ONTARIO POWER GENERATION

Report

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Title:
2021 DARLINGTON NUCLEAR GROUNDWATER MONITORING PROGRAM RESULTS

2021 Darlington Nuclear Groundwater Monitoring Program Results

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Revision Summary

Revision Number	Date	Comments
000	2022-07-12	Initial issue.

Executive Summary

Darlington Nuclear Generating Station (DNGS) has a mature and robust groundwater monitoring program in place to address the following primary objectives:

1. Confirm predominant on-site groundwater flow characteristics at the DNGS site;
2. Monitor changes to on-site groundwater quality to ensure timely detection of inadvertent releases to groundwater; and
3. Ensure that there are no adverse off-site impacts from DNGS groundwater.

In 2021, groundwater samples were collected as per the Sampling and Analysis Plan developed for the site, from a total of 81 sampling locations.

The findings in 2021 with respect to the above objectives are:

1. The predominant shallow groundwater flow patterns at the site remain unchanged in 2021 from historical groundwater flow interpretations. Outside the protected area, groundwater generally flows from the north to the south, towards the Lake. Inside the protected area and in the vicinity of the powerhouse, groundwater flows west and north towards the Forebay. Further south of the powerhouse, groundwater flows towards Lake Ontario.
2. The groundwater data collected from key areas at DNGS indicate that tritium concentrations have remained relatively constant over time, which points to consistent environmental performance. Groundwater monitoring will continue in these areas.
3. In 2021, there were no indications of adverse off-site impacts from constituents in groundwater associated with the DNGS. Tritium concentrations at perimeter groundwater monitoring locations remained very low. Municipal drinking water samples collected from downstream Water Supply Plants as part of the annual Ontario Power Generation DNGS Environmental Monitoring Program were well below the Ontario Drinking Water Quality Standard for tritium of 7,000 Bq/L.

1.0 INTRODUCTION

Ontario Power Generation (OPG), Darlington Nuclear Generating Station (DNGS), has a mature and robust annual groundwater monitoring program in place. The program examines the chemical, radiological, and physical characteristics of the groundwater beneath the site.

The specific objectives of this program are:

1. **Objective 1**: Confirm predominant on-site groundwater flow characteristics at the DNGS site;

2. **Objective 2:** Monitor changes to on-site groundwater quality to ensure timely detection of inadvertent releases to groundwater; and

3. **Objective 3:** Ensure that there are no adverse off-site impacts from DNGS groundwater.

This report presents groundwater data collected at DNGS for the period from January 1st to December 31st, 2021, and the associated interpretation of this data.

2.0 2021 PROGRAM DESIGN

The design of the DNGS groundwater monitoring program is risk-based in nature. The 2021 groundwater Sampling and Analysis Plan (SAP) was developed to meet the three objectives listed above.

The 2021 SAP specified the sampling locations, the frequency of sampling, (e.g. quarterly, annually), and the parameters for analysis.

The methodology used to collect data and subsequently draw conclusions for each objective is discussed in further detail below.

2.1 Objective 1 Methodology

Detailed interpretation of groundwater flow conditions beneath the DNGS was first carried out in 2010. On an annual basis, a set of water levels is collected from specific groundwater monitoring wells across the site such that OPG has a continued and robust understanding of groundwater flow patterns at the site.

In the second quarter of 2021 (Q2 2021), water level readings were collected from select monitoring locations. The data was subsequently used to calculate the groundwater elevation at each monitoring well location and generate groundwater elevation contours, from which horizontal flow directions and gradients were interpreted.

2.2 Objective 2 Methodology

In 2021, groundwater samples were collected from a total of 81 monitoring wells, as shown on Figures 1 and 2. The monitoring wells are distinguished by location: protected area (near the reactor buildings), controlled area (farther away from the reactor buildings but within the fence), and the site perimeter.

Groundwater samples were collected by qualified technicians. Prior to sample collection, each monitoring well was purged to remove standing water, ensuring that groundwater representative of the hydrogeological unit (see Section 3.1) in which the well is installed flowed into the well. Samples collected were predominantly analyzed for tritium. Select samples were analyzed for petroleum hydrocarbons (PHCs) and benzene / toluene / ethylbenzene / xylenes (BTEX). Groundwater samples in 2021 were analyzed for tritium by Bureau Veritas for Q1 to Q4. Groundwater samples were analyzed for conventional parameters by Bureau Veritas for Q1 to Q3, and by ALS for Q4.

The groundwater data generated from the sampling program was subsequently analyzed to either support previous conclusions, identify adverse trends, and/or to demonstrate no adverse off-site impacts.

2.3 Objective 3 Methodology

The sampling of monitoring wells at the site boundary was performed to confirm that there are no adverse off-site impacts from constituents in groundwater associated with the DNGS. The site perimeter wells are shown on Figure 1. The methodology for groundwater collection and analysis, as well as for data evaluation, was the same for the site perimeter wells as what is described above for Objective 2.

Figure 1: 2021 Monitoring Locations – Controlled Area and Site Perimeter Monitoring Wells

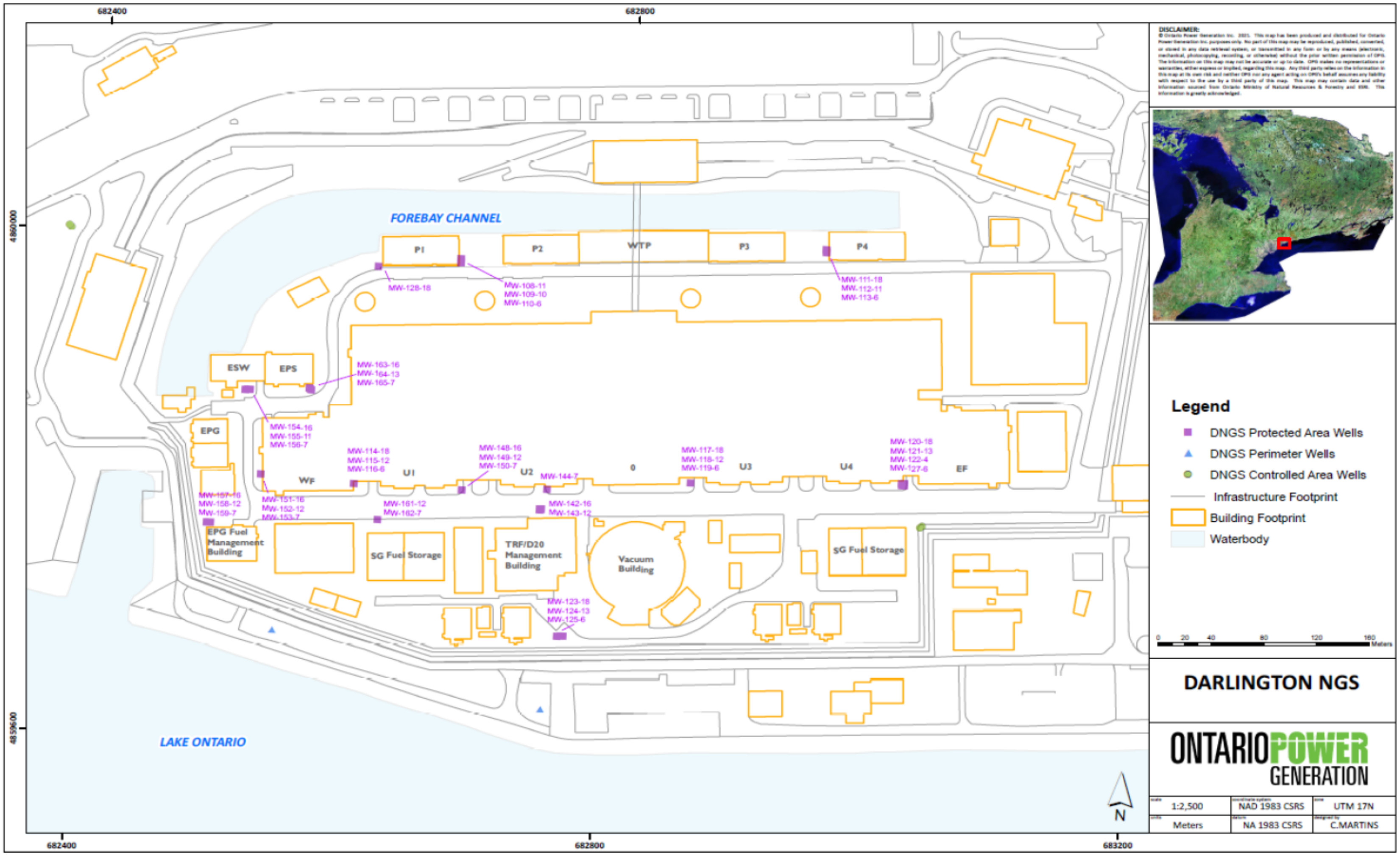


Figure 2: 2021 Monitoring Locations – Protected Area Monitoring Wells

3.0 2021 PROGRAM RESULTS

3.1 Objective 1 Results

The predominant groundwater flow patterns remain unchanged in 2021 from the historical interpretations of groundwater flow conditions.

