*	Confirmed	no	no	Likely	Likely	—	—	—
Ring-necked Duck	*Aythya collaris*	Probable	no	no	Likely	Likely	—	—	—
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Ruby-crowned Kinglet	*Regulus calendula*	Possible	yes	yes	Confirmed	Confirmed	—	—	—
Ruby-throated Hummingbird	*Archilochus colubris*	Confirmed	no	no	Likely	Likely	—	—	—

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Savannah Sparrow	*Passerculus sandwichensis*	Confirmed	no	no	Likely	Possible	—	—	—
Scarlet Tanager	*Piranga olivacea*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Song Sparrow	*Melospiza melodia*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Sora	*Porzana carolina*	Confirmed	no	no	Likely	Likely	—	—	—
Spotted Sandpiper	*Actitis macularius*	Probable	no	no	Likely	Likely	—	—	—
Swainson's Thrush	*Catharus ustulatus*	Possible	no	no	Likely	Likely	—	—	—
Swamp Sparrow	*Melospiza georgiana*	Confirmed	yes	no	Confirmed	Likely	—	—	—
Tennessee Warbler	*Leiothlypis peregrina*	Possible	no	no	Likely	Likely	—	—	—
Tree Swallow	*Tachycineta bicolor*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Upland Sandpiper	*Bartramia longicauda*	Possible	no	no	Possible	Unlikely	—	—	—
Veery	*Catharus fuscescens*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Vesper Sparrow	*Pooecetes gramineus*	Probable	no	no	Possible	Unlikely	—	—	—
Virginia Rail	*Rallus limicola*	Probable	no	no	Likely	Likely	—	—	—
Warbling Vireo	*Vireo gilvus*	Probable	no	no	Likely	Likely	—	—	—
White-breasted Nuthatch	*Sitta carolinensis*	Confirmed	no	no	Likely	Likely	—	—	—
White-crowned Sparrow	*Zonotrichia leucophrys*	N/A	yes	no	Confirmed	Likely	—	—	—
White-throated Sparrow	*Zonotrichia albicollis*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Willow Flycatcher	*Empidonax traillii*	Probable	no	no	Likely	Likely	—	—	—
Wilson's Snipe	*Gallinago delicata*	Probable	no	no	Likely	Likely	—	—	—
Wilson's Warbler	*Cardellina pusilla*	Possible	no	no	Possible	Possible	—	—	—
Winter Wren	*Troglodytes hiemalis*	Probable	no	no	Likely	Likely	—	—	—
Wood Duck	*Aix sponsa*	Confirmed	no	no	Likely	Likely	—	—	—
Wood Thrush	*Hylocichla mustelina*	Confirmed	yes	yes	Confirmed	Confirmed	THR	THR	SC
Yellow Warbler	*Setophaga petechia*	Confirmed	no	no	Likely	Likely	—	—	—

Table 1: Migratory Birds that Occur or Potentially Occur in the Regional Study Area

Common Name	Scientific Name	Breeding Status[a]	Observed in RSA	Observed in LSA	Presence in RSA	Presence in LSA	Conservation Status[b]		
							COSEWIC	SARA Schedule 1	ESA
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Confirmed	yes	yes	Confirmed	Confirmed	—	—	—
Yellow-billed Cuckoo	*Coccyzus americanus*	N/A	yes	no	Confirmed	Likely	—	—	—
Yellow-rumped Warbler	*Setophaga coronata*	Confirmed	no	no	Likely	Likely	—	—	—

a) Breeding evidence was determined from the Ontario Breeding Bird Atlas (OBBA; Cadman et al. 2007). N/A denotes a lack of observation in the OBBA survey squares that overlap with the Regional Study Area (i.e., 18UR19, 18US10 and 18US00).

b) Conservation status: END = Endangered; THR = Threatened; SC = Special Concern; NAR = Not at Risk, — = no status.

Abbreviations: LSA = Local Study Area; RSA = Regional Study Area; COSEWIC = Committed on the Status of Endangered Wildlife in Canada; SARA = *Species at Risk Act*; ESA = Ontario *Endangered Species Act, 2007*.

APPENDIX 5.6-4

Technical Memorandum GAL107-1547525 Bat Species at Risk (SARA) Section 73 Permitting Support

TECHNICAL MEMORANDUM

DATE January 24, 2018 **PROJECT No.** GAL107-1547525

TO Martin Klukas and Annie Morin
Canadian Nuclear Laboratories

CC

FROM Leigh Holt and Kyle Knopff **EMAIL** Leigh_Holt@golder.com; Kyle_Knopff@golder.com

BAT *SPECIES AT RISK ACT* (SARA) SECTION 73 PERMITTING SUPPORT

1.0 INTRODUCTION

Little brown myotis (*Myotis lucifugus*), northern myotis (*M. septentrionalis*) and tri-colored bat (*Perimyotis subflavus*) are listed as Endangered on Schedule 1 of the federal *Species at Risk Act* (*SARA*). The presence of all three SARA-listed species has been confirmed within the Canadian Nuclear Laboratories (CNL) Chalk River Laboratories (CRL) property. The Near Surface Disposal Facility (NSDF) Project is a development proposed by CNL within the federally-owned property and is the subject of an environmental assessment under the *Canadian Environmental Assessment Act, 2012*, summarised in an Environmental Impact Statement (EIS). The Project site, also known as the East Mattawa Road (EMR) site, is hereafter referred to as the site study area (SSA) to maintain consistency with the Terrestrial Environment Section of the EIS produced by Golder Associates Ltd. (Golder) (Golder 2017). The EIS predicted the NSDF Project footprint would permanently remove 28 ha of potential maternity roosting habitat from the SSA. This represents 2% of the available maternity roosting habitat in the CNL CRL property estimated for the EIS.

Concurrent with the preparation of the EIS, CNL initiated consultation with Environment and Climate Change Canada (ECCC) and submitted an application for a *SARA* Section 73 Permit (Application #831). The permit application was submitted to meet conditions of Section 73 of *SARA* and obtain approval for activities that would directly affect SARA-listed wildlife, including bats, which are incidental to carrying out the activity, but will affect individuals. Based on information provided in the EIS, the Permit application described predicted effects of the NSDF Project on bat maternity roosts and concluded that residences would not be affected because tree removal would occur outside of the maternity roosting period when roost trees would be unoccupied.

As part of their review of the *SARA* permit application, ECCC made the following comment:

> *The statement on page 25 of the application saying that bat maternity roosts that are unoccupied (e.g., in winter) are not considered residences is incorrect. Such roosts meet the definition of a residence in SARA and thus are protected on federal land by that Act. Activities that would damage or destroy them require a permit which can only be given if all permitting conditions identified in section 73 of SARA are met. In order for ECCC to determine if these conditions are met, it is important for ECCC to know whether there are roosts likely to be damaged or destroyed by your proposed activities and, if so, to have a sense of the importance of those roosts (e.g., how many bats are using them and when) and availability of suitable, unoccupied roosts in the area.*

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To address this comment, CNL designed and initiated field studies in spring and summer 2017 to verify the availability and occupancy of maternity roosting habitat in the SSA and within the remaining forested areas of the CRL property. The CRL property is hereafter referred to as the Regional Study Area (RSA) for consistency with the EIS. Two types of field studies were undertaken by CNL:

1) Forest stand assessments to identify suitable roost trees.

2) Acoustic monitoring of bat activity.

Golder was retained by CNL to provide analysis and assessment of the field data. The objectives of Golder's assessment were as follows:

- Assess forest stand data collected to refine and "ground truth" Golder's EIS predictions of potential maternity roosting habitat in the SSA and RSA to be "suitable" maternity roosting habitat.
- Calculate the availability of suitable roost tree habitat (i.e., number of suitable roost trees) within the SSA and RSA for stands where stand assessment plots were completed. Extrapolate stand-based estimates of suitable roost tree availability to other tree stands in the RSA where stand assessments were not conducted. Use these data to update estimates of available maternity roosting habitat in the SSA and RSA.
- Assess acoustic monitoring data to estimate roost occupancy by little brown myotis, northern myotis, and tri-colored bats, with consideration of roost tree use by all bat species present in the RSA. Use the acoustic data to compare occupancy levels of available roosting habitat in the SSA to the rest of the RSA.

Collectively, these analyses would be used to answer ECCC's question by estimating the number of potential maternity roosts that would be damaged or destroyed by the NSDF Project, estimating the number of alternative roosts that may be present in the RSA, and evaluating use of potential roosting habitats by bats (i.e., determine whether unoccupied roosting habitat is present).

2.0 DATA COLLECTION

All data used in the analyses presented here were collected by CNL and provided to Golder for analysis. This section summarizes the data collection methods employed by CNL to generate information about forest stands and bat activity.

2.1 Forest Stand Assessments

The objective of the forest stand assessments conducted by CNL was to refine the EIS predictions about the amount of potential maternity roosting habitat by enumerating suitable roost trees in plots within the SSA and within other forested stands throughout the remaining RSA (Figures 1 and 2)[1]. Stand assessments were conducted in fixed radius plots of 0.05 ha. The intensity of stand assessment field effort was higher in the SSA Forest Resources Inventory (FRI) stands than in the remainder of the RSA. The number of plots conducted within each FRI stand was highest (n= 31) in FRI stand 216 (a mature OrUS stand), which is within the SSA. There were only single plots conducted in 28 of the 32 FRI stands assessed outside of the SSA (i.e., 87.5% of assessed stands outside the SSA contained a single plot).

[1] Figures are attached at the end of the document.

Data that were collected for each tree assessed in each plot were: FRI stand ID, forest type, plot ID, species, quality (defined as live healthy trees without cavities considered acceptable growing stock [AGS], moribund trees considered unacceptable growing stock [UGS], and dead trees), diameter at breast height (DBH), cavity (if present, as C1 for nesting cavity, C2 for feeding cavity or C3 for escape cavity), decay class (1-5, modified from Watt and Caceres 1999), height, nest, and notes.

The data collected for the forest stand assessment were generally consistent with the Ontario Ministry of Natural Resources (OMNR) protocol for assessing potential maternity roost tree density within forest stands contained in the document: *Bats and Bat Habitats: Guidelines for Wind Power Projects* (OMNR 2011). Although intended for wind projects, a more generic guidance document has not yet been produced by the provincial government, and this guidance document has been recommended by provincial regulators (OMNRF 2015), and used by biologists, to assess forest stands that may represent maternity roosting habitat.

2.2 Acoustic Monitoring

Acoustic monitoring for bats was carried out by CNL across the RSA during June to August 2017 to confirm activity of the three SARA-listed bat species within the stands undergoing assessment of roost tree habitat potential, and within the area to be cleared for the NSDF Project (i.e., the SSA). This acoustic monitoring was undertaken using detectors set in a grid pattern within the SSA and randomly in the rest of the RSA (Figures 1 and 2).

Acoustic monitoring was also conducted at eight bat boxes installed as compensatory habitat to offset losses of maternity roost habitat associated with the NSDF project. These data were included in the analysis as general indicators of SARA-listed bat species activity.

Bat calls were analyzed by CNL staff to identify species. For each call recorded, CNL identified the species that emitted the call[2], and the time, date, and location that the call or “pass” was recorded[3]. Data for each recorded pass were provided by CNL on separate worksheets for each of the following four types of acoustic monitoring stations:

- RSA random points: 36 monitoring locations and 116 detector nights from 13 July to 11 August. Detectors were located throughout the RSA, outside of the SSA, and typically paired with forest stands where stand assessment data had been collected (Figure 1).
- NSDF grid: 44 monitoring locations and 104 detector nights from 22 June to 26 July. Detectors were located in a standardized grid pattern within the SSA.
- Exit surveys: 27 monitoring locations and 35 detector nights from 12 June to 21 June. Detectors were located adjacent to suitable roost trees within the SSA.
- Bat boxes: 8 monitoring locations and 20 detector nights from 21 June to 26 June. Detectors were located adjacent to bat boxes installed next to forested areas.

[2] Some calls are not of sufficiently high quality to distinguish between little brown myotis, northern myotis, or eastern small-footed myotis. These were recorded as undifferentiated “myotis” species.

[3] Bat data are generally reported interchangeably as calls or passes. An acoustic detector will record a series of calls emitted during echolocation by a bat, typically while in flight, so each set of calls recorded is from a single pass of a bat flying by a detector.

3.0 DATA ANALYSIS

3.1 Suitable Roost Trees

Forest stand data were analyzed using the following four steps to estimate the number of suitable roost trees present in the SSA and RSA.

- **Step 1** – Identify suitable roost trees from the data collected at each forest stand assessment plot.
- **Step 2** – Estimate the density of suitable roost trees in each forest stand for which plot data were collected.
- **Step 3** – Estimate the density of suitable roost trees within forest stands for which plot data were not collected.
- **Step 4** – Combine the information from the first three steps to estimate total number of suitable roost trees in the SSA and RSA.

