

Title:

DNNP – SITE PREPARATION LICENCE RENEWAL ACTIVITY REPORT – ENVIRONMENT

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**DNNP – Site Preparation Licence
Renewal Activity Report – Environment
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**DNNP – SITE PREPARATION
LICENCE RENEWAL ACTIVITY
REPORT – ENVIRONMENT**

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ACRONYMS AND ABBREVIATIONS

AAQC	Ambient Air Quality Criteria
BaP	Benzo(a)pyrene
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
COPC	Contaminant of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CWQG	Canadian Water Quality Guideline
DN	Darlington Nuclear
DNNP	Darlington New Nuclear Project
DNGS	Darlington Nuclear Generating Station
EA	Environmental Assessment
ELC	Ecological Land Classification
ECCC	Environment and Climate Change Canada
ERA	Environmental Risk Assessment
ESA	Endangered Species Act
HTO	Tritium Oxide
IWST	Injection Water Storage Tank
MDL	Method Detection Limit
MECP	Ministry of Environment, Conservation and Parks
OPG	Ontario Power Generation
PAH	Polycyclic Aromatic Hydrocarbons
PHC	Petroleum Hydrocarbons
PRSL	Power Reactor Site Preparation Licence
SARA	Species at Risk Act
TSD	Technical Support Document
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
VOC	Volatile Organic Compound

1.0 INTRODUCTION AND PURPOSE

Ontario Power Generation Inc. (OPG) currently maintains a *Nuclear Power Reactor Site Preparation Licence* (PRSL) 18.00/2022, issued by the Canadian Nuclear Safety Commission (CNSC) in August 2012, for the Darlington New Nuclear Project (DNNP). The DNNP site is within the Darlington Nuclear (DN) site, located in the Municipality of Clarington, in the Region of Durham, approximately 70 km east of the city of Toronto.

The DNNP PRSL allows OPG to conduct Site Preparation activities for the future construction and operation of a new nuclear generating station on the DNNP site adjacent to the existing Darlington Nuclear Generating Station (DNGS).

To fulfill OPG's initial application in 2009 - Application for a Licence to Prepare Site for the Future Construction of OPG New Nuclear at Darlington (hereinafter referred to as the "2009 application" [R-1]) - for the above PRSL and to support DNNP's environmental assessment (EA), OPG undertook extensive studies and thorough consultations to complete the site evaluation, which includes assessment of effects of the environment on the project, and assessment of effects of the project on the environment over the lifecycle of the DNNP facility.

The current DNNP PRSL expires on August 17, 2022. As such OPG is applying to renew the licence for another 10 years. The process and methodology for application for renewal is described in the *Darlington New Nuclear Project Power Reactor Site Preparation Licence Renewal Plan* (DNNP PRSL Renewal Plan) [R-2], which describes the development of discipline specific Licence Renewal Activity Reports.

The 2009 application [R-1] materials were prepared in compliance with RD-346 [R-3] and all applicable codes and standards at that time. As identified in the DNNP PRSL Renewal Plan [R-2], the requirements of REGDOC 1.1.1 [R-4] will be addressed and relevant baseline information will be updated. This Licence Renewal Activity Report addresses the following activities identified in the DNNP PRSL Renewal Plan [R-2] as it pertains to environmental components of the DNNP site evaluation:

1. Addressing REGDOC 1.1.1 [R-4] requirements and guidance which includes:
 - a) A review of 2009 application materials against REGDOC 1.1.1 [R-4] requirements and guidance and addressing any gaps that are identified, and
 - b) Addressing the passage of time since the 2009 application submission through;
 - i. a review of current codes, standards and practices referenced in the Licensing Basis and those associated with REGDOC 1.1.1 [R-4].
 - ii. updating or reviewing selected baseline data associated with the site.

This Licence Renewal Activity Report summarizes the results of the above assessment activities documented in the compliance assessment against REGDOC 1.1.1 [R-5] and the *Darlington New Nuclear Project Supporting Studies - Environment* (Supporting Environment Studies Report) [R-6].

2.0 SCOPE OF REVIEW

The existing environment is an important factor in determining suitability of a location for nuclear power generation. OPG completed a site evaluation in 2009 demonstrating that the DNNP site is a suitable location for a new nuclear generating station. To confirm that this conclusion remains valid, the following scope was carried out for the current review:

1. Review updated baseline data associated with environmental components.
2. Assess potential environment related gaps identified in the *Compliance Assessment of Darlington New Nuclear Project Site Preparation Licence Materials against REGDOC 1.1.1* (DNNP Compliance Assessment Document) [R-5] against REGDOC 1.1.1.
3. Review modern environmental codes, standards, and practices applicable to site evaluation, and assess and address the gaps.

The following environmental components were considered in this review: Climate, Meteorology and Air Quality; Geology and Hydrogeology; Hydrology, Surface Water and Sediment Quality; Aquatic Communities; Terrestrial Communities; and Radiation and Radioactivity. Each of the environmental components was reviewed as defined in Section 3.0.

Within the Existing Environmental Conditions Technical Support Documents ([R-7][R-8][R-9][R-10][R-11]) that were submitted for each of the environmental baseline components as supporting documentation for the 2009 application, three Study Areas were defined (Site, Local, and Regional). The Study Areas remain the same for this review.

2.1 Review Elements

2.1.1 Updated Baseline Data

This section provides an overview description of updated baseline data for each of the environmental components. A detailed description is presented in the Supporting Environment Studies Report [R-6] for relevant reports and studies that have occurred since the 2009 application for the DNNP's PRSL.

2.1.1.1 Climate, Meteorology and Air Quality

Baseline climate, meteorology and air quality conditions for the Local and Regional Study Areas were updated in 2019 [R-6].

Publicly available air quality monitoring data were gathered from four local continuous air quality monitoring stations for the years 2013-2018 [R-6]. The most recent Canadian Climate Normals (1981-2010) for temperature and precipitation available from Environment

and Climate Change Canada (ECCC) was retrieved for meteorological stations located in Oshawa, Bowmanville and Toronto's Pearson Airport. Wind data was collected from OPG's meteorological tower on the DNNP Site Study Area (2013-2018).

2.1.1.2 Geology and Hydrogeology

Baseline data collection and reporting since the 2009 application for the DNNP's PRSL includes soil sampling conducted in 2019 [R-6] and annual groundwater sampling reported through the DNGS groundwater monitoring program [R-12].

The soil sampling program, which included the collection of surface soil samples (0-20 cm) [R-6], supplements OPG sub-commitment (D-P-3.6) [R-13] to conduct a comprehensive soils characterization prior to site preparation. In particular, the potentially impacted soils identified in the *Darlington New Nuclear Project Commitments Report* (Commitments Report) [R-13] are the spoils disposal area, the cement plant area, and the asphalt storage area. These areas were sampled to identify the nature and extent of potential contamination due to past activities. In April 2019, soil samples were collected from 18 locations across DNNP Site Study Area, twelve of the areas were on the DNNP lands. Results of the 2019 soil sampling program will also be used to update the DN Environmental Risk Assessment (ERA).

The groundwater monitoring program samples a number of wells across the DNNP Site Study Area on an annual basis for conventional parameters and quarterly for tritium. The monitoring conducted in 2018 included sampling at 81 locations.

2.1.1.3 Hydrology, Surface Water and Sediment Quality

Baseline data collection since the 2009 application for the DNNP's PRSL includes surface water sampling, sediment sampling and stream flow monitoring conducted in 2019, as well as, surface water and sediment samples collected in 2011 and 2012 [R-6].

The surface water and sediment sampling executed in 2019 [R-6] address OPG sub-commitment (D-P-12.3) [R-13] to collect water and sediment data from the infill area, the future embayment area (including the vicinity of Darlington Creek), and offshore locations. Sediment and surface water data were collected from Coot's and Treefrog ponds in 2019 to confirm baseline data utilized in the 2016 DN ERA, to update the 2021 ERA and to support atmospheric deposition modelling by OPG.

In August 2012, sediment sampling was conducted in the embayment area and adjacent to the proposed infill area. In June 2019, sediment sampling was conducted within the embayment area, proposed infill area, offshore, and within Coot's Pond and Treefrog Pond [R-6].

Surface water sampling was conducted in November 2011 and August 2012 at four Lake Ontario Stations from the offshore, embayment, and Darlington Creek mouth areas. In

2019, surface water samples were collected quarterly from Lake Ontario stations (offshore, nearshore, embayment, Darlington Creek mouth, and reference location 60km east of DN near Cobourg), and within Coot's Pond and Treefrog Pond [R-6].

Thermal and lake current monitoring were completed in 2011/2012 and 2017/2018 [R-6].

Stream flow monitoring was completed to address OPG sub-commitment (D-P-12.6) [R-13] to confirm base flow estimates in Darlington Creek pre-construction and subsequently at the beginning of the Operation and Maintenance phase. Base flow monitoring was undertaken at five stations in Darlington Creek in April, June, September, and December 2019 [R-6].

2.1.1.4 Aquatic Communities

Several aquatic community studies have been conducted since the 2009 application for the DNNP's PRSL (Table 2-1) [R-6]. In 2019, four studies were conducted in support of two OPG sub-commitments [R-13]:

1. Aquatic Environment – Methodology Reports (DNNP Commitment D-P-12.4) commitment to conduct adult fish community surveys in the Site Study Area and reference locations on an ongoing basis; as well as, collection of baseline fish habitat information in the proposed infill area; and,
2. Surface Water Environment – Methodology Reports (DNNP Commitment D-P-12.3) commitment to conduct sediment quality monitoring in the infill area, future embayment area, and offshore locations.

The four 2019 studies were: Nearshore Fish Community, Video Collection of Fish Habitat of Infill Area, Sediment Particle Size (completed as part of the sediment sampling program described in Section 2.1.1.3 (Hydrology, Surface Water and Sediment Quality)¹, and Darlington Creek Tributary Fish Habitat Assessment [R-6]. Each of these studies was conducted within the Site Study Area as described in the Aquatic Environment Existing Environmental Conditions TSD [R-10]. The DNNP Site Study Area corresponds to the existing DN site property, extending approximately 3 km into Lake Ontario, and includes the offshore intake and diffuser areas of the DNNP and existing DNGS facilities [R-6].

A detailed discussion of each of these studies is presented in the Supporting Environment Studies Report [R-6].

¹ Sediment particle size is also used to assess fish habitat.

Table 2-1: Aquatic Community Related Studies that have Occurred Since 2009

Aquatic Study Type	Study Year(s)	Study Description
Fish	2009 to 2019	Annual sampling of White Sucker near the DNGS cooling water discharge diffuser and Bay of Quinte (reference area) to monitor radionuclide levels in fish tissue.
	2010 to 2015	Darlington Creek Fish Survey - Central Lake Ontario Conservation Authority (CLOCA) conducted electrofishing surveys in 2010 and 2015 in Darlington Creek.
	2009	Nearshore Fish Community in the DNNP Site Study Area - Gillnet sampling program conducted in the spring, summer and fall of 2009. Bottom 24-hour sets (depth range 3 to 15 m) six at sites located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, and the St. Marys Embayment. Note that only the spring results formed part of the supporting documentation for the DNNP PRSL 2009 application.
	2010	DNGS Forebay - An aquatic assessment was undertaken to characterize the fish and aquatic habitat within the DNGS forebay. Methods included gillnet, minnow traps, larval tow net, underwater video, and hydroacoustic techniques.
	2010	Nearshore Fish Community in the DNNP Site Study Area - Gillnet sampling program conducted in the fall of 2010. Bottom 24-hour sets (depth range 3 to 15 m) at six sites located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head).
	2011	Nearshore Fish Community in the DNNP Site Study Area - Gillnet sampling program conducted in the spring of 2011. Bottom 24-hour sets (depth range 3 to 15 m) at six sites located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head). Round Whitefish aging and Round Goby gut content was also conducted.
	2011	Nearshore Fish Community in the DNNP Site Study Area - Gillnet sampling program conducted in the summer of 2011. Bottom 24-hour sets (depth range 3 to 15 m) at six sites located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head). Additional focused bottom gillnetting at three sites (depth range 3 to 3.5 m) was conducted in the proposed infill area.
	2011	Nearshore Fish Community in the DNNP Site Study Area - Gillnet sampling program conducted in the late fall and early winter of 2011. Bottom 24-hour sets (depth range 3 to 15 m) at six sites located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head).

Aquatic Study Type	Study Year(s)	Study Description
	2012 to 2013	Aquatic Community Characterization Study - Gillnetting was undertaken (10-30 m depths) in the DNNP Site Study Area during summer 2012, fall 2012 and spring 2013 to assess seasonal utilization of habitat.
	2018	Aquatic Community Characterization Study - The fish community in the DNNP Site Study Area was surveyed using bottom 24-hour gillnet sets during spring, summer and fall. Net set locations covered a range of depths (5 to 30 m) having either gravel/cobble or sand substrates.
	2019	Nearshore Fish Community - Fish community assessment (24-hour bottom set gillnets) was carried out at nine locations in the DNNP Site Study Area (existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment) and at two reference sites (Thickson Point and Bond Head) during the spring, summer and fall. The gillnetting locations were consistent with the 2009-2011 nearshore fish community locations.
	2019	Fish Community Characterization Study - The fish community in the DNNP Site Study Area was surveyed using bottom 24-hour gillnet sets during spring, summer and fall. Net set locations covered a range of depths (5 to 30 m) having either gravel/cobble or sand substrates.
Ichthyoplankton	2011	Larval Fish Community Assessment - Larval tows using a benthic sled were undertaken with focus on assessing potential larval Round Whitefish presence and relative abundance in and around the DNNP Site Study Area (including reference sites).
	2013	DNNP Aquatic Community Characterization - In April and May, benthic larval tow sampling in depths of 10-30 meters was conducted in the DNNP Site Study Area.
	2016	DNGS Benthic Study - A benthic sled was used to sample larval fish and fish eggs during May, June, and August at the DNNP Site Study Area (mostly in front of DNGS). Bottom depths ranged from 5 to 15 meters.
	2018	Aquatic Community Characterization Study - Larval fish and egg sampling in the DNNP Site Study Area were conducted weekly using a benthic sled from the last week of March to the end of June. Tows were conducted in both gravel/cobble and sand substrates. Bottom depths ranged from 5 to 30 meters.
Plankton	2012 to 2013	Aquatic Community Characterization - Sampling of macrozooplankton in the DNNP Site Study Area (10-30 m depths). Sampling captured the summer, fall, and spring periods. Plankton nets were towed vertically through the water column (all seasons) and horizontally just above the lake bottom (spring).
	2018	Aquatic Community Characterization Study - The study area was identical to the study area for the 2012-13 aquatic study (HSL, 2013) but was extended to include the 5 m depth contour. Macrozooplankton samples in the DNNP Site Study Area were collected from the entire water column, as well as the bottom 10 m, during spring, summer and fall.