DNGS's groundwater flow systems are categorized into three hydrostratigraphic units (HU) based on previous hydrogeological investigations:

- Shallow/Water Table (HU 1);
- Interglacial Deposits (HU 2); and
- Shallow Bedrock (HU 5).

Monitoring wells are also installed within the deep bedrock (HU 6) at the DNGS. Groundwater level measurements collected from the wells installed in each HU are used to develop groundwater contour maps, from which flow directions are inferred. Figure 3 shows the inferred groundwater flow directions across the DNGS site at the water table. Within the protected area, groundwater levels vary to a limited extent over space (i.e., are typically within 1 m of each other), and groundwater flow directions are more complex because of the influence of infrastructure, the Forebay intake channel and Lake Ontario. As such, an overall interpretation of groundwater flow directions in that area is shown with the red arrows in Figure 3. The daily average water elevation on May 10,11 and 12, 2021 of 74.7 masl in Lake Ontario was obtained from the International Joint Commission (2022).

The predominant groundwater flow patterns are summarized as follows:

- In general, groundwater on the site flows from north to south, and discharges toward Lake Ontario.
- The eastern half of the DNGS site has a component of groundwater flow directed to the east from the north, and then south towards Lake Ontario.
- General flow in the interglacial deposits HU and the shallow bedrock HU are similar to that of the water table HU described above. From historical assessments, it is understood that vertical groundwater flow is predominantly downward from the water table (shallow groundwater) to interglacial deposits or to shallow bedrock.
- Groundwater flow direction is complex inside the protected area due to anthropogenic subsurface features as detailed below:
    - The powerhouse extends to bedrock and acts as a barrier to groundwater flow; therefore, groundwater flow at the water table on the north side of the powerhouse

may not be connected to or may be poorly connected to groundwater flow at the water table on the south side of the powerhouse.

- Groundwater on the north side of the powerhouse discharges into the Forebay Channel as the Condenser Cooling Water pumps lower the Forebay Channel water level, creating a hydraulic gradient directed to the Forebay Channel.

- On the south side of the powerhouse, groundwater flows from the east to the Forebay Channel; however, a component of that groundwater flow is directed to the lake.

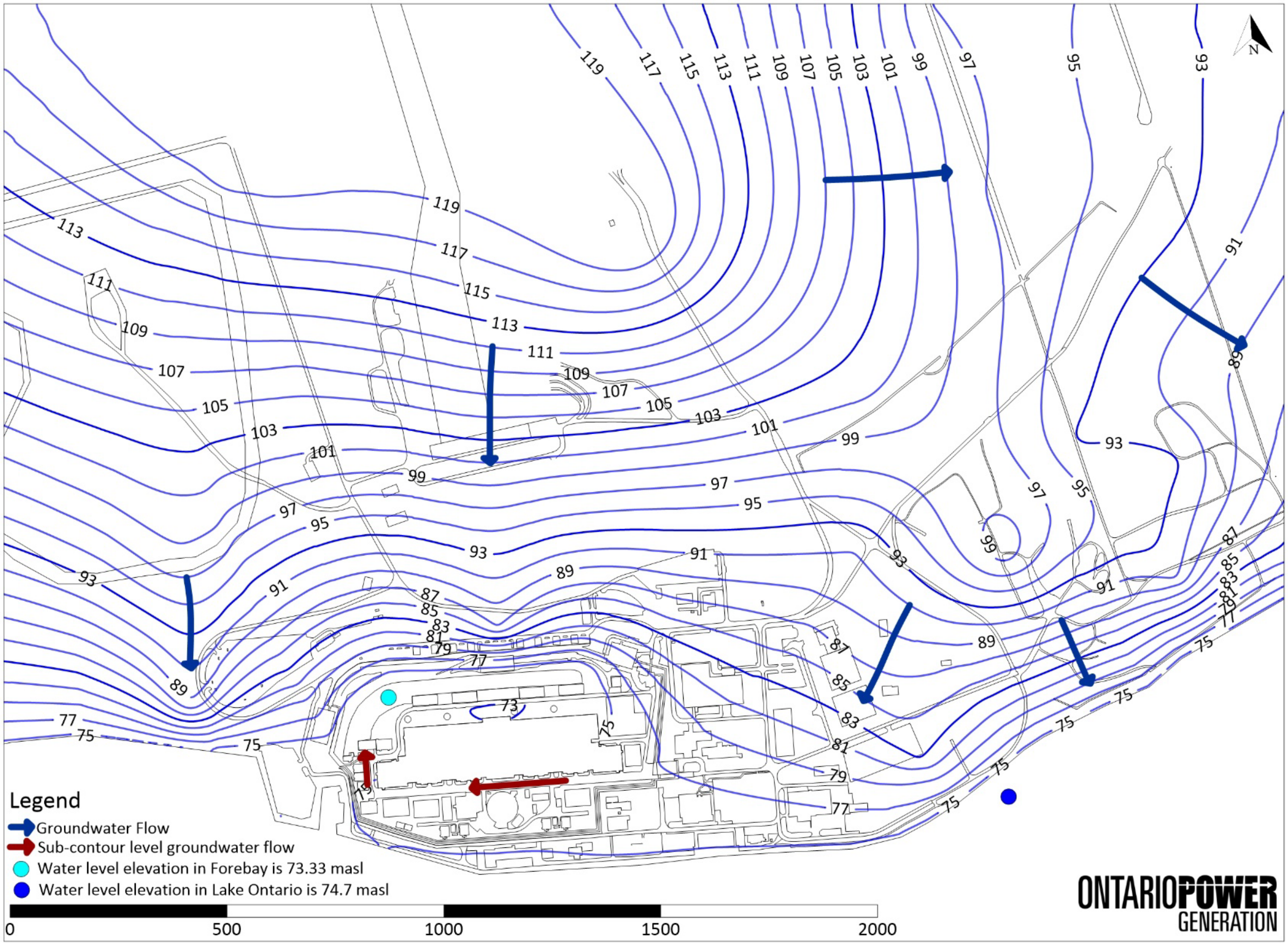


Figure 3: 2021 Inferred Shallow Groundwater (HU 1) Flow Direction

3.2 Objective 2 Results

Within the protected area, and to a lesser extent outside of that, tritium concentrations in groundwater will have a background contribution from tritium air emissions associated with the reactor. Tritium in air emissions enters groundwater through infiltration of wet deposition/precipitation. OPG carried out a program that spanned two years (February 2009 to March 2011) in which tritium was sampled at twelve locations within the protected area (CH2M Hill, 2011). Tritium concentrations showed variability over time and space, as would be expected with changing seasonal weather conditions. The maximum groundwater concentration measured was 1,924 Bq/L. This value is considered to appropriately bound expected background conditions for wells within the protected area.

The groundwater quality data collected from the key areas at DNGS in 2021 indicate that tritium concentrations have remained stable over time, as shown in the graphs provided in this section, which points to consistent environmental performance. Tritium concentrations are within the expected background levels. The groundwater program serves to provide a robust spatial-temporal understanding of tritium behaviour in this area, and across the Site.

3.2.1 Protected Area Groundwater Quality

In 2021, 38 monitoring wells were sampled in the protected area to assess tritium concentrations and temporal behaviour.