These steps are elaborated in the following sections.

3.1.1 Suitable Roost Tree Criteria

Data from each plot were used to identify trees that had the potential to be used by roosting bats. All tree species were included, and the following criteria were applied to identify suitable roost trees:

1) Trees with a diameter at breast height (DBH) greater or equal to 25 cm.

2) Trees with a Quality assignment of:

    a. Dead – a tree that has died; and

    b. UGS – a moribund tree, potentially with cavities, declining health but still alive.

3) Dead trees with a minimum height of 10 m.

These criteria are consistent with the OMNR provincial guidelines for identifying suitable bat maternity roosting habitat (OMNR 2011) and with a meta-analysis undertaken by Fabianek et al. (2015). The meta-analysis evaluated 34 studies and 66 data sets on bat tree roost selection criteria across North America for 12 cavity-roosting species, including little brown myotis and northern myotis. Fabianek et al. (2015) concluded that the most consistent set of characteristics of roost tree selection by tree-roosting bats, in order of importance, were: tree diameter (minimum of approximately 20 cm DBH) and height (minimum of approximately 10 m), density of standing snags within the stand, lower elevation, and lower canopy closure. Characteristics that were found to be not significantly related to roost tree selection were: distance to water, tree density, slope, and the amount of bark remaining on the tree trunk.

3.1.2 Suitable Roost Tree Density in Forest Stands with Plot Data

Suitable roost trees identified in each plot were used to calculate the density of suitable roost trees in each FRI stand within which plot data were collected. The density of suitable roost trees per hectare was calculated by summing all suitable trees identified in plots in the stand and dividing by the number of plots multiplied by the area of the plots (i.e., 0.05 ha). An example calculation for FRI stand 216 in the SSA is provided in Table 1.

Table 1: Example Calculations of Suitable Roost Tree Density for FRI stand 216 (SSA).

FRI Stand ID	Plot ID	Number of Suitable Roost Trees
216	1	15
216	2	12
216	3	21
216	4	33
216	5	6
216	6	39
216	7	9
216	8	18
216	9	21
216	10	10
216	11	14
216	12	22
216	13	4
216	14	20
216	15	4
216	16	24
216	19	5
216	20	4
216	21	11
216	22	5
216	25	6
216	26	1
216	27	6
216	28	1
216	30	20
216	31	16
216	37	2
216	38	30
216	39	6
216	40	12
216	23b	10
Total:	**31 plots**	**407 total suitable roost trees**
Density of Suitable Roost Trees within Stand (trees/ha)	**Sum of suitable roost trees for all plots in the stand = 262.6 trees/ha (0.05 ha/plot) * (# plots)**	

3.1.3 Suitable Roost Tree Density in Forest Stands without Plot Data

There were insufficient stand assessment data collected to predict suitable roost tree density for every FRI forest unit type and stand age present in the RSA. Consequently, the average suitable roost tree densities were calculated for each age class for all FRI Forest Unit types combined (Table 2). FRI forest stands that were not field-assessed were assigned the average suitable roost tree value based on the age class of the stand. The

estimated density of suitable roost trees is highest in mature stands, followed by immature stands, then sapling stands (Table 2).

Table 2: Average Suitable Roost Tree Density by Forest Stand Age.

Forest Stand Age Class	Average Suitable Roost Tree Density (roost trees / ha)	Number of Stands Assessed (n)	Standard Deviation	Minimum	Maximum
mature	48.5	17	61.4	0	262.6
immature	30.8	16	43.3	0	140
sapling	30.0	2	42.4	0	60

3.1.4 Number of Suitable Roost Trees in the SSA and RSA

The total number of suitable roost trees within the forested stands of the SSA and within the rest of the forested stands of the RSA was estimated by multiplying either the field-assessed (Section 3.1.2) or assigned density (Section 3.1.3) of suitable roost trees by the area of each individual FRI stand and then summing the area of all stands within the SSA and RSA. Examples of stand level estimates are as follows:

- FRI stand 7 (immature 24.2 ha MWUS field-assessed stand). Suitable roost tree density was estimated at 140 trees/ha using the methods described in Section 3.1.2. The calculated number of suitable roost trees within FRI stand 7 is 3,386 (140 trees/ha * 24.2 ha).
- FRI stand 6 (immature 4.7 ha MWUS non-field assessed stand). Suitable roost tree density was estimated at 30.8 trees/ha using the methods described in Section 3.1.3. The calculated number of suitable roost trees within FRI stand 6 is 145 (30.8 trees/ha * 4.7 ha).

The identification of a relatively high number of suitable roost trees in forested stands classified as sapling was unexpected (i.e., 30 roost trees/ha; Table 2). Sapling tree stands in the RSA contain trees between 10 to 39 years old, depending on the composition of leading tree species. Sampling was low in sapling stands (Table 2) and a true sapling stand would not be expected to contain large numbers of suitable roost trees. Potential sources of error include sampling in plot locations that do not represent the broader FRI polygon or the age of the stand as recorded in the FRI dataset. To evaluate the importance of this potential error, total suitable bat roost tree density in all forested stands of the SSA and RSA was calculated with and without inclusion of suitable roost trees within sapling stands.

3.2 Roost Occupancy and Bat Activity

3.2.1 Bat Activity Levels

Activity levels for each of the three SARA-listed bat species were evaluated across the entire monitoring period (i.e., June – August; Section 2.2) using data from all detector locations (i.e., all four types; Section 2.2) to provide information about the spatial distribution of overall bat activity and compare this to the roost occupancy information. Bat activity levels were estimated using number of calls/passes per detector night. The total number of calls recorded was divided by the number of deployment nights for each detector, standardizing activity data among detectors deployed for different numbers of nights.

Calls made by myotis species (i.e., little brown myotis, northern myotis, or eastern small-footed myotis [*Myotis leibii*]) are similar and can be difficult to distinguish, especially if the quality of the recording is low or calls occur in cluttered habitat. In cases where clear assignment to a particular myotis species was not possible, calls were

recorded as undifferentiated “myotis” species calls. When considering activity levels of individual SARA-listed bat species, undifferentiated myotis sp. were grouped with both the little brown myotis and northern myotis activity levels because the unknown myotis species recorded could be either of those two species.

3.2.2 Roost Occupancy

Roost occupancy was inferred from bat calls/passes detected 30 minutes before sunset and 60 minutes after sunset, consistent with the emergence window described by the OMNR (2011). Sunset times changed over the course of the acoustic monitoring period and sunset was calculated using the National Oceanic and Atmospheric Administration sunset calculator (NOAA 2017) for a position centered on the RSA (latitude 46.047 degrees and longitude -77.402 degrees).

The emergence window is the period of the night where the likelihood of capturing the activity of a bat that has just emerged from a roost to forage for the night is highest. A bat recorded in flight during this period is more likely to have emerged from a roost tree in close proximity to the detector. Bats are capable of long distance flights each night and can fly at speeds up to 35 km/hr (Fenton and Barclay 1980). Distinguishing roost emergence from foraging or commuting activity is not possible later during the night because bats detected at these times may have traveled long distances from a roost (e.g., Cryan et al. 2001).

The total number of calls recorded during the emergence windows at each detector location was divided by the number of emergence window nights surveyed for the detector, standardizing activity data among detectors deployed for different numbers of nights.

Bat box survey locations did not provide information occupancy of natural roosts. Consequently, this survey type was excluded from the roost occupancy analysis. The combined datasets from NSDF Grid and RSA Random points resulted in a sample of 220 detector nights from which recorded roost emergence activity was used to predict occupancy in forest stands that were not monitored. The bat activity data from the Exit Survey locations within the SSA were included in roost occupancy estimates for only those stands where the data were collected.

The commonly accepted maternity roosting period in Ontario is between 1 June and 30 June (OMNR 2011, OMNRF 2017). However, female bats will likely continue to use a tree for roosting after the maternity roosting period and therefore, their presence at maternity roosts will likely extend beyond June (Environment Canada 2015). The analysis of roost occupancy for stands where monitoring took place therefore focused on the entire dataset for the Exit Surveys, NSDF Grid and RSA Random points (i.e., June to August).

Female little brown myotis sometimes have maternity roosts consisting of hundreds of individuals, whereas female tri-colored bats and northern myotis tend to roost alone or in small colonies (Environment Canada 2015). Males of all species roost singly or in small groups (Environment Canada 2015). Female and male bat calls are indistinguishable using acoustic data, and a single pass during the roost emergence window was considered sufficient to infer maternity roost occupancy. Occupied roosting habitat identified through this analysis may therefore include maternity roosts of various sizes and other roost types (i.e., male roosts). The number of passes per detector night during the nightly emergence window (30 minutes before sunset to 60 minutes after sunset) provides an indication of the amount of roost use in the vicinity of a detector.

The number of bat passes per detector night during the nightly emergence window was estimated for the three SARA-listed species combined, and separately for all other bats combined (i.e., silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*], hoary bat [*Lasiurus cinereus*], eastern red bat [*Lasiurus borealis*],

and eastern small-footed myotis[4]). Consideration of other tree-roosting bats not listed under SARA, but present within the RSA, is useful to help identify occupancy and availability of roosting habitat. Bats that are not SARA-listed may occupy roosts that may then be unavailable to SARA-listed bats.

3.2.3 Intensity of Roost Occupancy in Forest Stands with Acoustic Monitoring Data

The intensity of roost occupancy by bats in FRI stands where acoustic monitors were deployed was estimated directly from the data collected in that stand (inclusive of NSDF Grid and Exit Survey datasets within the SSA, and RSA Random points datasets outside the SSA), using the average number of calls per detector emergence window. For example, there were 23 NSDF Grid monitoring locations and 17 Exit Survey locations within FRI stand 216. The sum of calls recorded across all 40 detector locations was divided by the total number of detector nights for all detector locations (n = 83). Calculations were made separately for the combined number of SARA-listed species calls (n = 52) and combined number of all bat species calls (n = 257). Overall, for stand 216, there were 0.63 calls per detector night of SARA-listed species (52 calls divided by 83 detector nights) and 3.1 calls per detector night of all bat species (257 calls divided by 83 detector nights).

3.2.4 Intensity of Roost Occupancy in Forest Stands without Acoustic Monitoring Data

In a manner similar to that described in Section 3.1.3, the average number of calls recorded per detector emergence window in each forest age class was used to estimate the intensity of roost occupancy in forest stands for which no acoustic data were available. Only two of the four acoustic datasets were used for this purpose: the NSDF Grid and RSA Random points. The reason for this is that the locations for acoustic monitoring in the NSDF Grid and RSA Random points datasets were selected in a similar manner (i.e., on a grid pattern, or completely randomly generated location, not targeting specific features), and there was a more equivalent distribution of survey effort within the SSA and RSA by only including these two datasets, although survey effort in forested stands in the SSA remains higher than survey effort in forested stands in the RSA.

Average intensity of roost occupancy was assigned to each forest stand for which no acoustic data were collected according to age of the stand. Average intensity of roost occupancy was calculated for these bat groupings:

- Combined calls from the three SARA-listed species (little brown myotis, northern myotis, undifferentiated myotis, and tri-colored bats) (Table 3), to predict roost tree occupancy of the SARA-listed species.
- Combined calls from all bat species present (the three SARA-listed species plus eastern small-footed myotis, silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*], hoary bat [*Lasiurus cinereus*] and eastern red bat [*Lasiurus borealis*]) (Table 4), to predict roost tree occupancy by all tree roosting bat species occurring on the CRL property / RSA.

[4] Eastern small-footed myotis may also be included with SARA listed bats in analyses that use undifferentiated myotis data.

Table 3: Average number of passes of SARA-listed Species during the roost emergence window in different forest age classes.

Forest Stand Age Class	SARA-listed Species Calls/Detector Night[5] (Emergence Window)	Detector Nights (n)	Standard Deviation	Minimum # Calls (per night)	Maximum # Calls (per night)
Mature	0.66	124	1.9	0	11
Immature	0.16	74	0.4	0	2
Sapling	0.14	7	0.4	0	1

Table 4: Average number of passes of all bats during the roost emergence window in different forest age classes.

Forest Stand Age Class	ALL Species Calls/Detector Night (Emergence Window)	Detector Nights (n)	Standard Deviation	Minimum # Calls (per night)	Maximum # Calls (per night)
Mature	6.6	124	15.9	0	125
Immature	4.4	74	6.3	0	42
Sapling	3.1	7	2.8	0	7

3.2.5 Roost Tree Occupancy Index

To obtain an index of roost tree occupancy, the field-assessed or predicted intensity of roost use was divided by the field-assessed or predicted density of suitable roost trees within each FRI stand. The resulting index provides relative levels of roost tree occupancy and can be used to evaluate the availability of suitable and unoccupied roosts. Stands with a high roost tree occupancy index score (i.e., relatively high intensity of roost use / roost tree density) may contain few suitable and occupied roosts, whereas stands with a low roost tree occupancy index score (i.e., relatively low intensity of roost use / roost tree density) likely contain suitable unoccupied roosting habitat.