Aquatic Study Type	Study Year(s)	Study Description
Benthic Invertebrates	2012 to 2013	Aquatic Community Characterization - Sampling of Lake Ontario (10-30 m depths) in the DNNP Site Study Area was undertaken during summer 2012 and spring 2013, using a benthic sled.
	2016	DNGS Benthic Study - Characterization of the benthic invertebrate community on Lake Ontario in the DNNP Site Study Area (mostly in front of DNGS), as well as two reference areas (Bond Head and Thickson Point). Epifauna (on-sediment dwellers) sampling occurred during May, June, and August 2016 using a benthic sled. Infauna (in-sediment dwellers) sampling occurred in late September/early August 2016 using a diver assisted airlift sampler; sampling occurred at the 5 m, 10 m, and 15 m depths.
	2018	Aquatic Community Characterization Study - During the spring (April to June), benthic invertebrate samples were collected in gravel/cobble and sand substrates across a range of depths (5 to 30 m) in the DNNP Site Study Area using a benthic sled.
Impingement and Entrainment	2010	DNGS Impingement Study – A fish impingement study was conducted at DNGS over a one-year period from May 4, 2010 to April 26, 2011.
	2016	DNGS Entrainment Study - An entrainment study for fish and benthic invertebrates was undertaken at DNGS over a one-year period from December 07, 2015 to November 22, 2016.
Thermal Effects	2009	Fish Survival - The effects of predicted temperature changes during operation of the proposed DNNP diffuser were assessed on the basis of modeled temperatures at three locations: the proposed DNNP diffuser location; the embayment created by the proposed lakefill; and the existing DNGS diffuser, with both facilities operating.
	2011 & 2013	Round Whitefish Survival - Egg incubation experiments on Round Whitefish collected in Lakes Ontario and Huron, and Lake Whitefish collected in Lake Huron were carried out in 2011-12 and 2012-13 to evaluate the effects of fixed and fluctuating temperatures on mortality and hatch success.
	2013	Round Whitefish Survival - A degree day model was used to predict the duration of the embryonic period for specific locations where temperature was continuously recorded, assumed three different fertilization dates in December, and then used a logistic quadratic model to predict survival at each location based on average temperature over the period.
	2015	Round Whitefish Survival - A hybrid thermal response model for early development of Round Whitefish using the lower temperature exposures using uncensored data and considering biological life-cycle imperatives.
	2016	Round Whitefish Survival - Consolidated and summarised findings with the published and grey literature on the thermal effects on whitefish eggs, and developed science-based thermal benchmarks.

Aquatic Study Type	Study Year(s)	Study Description
Habitat	2010	Nearshore Fish Community in the DNNP Site Study Area – Underwater video was analyzed for substrate composition, mussel and algae coverage, and macrophyte presence at gillnet sampling stations located at the existing DNGS diffuser, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head) in fall 2010.
	2011	Nearshore Fish Community in the DNNP Site Study Area - Underwater video was analyzed for substrate composition, mussel and algae coverage, and macrophyte presence at larval tow transect stations located at the existing DNGS diffuser and intake, proposed DNNP intake and diffuser, proposed infill area, the St. Marys Embayment, and two reference stations (Thickson Point and Bond Head) in spring 2011.
	2012	DNNP Aquatic Community Characterization - Acoustic sonar survey to determine substrate type and bathymetry covering an area of 3.4 km ² between the 10 and 30 m depth contours over an alongshore distance of approximately 1.5 km located offshore of the DNNP lands. Acoustic bottom classification was ground-truthed with sediment sample collection/analysis and underwater video.
	2016	2016 DNGS Benthic Study – Underwater video was analyzed for substrate composition, mussel coverage, and algae coverage at benthic tow stations in the DNNP Site Study Area (mostly in front of DNGS) and at two reference stations (Thickson Point and Bond Head) in May and August, 2016.
	2019	Darlington Creek Tributary Fish Habitat Assessment - Fish habitat survey and electrofishing of two tributaries of Darlington Creek.
	2019	Video Collection of Fish Habitat of Infill Area - Fish habitat assessment using underwater video in the 0 to 2.5 meter depth range in the proposed DNNP infill area.

2.1.1.5 Terrestrial Communities

Baseline data collection and reporting since the 2009 application for the DNNP PRSL includes annual biodiversity monitoring reported through the DN site biodiversity monitoring program, as well as other additional studies [R-6]. The main components of the annual biodiversity assessments are breeding birds, bats, amphibians, pond, and specific species-at-risk surveys. Vegetation assessments are also conducted as part of biodiversity monitoring, but on a five-year cycle. Additional studies captured specific data from areas outside of those assessed under the biodiversity program (e.g., breeding bird surveys in the northeast quadrant of DNNP, away from the pond (Treefrog, Polliwog, Dragonfly) complex). Baseline conditions over the past decade are summarized in the Supporting Environment Studies Report [R-6]. The use of the DNNP Site Study Area as breeding habitat, travel corridor and migratory refuge was considered when determining wildlife use.

2.1.1.6 Radiation and Radioactivity

Air

OPG has monitored and reported atmospheric radionuclide concentrations at the DNNP Site Study Area annually for tritium oxide (HTO), C-14, and noble gases (Ar-41, Xe-133, Xe-135, and Ir-192) since before the 2009 application as part of the DN Environmental Monitoring Program. Air sampling is currently conducted at six terrestrial monitoring stations for HTO, eight stations for noble gases and four stations for C-14. Results are used to support annual dose calculations for potential critical groups (see Section 5.0) and encompass the DNNP Site Study Area [R-14].

Soil

Radiological parameters sampled during the 2019 soil sampling program included tritium, C-14, beta-gamma emitters (Cs-137, Cs-134, Co-60, K-40, I-131). Samples were taken at 37 locations that included suspected potentially impacted soils, as well as locations to obtain horizontal coverage of the DNNP Site Study Area [R-6].

Groundwater

Tritium is measured each year in groundwater across the DNNP Site Study Area on a quarterly basis at 81 locations, which pertain to three identified areas: controlled, protected and perimeter. Results are reported annually as part of the DN Groundwater Monitoring Program [R-15].

Surface Water

Surface water samples were collected quarterly in 2019 within the DNNP Site Study Area at nine locations within Lake Ontario (infill area, embayment and offshore areas), as well as

Coot's Pond and Treefrog Pond. The following radionuclides were analysed: H-3, C-14, I-131, K-40, Co-60, Cs-134, Th-Series, and U-Series [R-6].

Sediment

Sediment samples were collected in 2019 within the DNNP Site Study Area at 23 locations within Lake Ontario, as well as Coot's Pond and Treefrog Pond. The following radionuclides were analysed: Am-241, Ag-110m, H-3, C-14, Co-60, Cs-134, Cs-137, I-131, K-40, Mn-54, Nb-94, Nb-95, Zr-95, Sb-125, Th-Series, and U-Series [R-6].

Aquatic Communities

Radiological monitoring of fish tissue has been conducted annually within the DNNP Site Study Area since before the 2009 application as part of the DN Environmental Monitoring Program [R-14]. Within the DNNP Site Study Area, fish sampling takes place near the cooling water discharge diffuser and background samples are taken from the Bay of Quinte area of Lake Ontario. A sample consists of the fish muscle tissue only, and excludes the head, skin, fins, and as many bones as possible. Analysis of HTO, C-14, Co-60, Cs-134, Cs-137, and K-40 are performed on each fish sample.

Terrestrial Communities

Fruits and vegetables, milk, animal feed, poultry and eggs are monitored annually for HTO and C-14 as part of the DN Environmental Monitoring Program [R-14]. In 2018, seven locations surrounding the DNNP Site Study Area were sampled for fruits and vegetables, Milk samples were collected monthly from three dairy farms, locally grown animal feed was collected twice a year from four dairy farms, eggs and poultry were sampled quarterly at one farm location.

2.1.2 Applicable Environmental Modern Codes, Standards and Practices

One of the objectives of the PRSL Renewal Plan is to identify modern codes, standards and practices that would apply to DNNP PRSL Renewal Activities. The process to identify applicable modern codes, standards and practices is documented in the DNNP PRSL Renewal Plan [R-2]. The final list of codes, standards and practices applicable to site evaluation subject to review as part of PRSL Renewal Activities, as well as the type of review that is to be conducted, are provided in Table 1 of the PRSL Renewal Plan and include the following relevant to environment: REGDOC 2.9.1, CSA N288.1, CSA N288.4, CSA N288.5, CSA N288.6, CCME Canadian Environmental Quality Guidelines, and Government of Canada Canadian Climate Normals. A review of these standards as they relate to the environmental components was conducted in the Supporting Environment Studies Report [R-6] and is summarized in Section 4.0 of this report by environmental component.

2.1.3 Existing DNNP Commitments

In the Commitments Report [R-13], OPG's commitment statements are organized and grouped into key commitments for all phases of DNNP activities. Many of the key commitments include sub-commitments which must be completed to satisfy the key commitment. Table 2-2 presents the commitments (organized by environmental components) for the Site Preparation Phase that have been progressed to date.

Table 2-2: DNNP Commitments By Environmental Component That Have Been Progressed

Environmental Component	Commitment to Be Completed Prior to Site Preparation		Sub-Commitment	
	ID	Description	ID	Description
Climate, Meteorology and Air Quality	D-P-3	EPC Environmental Management and Protection Plans	D-P-3.10	Smog Alert Action Plan
	D-P-12	Environmental Monitoring and Environmental Assessment Follow-up	D-P-12.2	Atmospheric Environment – Methodology Reports
Geology and Hydrogeology	D-P-12	Environmental Monitoring and Environmental Assessment Follow-up)	D-P-12.6	Geological and Hydrogeological Environment – Methodology Reports
Hydrology, Surface Water and Sediment Quality	D-P-3	EPC Environmental Management and Protection Plans	D-P-3.4	EPC Storm Water Management Plan/Procedure
	D-P-12	Environmental Monitoring and Environmental Assessment Follow-up	D-P-12.3	Surface Water Environment - Methodology Reports
			D-P-12.4	Aquatic Environment – Methodology Reports
			D-P-12.6	Geological and Hydrogeological Environment – Methodology Reports
Aquatic Communities	D-P-3	EPC Environmental Management and Protection Plans	D-P-3.9	EPC Aquatic Environment Mitigation Measures and Plans
	D-P-12	Environmental Monitoring and Environmental Assessment Follow-up	D-P-12.3	Surface Water Environment - Methodology Reports
			D-P-12.4	Aquatic Environment – Methodology Reports
	D-P-14	Fish Habitat Compensation Plan	D-P-14.1	Fish Habitat Compensation Plan
Terrestrial Communities	D-P-3	EPC Environmental Management and Protection Plans	D-P-3.7	EPC Terrestrial Environment Mitigation Measures and Plans
			D-P-3.8	EPC Bank Swallow Mitigation Measures and Plans
	D-P-12	Environmental Monitoring and Environmental Assessment Follow-up	D-P-12.5	Terrestrial Environment – Methodology Reports

3.0 REVIEW METHODOLOGY

Section 1.0 identified assessment activities from the DNNP PRSL Renewal Plan [R-2] that are addressed in this Licence Renewal Activity Report. The assessment consists of three main components: a) compliance review of 2009 application materials against REGDOC 1.1.1; b-i) address modern codes, standards and practices; and b-ii) revisit baseline data.

Part a) has been carried out and findings are documented in the DNNP Compliance Assessment Document [R-5]. Within the DNNP Compliance Assessment Document [R-5] two comparisons are conducted to identify a list of potential gaps. First, a regulatory gap assessment between the current REGDOC 1.1.1 and superseded RD-346 was conducted. Second, previous DNNP Site Preparation Licence submission documents were reviewed for information relevant to compliance with the new content in REGDOC 1.1.1. This process resulted in identification of six sections within REGDOC 1.1.1 that contain potential environment related gaps (see Table 4-1) that was forwarded for further evaluation and review. The potential environment related gaps were evaluated in the Supporting Environment Studies Report [R-6] and presented in Section 4.0.

Part b) has also been carried out and findings are documented in the Supporting Environment Studies Report [R-6]. Within that report, the updated codes and standards identified in Table 1 of the DNNP PRSL Renewal Plan [R-2] were considered and it was determined that seven of the updated codes and standards referenced in REGDOC 1.1.1 are applicable to environmental components (REGDOC 2.9.1, CSA N288.1, CSA N288.4, CSA N288.5, CSA N288.6, CCME Environmental Quality Guidelines, and Canadian Climate Normals). These seven standards were evaluated to determine if a potential gap currently exists. Additionally, subject matter experts identified updated standards that are not referenced in REGDOC 1.1.1 which were evaluated to determine if a potential gap currently exists; these were: provincial and federal species at risk listings, Ontario Ambient Air Quality Criteria, provincial groundwater and soil quality guidelines, and Health Canada's Guidelines for Canadian Drinking Water Quality. The Supporting Environment Studies Report [R-6] also addressed the passage of time since the 2009 application by revisiting select baseline information to determine if any change in baseline conditions had occurred that could impact the original conclusions concerning residual adverse effects of the project or the site evaluation. These results are presented in Section 4.0.