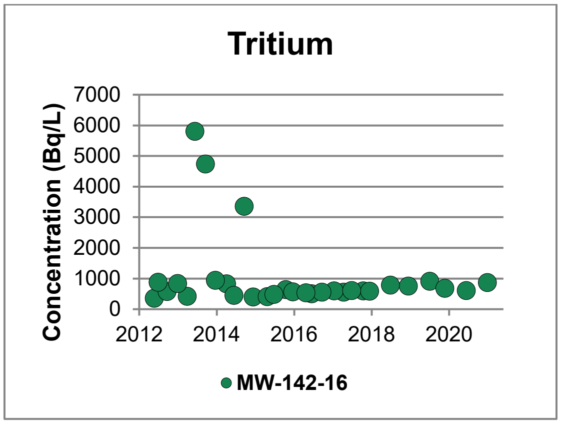
Previously, the presence of elevated tritium in groundwater in the protected area is attributed to the Injection Water Storage Tank (IWST) spill, which occurred southwest of Unit 0 in December 2009. Overall, at these locations, the highest tritium concentrations have declined since the spill, confirming that there are no new sources of tritium in groundwater.

Tritium concentrations across the protected area are discussed in more detail in the following sections. Analytical results for all wells sampled are provided in Table A-1 (Appendix A) and tritium concentrations are summarized on Figure 4 for HU 1, HU 2 and HU 5. For Figure 4, to simplify the presentation of data, and maintain a conservative approach, the annual maximum tritium concentration at each well is presented.

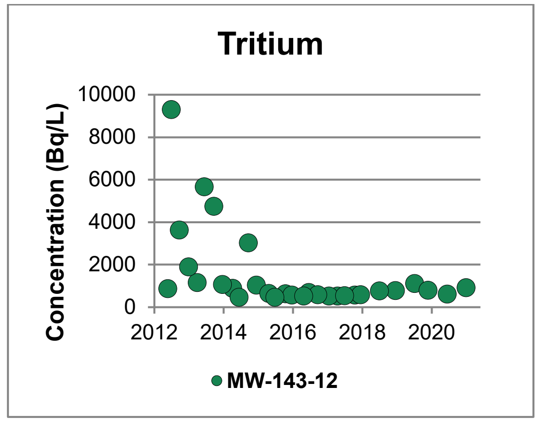
For the ease of discussion, the protected area groundwater results are sub-divided into five smaller areas: Unit 2 (U2) area, West Fueling Facility Auxiliary (WFFA) area, Emergency Power Generator (EPG) Fuel Management Building area, Emergency Power Service (EPS) Building area and the northern side of the powerhouse. The locations of groundwater monitoring wells discussed in the Sections below are shown in the summary Figure 4.

<u>U2 Area</u>

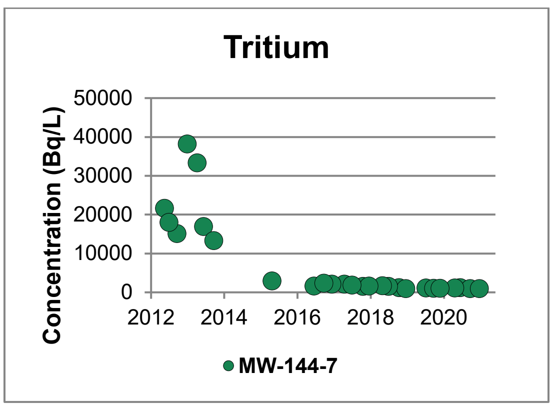
Tritium concentrations at the core of the IWST spill plume, found in the area southwest of Unit 0 and in the vicinity of U2, are declining. In 2021, the highest tritium concentration seen at the monitoring well nest consisting of MW-142-16, MW-143-12 and MW-144-7 was 1,180 Bq/L. The concentrations in these wells have declined to expected background values. Graphs 1 to 3 depict tritium concentrations over time for these monitoring wells.



Graph 1: MW-142-16 Tritium Data



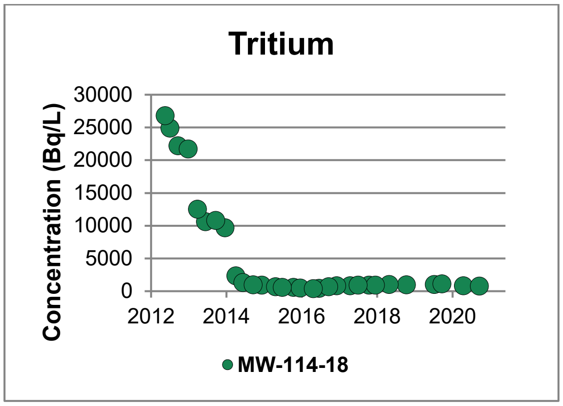
Graph 2: MW-143-12 Tritium Data



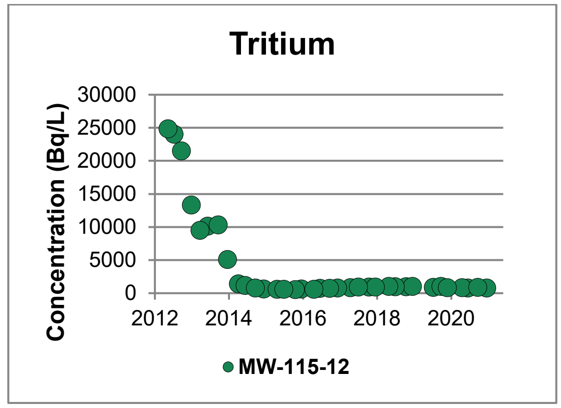
Graph 3: MW-144-7 Tritium Data

WFFA Area

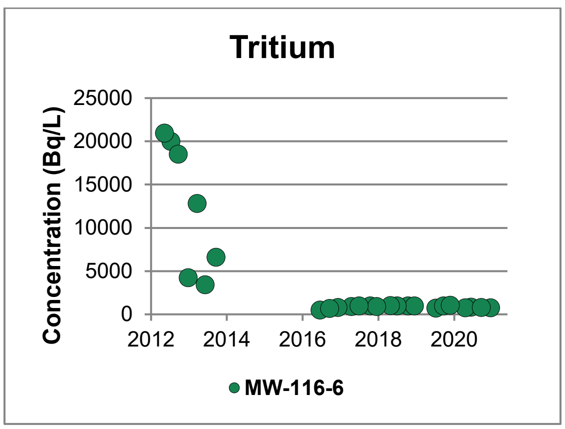
The tritiated groundwater from the IWST spill area has flowed along the southern wall of the powerhouse to the west. The monitoring well cluster consisting of MW-114-18, MW-115-12 and MW-116-6, located in the vicinity of the WFFA, had a maximum tritium concentration of 850 Bq/L in 2021. Tritium concentrations peaked in 2012, decreased to expected background values by 2016, and have remained at that level since (Graphs 4 to 6). A similar behaviour of tritium concentrations has been observed in the monitoring well cluster further west, consisting of MW-151-16 and MW-152-12 (Graphs 7 and 8). Maximum tritium concentrations in those wells were 830 Bq/L in 2021. Monitoring will continue in these areas.



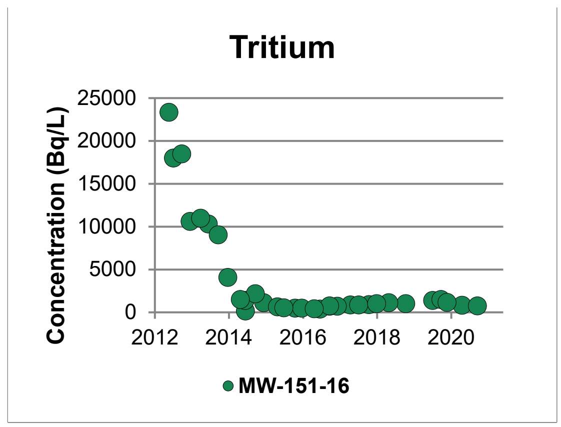
Graph 4: MW-114-18 Tritium Data



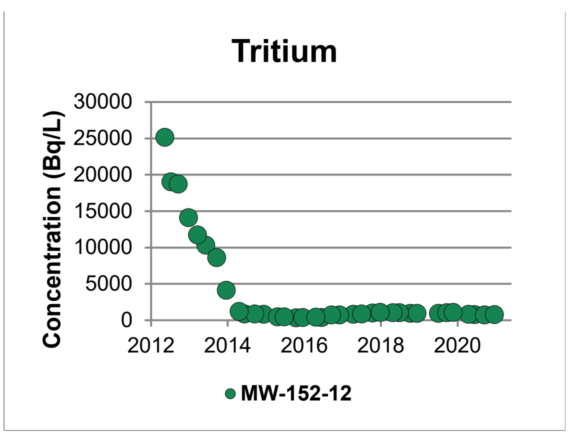
Graph 5: MW-115-12 Tritium Data



Graph 6: MW-116-6 Tritium Data



Graph 7: MW-151-16 Tritium Data



Graph 8: MW-152-12 Tritium Data

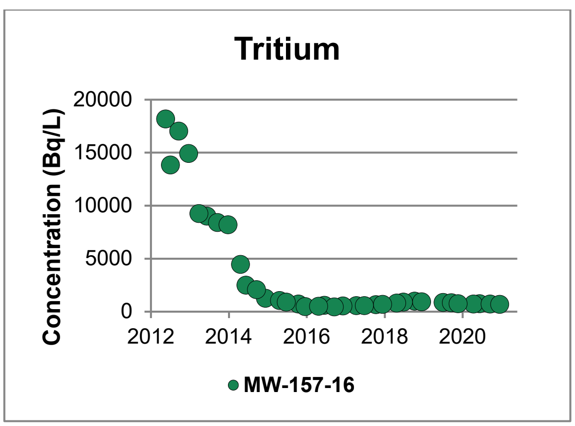
EPG Fuel Management Building Area

A small component of the tritium in groundwater influenced by the IWST spill migrated west towards the EPG area in the upper bedrock.