The roost tree occupancy index was used to:

- Estimate of the relative amount of roost occupancy for all bat species combined in each FRI stand in the SSA and RSA (intensity of roost use by all bats / density of roost trees).
- Estimate the relative amount of roost occupancy of the three SARA-listed bat species in each FRI stand in the SSA and RSA (intensity of roost use by SARA listed bats / density of roost trees).
- Examine relative roost occupancy in forested stands in the RSA to determine the potential for bats displaced by the NSDF Project to be accommodated in alternate suitable and unoccupied roosting habitat.

[5] The species included were little brown myotis, northern myotis, undifferentiated myotis (which could be either SARA-listed species or eastern small-footed myotis), and tri-colored bat.

4.0 RESULTS

4.1 Suitable Roost Trees

The CRL property (RSA) is dominated by forested ecosystems and the estimated number of suitable roost trees for the entire property, including suitable roost trees in sapling stands, exceeds 116,000 (Table 5). The number of suitable roost trees varies across the study area (Figure 3), but is substantially higher in stand 216, which encompasses most of the area to be affected by the NSDF Project footprint (SSA), compared to elsewhere in the RSA (Figure 3; Table 5). This difference may be an artifact of sampling intensity, which was much higher in stand 216 than in other forested stands in the RSA (Figures 1 and 2). Of the 32 forest stands surveyed outside of the SSA, 28 had a single plot conducted, 1 had 2 plots, and 2 had 3 plots. Certainty in the average roost tree density found in stand 216, where data were collected at 31 plot locations, is therefore much higher than certainty in the average roost tree density in other parts of the RSA.

Table 5: Estimated Number of Suitable Roost Trees in the SSA and RSA.

Study Area	Number of Suitable Roost Trees[a]	Area (ha)	Average Roost Tree Density (#/ha)
RSA outside of SSA	110,405	3,514	31
SSA	6,485	37	175
Total (CRL Property)	116,890	3,551[b]	33

[a] Includes sapling stands

[b] The total area considers the total area within the CRL property covered by the FRI dataset and excludes aquatic habitat and minor gaps and slivers in GIS. For that reason, there is a discrepancy between this value and the total RSA area (if total of suitable + unsuitable habitat is added, the total is 3,853 ha)

As indicated in Section 3.1.1, the high number of suitable roost trees found in forest stand assessments within stands identified as sapling in the FRI data was surprising. When sapling stands were excluded from the suitable roost tree analysis, the calculated total number of suitable roost trees in the RSA outside of the SSA is 108,551, a difference of 1,853 trees or 1.68%. The small difference is due to the relatively small area of sapling forest stand coverage in the RSA. Because the effect of sapling stand inclusion on total suitable roost tree calculations was negligible, sapling stands were retained for the calculations presented in Table 5 and for other analyses undertaken in this assessment.

4.2 Maternity Roost Habitat Availability

One of the objectives of estimating the number of suitable roost trees in forest stands in the RSA and SSA was to evaluate whether the predictions of the EIS developed for the NSDF Project were supported by the forest stand assessment data. The EIS for the NSDF Project presented coarse-scale estimation of potential maternity roost habitat within the SSA and RSA by assuming that maternity roost habitat for little brown myotis and northern myotis would be present in the following habitat types:

- Mature forest stands.
- Mature treed swamps.

The forest stand assessment data indicate that a large number of suitable maternity roost trees are also present in immature stands in the RSA, and that some sapling stands in the RSA may also contain suitable roost trees. Consequently, the amount of habitat containing suitable roost trees within the CNL property is likely higher than originally estimated in the EIS (Figures 3 and 4; Table 6).

Table 6: Changes to Availability of Bat Maternity Roost Tree Habitat as a result of the NSDF Project using the Original EIS Model and an Updated Model that incorporates all Forest Classes

Model	Roost Habitat Class	Regional Study Area				Local Study Area			
		Base Case [ha]	Application Case [ha]	Change in Area [ha]	Percent Change [%]	Base Case [ha]	Application Case [ha]	Change in Area [ha]	Percent Change [%]
Original EIS Habitat Suitability	Suitable	1,149	1,121	-28	-2	83	54	-28	-34
	Unsuitable	2,704	3,732	28	1	125	153	28	23
Updated Habitat Suitability	Suitable	2,943	2,909	-34	-1	114	81	-34	-30
	Unsuitable	910	944	34	4	93	126	34	37

ha = hectare; % = percent

However, the coarse habitat models used in the EIS and the updated model presented in Table 6 do not account for stand quality because they treat all forest stands as equivalent. Although suitable roosting habitat may be present more broadly in the RSA than predicted in the EIS, the relative stand quality estimated by density of suitable roost trees is much higher in the LSA and SSA than elsewhere in the RSA (Figures 3 and 4; Table 5). Consequently, although Table 6 indicates that the relative loss of roosting habitat caused by the NSDF project would decline from 2% of the RSA to 1% of the RSA (i.e., less important), the loss of individual suitable roost trees caused by the NSDF project would be 6,485 trees, representing 5.5% of all suitable roost trees estimated for the RSA.

4.3 Bat Activity Levels

Bat passes representing roost emergence, foraging, and commuting activity at detectors in the RSA were most commonly assigned to little brown myotis (Figure 5), followed by northern myotis (Figure 6), and then tri-colored bats (Figure 7).

Little brown myotis activity was detected throughout the RSA and SSA (Figure 5). Activity levels were similar at most sampling stations where little brown myotis were detected, but activity was elevated at three detectors located around the perimeter of Perch Lake (Figure 5). This is expected, because Perch Lake likely serves as a high-quality foraging habitat feature on the RSA landscape that attracts many bats each night. Bats foraging at Perch Lake could have traveled from roosts located several kilometers away (Cryan et al. 2001).

The activity of northern myotis was also evenly distributed throughout the RSA but at a lower level than little brown myotis activity (Figure 6). Similar to what was observed for little brown myotis activity (Figure 5), there were many detectors within the SSA that had no calls of northern myotis recorded, but many that did (Figure 6). Although there were no areas with especially high peaks in northern myotis activity recorded in the RSA, activity was highest at detectors deployed near Perch Lake.

Tri-colored bats had much lower general activity levels detected throughout the RSA than either of the two myotis species (Figure 7). Recordings of tri-colored bats were made at only eight detectors. This is not unexpected, because tri-colored bats were relatively rare in parts of Ontario, even prior to the arrival of white nose syndrome (WNS), which is a deadly fungal infection transmitted among bats in winter hibernacula and is the primary factor driving the Endangered listing of little brown myotis, northern myotis, and tri-colored bats under SARA (Environment Canada 2015). WNS has caused precipitous bat population declines in some parts of Ontario (Environment Canada 2015).

4.4 Roost Tree Occupancy

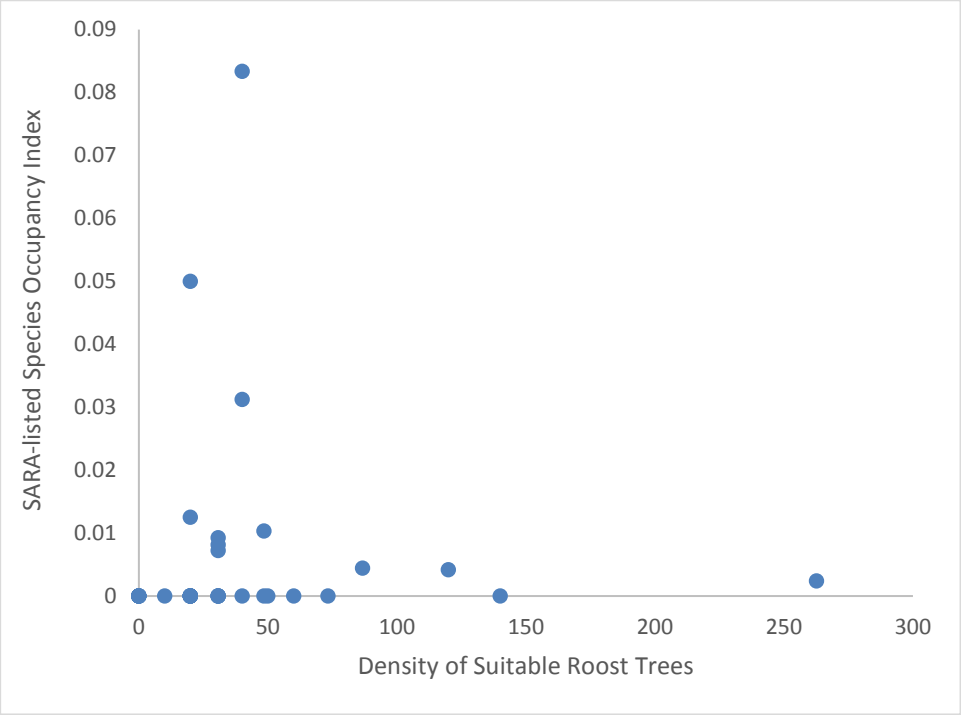
The combined primary emergence window acoustic monitoring results of all acoustic monitoring programs conducted in the SSA (including Exit Surveys), as well as the results of the stand assessments are provided in Table 7.

Table 7: SARA-species occupancy and suitable maternity roost data from the SSA

Stand ID	Age Class	# SARA-listed Species calls/detector night (primary emergence window)	# ALL Species calls/detector night (primary emergence window)	Density of Suitable Roost Trees (trees/ha)	Area of stand within SSA (ha)	Calculated # Suitable Roost Trees (within SSA)
215	Mature	Predicted – 0.66	Predicted – 6.55	Predicted – 48.5	0.02	0.76
216	Mature	0.63	3.10	262.6	22.7	5951.6
218	Mature	0	0	50	0.9	44.3
219	Mature	0	19.31	Predicted – 48.5	3.6	175.4
221	Mature	Predicted – 0.66	Predicted – 6.55	Predicted – 48.5	0.008	0.40
222	Immature	0.29	0.86	Predicted – 30.8	2.4	74.8
223	Immature	0.25	2	Predicted – 30.8	1.6	49.3
232	UCL	Not assessed (not treed)			0.005	-
354	Mature	0.38	13.54	86.7	2.2	188.2
501	UCL	Not assessed (not treed)			3.8	-
				Totals:	**37.2**	**6,485**

Despite the very high density of suitable roost trees in the SSA, which is dominated by stand 216, the number of calls per detector night in the primary emergence window was slightly below the average predicted for other mature stands in the RSA (0.63 compared to 0.66, see Table 7). The maximum number of passes of SARA-listed bats in the SSA was 10 passes per detector night in the primary emergence window. There were many detector locations for which no SARA-listed bats recorded. Within stand 216, for example, there were 30 detector locations out of 40 with no SARA-listed bats recorded. Although suitable roost trees are very abundant in stand 216, the available data indicate that many of them remain unoccupied. This intensity of roost use by SARA-listed bats estimated from acoustic detectors deployed in the SSA is consistent with individual roosting bats or small groups. The acoustic data yielded no evidence of large maternal roosting colonies of little brown myotis in the SSA.

Using data from stands in the SSA and in other parts of the RSA where both stand assessments and acoustic monitoring was conducted, there were many instances where stands containing suitable roost trees had no activity recorded by SARA-listed bats, indicating a degree of vacancy in available suitable roost tree habitat throughout much of the RSA (Plot 1). There is also variability among stands, and stands with intermediate densities of suitable roost trees (between 25 and 50) had the highest occupancy index scores. Many plots with higher numbers of suitable roost tree densities had much lower occupancy index scores, likely because suitable roost trees are so abundant in these stands and only a small number of them are occupied (e.g., stand 216 in the SSA).



Plot 1: SARA-listed bat species occupancy index as a function of the number of suitable roost trees present within stands having both acoustic monitoring and stand assessments conducted.

The calculated roost tree occupancy index varied among forested stands in the RSA (Figure 8). The weighted circles depicted in Figure 8 are positioned on the centroid of each FRI forest stand, and the relative size of each circle represents the roost tree occupancy index score within the stand. As shown on Figure 8, the proportion of SARA-listed bat species roost occupancy compared to other non-listed bat species is generally low throughout the RSA. Considering occupancy as a whole, only a small number of forest stands had relatively high roost tree occupancy index values, with one occurring on the west margin of the CRL property boundary, and another within the north portion of the SSA. The majority of stands had relatively low to moderate occupancy index values, even in cases where substantial numbers of suitable roost trees were present (compare Figure 3 to Figure 8). Based on these data, it can be inferred that stands with lower relative roost tree occupancy likely contain suitable roosting habitat that is currently unoccupied.