Potential gaps that could affect residual adverse effects of the Project (effects that remain after mitigation identified in the Environmental Impact Statement [R-16]) or the original conclusions of the site evaluation may require updates to existing commitments or new commitments to capture additional or revised requirements. These recommendations are provided in Section 7.0.

4.0 REVIEW FINDINGS (CONFORMANCES AND POTENTIAL GAPS)

Six sections within REGDOC 1.1.1 containing potential gaps relevant to environmental components were identified in the DNNP Compliance Assessment Document [R-5] and are listed in Table 4-1. The DNNP PRSL renewal plan [R-2] identified a number of codes and standards that have been updated since the 2009 application was submitted. Of these codes and standards, seven apply to the environment. OPG's assessment of project effects and site evaluation work for the DNNP were reviewed against these seven standards to examine the degree to which OPG's work complies with these new or revised standards [R-6]. The type of review was specified by OPG as high level or clause-by-clause. According to the DNNP PRSL Renewal Plan [R-2], these types of reviews are defined as follows:

Clause by Clause Review: An assessment conducted against individual clauses of a current code, standard or practice to demonstrate with supporting evidence whether requirements or guidance identified in the clause are met.

High Level Review: An assessment conducted to establish the degree of conformance to the intent of a clause or groups of clauses of a current code, standard or practice.

Incremental high level or clause-by-clause review applies to standards that were part of the existing licensing basis but have been revised or updated since the time of the 2009 application. Only the differences between the two versions are subject to review.

Compliance with the entire standard is not considered necessary, but rather the focus is on sections that are applicable to site evaluation as indicated in REGDOC 1.1.1 [R-4]. See the PRSL Renewal Plan for further details on the review methodologies [R-2].

The review of standards applicable to site evaluation was undertaken in a stepwise process, as follows:

1. REGDOC 1.1.1 was reviewed to determine where each code or standard was referenced.
2. The section referenced in REGDOC 1.1.1 was evaluated to determine which clauses from the code or standard would be relevant to the topic in REGDOC 1.1.1.
3. The relevant OPG DNNP documents were evaluated to determine compliance with the identified clause or group of clauses.
4. A compliance category was assigned (compliant, gap, not applicable).

Of these seven standards, two were determined to contain potential gaps [R-6] as shown in Table 4-2.

In addition, subject matter experts identified updated standards relevant to environment that are not referenced in REGDOC 1.1.1 and therefore were not included in the DNNP PRSL renewal plan [R-2]. These are shown in Table 4-3.

Each potential gap is dispositioned in this report under the environmental components and sections identified in Table 4-1, Table 4-2, and Table 4-3.

Table 4-1: REGDOC 1.1.1 Sections Containing Potential Environment Related Gaps Identified in [R-5]

REGDOC 1.1.1 Clause	Title of Clause	Subject for Potential Gap	Environmental Component and Discussion Section
Generic Gap	-	New and updated codes and standards.	See Table 4-2
C.5.4	Baseline hydrogeology and groundwater quality	Rate of transfer between aquifers, and capture zones of wells.	Geology and Hydrogeology (Section 4.2.2)
C.6	Baseline terrestrial flora, fauna and food chain data	Description of natural and human-induced pre-existing environmental stresses and the current ecological conditions that indicate such stresses.	Terrestrial Communities (Section 4.2.5)
C.7.1	Baseline aquatic biota and habitat	Multiple Potential Gaps (see Section 4.2.4).	Aquatic Communities (Section 4.2.4)
C.7.2	Baseline food chain data	Aquatic reference locations sampled over multiple years to understand year-to-year variability.	Aquatic Communities (Section 4.2.4)
G.5.4	Effects of thermal plume on the aquatic environment	Model thermal plume, list of susceptible species, potential of gas-bubble disease.	Aquatic Communities (Section 4.2.4)

Table 4-2: Updated Codes and Standards in REGDOC 1.1.1 Applicable to Environment [R-2]

Document Number	Document Title	Type of Review	Potential Gap?	Environmental Component and Discussion Section
REGDOC 2.9.1	Environmental Protection: Environmental Principles, Assessments and Protection Measures	Incremental High Level	No (OPG DNNP documents meet the clause requirements)	-
CSA N288.1	Guidelines for Calculating Derived Release Limits for Radioactive Material in Airborne and Liquid Effluents for Normal Operation of Nuclear Facilities	Incremental High Level	No (OPG DNNP documents meet the clause requirements)	-
CSA N288.4	Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium mines and Mills	High Level	No (OPG DNNP documents meet the clause requirements)	-
CSA N288.5	Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills	High Level	No (OPG DNNP documents meet the clause requirements)	-
CSA N288.6	Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills	Clause by Clause	No (OPG DNNP documents meet the clause requirements)	-
CCME	Canadian Environmental Quality Guidelines	Incremental High Level	Yes (New Canadian Ambient Air Quality Standards)	Climate, Meteorology and Air Quality (Section 4.2.1)
CCME	Canadian Environmental Quality Guidelines	Incremental High Level	Yes (Changes to Soil Quality Guidelines)	Geology and Hydrogeology (Section 4.2.2)

CCME	Canadian Environmental Quality Guidelines	Incremental High Level	Yes (Changes to Canadian Water Quality Guidelines)	Surface Water and Sediment Quality (Section 4.2.3)
Government of Canada	Canadian Climate Normals	Incremental Clause by Clause	Yes (Climate Normals Updated)	Climate, Meteorology and Air Quality (Section 4.2.1)

Note: Details of the Potential Gap evaluation is presented in Appendix A of the Supporting Environment Studies Report [R-6].

Table 4-3 Updated Codes and Standards Applicable to Environment that are not in REGDOC 1.1.1

Provincial/ Federal	Code/Standard	Potential Gap?	Environmental Component and Discussion Section
Province of Ontario	Ambient Air Quality Criteria	Yes (Changes to Guidelines)	Climate, Meteorology and Air Quality (Section 4.2.1)
Province of Ontario	Table 3 Full Depth Generic Site Conditions Standards in a Non Potable Ground Water Condition – (Non-Potable Groundwater)	Yes (Changes to Guidelines)	Geology and Hydrogeology (Section 4.2.2)
Province of Ontario	Ontario Drinking Water Quality Standards	No (Guidelines have not changed)	-

Province of Ontario	Table 3 Full Depth Generic Site Conditions Standards in a Non Potable Ground Water Condition – Soil Standards other than Sediment (Industrial / Commercial / Community Property Use)	Yes (Changes to Guidelines)	Geology and Hydrogeology (Section 4.2.2)
Government of Canada	Health Canada's Guidelines for Canadian Drinking Water Quality	Yes (Changes to Guidelines)	Hydrology, Surface Water and Sediment (Section 4.2.3)
Province of Ontario	Provincial Water Quality Objectives, including Interim Objectives	Yes (Changes to Guidelines)	Hydrology, Surface Water and Sediment (Section 4.2.3)
Province of Ontario	Provincial Sediment Quality Guidelines (Lowest Effect Level)	No (Guidelines have not changed)	-
Province of Ontario	<i>Endangered Species Act</i>	Yes (Changes to Species List)	Aquatic Communities (Section 4.2.4) Terrestrial Communities (Section 4.2.5)
Government of Canada	<i>Species at Risk Act</i>	Yes (Changes to Species List)	Aquatic Communities (Section 4.2.4) Terrestrial Communities (Section 4.2.5)

Note: Details of the Potential Gap evaluation is presented in relevant sections of the Supporting Environment Studies Report [R-6].

4.1 Review Findings Related to Updated Baseline Data

4.1.1 Climate, Meteorology and Air Quality

As identified in Section 2.1.3, mitigation and commitments were previously developed to reduce, control or eliminate adverse effects related to climate, meteorology and air quality. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any permitting requirements.

Depending upon the measurement parameter, baseline air quality is considered to have generally improved or to be within the natural variability experienced in the area as compared to conditions documented in the 2009 application for the DNNP PRSL. In the intervening period, there has been a significant reduction in the mean 1-hr and 24-hr ambient nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) concentrations and 24-hr ambient particulate matter (PM_{2.5}) concentrations. The 24-hr ambient total suspended particulate (TSP) and PM₁₀ concentrations have remained relatively stable. As such, the updated baseline conditions do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary [R-6].

4.1.2 Geology and Hydrogeology

As identified in Section 2.1.3, mitigation and commitments were previously developed to reduce, control or eliminate adverse effects related to geology and hydrogeology. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any permitting requirements.

An update to baseline surficial soil quality within the DNNP Site Study Area was conducted based on the 2019 sampling program which included soil data for potentially impacted soils in DNNP lands [R-6]. Screening against appropriate benchmarks indicated that soils were found to be of good quality with the exception of soils within the yard waste and building materials dump site [R-6]. This aligns with the assumption made in the *Geological and Hydrogeological Environment - Existing Environmental Conditions Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Geological and Hydrogeological Environment Existing Conditions TSD) [R-8] that the yard waste and building materials dump site would have soils that exceeded soil quality guidelines. As such, the 2019 soil quality baseline data does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Annual groundwater monitoring has occurred across the DNNP Site Study Area since the 2009 application for the DNNP PRSL. Groundwater quality has been consistent with that documented in the 2009 application for the DNNP's PRSL [R-6]. Groundwater quality continues to meet applicable guidelines, with the exception of a few areas where natural

geologic properties account for elevated concentrations [R-6]. As such, the updated groundwater baseline data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.1.3 Hydrology, Surface Water and Sediment Quality

As identified in Section 2.1.3, mitigation and commitments were previously developed to reduce, control or eliminate adverse effects related to hydrology, surface water and sediment quality. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any permitting requirements.

Baseflow estimates were taken in 2008 for Darlington Creek and reported in the *Surface Water Environment – Existing Environmental Conditions Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Surface Water Environment Existing Conditions TSD) [R-9]. The baseflow estimates (discharge) taken in 2019 indicate that discharge was higher than it was in 2008, but the difference is within expected natural variability [R-6]. As such, the updated discharge measurements do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Lake current direction was measured historically and discussed within the Surface Water TSD [R-9]. Lake currents were also measured as part of the 2011 Thermal and Current Monitoring Program [R-6]. Both reports were in agreement and concluded that lake currents were predominately alongshore at the Port Darlington acoustic doppler current profiler and favoured a westerly direction at CM01 offshore of the DNNP Site Study Area [R-6].

Lake water temperature and thermal plume character was described in the Surface Water TSD [R-9]. Additional studies conducted in 2011/2012 and 2017/2018 had findings consistent with those described in the Surface Water Environment Existing Conditions TSD [R-6]. In winter, warm thermal plumes rise from the diffuser and spread along the lake surface. In summer, warm water plumes are still most common but coldwater plumes also occur – this happens when the intake occurs below the lake stratification layer during periods of high surface water temperatures. Cold plumes rise due to discharge velocity and generally mix vertically through the water column but they can form a diving plume.

Surface water sampling was conducted in 2007/2008 within Lake Ontario, Coot's Pond and Treefrog Pond and was reported in the Surface Water Environment Existing Conditions TSD [R-9]. In 2019, surface water quality was sampled at both ponds and at ten locations within Lake Ontario. Sampling locations were similar between studies for both ponds and six Lake Ontario sampling locations. Review of the data concluded that surface water meets water quality guidelines with a few exceptions for the following parameters: total ammonia, un-ionized ammonia, total suspended solids, total aluminum, total iron, total boron, dissolved zinc, total phosphorus, pH, and *E. coli* [R-6]. Of these 10 parameters that

exceeded water quality guidelines only three were not also considered in exceedance in the 2009 application: un-ionized ammonia, total phosphorus, and pH. Exceedances for phosphorus and pH were marginal. Total phosphorus and un-ionized ammonia are unlikely to be attributed to DNGS operations and are potentially due to agricultural inputs into Lake Ontario [R-6]. Additionally, water quality was sampled in Lake Ontario in 2011/ 2012 and was determined to be of similar quality to that presented in the Surface Water Existing Conditions Report [R-9]. As such, the updated surface water quality does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Similar to the results of sediment quality of Lake Ontario samples collected in 2007/2008 [R-17], the sediment quality of those collected in 2019 meets sediment quality guidelines with the exceptions of total Kjeldahl nitrogen and total phosphorus [R-6]. Within the 2009 supporting documents, total phosphorus exceeds sediment quality guidelines, but total Kjeldahl nitrogen was not measured. However, elevated total phosphorus and total Kjeldahl nitrogen are unlikely to be attributed to DNGS operations and are potentially due to agricultural inputs into Lake Ontario [R-6]. The updated Lake Ontario sediment quality data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary. Sediment grain size (fish habitat) within Lake Ontario is discussed in Section 4.1.4.

Sediment collected in Coot's Pond had higher cadmium, nickel, and zinc concentrations in 2019 compared to 2007/2008 with some samples exceeding sediment quality guidelines. These elevated sediment concentrations are attributed to stormwater runoff from the DN landfill.

Within Treefrog Pond, concentrations of antimony and PHC F3 were higher in 2019 compared to 2007/2008; however, no sediment quality guidelines are available for these parameters. Concentrations of cadmium and selenium were higher in Treefrog Pond in 2019 compared to 2007/2008 and some samples exceeded sediment quality guidelines [R-6]. Regardless, there is no impact to the DNNP as this pond is planned to for removal during the construction phase.