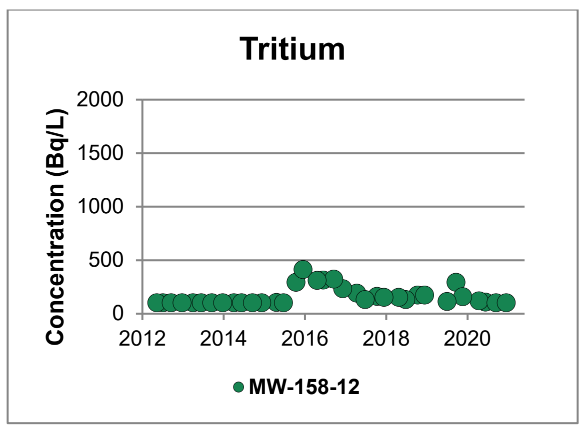
At MW-157-16, which is installed in the upper bedrock, tritium concentrations have decreased in the same manner as in the WFFA area over time (Graph 9). In 2021, the maximum tritium concentration was 720 Bq/L.

There are two shallower wells clustered with MW-157-16. Monitoring well MW-158-12 is installed in the interglacial deposits and tritium has historically been non-detect (< 100 Bq/L). In 2016, there was a slight increase in tritium concentrations at this well, which has been attributed to dewatering activities leading to interactions between groundwater in the bedrock and overburden. In 2021, tritium concentrations were still above the method detection limit in Q1 and Q2 (at a maximum concentration of 118 Bq/L) but have decreased to below detection in Q3 and Q4 (<100 Bq/L). The results are seen in Graph 10.

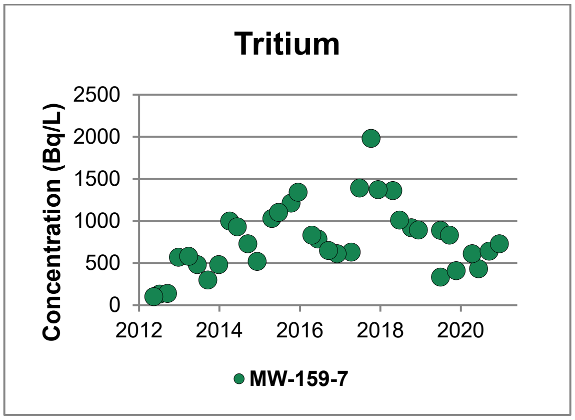
Tritium concentrations in MW-159-7, which is installed in the water table, have shown a decline since higher concentrations were observed in 2016 (Graph 11). In 2021, concentrations ranged from 430 Bq/L to 730 Bq/L.



Graph 9: MW-157-16 Tritium Data



Graph 10: MW-158-12 Tritium Data

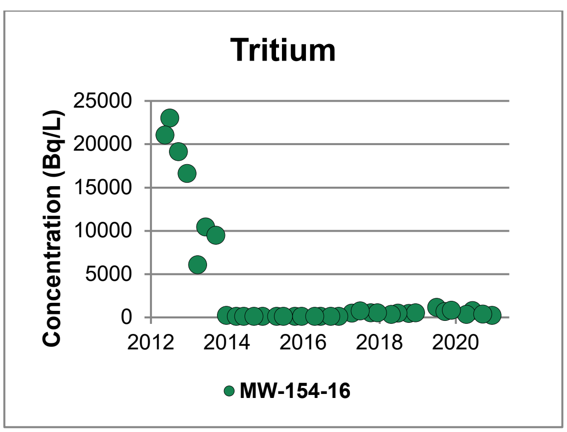


Graph 11: MW-159-7 Tritium Data

EPS Building Area

The majority of the tritium in groundwater from the WFFA area has historically flowed downgradient towards the EPS building area and discharged into the Forebay Channel. Tritium concentrations in groundwater associated with the IWST spill peaked in 2012 at 26,500 Bq/L. Tritium concentrations at MW-154-16 (closest to the Forebay) showed a slight increase. The adjacent shallower wells MW-155-11 and MW-156-7 were not affected by and have not shown influence of the plume since that time. The maximum tritium concentration in 2021 from MW-154-16 was 740 Bq/L and is within expected background values (Graph 12).

The slow discharge of groundwater into the Forebay Channel is diluted by the large inflow of lake water and the Forebay water quality is monitored before it is discharged back to the lake.



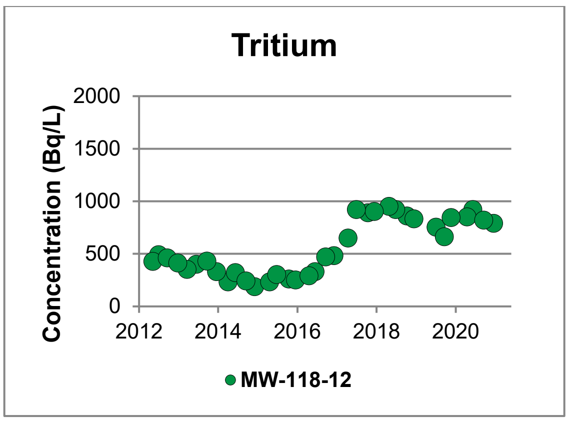
Graph 12: MW-154-16 Tritium Data

Northern Side of Powerhouse

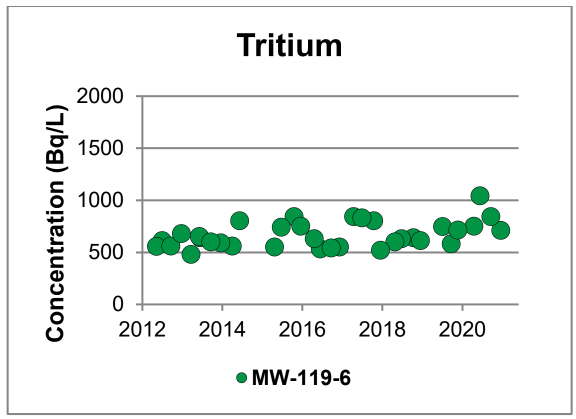
In monitoring wells located on the northern side of the Powerhouse, tritium concentrations ranged from <100 Bq/L to 290 Bq/L in 2021, and are within expected background values.

South of Powerhouse – Units 3 and 4

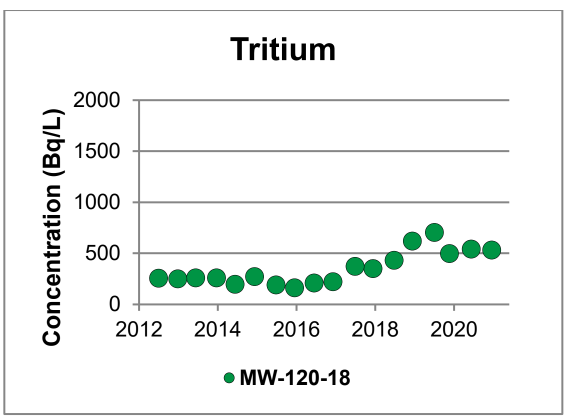
Within the vicinity of Unit 3 and Unit 4, tritium concentrations remain within expected background values. Tritium concentrations in groundwater over time are shown for well clusters MW-118-12 and MW-119-6 (south of the powerhouse near Unit 3) and MW-120-18 MW-121-13, MW-122-4 and MW-127-6 (south of the powerhouse in the area of Unit 4). Graph 13 to Graph 18 display the concentrations of tritium at the above-mentioned monitoring wells.