5.0 DISCUSSION AND CONCLUSION

The objective of the analyses presented in this technical memorandum was to provide answers to the questions posed by ECCC in their review of CNL's SARA Section 73 permit application. The question posed by ECCC can be divided into three sub-questions, as follows:

- Will roosts used by SARA listed bats be damaged or destroyed by the NSDF Project?
- What is the importance of these roosts for SARA listed bats?
- What is the availability of suitable, unoccupied roosts in the area?

Each of these sub-questions is answered in the following sections.

5.1 Will roosts used by SARA listed bats be damaged or destroyed by the NSDF Project?

Forest plot data collected by CNL demonstrate a high density of suitable roost trees for bats in forest stands encompassing the SSA. The density of suitable roost trees within these stands is higher than in any other forest stands in the RSA, although increased survey intensity in other stands in the RSA may alter this conclusion. Acoustic monitoring in the SSA during the roost emergence window indicates that SARA-listed bats are roosting in suitable roost trees in the SSA, although estimated occupancy per suitable roost tree is lower than most other stands in the RSA. Overall, the data strongly support a conclusion that some roosts used by SARA-listed bats will be damaged or destroyed by the NSDF Project, but that potential roost tree occupancy is low.

5.2 What is the importance of these roosts for SARA listed bats?

Suitable roost trees in the SSA are likely used by SARA-listed bat species both as maternity roosts and for other types of roosting (e.g., roosts used by males). Data collected during the roost emergence window in the SSA did not identify intensity of roost occupancy values consistent with maternal roosts used by large numbers of little brown myotis[6]. Data coverage within the SSA was high (Figure 2), but lack of detection of large maternal roosting colonies of little brown myotis does not guarantee that none are present. A precautionary conclusion given the amount of available habitat would be that some larger maternal roosting colonies of little brown myotis could be present in the SSA.

Under the provincial wind power guidance for assessing candidate maternity roost stands and individual roost trees (OMNR 2011), confirmation of endangered bats roosting in a single roost tree within a stand is sufficient to designate the entire forest stand as confirmed Significant Wildlife Habitat for bat maternity colonies. Using this definition, forest stands within the SSA can be considered Significant Wildlife Habitat for bat maternity colonies.

As part of the question about the importance of roosts in the SSA, ECCC wanted to understand how many bats used the roosts and when. Precisely determining roost tree occupancy rates by bats is difficult (OMNR 2017); this difficulty is compounded in large areas containing high densities of suitable roost trees, such as the SSA. The SSA contains thousands of suitable roost trees and completing roost surveys (visual or acoustic) for the entire SSA is impractical. Thus, uncertainty remains about the timing of roost use and precise number of bats using roosting habitat in the SSA. However, a reasonable conclusion given the available data would be that the SSA contains important roosting habitat for SARA listed bats, although it does not appear to be more important than other forested stands in the RSA when occupancy is considered.

Based on the number of suitable roost trees present in the SSA, the number of bats that currently use the SSA as roosting habitat and would be displaced by the NSDF Project could be substantial. No other forest stands in the RSA contain as many suitable roost trees. However, suitable roost tree density in forest stands in the SSA is better understood than in other stands in the RSA because sampling intensity was much higher in the SSA. Higher sampling intensity in other parts of the RSA in the future may identify additional stands with higher suitable roost tree density. Moreover, despite the high density of suitable roost trees in the SSA, occupancy index scores were lower than in many other stands in the RSA, suggesting that many of the suitable roost trees present in the SSA remain unoccupied.

[6] Northern myotis and tri-colored bats are not expected to roost in large maternal colonies (Environment Canada 2015).

5.3 What is the availability of suitable, unoccupied roosts in the area?

Understanding the occupancy rates for available suitable roost trees in the RSA is important for evaluating the importance of removing roosting habitat in the SSA. If suitable roost trees outside of the SSA are already fully occupied, there would potentially be insufficient vacancy to accommodate bats displaced from the SSA as a result of the NSDF Project. In this case, the effects of tree removal in the SSA would have greater consequences for displaced bats. If suitable roost trees outside of the SSA are vacant, then displaced bats from the SSA can be accommodated and the effects of removing suitable roost tree from the SSA will have lower consequences for bats. Other important habitats, such as foraging habitats associated with Perch Lake, would not change as a result of the NSDF Project and bats would be able to access these important habitats from alternate roost sites up to several kilometers away (Cryan et al. 2001).

Although the density of suitable roost trees is higher in the SSA than it is in other parts of the RSA, suitable roosting habitat is abundant throughout the RSA. The majority of stands had relatively low to moderate occupancy index values, even in cases where substantial numbers of suitable roost trees were present. Most occupied roosting habitat was occupied at relatively low levels by bats that are not SARA-listed. These results indicate that a large number of suitable unoccupied roost trees are present in the RSA and that these likely are more than sufficient to accommodate SARA-listed bats displaced by the NSDF Project.

The presence of WNS in populations of little brown myotis, northern myotis, and tri-colored bats overlapping the RSA has not been confirmed; however, Environment Canada (2015) estimates that populations of little brown myotis, northern myotis, and tri-colored bats have been reduced by 94% in WNS-affected provinces such as Ontario (Environment Canada 2015). If local populations have been affected by WNS, the population will be well below the size required for roost trees to be limiting. Bats are known to use other suitable roosts if previously used roosts are removed outside of the roosting season (Silvis et al. 2015). This evidence provides additional support for the inference that the amount of vacant tree roosting habitat available in the RSA following construction of the NSDF Project will be sufficient to accommodate SARA-listed bats displaced from the SSA.

5.4 Conclusion

The combined results of the analyses described in this technical memorandum support the predictions of the EIS for the NSDF Project. Implementing the NSDF Project will very likely result in the damage or destruction of suitable and seasonally occupied maternity roosts for all three SARA-listed bat species within the SSA. Although the roosts removed by the NSDF Project may be used by large numbers of SARA-listed bats, especially little brown myotis and northern myotis, the NSDF Project would remove the roosts during winter when they are unoccupied. The data collected by CNL during the summer of 2017 indicates that suitable maternity roost trees that are currently unoccupied are present in the RSA outside of the SSA in sufficient abundance to accommodate the three SARA-listed bats that will be displaced as a result of the NSDF Project. This finding is supported even though the density of roost trees calculated in the RSA outside of the SSA was much lower than the number observed in the SSA. The conclusion would be even stronger if additional survey effort identified that a higher number of suitable roost trees are present in the RSA outside of the SSA.

6.0 CLOSURE

We trust the information contained in the technical memo meets your requirements at this time. If you have any further questions or concerns, please do not hesitate to contact the undersigned.

Yours Truly,

ORIGINAL SIGNED

Leigh Holt, MASc, RPBio (BC)
Biologist

ORIGINAL SIGNED

Mitch Firman, BSc, RPBio (BC)
Wildlife Biologist

ORIGINAL SIGNED

Kyle Knopff, PhD, PBiol (AB)

Associate, Senior Wildlife Biologist

7.0 REFERENCES

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Attachments:

Figure 1: Stand Assessment and Acoustic Monitoring Locations – RSA

Figure 2: Stand Assessment and Acoustic Monitoring Locations – SSA

Figure 3: Ground-Truthing of EIS Figure 5.6.4-11: Bat Habitat Availability and Distribution in the RSA – Base Case Using Field-collected Stand Assessment Data (Field-assessed and Predicted)

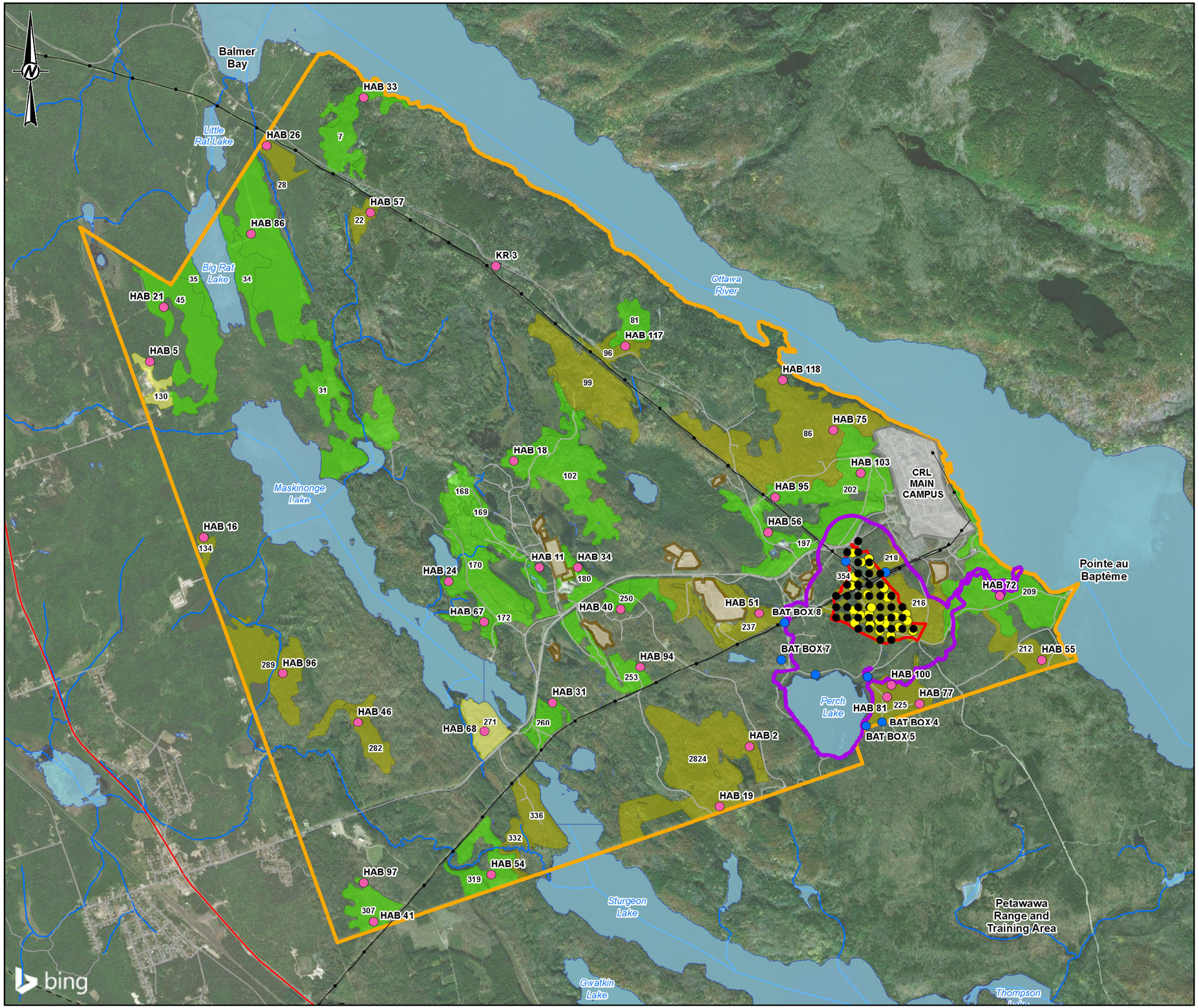
Figure 4: Ground-Truthing of EIS Figure 5.6.4-12: Bat Habitat Availability and Distribution in the LSA and SSA – Base Case Using Field-collected Stand Assessment Data (Field-assessed and Predicted)

Figure 5: Activity Levels of Little Brown Myotis across the RSA – entire night (12 June through 11 August 2017)

Figure 6: Activity Levels of Northern Myotis across the RSA – entire night (12 June through 11 August 2017)

Figure 7: Activity Levels of Tri-Colored Bat across the RSA – entire night (12 June through 11 August 2017)

Figure 8: Inferred tree roost occupancy by SARA-listed bat species relative to all bat species – RSA



LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

FRI STANDS WITH FOREST STAND ASSESSMENT PLOTS[2]

- MATURE (FRI STAND ID)
- IMMATURE (FRI STAND ID)
- SAPLING (FRI STAND ID)

ACOUSTIC MONITORING LOCATIONS[3]

- NSDF GRID (DETECTOR SITE ID)
- EXIT SURVEYS (DETECTOR SITE ID)
- BAT BOXES (DETECTOR SITE ID)
- RSA RANDOM POINTS (DETECTOR SITE ID)

1 0 1

1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.
2. FRI STAND AGE CLASS AS DETERMINED BY GOLDER IN THE EIS.
3. SEE FIGURE 2 FOR ACOUSTIC MONITORING LOCATIONS WITHIN THE LOCAL STUDY AREA.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: © 2018 MICROSOFT CORPORATION © 2018 DIGITALGLOBE ©CNES (2018) DISTRIBUTION AIRBUS DS
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
STAND ASSESSMENT AND ACOUSTIC MONITORING LOCATIONS – RSA