The Ecological Risk Assessment and Assessment of Effects on Non-Human Biota TSD [R-17] states that soil quality within the DNNP area to be excavated are below soil criteria for industrial sites (with the exception of beryllium which has concentrations representative of natural site conditions). It concludes that there are no project activities which will result in a release of conventional constituents that may affect soil or groundwater concentrations such that stormwater would be measurably affected. Therefore, the updated Coot's Pond and Treefrog Pond sediment quality data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary to address the DNNP. This updated data will also be used in the routine update of the DN ERA.

4.1.4 Aquatic Communities

As identified in Section 2.1.1.4, many aquatic community studies have been conducted since the *Aquatic Environment Existing Environmental Conditions – Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Aquatic Environment Existing Conditions TSD) [R-10]. These studies provide updated and/or additional baseline data for the DNNP pre-construction phase. As identified in Section 2.1.3, mitigation and commitments were previously developed to reduce, control or eliminate adverse effects related to aquatic communities. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any permitting requirements.

Studies that were conducted in 2019 to repeat previous studies presented in the Aquatic Environment Existing Conditions TSD [R-10] include: Nearshore Fish Community, Video Collection of Fish Habitat of Infill Area, and Darlington Creek Tributary Fish Habitat Assessment [R-6]. Each of these studies demonstrated similar findings between years.

Sediment particle size was sampled within Lake Ontario in 2019 and compared to samples collected in 2012, as well as samples collected in 2008 reported in the Aquatic Environment Existing Conditions TSD [R-10]. The comparison concluded that sediment particle size has not changed [R-5].

Current baseline conditions within the vicinity of DNNP are similar to conditions reported in the Aquatic Environment Existing Conditions TSD [R-10]; any observed differences are attributed to natural variability [R-6]. As such, the updated baseline aquatic community data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.1.5 Terrestrial Communities

The terrestrial community of the DNNP Site Study Area has undergone some changes since the *Terrestrial Environment - Existing Environmental Conditions Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Terrestrial Environment Existing Conditions TSD) [R-11] was compiled. A detailed review is provided in the Supporting Environment Studies Report [R-6] and a summary is presented here. All potential baseline changes were evaluated against the Commitments Report [R-14] to determine if any update to commitments are required to mitigate project effects such that residual adverse effects identified in the Environmental Impact Statement [R-16] remain unchanged.

The environmental sub-components with potential changes to baseline conditions were previously considered through the 2009 application and detailed mitigation and commitments were developed to reduce, control or eliminate adverse effects. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any

permitting requirements. Therefore, the existing mitigation and commitments summarized in Table 4-4 are valid to address potential change in adverse effects.

The only change requiring an update to commitments (specifically D-P-3.7) pertains to the occurrence of a new Butternut tree (sapling) (*Juglans cinerea*), which is a federal and provincial species at risk. This recently identified Butternut tree was discovered in 2018 and a Butternut Health Assessment found it to be retainable. In the 2009 application only one Butternut tree was identified on the DNNP Site Study Area and it was assessed non-retainable as it was severely affected by Butternut Canker [R-11]. OPG proposes an update to commitment D-P-3.7 to include the new Butternut in site planting plans through the ESA Notice of Activity process for new Butternut.

With the updated commitment, the changes in the terrestrial baseline environment do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Table 4-4: Summary of Terrestrial Baseline Changes and Relevant Commitments

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
Vegetation Communities and Species	Wetland Ecosystem	<ul style="list-style-type: none"> 11 ha (34%) increase in wetland habitat in the Site Study Area, 9 ha of which are within the Area of Direct Effects. 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Use best management practices to prevent or minimize the potential runoff of sediment and other contaminants into wildlife habitat associated with Coot's Pond during site preparation and construction phases. (D-P-3.7) Development of stormwater management techniques to provide for adequate flow and water quality (e.g., TSS) to Coot's Pond. (D-P-3.4) Create of new fish-free wetland ponds with riparian plantings in appropriate areas on the DNNP Site Study Area. (D-P-3.7) Wetlands will be incorporated into the new lake infill area after the Construction phase. (D-P-3.7) Compensate for the loss of ponds by designing compensation ponds that maximize ecological function, and not necessarily limited to "like-for-like". (D-P-3.7) Salvage and relocate or replant rare plant species to suitable existing or created habitat in advance of site preparation activities. (D-P-3.7) Salvage and relocate aquatic plants and biota where practicable, to a suitable existing or created habitat in advance of site preparation activities. (D-P-3.7) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] were developed to be adaptable and will be scaled appropriately to address changes to baseline and future permitting requirements. Therefore, the original conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary. 	<ul style="list-style-type: none"> No
	Woodland Ecosystem	<ul style="list-style-type: none"> Identification of a new retainable Butternut tree. 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> Yes, Include Butternut in site planting plans through the ESA Notice of Activity process for new Butternut in commitment D-P-3.7 (see Section 4.1.5). With this updated commitment, the original conclusions regarding residual adverse effects of the project remain 	<ul style="list-style-type: none"> No

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
			<ul style="list-style-type: none"> Develop and implement a management plan for species at risk, as may be appropriate. (D-P-3.7) 	valid and no further actions are necessary.	
Insects	Dragonflies and Damselflies	<ul style="list-style-type: none"> Possible decline in dragonfly and damselfly community. 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared (D-P-3.7) Use best management practices to prevent or minimize the potential runoff of sediment and other contaminants into wildlife habitat associated with Coot's Pond during site preparation and construction phases. (D-P-3.7) Development of stormwater management techniques to provide for adequate flow and water quality (e.g., TSS) to Coot's Pond. (D-P-3.4) Create of new fish-free wetland ponds with riparian plantings in appropriate areas on the DNNP Site Study Area. (D-P-3.7) Wetlands will be incorporated into the new lake infill area after the Construction phase. (D-P-3.7) Develop a follow-up program for insect communities as appropriate, with a focus for this follow-up program on species at risk and the use of this follow-up program to verify the conclusions of the Ecological Risk Assessment. (D-P-12.5) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] were developed to be adaptable and will be scaled appropriately to address changes to baseline and future permitting requirements. Therefore, the original conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary. 	<ul style="list-style-type: none"> No
	Migrant Butterfly Stopover Area	<ul style="list-style-type: none"> Decrease of 10 ha (10%) of migrant butterfly stopover habitat in the Site Study Area. 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared (D-P-3.7) Re-planting of approx. 40 to 50 ha of Cultural Meadow. (D-P-3.7) Develop a follow-up program for insect communities as appropriate, with a focus for this follow-up program on species at risk and the use of this follow-up program to verify the conclusions of the Ecological Risk Assessment. (D-P-12.5) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] were developed to be adaptable and will be scaled appropriately to address changes to baseline and future permitting requirements. Therefore, the original conclusions regarding residual adverse effects of the project remain 	<ul style="list-style-type: none"> No

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
Bird Communities and Species	Breeding Birds	<ul style="list-style-type: none"> Occurrence of six SAR breeding species: <ul style="list-style-type: none"> Bank Swallow¹ Barn Swallow¹ Eastern Wood Pewee¹ Wood Thrush¹ Bobolink¹ Eastern Meadowlark¹ Decade of data confirming persistence of Bank Swallow colony at DNNP Site Study Area and records of nocturnal roosting at Coot's Pond. Decade of data related to Least Bittern breeding occurrence on site. 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Post-development restoration of Woodland, dominated by Sugar Maple. (D-P-3.7) Re-planting of approx. 40 to 50 ha of Cultural Meadow and approximately 15 to 20 ha of Cultural Thicket with native shrub plantings. Include native forb seeds in hydroseed mix for Cultural Meadow to be restored. (D-P-3.7) Cultural meadow and cultural thicket habitat loss will be offset by developing restoration plans tailored to the needs of the Eastern Meadowlark, Bobolink, and Monarch including native grasslands consisting of tall vegetation species. (D-P-3.7). Use best management practices to prevent or minimize the potential runoff of sediment and other contaminants into wildlife habitat associated with Coot's Pond during site preparation and construction phases. (D-P-3.7) Development of stormwater management techniques to provide for adequate flow and water quality (e.g., TSS) to Coot's Pond. (D-P-3.4) Create of new fish-free wetland ponds with riparian plantings in appropriate areas on the DNNP Site Study Area. (D-P-3.7) Wetlands will be incorporated into the new lake infill area after the Construction phase. (D-P-3.7) Conduct more sampling to confirm the presence of Least Bittern before site preparation activities begin. (D-P-12.5) Further site and species specific information pertaining to Bobolink will be required. (D-P-12.5) Avoid disruption to breeding migratory birds on the site and avoid habitat destruction (e.g. vegetation clearing, initial grading) at a minimum between the period May 1 and July 31 of any year. (D-P-3.7) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) Develop and implement a management plan for species at risk, as may be appropriate. (D-P-3.7) 	<p>valid and no further actions are necessary.</p> <ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] were developed to be adaptable and will be scaled appropriately to address changes to baseline as well as ESA/SARA permitting. Therefore, the original conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary. No revision is proposed at this time, however, as Bank Swallow have become a SAR since the 2009 application and will be included in ESA permitting, the Bank Swallow Specific Mitigation under D-P-3.8 may need to be revisited in the future to align with the conditions of the ESA permit. 	<ul style="list-style-type: none"> No

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
			<p>Bank Swallow Specific Mitigation</p> <ul style="list-style-type: none"> Bank Swallow mitigation measures and plans to be developed in consultation with the CNSC, EC, MNR and CLOCA. (D-P-3.8) When the project site is developed, every effort should be made to minimize the destruction of the natural bluff, using the best available technology economically achievable. In particular, the bluff should remain intact until all site layout options for the selected reactor technology have been thoroughly evaluated. The bluff should only be removed if it is then determined that this is absolutely necessary for the development of the project. The evaluation of site layout alternatives to be undertaken in consultation with relevant departments/agencies. (D-P-3.8) If the bounding case scenario is realized (i.e., all bluff habitat used by Bank Swallows east of the existing Darlington Nuclear Generating Station to the Darlington Nuclear (DN) site boundary would be lost), implement a plan that includes the following: <ul style="list-style-type: none"> 1) Provision of artificial Bank Swallow habitat on the Darlington Nuclear (DN) site; (The detailed plan to implement this will be finalized once the site layout is prepared and site-specific opportunities for artificial habitat creation are determined.) 2) Acquisition of lands containing existing colonies for study and protection; 3) Provision of artificial nesting habitat for related Chimney Swift and Purple Martins on the DN site; 4) Partner to undertake research into declining aerial foragers in Ontario, and 5) Integration of interpretive opportunities, such as, interpretive signage and observation decks. (D-P-3.8) If the actual site development is less than the bounding case scenario, OPG intends to apply mitigation measures appropriate to the actual effect based on the actual site layout and associated effect. The preferred options will be the provision of artificial Bank Swallow habitat (item 1 above) plus a combination of items 3, 4 and 5 above. (D-P-3.8) Prior to site preparation activities, develop a Bank Swallow mitigation plan for implementation during the site preparation and construction phase, and verification of the implementation plan. This mitigation plan will include all relevant details of timing, assessing performance and function. Verification will be conducted through EA Follow-up. (D-P-3.8) Based on OPG's on-going monitoring of Bank Swallow colonies, refinements to the additional mitigation measures will be made considering evolving science and opportunities to build on OPG's Biodiversity Plan at Darlington. (D-P-3.8). Undertake an adaptive management approach as part of a Follow-up and Monitoring Program for nesting Bank Swallows on site, involving creation of new banks of predetermined characteristics for the birds to nest in, monitoring the 		

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
			<p>results in terms of numbers of successful nests created, and adapting the best design for the creation of additional sites. (D-P-12.5)</p> <ul style="list-style-type: none"> Verify the results (of the Bank Swallow mitigation plan) predicted in the EIS during initial operation of the DNNP. (D-P-12.5) 		
	Migrant Songbirds and their Habitat	<ul style="list-style-type: none"> Occurrence of six migrant SAR bird species: <ul style="list-style-type: none"> Olive-sided Flycatcher¹ Common Nighthawk² Eastern Whip-Poor-Will² Canada Warbler¹ Rusty Blackbird² Least Bittern (previously considered a breeding species. New information indicates also a migrant species at the DNNP Site Study Area) 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Re-plant approximately 15 to 20 ha of Cultural Thicket with native shrub plantings, and Woodland dominated by Sugar Maple. (D-P-3.7) Implementation of Good Industry Management Practice in the initial design and development of security fencing systems, to reduce the incidence of bird entanglement and entrapment to the extent practicable. (D-P-7.2) Implement Good Industry Management Practice in the design and development of lighting systems that will, among other considerations (e.g., mitigation of bird strikes, navigation safety) serve to reduce, to the extent practicable, the night-time visibility of the overall site and its dominant features, including cooling towers. (D-P-7.2) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] including for ESA/SARA permitting, are sufficient to address potential for change to the effects of the project. Therefore, the original conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary. 	<ul style="list-style-type: none"> No
Amphibians and Reptiles	Breeding and Key Summer Habitat	<ul style="list-style-type: none"> Occurrence of one breeding SAR turtle species: <ul style="list-style-type: none"> Common Snapping Turtle₁ 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Use best management practices to prevent or minimize the potential runoff of sediment and other contaminants into wildlife habitat associated with Coot's Pond during site preparation and construction phases. (D-P-3.7) Development of stormwater management techniques to provide for adequate flow and water quality (e.g., TSS) to Coot's Pond. (D-P-3.4) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in <i>Darlington New Nuclear Project Commitments Report</i> [R-13] were developed to be adaptable and will be scaled appropriately to address changes to baseline and future permitting requirements. Therefore, the original conclusions regarding 	<ul style="list-style-type: none"> No