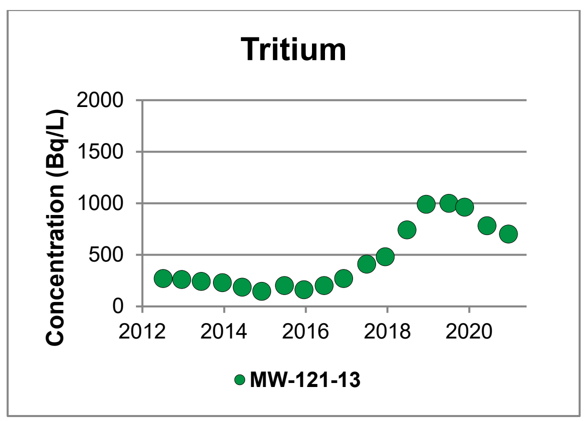
Graph 13: MW-118-12 Tritium Data



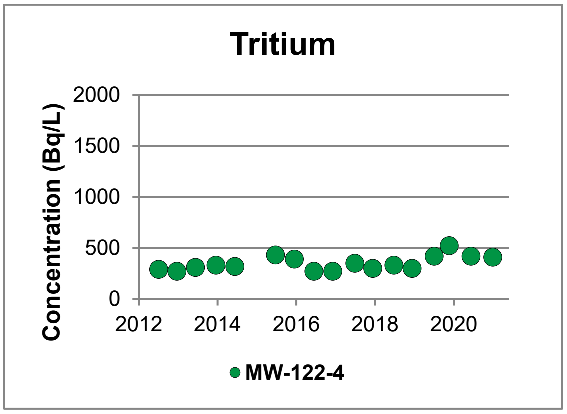
Graph 14: MW-119-6 Tritium Data



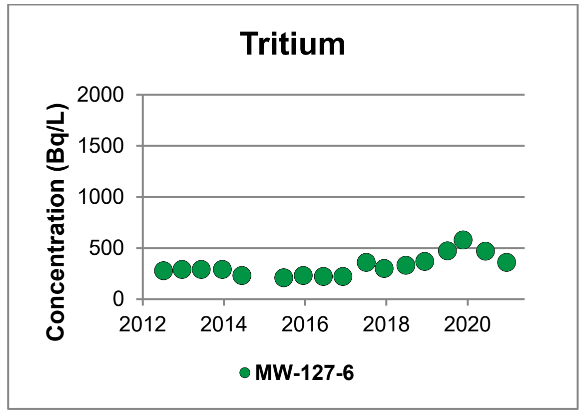
Graph 15: MW-120-18 Tritium Data



Graph 16: MW-121-13 Tritium Data



Graph 17: MW-122-4 Tritium Data



Graph 18: MW-127-6 Tritium Data

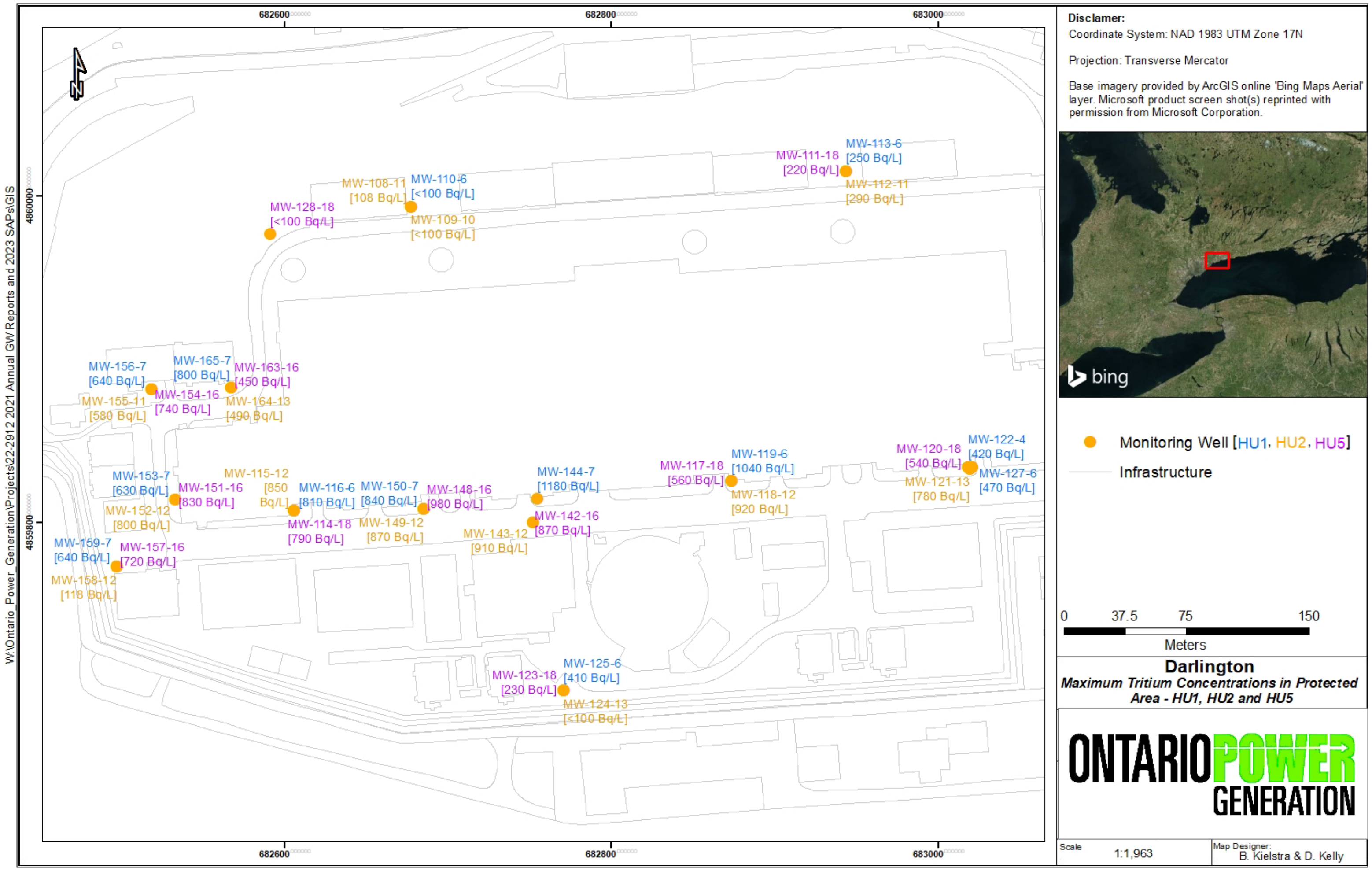


Figure 4: 2021 Maximum Tritium Concentrations in Protected Area - HU 1, HU 2 and HU 5

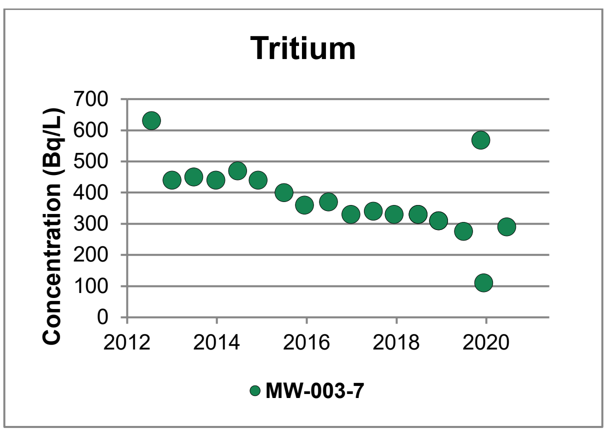
3.2.2 Controlled Area Groundwater Quality

In 2021, 11 monitoring wells were sampled in the controlled area to assess tritium concentrations and trends.

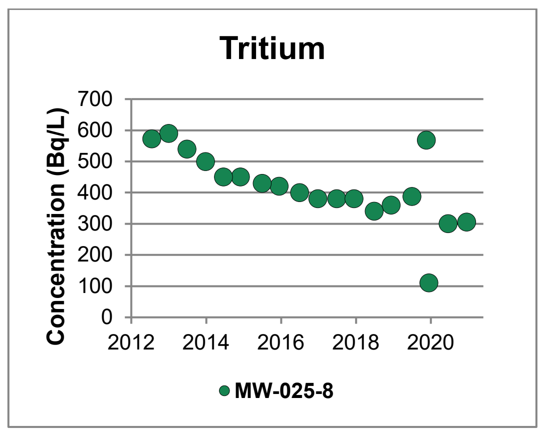
Tritium concentrations in the controlled area wells are within historical ranges for the controlled area.