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	1

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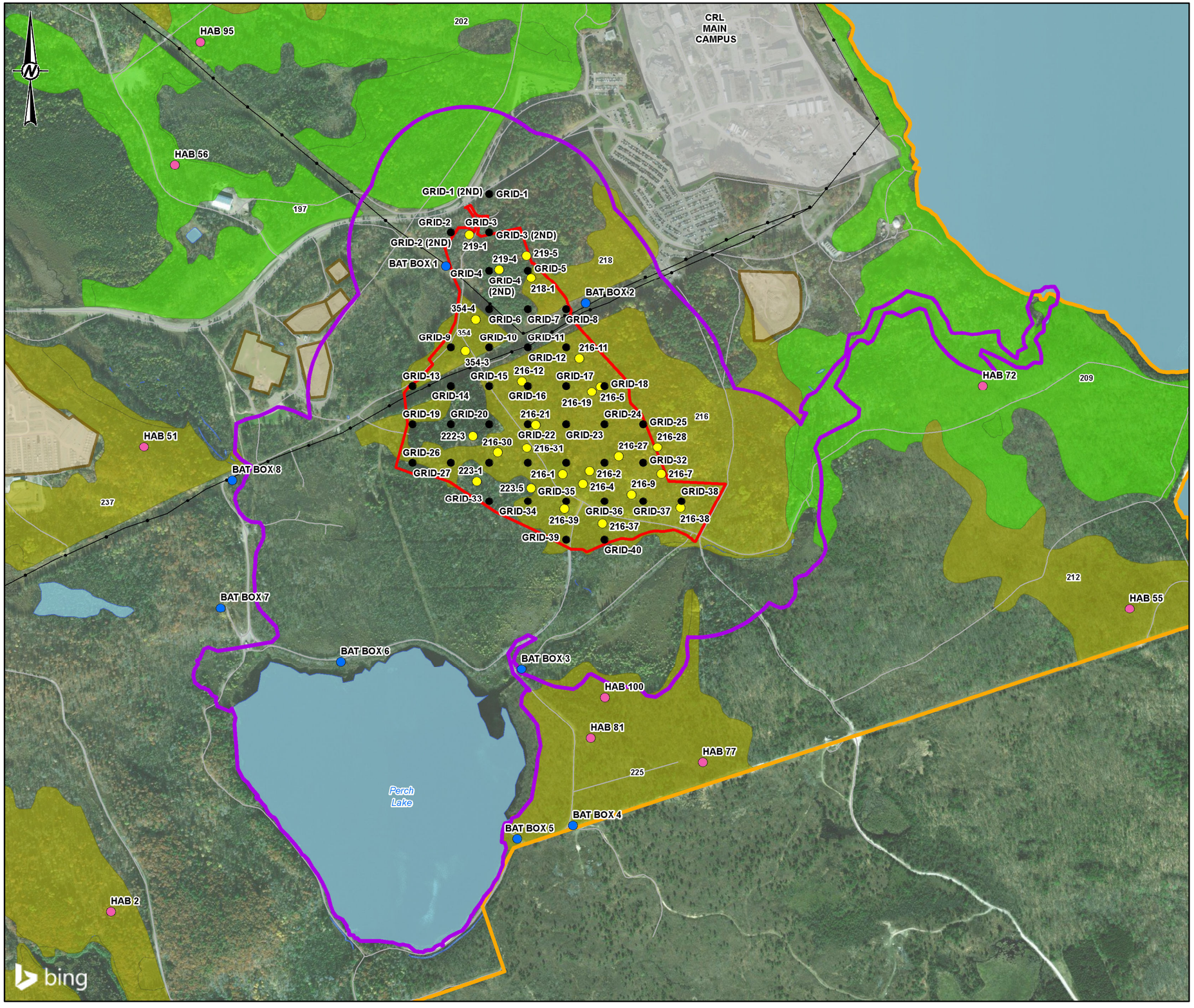

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

FRI STANDS WITH FOREST STAND ASSESSMENT PLOTS[2]

- MATURE (FRI STAND ID)
- IMMATURE (FRI STAND ID)

ACOUSTIC MONITORING LOCATIONS

- NSDF GRID (DETECTOR SITE ID)
- EXIT SURVEYS (DETECTOR SITE ID)
- BAT BOXES (DETECTOR SITE ID)
- RSA RANDOM POINTS (DETECTOR SITE ID)

200 0 200 400
1:10,000 METERS

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.
2. FRI STAND AGE CLASS AS DETERMINED BY GOLDER IN THE EIS.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: © 2018 MICROSOFT CORPORATION © 2018 DIGITALGLOBE ©CNES (2018) DISTRIBUTION AIRBUS DS
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
STAND ASSESSMENT AND ACOUSTIC MONITORING LOCATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
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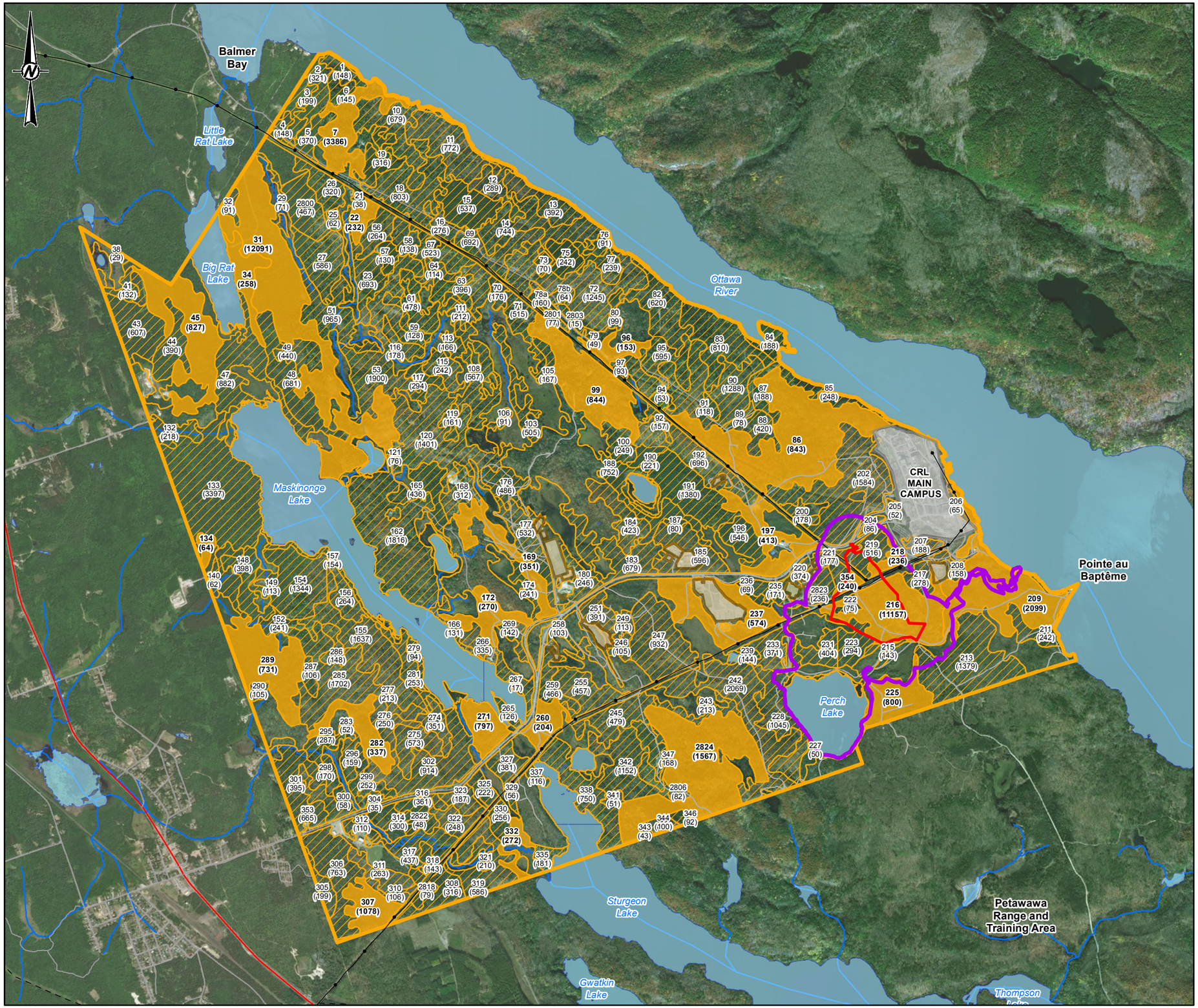

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

SUITABLE MATERNITY ROOST HABITAT FOREST STANDS

- PREDICTED (FRI STAND ID AND CALCULATED NUMBER ROOST TREES IN PARENTHESES)
- FIELD ASSESSED (FRI STAND ID AND CALCULATED NUMBER ROOST TREES IN PARENTHESES)

1 0 1

1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
BAT HABITAT AVAILABILITY AND DISTRIBUTION IN THE RSA – BASE CASE USING FIELD-COLLECTED STAND ASSESSMENT DATA (ACTUAL AND PREDICTED)

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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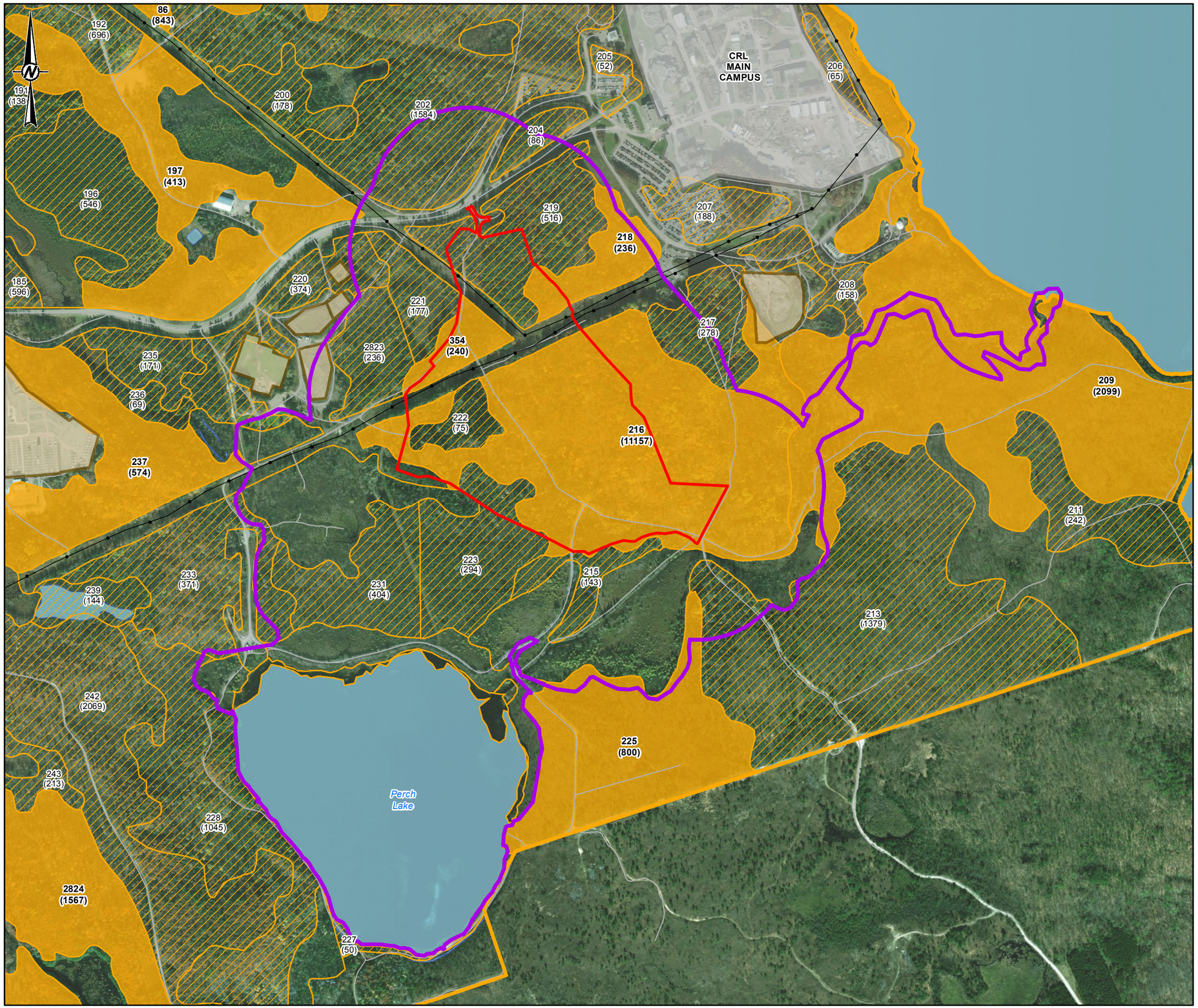

LEGEND

- TRANSMISSION LINE
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

SUITABLE MATERNITY ROOST HABITAT FOREST STANDS

- PREDICTED (FRI STAND ID AND CALCULATED NUMBER ROOST TREES IN PARENTHESES)
- FIELD ASSESSED (FRI STAND ID AND CALCULATED NUMBER ROOST TREES IN PARENTHESES)