Environmental Sub-component	VEC	Baseline Change	DNNP PRSL Mitigation and/or Follow-up Commitments Relevant to Addressing this Change [R-13]	Revised or Additional Commitment Proposed?	Impact on Project Residual Adverse Effects?
			<ul style="list-style-type: none"> Creation of new fish-free wetland ponds with riparian plantings in appropriate areas on the DNNP Site Study Area. (D-P-3.7) Wetlands will be incorporated into the new lake infill area after the Construction phase. (D-P-3.7) Develop and implement a management plan for species at risk, as may be appropriate. (D-P-3.7) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	residual adverse effects of the project remain valid and no further actions are necessary.	
Mammal Communities and Species	Breeding Mammal	<p>Use of Site Study Area as foraging/roosting habitat for seven species of bats, including three SAR bat species:</p> <ul style="list-style-type: none"> Big Brown Bat Silver-haired Bat Hoary Bat Eastern Red Bat <p>SAR species</p> <ul style="list-style-type: none"> Little Brown Myotis² Northern Myotis² Tri-coloured Bat² 	<ul style="list-style-type: none"> Perform a thorough evaluation of site layout opportunities before site preparation activities begin, in order to minimize the overall effects on the terrestrial environment and maximize the opportunity for quality terrestrial habitat rehabilitation. (D-P-3.7) Good Industry Management Practices applied during clearing and grubbing activities to reduce environmental impact include: <ul style="list-style-type: none"> Minimizing the area to be cleared to the extent feasible; Minimizing compaction of roots in areas that will not be cleared; and Compliance with seasonal constraints and regulatory requirements (D-P-3.7) Re-plant approximately 40 to 50 ha of Cultural Meadow and approximately 15 to 20 ha of Cultural Thicket with native shrub plantings, and Woodland dominated by Sugar Maple. (D-P-3.7) Use best management practices to prevent or minimize the potential runoff of sediment and other contaminants into wildlife habitat associated with Coot's Pond during site preparation and construction phases. (D-P-3.7) Development of stormwater management techniques to provide for adequate flow and water quality (e.g., TSS) to Coot's Pond. (D-P-3.4) Create of new fish-free wetland ponds with riparian plantings in appropriate areas on the DNNP Site Study Area. (D-P-3.7) Wetlands will be incorporated into the new lake infill area after the Construction phase. (D-P-3.7) Develop a follow-up program to verify the effectiveness of mitigation measures for mammals. (D-P-12.5) Develop a follow-up program for mammal species and communities as appropriate, with a focus for this follow-up program on species at risk and the use of this follow-up program to verify the conclusions of the Ecological Risk Assessment. (D-P-12.5) Develop and implement a management plan for species at risk, as may be appropriate. (D-P-3.7) Monitor conditions to confirm the EIS predictions of habitat restoration post construction. (D-P-12.5) 	<ul style="list-style-type: none"> No further mitigation required to address change in baseline conditions. Mitigation and commitments documented in Darlington New Nuclear Project Commitments Report [R-13], including for ESA/SARA permitting, are sufficient to address potential for change to the effects of the project. Therefore, the original conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary. 	<ul style="list-style-type: none"> No

¹ Status change to a species-at-risk since the 2009 application.

² New species-at-risk records for the DNNP Site Study Area since the 2009 application.

4.1.6 Radiation and Radioactivity

Air

The latest Environmental Monitoring Program (EMP) report demonstrated that all levels of radionuclides monitored have remained relatively constant since 2009 [R-14]. Noble gas parameters measured at the DNNP Site Study Area boundary have average dose rates that are typically below detection limits [R-14]. For both HTO and C-14, a Mann-Kendall trend analysis at the 95% confidence level does not indicate any statistically significant trend over the past 10 years. As such, the updated baseline conditions do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary [R-6].

Soil

As there are no specific soil standards for radionuclides, a comparison to background levels was made to provide additional context to measured data. Of the seven measured parameters (tritium, C-14, Cs-137, Cs-134, Co-60, K-40, I-131), six had detectable activity with only H-3, C-14, and Co-60 detected above background levels. Concentrations above background can be expected, due to influence from Darlington Nuclear Generating Station (DNGS), and were noted also in 2007-2008 sampling. As such, the 2019 soil quality baseline data does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

It should be noted that background information was referenced from either the 2017 Results of Environmental Monitoring Program report [R-18], or the Review of Environmental Radioactivity in Canada report [R-19].

Groundwater

As previously stated in section 4.1.2 annual groundwater monitoring has occurred across the DNNP Site Study Area since before the 2009 application. Apart from the DNGS December 2009 Injection Water Storage Tank (IWST) spill which caused an increase in localized concentrations of tritium in groundwater within the DNGS protected area, results for tritium in groundwater in 2016 [R-21], 2017 [R-20] and 2018 [R-15] indicated that in general, tritium concentrations within the DNNP Site Study Area have remained relatively constant or have decreased, demonstrating stable trends over time. Slight increases in tritium concentrations were observed at some locations within the protected area. The 2018 annual report indicates that these are likely due to the stabilization of groundwater levels following dewatering activities [R-15]. As such, the updated groundwater baseline data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Surface Water

All radiological parameters meet applicable water quality guidelines. Both tritium and I-131, and all other measured radionuclides were below guidelines in 2019 and were at levels similar to those presented in the Surface Water Environment Existing Conditions TSD [R-9]. As such, the updated surface water quality does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Sediment

Within Lake Ontario one location was sampled in both 2007/2008 and 2019 and only K-40 concentration showed a statistically meaningful increase. K-40 occurs naturally in soil and rocks and the range of background levels of K-40 in beach sand (which can be applied to sediment) for Southern Ontario [R-19] was not exceeded. The remaining 22 locations sampled in 2019 within the DNNP Site Study Area are considered additional baseline information. The updated Lake Ontario sediment quality data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

The only radionuclide in sediment in Coot's Pond to have higher activity in 2019 compared to 2007/2008 was K-40, but this higher activity was within the range of background levels. With respect to Treefrog Pond the only radionuclide to have higher activity in 2019 compared to 2007/2008 was Cs-137. However, there is no impact to the DNNP as Treefrog Pond is planned for removal during the construction phase.

Aquatic Communities

Based on the past 10 years of fish tissue monitoring data, a Mann-Kendall trend analysis at the 95% confidence level indicates that there is no statistically significant trend for HTO or C-14 in fish collected within the DNNP Site Study Area [R-6].

The majority of the gamma activity in fish is naturally occurring K-40. A small amount of Cs-137 due to fall out from nuclear weapons testing is usually observed. The Cs-137 detected in fish is not a result of reactor operations given that Cs-134 and Co-60, which are indicative of reactor operation, were not detected in any fish samples at the DNNP Site Study Area in 2018. The average Cs-137 concentration for fish sampled from the DNNP Site Study Area was 0.1 Bq/kg and has decreased slightly over time. Given the level of uncertainty at such low concentrations, this is not distinguishable from background.

As such, the updated baseline aquatic community data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Terrestrial Communities

Since the 2009 application, radiological monitoring of fruits and vegetables, milk, and animal feed within the vicinity of the DNNP Site Study Area has continued annually with the addition of poultry and eggs to the annual program starting in 2014 [R-6]. A Mann-Kendall

trend analysis of average fruit and vegetable activity at the 95% confidence level did not indicate any statistically significant trend over the past 10 years for HTO and C-14 [R-14]. Similarly, a Mann- Kendall trend analysis of milk activity at the 95% confidence level did not indicate any statistically significant trend over the past 10 years for HTO and C-14 [R-14]. No trend analysis was performed on animal feed since, beginning in 2013, wet feed and dry feed have been sampled separately, resulting in changes to sampling frequency and replicates [R-14]. However, no apparent trend was observed from inspection of HTO and C-14 data. No trend analysis was performed for poultry and eggs as only five years of data have been collected from these locations thus far [R-14], however no apparent trend was observed from inspection of HTO and C-14 data. As such, the updated baseline terrestrial community data do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.2 Review Findings Related to Applicable Environmental Codes, Standards and Practices

In this section a review of applicable environmental codes, standards and practices is presented. More detail on the specific findings and conclusions can be found in the Supporting Environment Studies Report [R-6].

4.2.1 Climate, Meteorology and Air Quality

As identified in the Supporting Environment Studies Report [R-6], three standards pertaining to climate, meteorology and air quality have changed since the 2009 application documents were published. These are: 1) the Ontario Ambient Air Quality Criteria (AAQC); 2) the Canadian Ambient Air Quality Standards (CAAQS); and 3) the Canadian Climate Normals. Each of the three is described below.

Ontario AAQC

In the previous air quality assessment, [R-7] [R-22], acrolein was found to be the most restrictive contaminant for emissions from both fixed diesel engines and transportation sources. As a result of changes to air quality standards the most restrictive contaminant is now benzo(a)pyrene (BaP) whose current AAQC is $0.00005 \mu\text{g}/\text{m}^3$ [R-23].

Assessment/Disposition

The sub-commitment D-P-12.2 [R-13] was developed to be adaptable and can conform to any permitting requirements. The sub-commitment D-P-12.2 states that “OPG to develop a follow-up and adaptive management program for air contaminants (such as acrolein, NO_2 , SO_2 , SPM, $\text{PM}_{2.5}$ and PM_{10})”; thus, the changes above can be adequately addressed. When this sub-commitment is carried out (prior to site preparation), the program will be developed to appropriately address updated standards and will include both acrolein (a VOC) and BaP (a Polycyclic Aromatic Hydrocarbon or PAH) [R-6]. This change does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

CAAQS

Since reporting of the *Atmospheric Environment - Existing Environmental Conditions Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Atmospheric Environment Existing Conditions TSD) [R-7], the Canadian Council of Ministers of the Environment (CCME) established the CAAQS in May 2013, which provides standards for the following relevant Contaminants of Potential Concern (COPCs): $\text{PM}_{2.5}$, NO_2 , and SO_2 . The CAAQS were initially established as non-binding target levels for air quality across Canada. Since that time, however, ECCC has adopted and begun to enforce these standards. Although many of the CAAQS are not yet enforced, ECCC has identified CAAQS that will be enforced starting in 2020 and in 2025.

Assessment/Disposition

As the CAAQS come into effect in 2020 and 2025, the mitigation measures proposed in the *Atmospheric Environmental - Assessment of Environmental Effects Technical Support Document, New Nuclear – Darlington Environmental Assessment* (Atmospheric Environment Environmental Effects TSD) [R-22] are expected to reduce the potential occurrence of PM_{2.5}, NO₂, and SO₂ exceedances. It is important to note that these potential exceedances are tied to the previous dispersion modelling results, which were based on a highly conservative or “bounding” assessment scenario. The bounding assessment scenario varied by contaminant of concern and included the simultaneous and maximum operation of equipment during the peak year of site preparation and construction activities.

This change is addressed with OPG’s commitment to develop a comprehensive and adaptive air quality monitoring/management plan for the Site Preparation phase (D-P-12.2; [R-13]) which will include monitoring of PM_{2.5}, NO₂, and SO₂ [R-6]. Changes to CAAQS for PM_{2.5} will also be factored into the development of the Nuisances Effects Management Plan(s) and Dust Management Plan as outlined in D-P-3.2 and D-P-12.2 of the Commitments Report [R-13]. As such, the implementation of CAAQS does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

Canadian Climate Normals

The Canadian Climate Normals presented in the Atmospheric Environment Existing Conditions TSD [R-7] were averaged between 1971 and 2000. However, the most recent Canadian Climate Normals cover the period 1981-2010.

Assessment/Disposition

The minor differences in air temperature, precipitation, and wind described in the Canadian Climate Normals are not expected to alter conclusions with respect to effects of the project on the atmospheric environment [R-6]. This change is addressed with OPG’s commitment to develop a comprehensive and adaptive air quality monitoring/management plan for the Site Preparation phase (D-P-12.2; [R-13]), any minor change in Canadian Climate Normals will be accounted for in this plan. As such, the updated Canadian Climate Normals do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.2.2 Geology and Hydrogeology

As identified in the Supporting Environment Studies Report [R-6], three standards pertaining to Geology and Hydrogeology have changed since the 2009 application documents were published. These are: 1) Section C.5.3 of REGDOC 1.1.1 - Rate of transfer between aquifers, and capture zones of wells; 2) the groundwater quality guidelines; and, 3) the soil quality guidelines.

Section C.5.4 of REGDOC 1.1.1

Under the subheading 'Rates and directions of groundwater flows' within REGDOC 1.1.1, it is stated that *the applicant shall determine the rate of transfer between aquifers, and capture zones of wells*. This potential gap was identified in the DNNP Compliance Assessment document [R-5].

Assessment/Disposition

The hydraulic properties of the subsurface at the DNNP Site Study Area have been extensively characterized through monitoring and testing of wells in the existing groundwater monitoring network. The rates and direction of groundwater flow and the transfer of water between aquifers are all understood on the basis of water level, hydraulic conductivity, hydraulic gradient, transmissivity (rate of transfer), and vertical gradient information available for the DNNP Site Study Area [R-8]. An in-depth understanding of the groundwater flow system has been developed through field investigations, involving the installation of numerous monitoring wells and observations and testing on the wells, in addition to extensive groundwater modelling that was focused on groundwater flow at and around the site. Flow gradients occur toward Lake Ontario and Darlington Creek; therefore, determination of capture zone of wells is not applicable as any residential wells occur upgradient from the DNNP Site Study Area [R-6]. Therefore, the general intent of REGDOC 1.1.1 has been met and the original conclusions regarding residual adverse effects of the project remain valid, no further actions are necessary.

Groundwater Quality Guidelines

The 2009 application materials supporting the DNNP PRSL used 2004 Ministry of the Environment, Conservation and Parks (MECP) Table 3 (non-potable groundwater) groundwater quality guidelines; however, the MECP Table 3 guidelines were updated in 2011 [R-6]. The updated guidelines resulted in thirty-five parameters having more stringent values but only six parameters listed in the 2016 DN ERA [R-24] had concentrations that exceeded the updated guideline [R-6]. Of the six parameters, two parameters, cobalt and nickel, were determined to be non-reproducible as identified in the Geological and Hydrogeological Environment Existing Conditions TSD [R-8]. The other four parameters only exceeded the updated guideline (sodium, chloride, PHC F3, and chrysene).