The presence of tritium at MW-003-7 and MW-025-8 is mainly attributed to a past spill from the building effluent lagoon in 2001. Corrective actions to address this spill were implemented. Groundwater monitoring results indicate that tritium concentrations have been declining (Graphs 19 and 20).

The results are further presented in Table A-2 (Appendix A) and summarized in Figure 5 for HU 1, HU 2 and HU 5. For Figure 8, the annual maximum tritium concentration is presented for each monitoring well cluster.



Graph 19: MW-003-7 Tritium Data



Graph 20: MW-025-8 Tritium Data

3.2.3 Petroleum Hydrocarbons and BTEX in Groundwater

In 2021, groundwater monitoring was conducted in the vicinity or downgradient of the EPG, Standby Generators and the Construction Boilerhouse to detect underground fuel oil piping leaks.

Ten (10) monitoring wells were sampled for PHCs and BTEX and their analytical results were compared to the Ministry of the Environment, Conservation and Parks (MECP) Table 3 Standard: “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act” for 2011, Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition. This comparison was conducted for assessment purposes only, because the standards are used as a best management practice in this case.

In 2021, all sample results met the MECP Table 3 standards for PHCs and BTEX. The majority of results were non-detects.

At MW-143-12, PHC F2 and F3 were detected at concentrations above the standards in 2020. The sample results from Q2 2021 were well below the established standards. This monitoring well is located on a roadway and had shown some exceedances for PHC parameters in past years. This monitoring well was repaired in 2015 due to well integrity issues identified at that time; specifically, MW-143-12 did not appear to have an adequate seal at surface and may have been experiencing some surface water infiltration. The results indicate that concentrations have declined following the repairs.

The analytical results for PHCs and BTEX are presented in Table A-4 (Appendix A)

3.3 Objective 3 Results

In 2021, 30 monitoring wells located at the property boundary were sampled. Additional samples were collected at select wells in Q1.

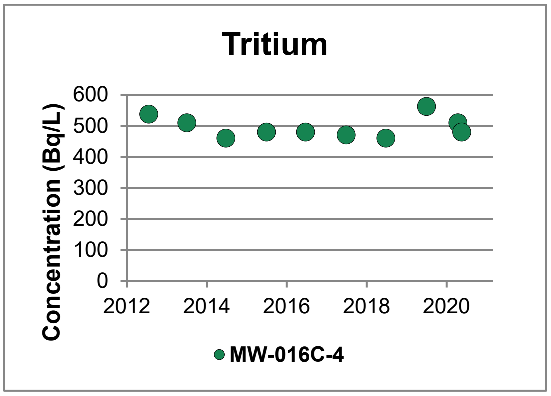
The 2021 results showed that the tritium concentrations in monitoring wells MW-016C-4, MW-033-8 and MW-079-4, all in HU 1, were above the method detection limit, as discussed in the paragraphs below. Overall, low tritium concentrations at site-perimeter locations indicated that there are no adverse off-site impacts from DNGS groundwater.

MW-016C-4, located at the southern perimeter of the station, had tritium concentrations of 510 Bq/L and 480 Bq/L in Q1 and Q2 2021, respectively. Given the proximity to the protected area and that this well monitors shallow groundwater (HU 1), it is expected that the observed concentrations of tritium can be attributed to inputs from atmospheric deposition.

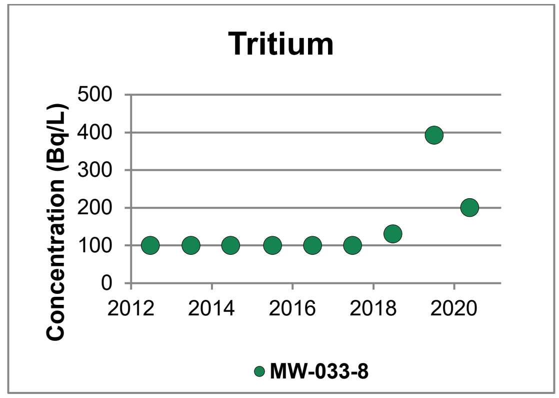
MW-033-8, located at the western perimeter of the station, had a concentration of 200 Bq/L in 2021. MW-079-4, located at the northwest corner of the property, had tritium concentrations of 133 Bq/L in Q1 and less than detection (<100 Bq/L) in Q2 of 2021. These monitoring wells are also screened within the shallow groundwater table, which can be expected to receive tritium inputs from atmospheric deposition.

As part of the annual OPG DNGS Environmental Monitoring Program, municipal drinking water samples are collected from the downstream Water Supply Plants (WSPs). In 2021, the data from this sampling demonstrated that the annual average tritium concentration at each WSP was well below the Ontario Drinking Water Quality Standard (ODWQS) for tritium of 7,000 Bq/L. This further supports that there were no indications of adverse off-site impacts from DNGS groundwater.

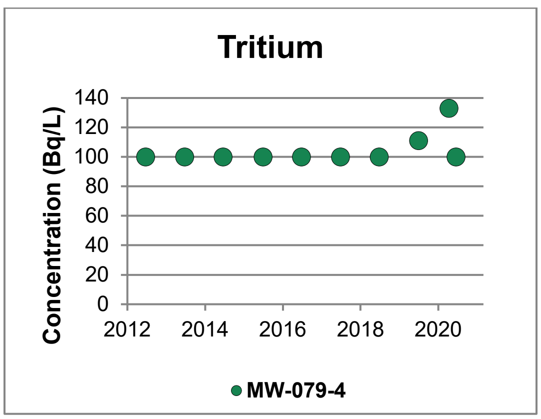
Tritium concentrations in perimeter groundwater monitoring locations are presented Table A-3 (Appendix A) and maximum tritium concentrations in perimeter groundwater monitoring locations are shown in Figures 8 to 10 for HU 1, HU 2 and HU 5, respectively. Graphs 21 to 23 display tritium concentrations over time for the three wells mentioned above.