200 0 200 400
1:10,000 METERS

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
BAT HABITAT AVAILABILITY AND DISTRIBUTION IN THE LSA AND SSA – BASE CASE USING FIELD-COLLECTED STAND ASSESSMENT DATA (ACTUAL AND PREDICTED)

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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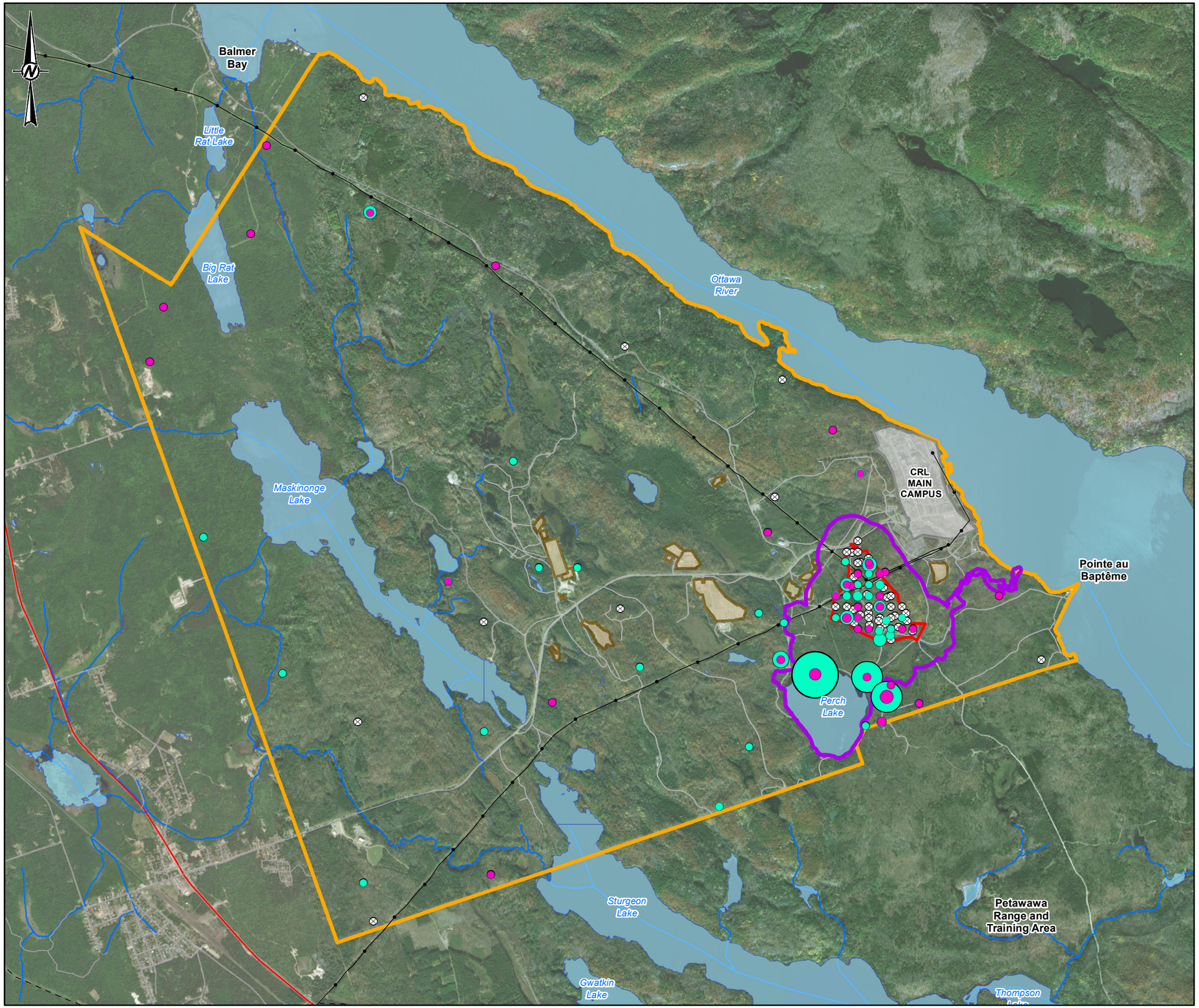

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

ACOUSTIC MONITORING LOCATIONS - ICONS SCALED BY ACTIVITY LEVEL

- LITTLE BROWN MYOTIS # PASSES/DETECTOR NIGHT
- UNDIFFERENTIATED MYOTIS # PASSES/DETECTOR NIGHT
- NO ACTIVITY RECORDED

ACTIVITY LEVEL

- 0.2 PASSES / DETECTOR NIGHT
- 43 PASSES / DETECTOR NIGHT
- 86 PASSES / DETECTOR NIGHT

1 0 1

1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
ACTIVITY LEVELS OF LITTLE BROWN MYOTIS ACROSS THE RSA – ENTIRE NIGHT (12 JUNE THROUGH 11 AUGUST 2017)

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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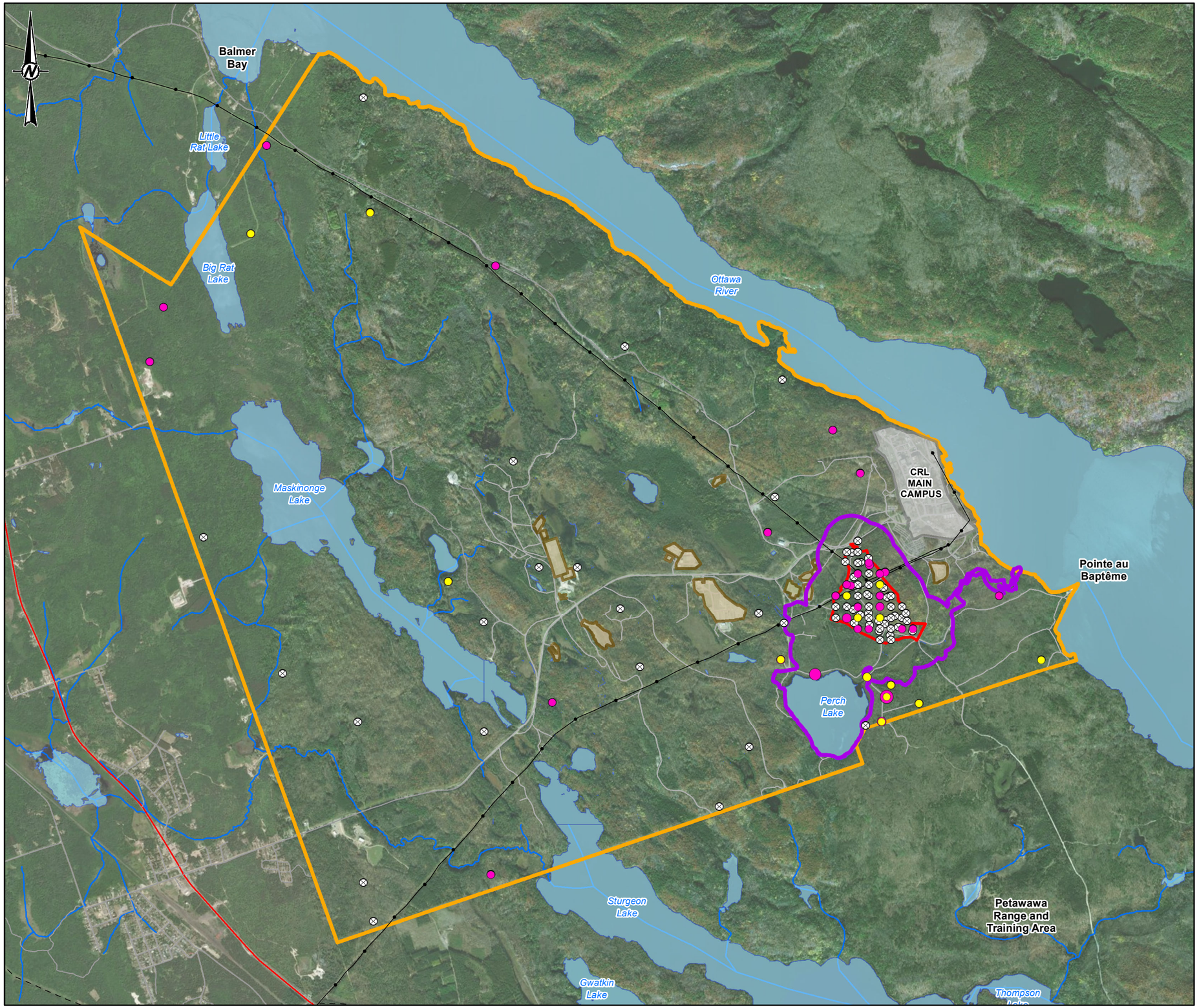

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

ACOUSTIC MONITORING LOCATIONS - ICONS SCALED BY ACTIVITY LEVEL

- NORTHERN MYOTIS # PASSES/DETECTOR NIGHT
- UNDIFFERENTIATED MYOTIS # PASSES/DETECTOR NIGHT
- NO ACTIVITY RECORDED

ACTIVITY LEVEL

- 0.2 PASSES / DETECTOR NIGHT
- 43 PASSES / DETECTOR NIGHT
- 86 PASSES / DETECTOR NIGHT

1 0 1

1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.
2. SCALE HAS BEEN MAINTAINED AT THE LEVELS PRESENTED IN FIGURE 5 TO FACILITATE COMPARISON AMONG SPECIES.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
ACTIVITY LEVELS OF NORTHERN MYOTIS ACROSS THE RSA – ENTIRE NIGHT (12 JUNE THROUGH 11 AUGUST 2017)

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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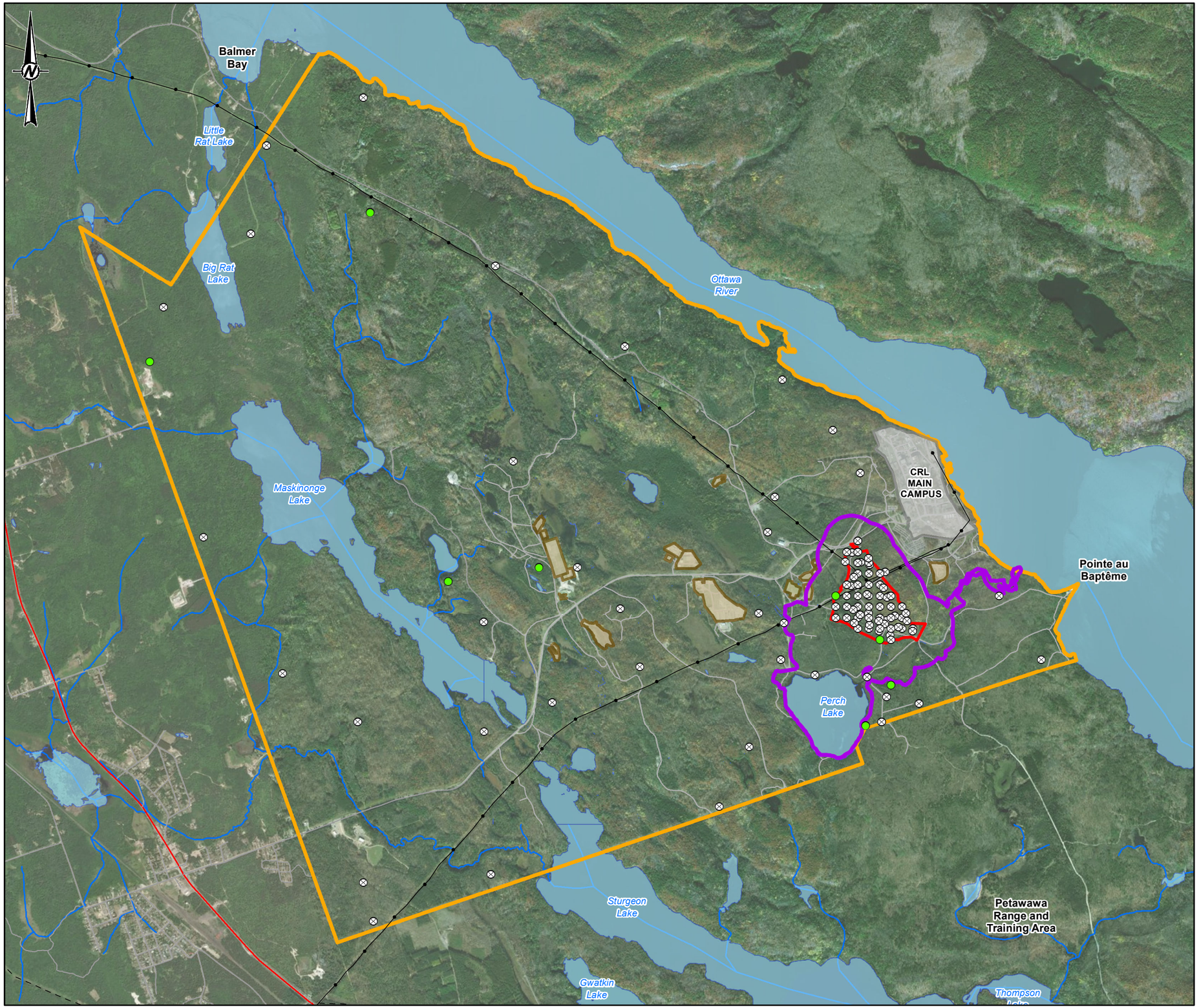