Assessment/Disposition

The four parameters were deemed unlikely to impact the project effects on the environment [R-6]. Exceedances of sodium, chloride, and PHC F3 are attributed to natural background. There was one marginal exceedance of chrysene, which is a PAH (1.1 µg/L compared to the guideline of 1.0 µg/L). This exceedance is considered anomalous as PAHs in all other samples (107 wells with two sampling events each) were below the method detection limits (MDL). As such, the updated groundwater quality guidelines do not alter the original

conclusions regarding residual adverse effects of the project and no further actions are necessary.

Soil Quality Guidelines

The 2009 application materials supporting the DNNP PRSL used 2004 MECP Table 3 (Industrial /Commercial/ Community) soil quality guidelines; however, the MECP Table 3 guidelines were updated in 2011 [R-6]. The updated guidelines resulted in thirteen parameters that did not exist previously or had more stringent values. Of these thirteen, only barium exceeded the updated guideline (670 µg/L) but the exceedance was marginal with a concentration of 685 µg/L [R-6].

CCME Soil Quality Guidelines (SQGs) have not changed substantially since the 2009 application. A new commercial/industrial soil guideline has been published for beryllium, while the existing commercial/industrial soil guideline for silver was not applied in the 2009 application. The nickel guideline (residential/parkland) has decreased to become slightly more stringent [R-6].

Assessment/Disposition

The concentration of barium appears to be a natural condition of the site as exceedances are only in deep soil samples near bedrock. This also means receptor exposures to higher barium concentrations are unlikely, since receptors are typically only exposed to surficial soils [R-6]. As such, the updated soil quality guidelines do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

In the case of the commercial/industrial CCME SQGs for beryllium and silver, the more restrictive residential/parkland guidelines were applied in support of the 2009 application. For the CCME SQG for nickel, although the residential/parkland value has become more stringent, the more relevant commercial/industrial guideline became less stringent since the 2009 application supporting documents were submitted [R-6]. Overall, the changes to CCME SQGs do not alter the finding that soil parameters are below the applicable CCME guidelines, and therefore the changes do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.2.3 Hydrology, Surface Water and Sediment Quality

As identified in the Supporting Environment Studies Report [R-6], the only code or standard pertaining to Hydrology, Surface Water and Sediment Quality that has changed since the 2009 application documents were published was the surface water quality guidelines.

Surface Water Quality Guidelines

Three of the surface water quality guidelines (Ontario Provincial Water Quality Objectives, CCME Canadian Water Quality Guidelines (CWQGs), and Health Canada's Guideline for

Canadian Drinking Water Quality) used in 2009 application materials supporting the DNNP PRSL have been updated since the 2009 application [R-6]. However, only two of these guidelines have become more stringent; the CCME CWQGs and Health Canada's Guidelines for Canadian Drinking Water Quality have more stringent guidelines for three and seven parameters, respectively [R-6].

Assessment/Disposition

Of the lowest selected guideline values used in the Ecological Risk Assessment TSD [R-17], strontium, zinc, nitrite and *E. coli* are the only parameters that have become more stringent and were the lowest selected guideline. Strontium concentrations for surface water in the DNNP Site Study Area did not exceed the new guideline. Guideline decreases for zinc and nitrite are due to selection of the filtered guideline for zinc and the nitrogen-based guideline for nitrite [R-6]. The updated CCME CWQG for zinc of 7 µg/L represents the dissolved form while the guideline of 30 µg/L applied in the 2009 application supporting documents was for total zinc. The maximum measured total zinc of 9.4 µg/L in 2007/2008 occurred at Treefrog Pond and exceeded the new dissolved zinc guideline (7 µg/L). This dissolved zinc guideline is overly-conservative for total zinc and is not directly comparable to the new guideline. For nitrite, the CCME CWQG applied in the 2009 application supporting documents was expressed as NO₂ (whole molecule). The current CWQG is expressed as nitrite-N. The maximum nitrite measurement in 2007/2008 of 0.07 mg/L as NO₂ at Coot's Pond numerically exceeds the current 0.06 mg/L nitrite-N guideline, but does not exceed when expressed in comparable units (i.e., 0.07 mg/L of NO₂ = 0.02 mg/L of NO₂-N). Health Canada drinking water guidelines for *E. coli* are 'non-detectable' levels. However, considering these are drinking water quality guidelines, they are overly-conservative and not applicable to surface water [R-6]. These changes do not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

4.2.4 Aquatic Communities

As identified in the Supporting Environment Studies Report [R-6], two applicable standards pertaining to aquatic communities have changed since the 2009 application for the DNNP's PRSL; the provincial Endangered Species Act (ESA), and the federal Species at Risk Act (SARA). Species lists have been updated under both the ESA and SARA. Potential gaps were identified relating to the following three sections of REGDOC 1.1.1 [R-5] [R-6]: Section C.7.1 - Baseline Aquatic Biota and Habitat; Section C.7.2 - Baseline Food Chain Data; and Section G.5.4 - Effect of Thermal Plume on the Aquatic Environment.

ESA (Provincial) and SARA (Federal)

Since the 2009 application for the DNNP's PRSL, the following species have become listed as a provincial species at risk:

- American Eel (*Anguilla rostrata*): listed as endangered. The species was described as a transition species to be listed in the ESA in the supporting documentation for the 2009 application.
- Lake Sturgeon (*Acipenser fulvescens*, Great Lakes – Upper St. Lawrence population): listed as endangered. At the time the supporting documentation for DNNP's PRSL was submitted, there was no provincial listing for Lake Sturgeon.

Before site preparation activities occur, the provincially-listed American Eel and Lake Sturgeon would have to be assessed as part of the Overall Benefit permitting process under the ESA (S. 17(2)(c)). Requirement for this permit was identified under D-P-3.7 of the Commitments Report [R-13]. Thus, listing of these two fish species does not alter conclusions with respect to residual adverse effects of the project and does not impact conclusions of the original site evaluation.

The following updates are provided with regards to federal species at risk since the 2009 application for the DNNP's PRSL:

- American Eel: The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed American Eel as threatened (2012). At the time of the 2009 application for the DNNP PRSL, the species was assessed as Special Concern. The SARA status has remained unchanged (i.e., not listed on Schedule 1 of SARA).
- Lake Sturgeon (Great Lakes – Upper St. Lawrence populations): Lake Sturgeon has remained assessed as threatened by COSEWIC. The SARA status has remained unchanged (i.e., not listed on Schedule 1 of SARA). Note that Lake Sturgeon have not been present in aquatic sampling around the DNNP Site Study Area since 1999.
- Atlantic Salmon (*Salmo salar*, Lake Ontario Population): COSEWIC assessed the species as extinct (2010); the species was considered extirpated at the time of the 2009 application for the DNNP PRSL.
- Deepwater Sculpin (*Myoxocephalus thompsonii*): COSEWIC assessment (Special Concern) and SARA status have not changed. The species is listed in Schedule 1 of SARA as a species of Special Concern.

Although COSEWIC designations of species at risk have changed for some aquatic species (American Eel and Atlantic Salmon), none of the fish are listed in Schedule 1 of SARA, which is the official list of wildlife species at risk. However, despite not being listed in Schedule 1 of SARA, these fish were considered as species of conservation concern in the documents supporting DNNP's PRSL. Deepwater Sculpin remains as a species of Special Concern under Schedule 1.

There has been no change to the federal status of these species and the change in COSEWIC designations do not alter the original conclusions regarding residual adverse effects of the project. As such, no further actions are necessary.

Section C.7.1 - Baseline Aquatic Biota and Habitat

Ten potential gaps pertaining to Section C.7.1 of REGDOC 1.1.1 were identified (Table 4-5) in [R-5].

Assessment/Disposition

Review of additional reporting and studies since the 2009 application for the DNNP's PRSL identified that nine of the ten potential gaps have been addressed (dispositions presented in Table 4-5) and no further actions are necessary [R-6].

The remaining potential gap - *Fish Habitat Map Inclusive of: spawning, nursery, rearing, feeding, refuge/cover, movement corridors, existing thermal discharge, lake currents, contaminant pulses, storm water release points, groundwater plumes, shoreline plant communities* - was assessed to determine if it had the potential to impact conclusions regarding project effects or site evaluation. Although a specific fish habitat map satisfying all these requirements was not produced, it was determined that the information relevant to the creation of habitat maps was already considered during the original assessment of project effects and therefore the intent of Section C.7.1 has been met [R-6]. This potential gap does not impact conclusions about residual adverse effects of the project or the site evaluation and no further actions are necessary.

Table 4-5: Potential Gaps Regarding REGDOC 1.1.1 Section C.7.1 (Baseline Aquatic Biota and Habitat)

Subject of Potential Gap [R-5]	Potential Gap Exists After Review of Additional Studies?	Disposition	Impact on Residual Adverse Effects of the Project?
Fish Habitat Map inclusive of: spawning, nursery, rearing, feeding, refuge/cover, movement corridors, existing thermal discharge, lake currents, contaminant pulses, storm water release points, groundwater plumes, shoreline plant communities.	Yes	Although a specific fish habitat map satisfying all these requirements was not produced, it was determined that the information relevant to the creation of habitat maps was already considered during the original assessment of project effects and therefore the intent has been met.	No
Watershed Map delineating watershed boundaries and land use.	No	Detailed land use, including ELC classification, for the DNGS property is presented in the Supporting Environment Studies Report [R-6].	No
Review of past site clearing and shoreline development.	No	The shoreline of the DNNP-lands is undeveloped. During construction of the DNGS facility the DNNP lands were used for construction staging as described in <i>Geological and Hydrogeological Environment – Environmental Effects Technical Support Document, New Nuclear – Darlington Environmental Assessment</i> (Geological and Hydrogeological Environment Effects TSD) [R-25].	No
Potential effects of climate change on habitat suitability and how that may alter spatial distributions of biota.	No	Climate change is discussed in the Aquatic Environment Effects TSD [R-26]. This includes discussion on increased temperature and reduced basin runoff and effects on VECs include increased algal growth and shift toward more warmwater fish species relative to coldwater species.	No
Background ranges of habitat characteristics that may be affected by project.	No	As identified in Section 2.1.1.4, background conditions of fish, invertebrates, and plankton have been well quantified with field studies.	No
Site background information and biological life history that affect population growth and the capacity to recover from adverse effects.	No	Environmental monitoring of the existing DNGS facility has demonstrated that the aquatic community is resilient to nuclear power production activities.	No
Cover and standing biomass of aquatic plants as a basis to predict and detect changes.	No	Standing biomass of aquatic plants has not be estimated because they are notably absent. Due to the erosional nature of the site, aquatic macrophyte presence is negligible. The filamentous algae <i>Cladophora</i> (<i>Cladophora sp.</i>) is present and can form dense mats.	No
Adequate characterization of the VC structural attributes; including specific attribute that is focus of assessment as important to project. VC characterization of population, geographical distribution of species, and spawning requirements. Statement of confidence of characterization.	No	As described in Section 2.1.1.4, the aquatic community structure has been well studied in the vicinity of the DNNP lands.	No
Information on stability of VCs and capacity to be resilient to project disturbance, baseline values and trends of VCs.	No	Environmental monitoring of the existing DNGS facility has demonstrated that the aquatic community is resilient to nuclear power production activities.	No
An aquatic species inventory list based on field studies for the site and local study area and available published information for the regional study area for fish, benthic invertebrates, major macrophyte species along with evidence that information is representative by identification of expected species compared to catalogued species found during field investigations.	No	As identified in Section 2.1.1.4, numerous field investigations have been conducted resulting in a comprehensive species inventory.	No

Section C.7.2 - Baseline Food Chain Data

As identified in [R-5], Section C.7.2 within REGDOC 1.1.1 states that *characterization information shall include reference locations that would not be exposed to project effects made over multiple years to understand natural year-to-year variability*. Sampling of reference location(s) over multiple years was not included in the Aquatic Environment Existing Conditions TSD [R-10].

Assessment/Disposition

Since the 2009 application for the DNNP's PRSL, reference locations have been established at Thickson Point and Bond Head and have been sampled over multiple years for fish community (including supporting water quality measurements) [R-6]. As such, the intent of Section C.7.2 has been met. The original conclusions regarding residual adverse effects of the project are not impacted and no further actions are necessary.

Section G.5.4 - Effect of Thermal Plume on the Aquatic Environment

As identified in [R-5], the following activities identified in Section G.5.4 within REGDOC 1.1.1. were not included in the Aquatic Environment Assessment of Environmental Effects TSD [R-26]: *descriptions of models (physical, mathematical, conceptual) used to predict temperature effects and thermal discharge jet effects, and to account for long-term effects of climate warming relative to incremental effects of the project, a listing of aquatic fish and shellfish species, aquatic plants, and invertebrates, identifying which life stages are susceptible to exposure to the interaction, and which subset of species are most sensitive; and the potential for gas-bubble disease*.