Graph 21: MW-016C-4 Tritium Data



Graph 22: MW-033-8 Tritium Data



Graph 23: MW-079-4 Tritium Data

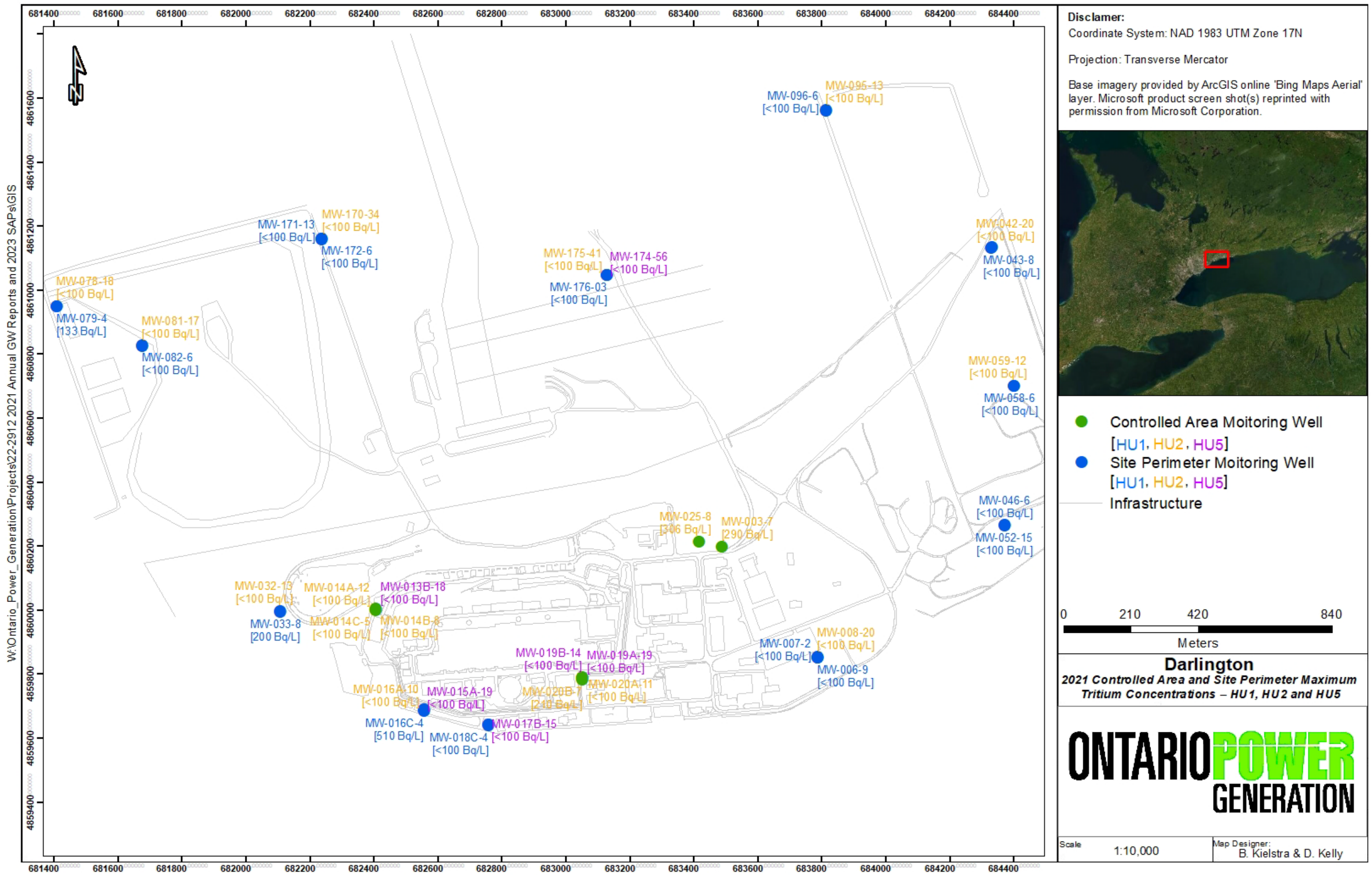


Figure 5: 2021 Controlled Area and Site Perimeter Maximum Tritium Concentrations – HU 1, HU 2 and HU 5

4.0 2021 QUALITY ASSURANCE AND QUALITY CONTROL

The Quality Assurance and Quality Control for the groundwater monitoring program encompasses all activities in field sample collection, laboratory analysis and laboratory quality control. The objective is to provide confidence in the interpretation of the DNGS groundwater monitoring data through a systematic and documented process.

4.1 Quality Assurance Program for Laboratories

ALS is accredited to ISO 17025 by the Standards Council of Canada for environmental tests. Many of the conventional contaminants are governed by criteria established in the MECP's "Guidelines for Use at Contaminated Sites in Ontario" and a companion document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario". ALS has developed their analytical protocols to meet the recommended analytical protocols documented in these publications.

Bureau Veritas is accredited to ISO 17025 by the Standards Council of Canada for environmental tests. Many of the conventional parameters are governed by criteria established in the MECP's "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act". Bureau Veritas has a Quality Assurance Department, which routinely monitors procedures and processes by way of compliance audits, quality system audits and method audits to ensure compliance with accreditation and regulatory requirements. Bureau Veritas is also accredited by the Standards Council of Canada for radiological tests (e.g., tritium concentrations in water).

4.2 Quality Control Results

Duplicates, field blanks, and travel blanks were collected at a prescribed frequency to measure sampling and analytical performance.

In 2021, field duplicate samples were collected from 10 monitoring locations. The 2012 groundwater monitoring program design specifies that a field duplicate must be collected for every 10 samples collected and this requirement was met for the samples outlined in the 2021 SAP. The analytical results and calculated relative percentage differences (RPD) were evaluated to understand the sampling precision. All sample pairs showed a RPD below 20 percent. Therefore, the field technique and the laboratory's analytical methods employed were determined to be reproducible and reliable.

All field blank results were non-detectable. Therefore, no significant contamination of those samples occurred during the sample collection process.

Similarly, all travel blank results were non-detectable as well, indicating that there was no contamination of the samples during handling and transportation.

The QA/QC calculations and results discussed above are presented in Tables A-5 and A-6 (Appendix A).

5.0 SUPPLEMENTARY STUDIES AND AUDITS

There were no supplementary studies related to DNGS groundwater initiated in 2021. There were no audits completed on the DNGS groundwater program in 2021.

6.0 CSA N288.7 UPDATE

OPG has committed to the Canadian Nuclear Safety Commission to be compliant with Canadian Standards Association (CSA) N288.7, "Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills", for the Darlington site by December 31, 2022. A gap analysis was completed in 2017. The documentation to bring the groundwater monitoring program at DN into compliance with the standard is in progress.

7.0 NOMENCLATURE OF SAMPLING LOCATIONS

Sampling Location Type	Identifier	Explanation of Nomenclature
Monitoring Well	MW-*XXX*-*YY*	*XXX* represents a unique identifier *YY* represents the depth of the monitoring well in metres

8.0 ACRONYMS

µCi/kg	Micro curie per Kilogram
Bq/L	Becquerel per Litre
BTEX	Benzene / Toluene / Ethylbenzene / Xylene
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DNGS	Darlington Nuclear Generating Station
EMP	Environmental Monitoring Program
EPG	Emergency Power Generator
EPS	Emergency Power Service
HU	Hydrostratigraphic Unit
IWST	Injection Water Storage Tank
MECP	Ministry of Environment, Conservation and Parks
MW	Monitoring Well
ODWQS	Ontario Drinking Water Quality Standard
OPG	Ontario Power Generation Inc.
PHC	Petroleum Hydrocarbon
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAP	Sampling and Analysis Plan
WFFA	West Fueling Facility Auxiliary
WSP	Water Supply Plant

9.0 REFERENCES

CH2M Hill, 2011. Geological and Hydrogeological Environment Technical Support Document Darlington Nuclear Generating Station Refurbishment and Continued Operation Environmental Assessment. Report No. NK38- REP- 07730–10003. December.

International Joint Commission, 2022. International Lake Ontario-St. Lawrence River Board- Lake Ontario Daily Mean Levels [WWW Document]. Int. Jt. Comm. Int. Lake Ont.-St Lawrence River Board. June.

Appendix A: Tables A-1 to A-6

Table A-1: 2021 DNGS Protected Area Tritium Results

Sample Location Name	Unit s	Q1	Q2	Q3	Q4
0-10140-MW-108-11	Bq/L	---	108	---	100
0-10140-MW-109-10	Bq/L	---	<100	---	<100
0-10140-MW-110-6	Bq/L	<100	<100	<100	<100
0-10140-MW-111-18	Bq/L	---	118	---	220
0-10140-MW-112-11	Bq/L	---	220	---	290
0-10140-MW-113-6	Bq/L	---	170	---	250
0-10140-MW-114-18	Bq/L	790	---	750	---
0-10140-MW-115-12	Bq/L	830	750	850	780
0-10140-MW-116-6	Bq/L	770	810	780	770
0-10140-MW-117-18	Bq/L	560	---	310	---
0-10140-MW-118-12	Bq/L	850	920	820	790
0-10140-MW-119-6	Bq/L	750	1,040	840	710
0-10140-MW-120-18	Bq/L	---	540	---	530
0-10140-MW-121-13	Bq/L	---	780	---	700
0-10140-MW-122-4	Bq/L	---	420	---	410
0-10140-MW-123-18	Bq/L	230	210	220	220
0-10140-MW-124-13	Bq/L	<100	<100	<100	<100
0-10140-MW-125-6	Bq/L	250	250	410	370
0-10140-MW-127-6	Bq/L	---	470	---	360
0-10140-MW-128-18	Bq/L	---	<100	---	<100
0-10140-MW-142-16	Bq/L	---	610	---	870
0-10140-MW-143-12	Bq/L	---	620	---	910
0-10140-MW-144-7	Bq/L	1,160	1,180	940	950
0-10140-MW-148-16	Bq/L	NA	980	NA	---
0-10140-MW-149-12	Bq/L	700	770	790	870
0-10140-MW-150-7	Bq/L	740	670	750	840
0-10140-MW-151-16	Bq/L	830	---	750	---
0-10140-MW-152-12	Bq/L	800	780	720	760
0-10140-MW-153-7	Bq/L	520	630	660	600
0-10140-MW-154-17	Bq/L	330	740	350	210
0-10140-MW-155-11	Bq/L	580	550	530	510
0-10140-MW-156-7	Bq/L	490	620	740	640
0-10140-MW-157-16	Bq/L	710	720	690	670
0-10140-MW-158-12	Bq/L	118	105	<100	<100
0-10140-MW-159-7	Bq/L	610	430	640	730
0-10140-MW-163-16	Bq/L	<100	450	<100	<100
0-10140-MW-164-13	Bq/L	160	490	290	290
0-10140-MW-165-7	Bq/L	800	770	740	740