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

ACOUSTIC MONITORING LOCATIONS - ICONS SCALED BY ACTIVITY LEVEL

- TRI-COLOR BAT # PASSES/DETECTOR NIGHT
- NO ACTIVITY RECORDED

ACTIVITY LEVEL

- 0.2 PASSES / DETECTOR NIGHT
- 43 PASSES / DETECTOR NIGHT
- 86 PASSES / DETECTOR NIGHT

1 0 1

1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.
2. SCALE HAS BEEN MAINTAINED AT THE LEVELS PRESENTED IN FIGURE 5 TO FACILITATE COMPARISON AMONG SPECIES.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
ACTIVITY LEVELS OF TRI-COLORED BAT ACROSS THE RSA – ENTIRE NIGHT (12 JUNE THROUGH 11 AUGUST 2017)

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	7

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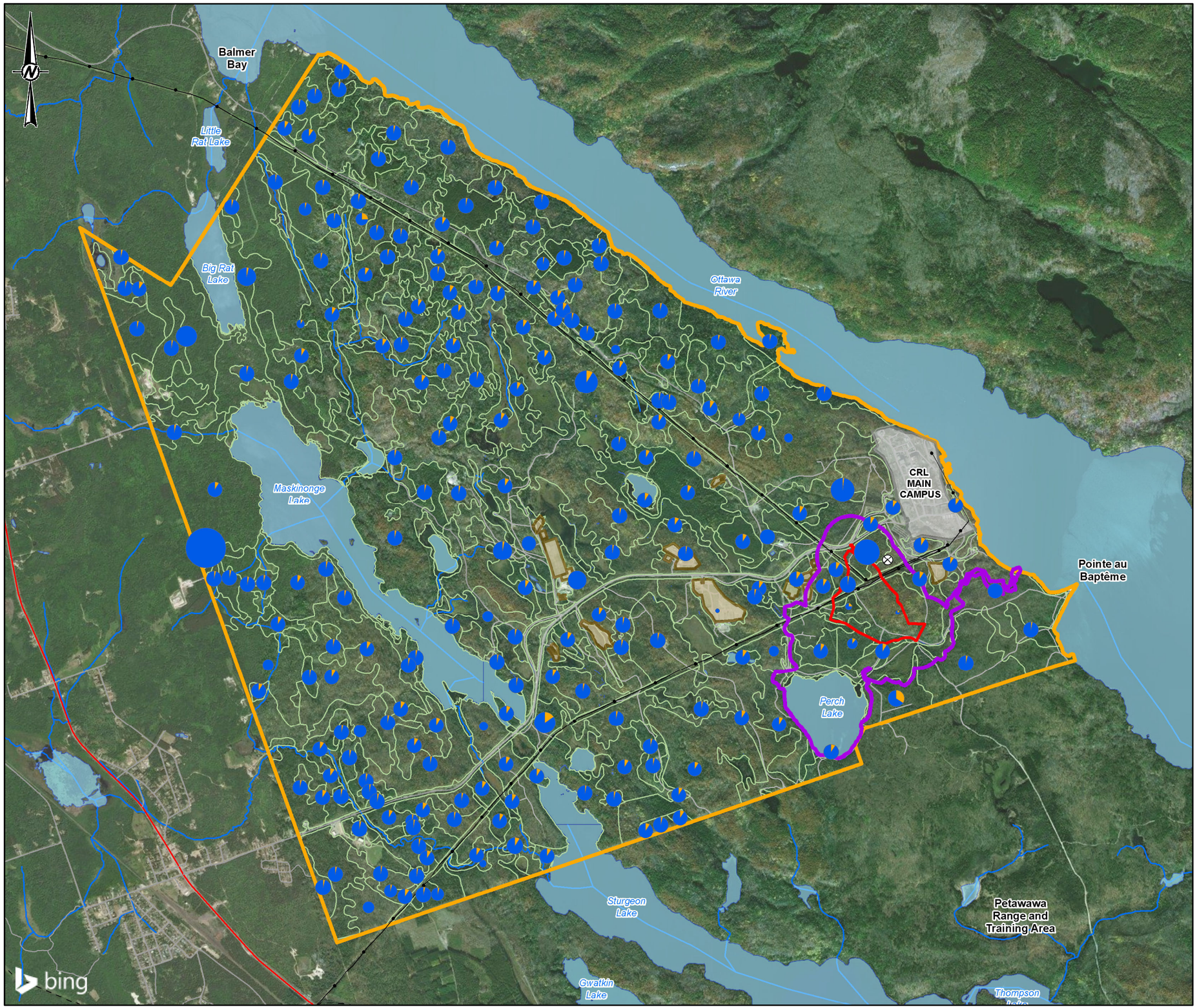

LEGEND

- HIGHWAY
- ROAD
- TRANSMISSION LINE
- NATURAL GAS PIPELINE
- RIVER/STREAM
- WATERBODY
- CRL MAIN CAMPUS
- WASTE MANAGEMENT AREA (WMA)[1]
- FRI STAND POLYGON

EIS ASSESSMENT BOUNDARIES FOR TERRESTRIAL ENVIRONMENT

- REGIONAL STUDY AREA (CRL PROPERTY)
- LOCAL STUDY AREA
- SITE STUDY AREA (NSDF PROJECT SITE)

INFERRED BAT ROOST OCCUPANCY - ICONS SCALED BY EMERGENCE PERIOD ACTIVITY LEVEL (ICONS LOCATED AT CENTROID OF EACH FRI STAND POLYGON)[2]

- SARA-LISTED BAT SPECIES
- ALL BAT SPECIES
- NO ACTIVITY RECORDED

SARA-LISTED BAT SPECIES
ALL OTHER BAT SPECIES

EMERGENCE PERIOD ACTIVITY LEVEL

- 0.01 PASSES / DETECTOR NIGHT/ DENSITY OF SUITABLE ROOST TREES
- 0.14 PASSES / DETECTOR NIGHT/ DENSITY OF SUITABLE ROOST TREES
- 0.97 PASSES / DETECTOR NIGHT/ DENSITY OF SUITABLE ROOST TREES

1 0 1
1:35,000 KILOMETRES

NOTE(S)

1. LIQUID DISPOSAL AREA ENCOMPASSES REACTOR PIT 1 AND 2, CHEMICAL PIT AND LAUNDRY PIT.
2. SCALED ICONS OF INFERRED BAT ROOST OCCUPANCY ARE POSITIONED AT THE CENTROID OF EACH FRI STAND / POLYGON.

REFERENCE(S)

1. BASEDATA MNRF 2016 AND CANVEC 2016
2. IMAGERY: © 2018 MICROSOFT CORPORATION © 2018 DIGITALGLOBE ©CNES (2018) DISTRIBUTION AIRBUS DS
3. PROPERTY BOUNDARY AND NSDF LOCATION PROVIDED BY CNL (MAY 2016 AND MAY 2017)
4. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 18N

CLIENT
CANADIAN NUCLEAR LABORATORIES LTD.

PROJECT
NEAR SURFACE DISPOSAL FACILITY

TITLE
INFERRED TREE ROOST OCCUPANCY BY SARA-LISTED BAT SPECIES RELATIVE TO ALL BAT SPECIES – RSA

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-01-24
DESIGNED	PR
PREPARED	PR
REVIEWED	LH
APPROVED	KK/RG

PROJECT NO.	CONTROL	REV.	FIGURE
1547525	0015	1D2	8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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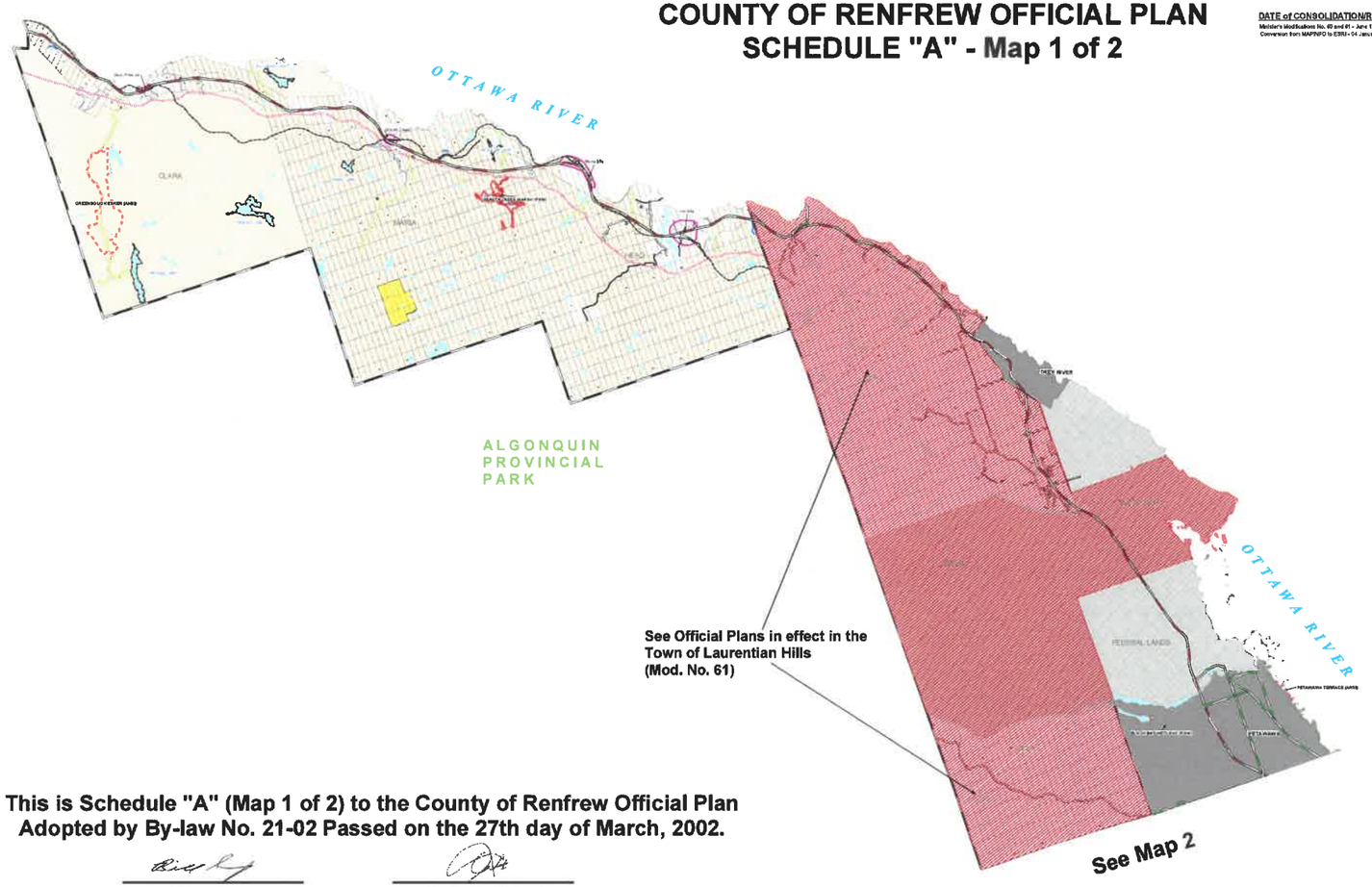
APPENDIX 5.9-1

Land Use Plan Designation Maps

COUNTY OF RENFREW OFFICIAL PLAN
SCHEDULE "A" - Map 1 of 2

DATE of CONSOLIDATION/REVISION
Minister's Modifications No. 49 and 61 - June 18, 2003
Conversion from MAPINFO to ESRI - 04 January 2007



LEGEND

- Non County Areas
- Crown Land
- Urban Community (see Local Official Plan)
- Village Community
- Rural Hamlets
- Rural (for North Algona Wilberforce see Policy 5.4 (C) - Forestry)
- Agriculture
- Mineral Aggregate
- Environmental Protection Area
- Provincially Significant Wetland
- Area of Natural & Scientific Interest
- Highly Sensitive Lakes (see Policies 9.4 (1) and 9.4 (3))
- Lakes and Rivers (for all islands in Bonnechere Valley see Policy 9.4 (2))
- County Forest
- Mining Resource
- Active Waste Disposal Site
- Inactive Waste Disposal Sites
- Special Policy Exception Areas
- Environmental Protection
- Flood Plain
- Municipal Roads
- Municipal Seasonal Roads
- Crown Access Roads
- County Roads
- Provincial Highways
- Railway
- Natural Gas Pipeline
- Municipal Boundary
- Lot and Concession Lines
- Geographic Township Boundary
- Local Official Plan in effect