Assessment/Disposition

Review of the reports and studies conducted since the 2009 application for the DNNP's PRSL addresses this potential gap. The effects of predicted temperature changes during operation of the proposed DNNP diffuser were assessed on the basis of modeled temperatures at three locations including the proposed diffuser location; the embayment created by the proposed lakefill; and the existing DNGS diffuser, with both facilities operating [R-6]. A range of climatic conditions was covered that included years during which temperatures were similar to long term averages, as well as a warmer-than-average year and a colder-than average year. Temperature changes were assessed against published temperature benchmarks for the fish species that have been recorded in abundance in the area, or that were of particular conservation concern. All life stages that could be present were considered. A conservative approach was taken that assumed that if suitable habitat existed, the species could be present, regardless of whether the species had actually been observed in the area. The species considered were Round Whitefish, Emerald Shiner, Alewife, White Sucker and Lake Trout. While these specific species were considered in the assessment, they were also considered as representative of the potential effects on other species with similar habitat requirements. No effects from the operation of

the DNNP diffuser were predicted for the five species considered. The lack of effects on Round Whitefish, Alewife, and Lake Trout is important as these species prefer cold waters and can be considered sentinel species sensitive to climate change effects in this system. Round and Lake Whitefish egg incubation experiments identified that Round Whitefish developing eggs were more sensitive to temperature changes and a thermal benchmark of 3.7 °C above ambient temperatures was established; using models, this benchmark was further revised to 2.9°C to 3.4°C above ambient that would result in a 90% probability of survival [R-6]. Further, under commitment D-P-12.4 [R-12], an aquatic monitoring program will be implemented as a condition of any Fisheries Act Authorization. Similarly, OPG has committed (D-C-1.2) to work with ECCC to ensure that thermal modelling and assessment of climate change scenarios are incorporated into the design of the DNNP diffuser to address policy objectives and compliance with applicable Federal statutes [R-13]. As such, the intent of Section G.5.4 has been met. The conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary.

Gas –bubble disease is easily recognized during fish examinations with signs including exophthalmia and gas-filled bubbles on the head, mouth, jaws and caudal fin. The occurrence of gas-bubble disease has never been observed during the many studies conducted throughout the operation of the DNGS facility; therefore, it is unlikely to be an effect of the DNNP diffuser. The diffuser discharge system at DNGS was designed to reduce the temperature change to surrounding waters and therefore would also minimize the potential for gas bubble trauma in fish. Concern for gas-bubble disease is addressed with OPG's commitment D-C-1.2 [R-13] to design the diffuser such that the thermal discharge will not be deleterious or it can be mitigated such that it causes minimal harm to fish. As such, the intent of Section G.5.4 has been met. The conclusions regarding residual adverse effects of the project remain valid and no further actions are necessary.

4.2.5 Terrestrial Communities

As identified in the Supporting Environment Studies document [R-6], three standards pertaining to Terrestrial Communities have changed since the 2009 application documents were published. These are: 1) Section C.6 of REGDOC 1.1.1 – description of natural and human-induced pre-existing environmental stresses and the current ecological conditions that indicate such stresses, 2) the Species at Risk Act (SARA); and, 3) the Endangered Species Act (ESA).

Section C.6 of REGDOC 1.1.1

As identified in [R-5], Section C.6 within REGDOC 1.1.1. states that characterization information *shall include description of natural and human-induced pre-existing environmental stresses and the current ecological conditions that indicate such stresses.*

Assessment/Disposition

Information to address this gap has been provided in the Supporting Environment Studies Report [R-6] wherein the following existing stresses have been identified; Roads (Energy Drive and Highway 401 interchanges); Installation of New Water/Sewer Lines; Soil Disposal – Bobolink Hill; Campus Plan Projects; Pond Berms; Agriculture; Yard Waste and Building Materials Dump Site; *Phragmites*; Emerald Ash Borer; and Lake Ontario Water Levels.

It was also concluded that these existing stressors do not change the residual adverse effects of the project, nor the conclusions about site evaluation, and no further actions are necessary.

SARA and ESA

Since the 2009 application both SARA and ESA species lists have been updated. Due to these updated standards, and continued monitoring since 2009, there are six additional ESA and SARA species that are new records for the DNNP Site Study Area [Common Nighthawk (*Chordeiles minor*), Eastern Whip-poor-will (*Caprimulgus vociferus*), Rusty Blackbird (*Euphagus carolinus*), Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-coloured Bat (*Perimyotis subflavus*)]. Additionally, status change to a species at risk has occurred for nine species [Eastern Wood-Pewee (*Contopus virens*), Olive-sided Flycatcher (*Contopus cooperi*), Canada Warbler (*Cardellina canadensis*), Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Wood Thrush (*Hylocichla mustelina*), Bobolink (*Dolichonyx oryzivorus*), Eastern Meadowlark (*Sturnella magna*), and Snapping Turtle (*Chelydra serpentina*)] since the 2009 application was submitted [R-6].

Assessment/Disposition

Mitigation measures and commitments documented in the Commitments Report [R-13] were reviewed concerning the six new species at risk and the nine species at risk where status change occurred. No further mitigation or additional commitments are required to address this change. Further, one of the closure criteria for commitment D-P-3.7 is to submit the deliverable, EPC Terrestrial Environment Mitigation Measures and Plans, as part of the Overall Benefits permitting process for species at risk. The Overall Benefits permit will address any project impacts to species at risk [R-13]. As Bank Swallows have become a species at risk since the 2009 application and will be included in the Overall Benefits permit, the Bank Swallow specific mitigation listed under commitment D-P-3.8 may need to be revisited in the future to align with the conditions of this permit.

Mitigation Commitment

No further mitigation or updated commitments are required at this time.

4.2.6 Radiation and Radioactivity

As identified in the DNNP PRSL Renewal Plan [R-2], the following CSA documents applicable to the radiation and radioactivity environmental component have been revised or created since the 2009 application: N288.1, N288.4, N288.5, and N288.6. Review of these documents demonstrated that the site evaluation remains compliant with the CSA documents as cited by REGDOC 1.1.1 [R-6].

5.0 RADIOLOGICAL DOSE TO THE PUBLIC

The section presents the radiation dose to members of the public described in the *Radiation and Radioactivity Environment Existing Environmental Conditions Technical Support Document* (Radiation Existing Conditions TSD) [R-27] as well as the most recent evaluation of radiological dose to the public presented in *2018 Results of Environmental Monitoring Programs* (2018 EMP) report [R-14]. The dose results in these reports will be compared to determine if there is any change in public dose that would alter the original conclusions regarding residual adverse effects of the project.

5.1 Dose to Public 2007

As part of the 2009 application the public dose that was calculated for 2007 was presented in the Radiation Existing Conditions TSD [R-27].

In order to determine the potential doses for comparison with regulatory requirements, doses to members of potential critical groups that reside in the vicinity of the DNNP Site Study Area were calculated. The OPG assessment of doses to potential critical groups is based to the extent possible on measured concentrations of radionuclides in environmental media; however, if the measured concentrations are not statistically measurable above background then concentrations are modelled from measured station emission data using environmental pathways modelling [R-27]. The radiological dose for each potential critical group is presented in Table 5-1. The locations of critical groups are depicted in Figure 5-1.

The highest critical group dose for the DNNP Site Study Area was 1.4 $\mu\text{Sv/a}$ (microsieverts per year) for the Farm nursing infant. The annual regulatory limit is 1000 $\mu\text{Sv/a}$; therefore, the critical group dose was well below that limit.

Table 5-1: Potential Critical Group Doses in 2007

Potential Critical Group	Dose per Age Class ($\mu\text{Sv/a}$)					
	Adult	15-year-old	10-year-old	5-year-old	1-year-old	Nursing Infant
Rural Residents	0.7	0.6	0.6	0.5	0.6	1
Bowmanville Residents	0.4	0.4	0.4	0.3	0.4	0.6
Oshawa Residents	0.2	0.1	0.1	0.1	0.2	0.3
St. Mary's Cement Workers	0.3	N/A	N/A	N/A	N/A	N/A
Campers	0.2	0.2	0.2	0.2	0.2	0.4
Farm Residents	0.9	0.7	0.7	0.7	0.8	1.4
Dairy Farm Residents	0.7	0.7	0.8	0.8	1.2	0.8
West/East Beach Residents	0.6	0.6	0.5	0.4	0.5	0.8
Sport Fishers	0.03	0.03	0.03	0.02	0.02	0.03

Note: Table taken from [R-27].

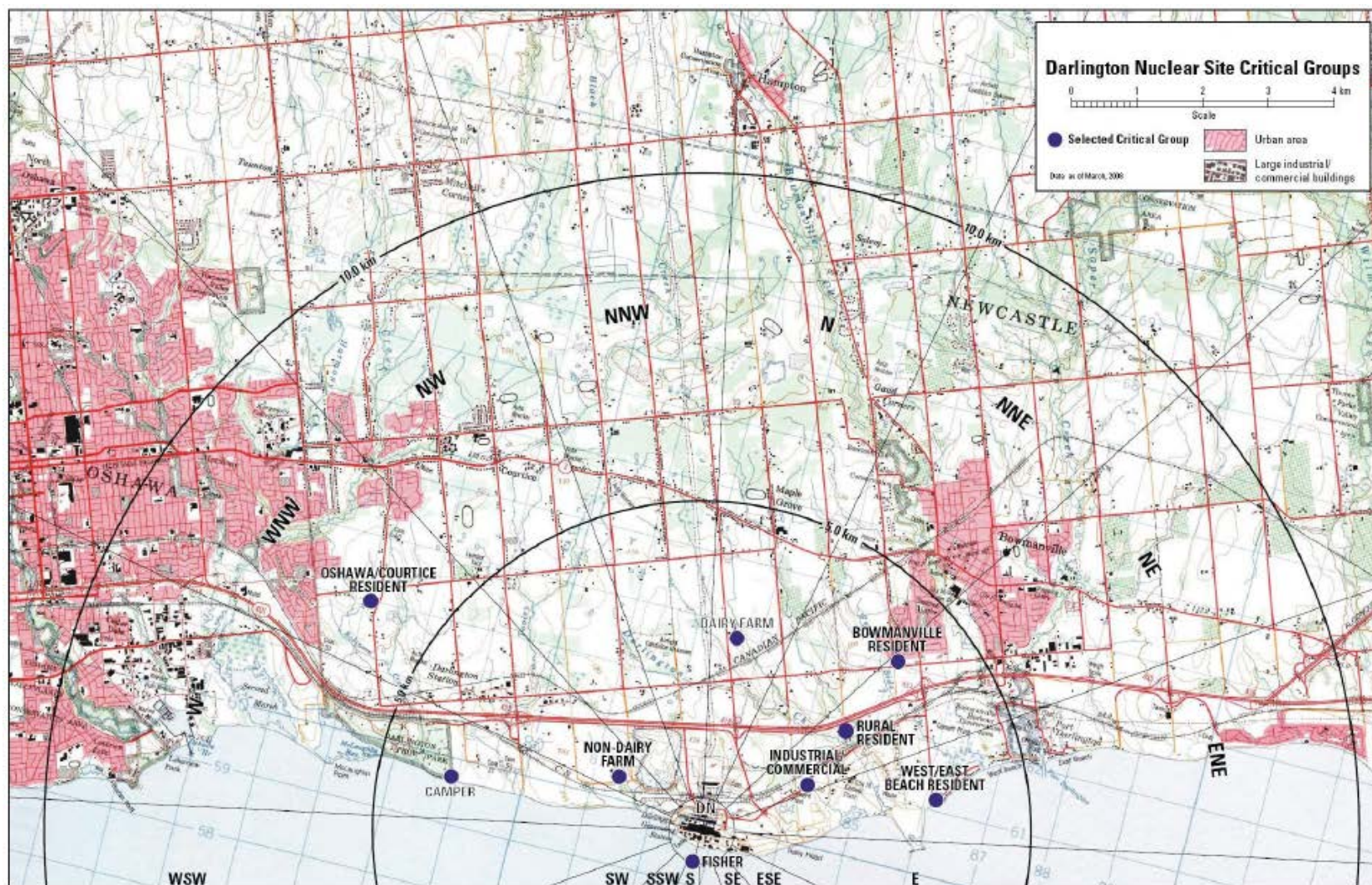


Figure 5-1: Darlington Nuclear Critical Group Locations, 2007

Note: Taken from [R-27].

5.2 Dose to Public 2018

The most recent public dose calculation is presented within the 2018 EMP [R-14]. Doses were reported for the three potential critical groups receiving the highest doses. Currently, three age groups are considered, in accordance with recent CSA guidance, as compared to six age groups in 2007. In addition, some changes to methodology and transfer parameters have occurred due to updates to CSA N288.1-08, as well as, characteristics for potential critical groups based on site specific survey data. Locations of critical groups are depicted in Figure 5-2.

The three potential critical groups which yielded the highest dose estimates based on the pathways analysis were the Dairy Farm Resident, the Farm Resident, and the Rural Resident (Table 5-2). The highest critical group dose for the DNNP Site Study Area was 0.8 $\mu\text{Sv/a}$ for the adult Farm Resident. The annual regulatory limit is 1000 $\mu\text{Sv/a}$; therefore, the critical group dose was well below that limit.

Table 5-2: Potential Critical Group Doses in 2018

Potential Critical Group	Dose per Age Class ($\mu\text{Sv/a}$)		
	Adult	Child (10-year-old)	Infant (1-year-old)
Dairy Farm Residents	0.5	0.5	0.5
Farm Residents	0.8	0.7	0.5
Rural Residents	0.4	0.3	0.2

Note: Taken from [R-14].