0 5 10 20

Kilometres

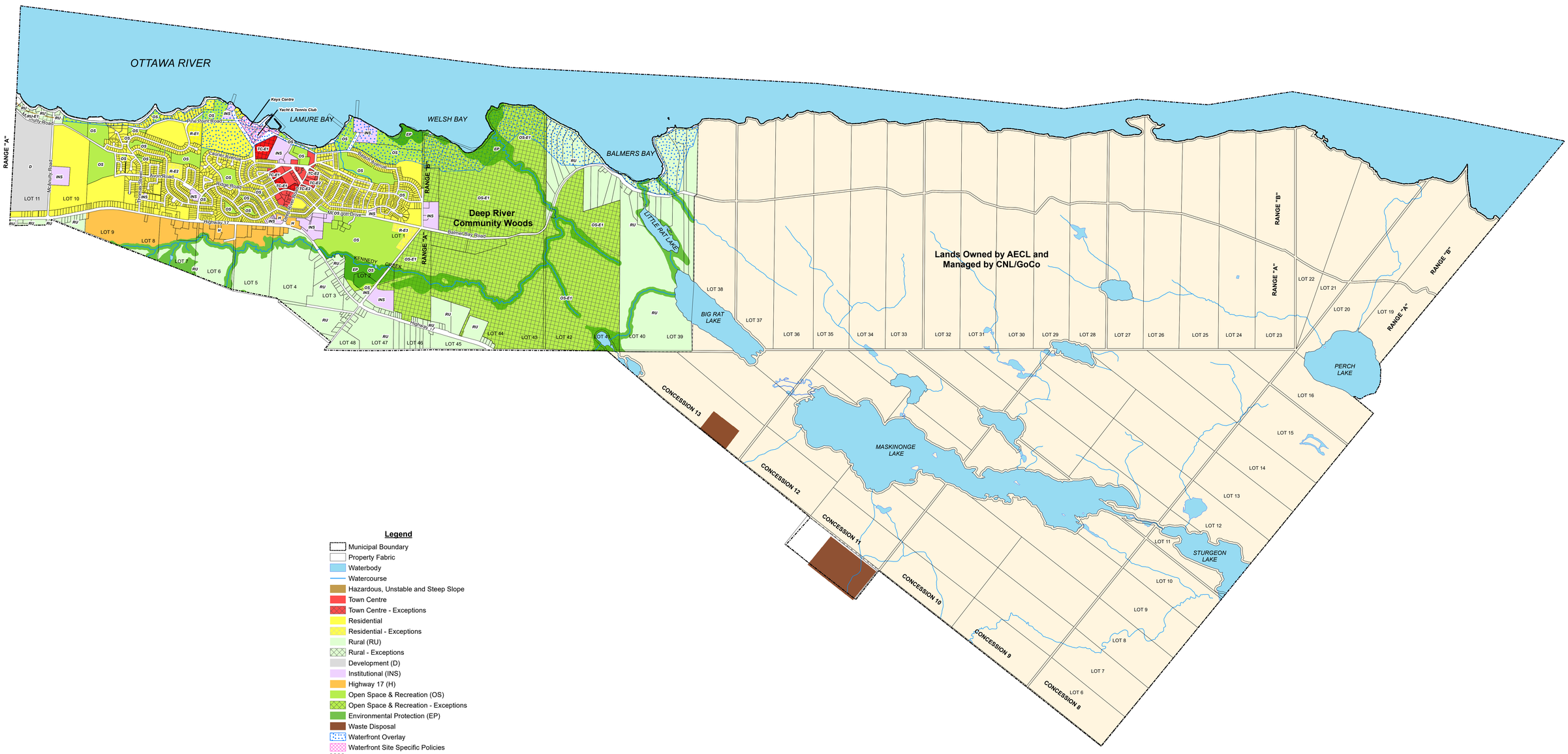
1:120,000

This is Schedule "A" (Map 1 of 2) to the County of Renfrew Official Plan Adopted by By-law No. 21-02 Passed on the 27th day of March, 2002.

Warden

C.A.O./Clerk

Town of Deep River Official Plan
Schedule "A" - Land Use Plan



Legend

- Municipal Boundary
- Property Fabric
- Waterbody
- Watercourse
- Hazardous, Unstable and Steep Slope
- Town Centre
- Town Centre - Exceptions
- Residential
- Residential - Exceptions
- Rural (RU)
- Rural - Exceptions
- Development (D)
- Institutional (INS)
- Highway 17 (H)
- Open Space & Recreation (OS)
- Open Space & Recreation - Exceptions
- Environmental Protection (EP)
- Waste Disposal
- Waterfront Overlay
- Waterfront Site Specific Policies
- Lands Owned by AECL

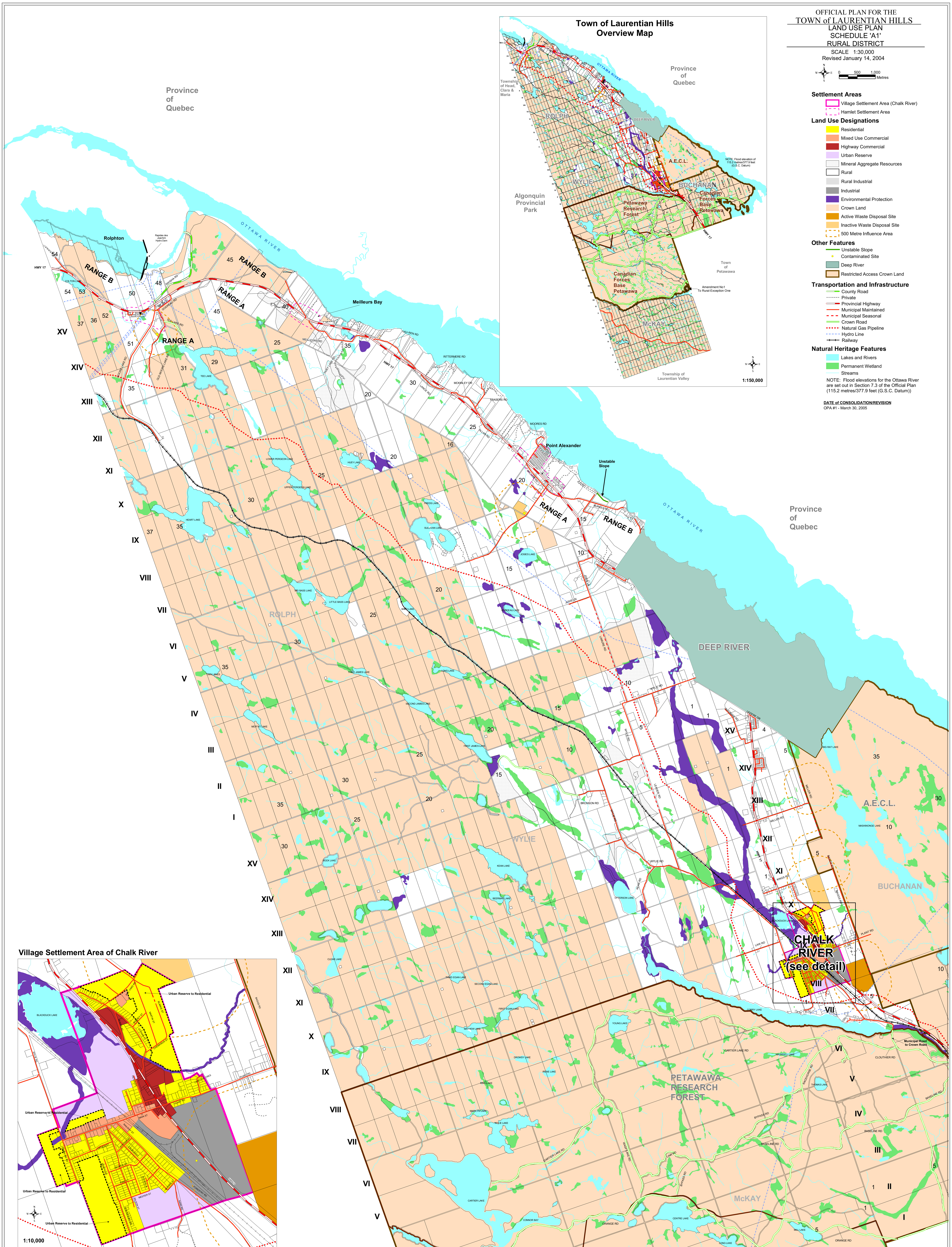
Scale

1:15,000

1,500 750 0 1,500 3,000 4,500 6,000 Feet

500 250 0 500 1,000 1,500 2,000 Meters

Notes:
1. Data layers obtained from the County of Renfrew
2. Detailed Map of Town Included as Schedule A-1



Produced by the County of Renfrew Development & Property Department
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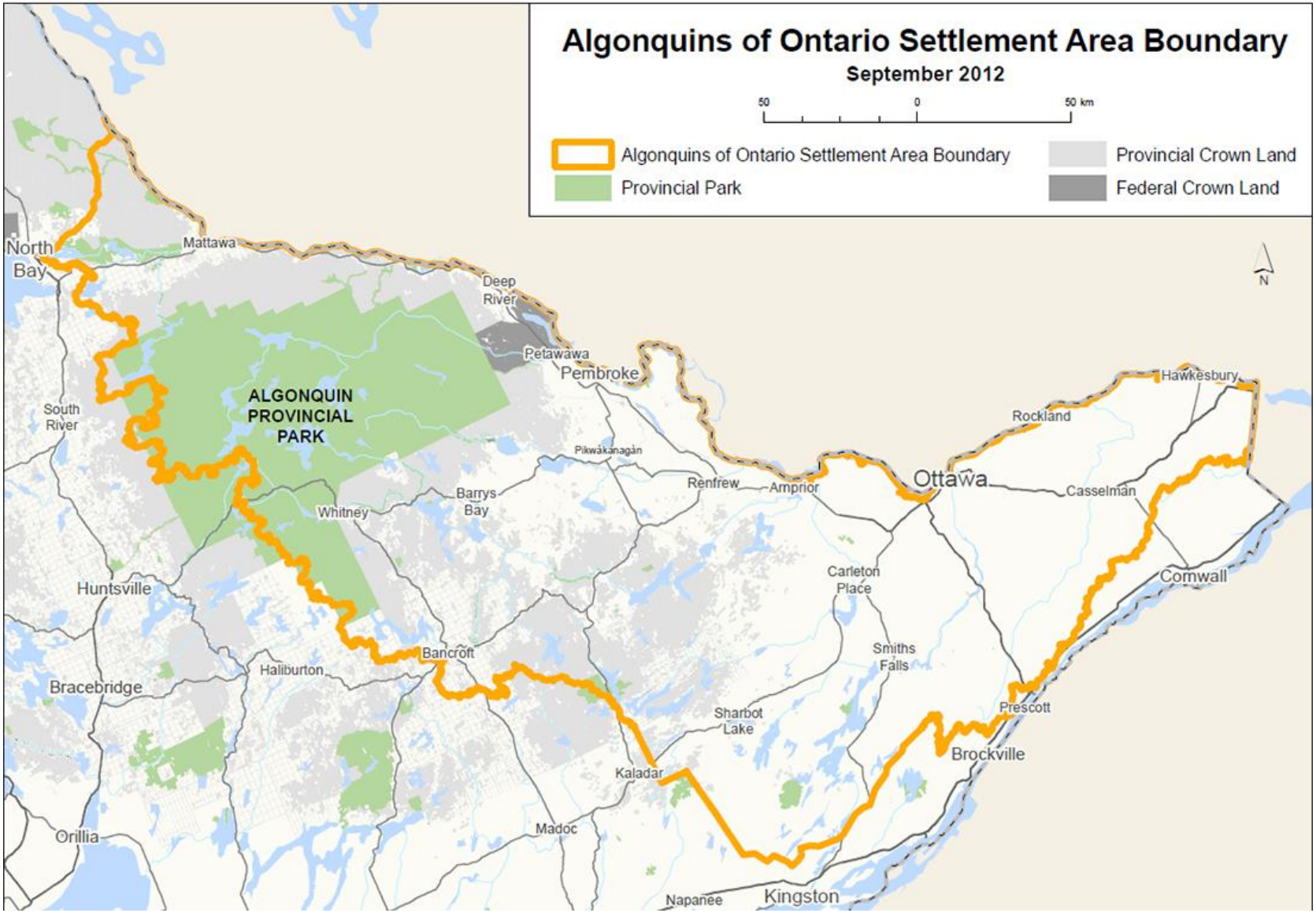

Figure A4: Map of the Algonquins of Ontario Land Claim

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