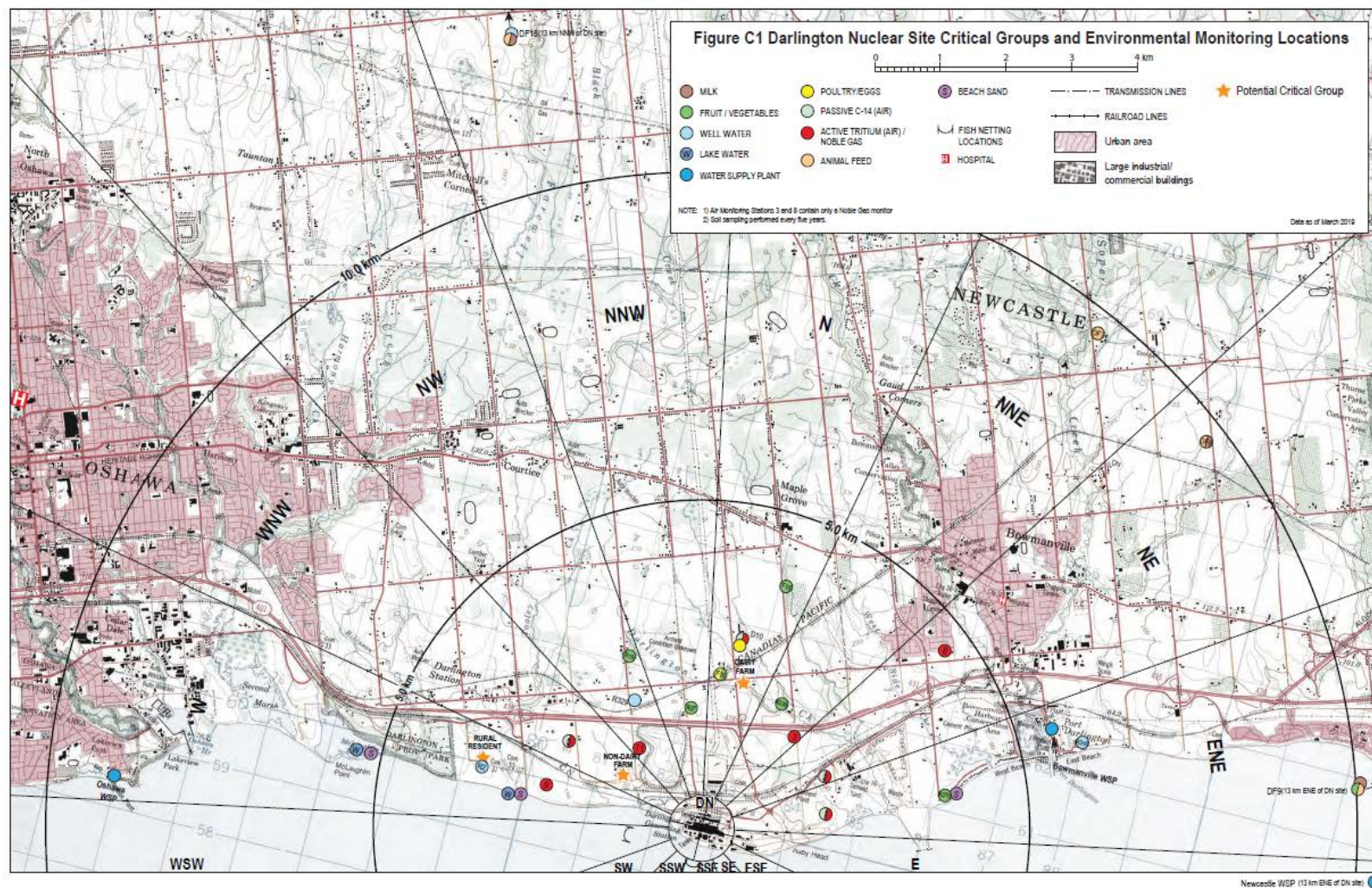


Figure 5-2: Darlington Critical Group Locations, 2018

Note: Taken from [R-14].

5.3 Evaluation

The DNNP Site Study Area public dose (the dose for the group and age class with the highest reported dose within a given year) is presented on a logarithmic scale in Figure 5-3. The DN dose remains essentially unchanged over the last ten years and has remained below 1% of the legal limit.

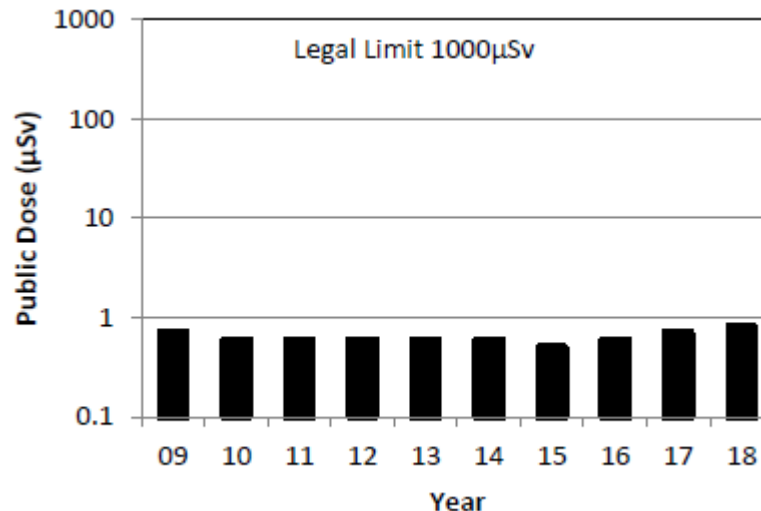


Figure 5-3: Darlington Nuclear Annual Public Dose Trend

Note: Taken from [R-14].

The current public dose for the DNNP Site Study Area is similar to that presented in the 2009 Radiation Existing Conditions TSD [R-27] included as a supporting document of the 2009 application. As such, the updated public dose assessment does not alter the original conclusions regarding residual adverse effects of the project and no further actions are necessary.

6.0 INTERFACE WITH OTHER REVIEWS

The full scope of reviews conducted for this Licence Renewal Activity Report is contained within this document.

7.0 OVERALL ASSESSMENT AND CONCLUSIONS

The conclusions of this Licence Renewal Activity Report are summarized in Table 7-1.

As identified in Section 3.0, three main licence renewal activity components were addressed in this report:

- a) compliance review of 2009 application materials against REGDOC 1.1.1;
- b) i) address modern codes, standards and practices; and
ii) revisit baseline data.

The environmental components that were reviewed in this Licence Renewal Activity Report included: climate, meteorology and air quality; geology and hydrogeology; hydrology, surface water and sediment; aquatic communities; terrestrial communities; and radioactivity.

The compliance review of 2009 application materials against REGDOC 1.1.1 documented in the DNNP Compliance Assessment document [R-5] identified six sections that contained potential gaps (Table 4-1). Review of these gaps against studies and reports conducted since the 2009 application, as well as the Commitments Report [R-13], demonstrated that the majority of information needed to address these potential gaps already exists. Where information was lacking it was provided within the Supporting Environment Studies Report [R-6]. Therefore, the conclusions drawn from the original site evaluation, based on RD-346, remain valid as the intent of REGDOC 1.1.1 has been satisfied.

Seven updated environmental standards were identified from review of REGDOC 1.1.1 (Table 4-2). An evaluation of these standards identified two containing potential gaps, updated environmental quality guidelines and Canadian Climate Normals. Additionally, subject matter experts identified updated standards that are not referenced in REGDOC 1.1.1 related to updated environmental quality guidelines and species-at-risk listings (Table 4-3). The application of updated environmental quality guidelines to the data presented in the 2009 existing conditions TSDs demonstrated that parameters at most locations were below current guidelines. With very few exceptions, any exceedances of current guidelines also exceeded the previous standard as reported in the 2009 supporting documents. Therefore, application of these updated standards to baseline data, as discussed in Section 4.2, does not alter the original conclusions regarding residual adverse effects of the project or site evaluation.

Review of additional baseline data collected since submission of the 2009 application identified that some baseline conditions had changed. The DNGS IWST spill caused an increase in localized concentrations of tritium in groundwater within the DNGS protected area. Sediment at Coot's and Treefrog ponds had elevated levels of certain parameters. Ecological land classification had changed due to natural community succession and

infrastructure development. New terrestrial SAR species have been observed on site. Additionally, other species that previously existed on the site are now a SAR species. Mitigation and commitments documented in the DNNP Commitments Report [R-13] were developed to reduce, control or eliminate adverse effects. These mitigation and commitments were developed to be adaptable and will be scaled appropriately to address identified changes to baseline as well as to conform to any permitting requirements. All but one change to baseline conditions was adequately addressed by existing commitments. The one exception was the observation of a retainable Butternut tree. Therefore, an update to commitment D-P-3.7 is proposed to include Butternut in site planting plans through the ESA Notice of Activity process for new Butternut.

It was determined that radioactivity documented in the 2009 supporting documents for air, soil, groundwater, surface water, sediment, aquatic and terrestrial communities was similar to current baseline data. Public dose remains essentially unchanged from that reported in the 2009 supporting documents and is less than 1% of regulatory guidelines.

In closing, assessment of the three main licence renewal activity components did not alter the original conclusions regarding residual adverse effects of the project; therefore, the site evaluation remains valid.

Table 7-1: Summary of the Licence Renewal Activity Report – Environment

Environmental Component	Baseline Change	REGDOC 1.1.1 Gap	Updated Code or Standard¹	Revised or Additional Commitment Proposed?	Change to Project Residual Adverse Effects?
Climate, Meteorology and Air Quality	<ul style="list-style-type: none"> Reduction of mean 1-hr and 24-hr ambient nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) concentrations and 24-hr ambient particulate matter (PM_{2.5}) concentrations. 	<ul style="list-style-type: none"> No 	<ul style="list-style-type: none"> Canadian Climate Normals Ontario Ambient Air Quality Criteria (AAQC) Canadian Ambient Air Quality Standards (CAAQS) 	<ul style="list-style-type: none"> No 	<ul style="list-style-type: none"> No
Geology and Hydrogeology	<ul style="list-style-type: none"> No change to baseline conditions described in the 2009 application. 	<ul style="list-style-type: none"> Section C.5.3 - Rate of transfer between aquifers, and capture zones of wells. 	<ul style="list-style-type: none"> MECP Table 3 (Non-potable) groundwater quality guidelines MECP Table 3 (Industrial \ Commercial \ Community) soil quality guidelines CCME Soil Quality Guidelines (SQGs) 	<ul style="list-style-type: none"> No 	<ul style="list-style-type: none"> No
Hydrology, Surface Water and Sediment Quality	<ul style="list-style-type: none"> Surface water exceedance of un-ionized ammonia, total phosphorus, and pH Coot's Pond sediment had higher concentrations of cadmium, nickel, and zinc in exceedance of quality guidelines Treefrog Pond, sediment concentrations of antimony, PHC F3, cadmium and selenium increased. Only cadmium 	<ul style="list-style-type: none"> No 	<ul style="list-style-type: none"> CCME Canadian Water Quality Guidelines (CWQGs) MECP interim Provincial Water Quality Objectives (iPWQO) Health Canada's Guideline for Canadian Drinking Water Quality 	<ul style="list-style-type: none"> No 	<ul style="list-style-type: none"> No

Environmental Component	Baseline Change	REGDOC 1.1.1 Gap	Updated Code or Standard ¹	Revised or Additional Commitment Proposed?	Change to Project Residual Adverse Effects?
	and selenium exceeded quality guidelines				
Aquatic Communities	<ul style="list-style-type: none"> • Within natural variability 	<ul style="list-style-type: none"> • Section C.7.1 - Baseline Aquatic Biota and Habitat • Section C.7.2 - Baseline Food Chain Data • Section G.5.4 - Effect of Thermal Plume on the Aquatic Environment 	<ul style="list-style-type: none"> • Endangered Species Act (ESA) • Species at Risk Act (SARA) 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • No
Terrestrial Communities	<ul style="list-style-type: none"> • 11 ha (34%) increase in wetland habitat in the Site Study Area, 9 ha of which are within the Area of Direct Effects. • Recently identified retainable Butternut tree • Possible decline in dragonfly and damselfly community • Decrease of 10 ha (10%) of migrant butterfly stopover habitat in the Site Study Area • Occurrence of six SAR breeding species: <ul style="list-style-type: none"> • Bank Swallow² • Barn Swallow² 	<ul style="list-style-type: none"> • Section C.6 - description of natural and human-induced pre-existing environmental stresses and the current ecological conditions that indicate such stresses 	<ul style="list-style-type: none"> • Endangered Species Act (ESA) • Species at Risk Act (ESA) 	<ul style="list-style-type: none"> • Addition of Butternut to site planting plans through the ESA Notice of Activity process for new Butternut 	<ul style="list-style-type: none"> • No

Environmental Component	Baseline Change	REGDOC 1.1.1 Gap	Updated Code or Standard ¹	Revised or Additional Commitment Proposed?	Change to Project Residual Adverse Effects?
	<ul style="list-style-type: none"> • Eastern Wood Pewee² • Wood Thrush² • Bobolink² • Eastern Meadowlark² • Decade of data confirming persistence of Bank Swallow colony at DNNP Site Study Area and records of nocturnal roosting at Coot's Pond • Decade of data related to Least Bittern breeding occurrence on site • Occurrence of six migrant SAR bird species: 				

	<ul style="list-style-type: none"> ○ Olive-sided Flycatcher² ○ Common Nighthawk³ ○ Eastern Whip-Poor-Will³ ○ Canada Warbler² ○ Rusty Blackbird³ ○ Least Bittern (previously considered a breeding species. New information indicates also a migrant species at the DNNP Site Study Area) • Occurrence of one breeding SAR turtle species: <ul style="list-style-type: none"> ○ Common Snapping Turtle² • Use of Site Study Area as foraging/roosting habitat for seven species of bats, including three SAR bat species: <ul style="list-style-type: none"> ○ Big Brown Bat ○ Silver-haired Bat ○ Hoary Bat ○ Eastern Red Bat • SAR species <ul style="list-style-type: none"> ○ Little Brown Myotis³ ○ Northern Myotis³ ○ Tri-coloured Bat³ 				
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Environmental Component	Baseline Change	REGDOC 1.1.1 Gap	Updated Code or Standard ¹	Revised or Additional Commitment Proposed?	Change to Project Residual Adverse Effects?
Radiation and Radioactivity	<ul style="list-style-type: none"> • DNGS IWST spill caused an increase in localized concentrations of tritium in groundwater within the DNGS protected area • Sediment K-40 higher at one Lake Ontario location • Sediment Cs-137 higher in Treefrog Pond 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • CSA N288.1 • CSA N288.4 • CSA N288.5 • CSA N288.6 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • No

¹ Updated code or standard since 2009.

² Status change to a species-at-risk since the 2009 application.

³ New species-at-risk records for the DNNP Site Study Area since the 2009 application.

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