Notes:
NA denotes that sample could not be collected and the result is not available
--- denotes that samples were not required
< denotes that result is below the laboratory method detection limit

Table A-2: 2021 DNGS Controlled Area Tritium Results

Sample Location Name	Units	Q1	Q2	Q3	Q4
0-10140-MW-003-7	Bq/L	---	290	---	276
0-10140-MW-013B-18	Bq/L	---	<100	---	<100
0-10140-MW-014A-12	Bq/L	---	<100	---	<100
0-10140-MW-014B-8	Bq/L	---	<100	---	<100
0-10140-MW-014C-5	Bq/L	---	<100	---	<100
0-10140-MW-019A-19	Bq/L	---	<100	---	<100
0-10140-MW-019B-14	Bq/L	---	***	---	<100
0-10140-MW-020A-11	Bq/L	---	<100	---	<100
0-10140-MW-020B-7	Bq/L	---	210	---	190
0-10140-MW-020C-3	Bq/L	---	180	---	240
0-10140-MW-025-8	Bq/L	---	300	---	306

Notes:
--- denotes that samples were not required
< denotes that result is below the laboratory method detection limit
*** denotes dry well

Table A-3: 2021 DNGS Perimeter Tritium Results

Sample Location Name	Units	Q1	Q2	Q3	Q4
0-10140-MW-006-9	Bq/L	<100	<100	---	---
0-10140-MW-007-2	Bq/L	<100	<100	---	---
0-10140-MW-008-20	Bq/L	<100	<100	---	---
0-10140-MW-015A-19	Bq/L	<100	<100	---	---
0-10140-MW-016C-4	Bq/L	510	480	---	---
0-10140-MW-016A-10	Bq/L	<100	<100	---	---
0-10140-MW-017B-15	Bq/L	---	<100	---	---
0-10140-MW-018C-4	Bq/L	---	<100	---	---
0-10140-MW-018A-11	Bq/L	---	<100	---	---
0-10140-MW-032-13	Bq/L	---	<100	---	---
0-10140-MW-033-8	Bq/L	---	200	---	---
0-10140-MW-042-20	Bq/L	---	<100	---	---
0-10140-MW-043-8	Bq/L	---	<100	---	---
0-10140-MW-045-10	Bq/L	---	<100	---	---
0-10140-MW-046-6	Bq/L	---	<100	---	---
0-10140-MW-052-15	Bq/L	---	<100	---	---
0-10140-MW-058-6	Bq/L	---	<100	---	---
0-10140-MW-059-12	Bq/L	---	<100	---	---
0-10140-MW-078-18	Bq/L	<100	<100	---	---
0-10140-MW-079-4	Bq/L	133	<100	---	---
0-10140-MW-081-17	Bq/L	---	<100	---	---
0-10140-MW-082-5	Bq/L	---	<100	---	---
0-10140-MW-095-13	Bq/L	<100	<100	---	---
0-10140-MW-096-6	Bq/L	<100	<100	---	---
0-10140-MW-170-34	Bq/L	---	<100	---	---
0-10140-MW-171-13	Bq/L	---	<100	---	---
0-10140-MW-172-6	Bq/L	---	<100	---	---
0-10140-MW-174-56	Bq/L	---	<100	---	---
0-10140-MW-175-41	Bq/L	---	<100	---	---
0-10140-MW-176-3	Bq/L	---	<100	---	---

Notes:
--- denotes that samples were not required
< denotes that result is below the laboratory method detection limit

Table A-4: 2021 DNGS BTEX and Petroleum Hydrocarbon Results

Parameter	Units	MECP Table 3 Standard	0-10140-MW-110-6				0-10140-MW-020A-11	0-10140-MW-020B-7	0-10140-MW-020C-3
			Q1	Q2	Q3	Q4	Q2		
Benzene	Bq/L	44	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
Toluene	Bq/L	18,000	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
Ethylbenzene	Bq/L	2,300	<0.2	<0.2	<0.2	<0.5	<0.2	<0.2	<0.2
o-Xylene	Bq/L	--	<0.2	<0.2	<0.2	<0.3	<0.2	<0.2	<0.2
p+m-Xylene	Bq/L	--	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	Bq/L	4,200	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
F1 (C6-C10) - BTEX	Bq/L	750	<25	<25	<25	<25	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	Bq/L	150	<100	<100	<100	<100	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	Bq/L	500	<200	<200	<200	<200	<200	<200	<200
F4 (C34-C50 Hydrocarbons)	Bq/L	500	<200	<200	<200	< 200	<200	<200	<200

Parameter	Units	MECP Table 3 Standard	0-10140-MW-143-12	0-10140-MW-144-7	0-10140-MW-158-12	0-10140-MW-159-7	0-10140-MW-161-12	0-10140-MW-162-7
			Q2					
Benzene	Bq/L	44	<0.2	<0.2	0.62	<0.2	<0.2	<0.2
Toluene	Bq/L	18,000	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	Bq/L	2,300	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o-Xylene	Bq/L	--	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p+m-Xylene	Bq/L	--	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Total Xylenes	Bq/L	4,200	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
F1 (C6-C10) - BTEX	Bq/L	750	300	<25	<25	<25	<25	<25
F2 (C10-C16 Hydrocarbons)	Bq/L	150	<100	<100	<100	<100	<100	<100
F3 (C16-C34 Hydrocarbons)	Bq/L	500	<200	<200	<200	<200	<200	<200
F4 (C34-C50 Hydrocarbons)	Bq/L	500	<200	<200	<200	<200	<200	<200

Note:
< denotes that result is below the laboratory method detection limit

Table A-5: 2021 DNGS Quality Control Results - Blanks

QA/QC Sample Type	Parameter	Sample Result (µg/L)	
		Q2 (12-May-21)[1]	Q2 (22-Apr-21)[2]
Field Blank	Benzene	<0.2	<0.2
	Toluene	<0.2	<0.2
	Ethylbenzene	<0.2	<0.2
	o-Xylene	<0.2	<0.2
	p+m-Xylene	<0.4	<0.4
	Total Xylenes	<0.4	<0.4
	F1 (C6-C10) - BTEX	<25	--
Trip Blank	Benzene	<0.2	<0.2
	Toluene	<0.2	<0.2
	Ethylbenzene	<0.2	<0.2
	o-Xylene	<0.2	<0.2
	p+m-Xylene	<0.4	<0.4
	Total Xylenes	<0.4	<0.4
	F1 (C6-C10) - BTEX	<25	--

Notes:

< denotes that result is below the laboratory method detection limit

1 – Field blank collected near the vicinity of 0-10140-MW-159-7

2 – Field blank collected near the vicinity of 0-10140-MW-020-11

Table A- 6: 2021 DNGS Quality Control Results – Duplicates

Sample Location	Sample Date	Parameter	Units	Results		RPD (%)
				Field Duplicate	Regular Sample	
MW-079-4	20-May-2021	H3	Bq/L	<100	<100	0.0
MW-111-18	11-May-2021	H3	Bq/L	<100	118	16.5
	16-Nov-2021	H3	Bq/L	190	220	14.6
MW-118-12	18-Mar-2021	H3	Bq/L	870	850	2.3
	11-May-2021	H3	Bq/L	920	920	0.0
	19-Aug-2021	H3	Bq/L	880	820	0.0
	18-Nov-2021	H3	Bq/L	760	790	3.9
MW-121-13	11-May-2021	H3	Bq/L	780	780	0.0
	18-Nov-2021	H3	Bq/L	680	700	2.9
MW-149-12	17-Mar-2021	H3	Bq/L	760	700	0.0
	14-May-2021	H3	Bq/L	750	770	2.6
	18-Aug-2021	H3	Bq/L	790	790	0.0
	17-Nov-2021	H3	Bq/L	820	870	5.9
MW-151-16	17-Mar-2021	H3	Bq/L	820	830	1.2
	18-Aug-2021	H3	Bq/L	780	750	3.9
MW-171-13	20-Apr-2021	H3	Bq/L	<100	<100	0.0
MW-175-41	20-Apr-2021	H3	Bq/L	<100	<100	0.0
MW-143-12	13-May-2021	PHC F2 (C10-C16)	µg/L	<100	<100	0.0
	13-May-2021	PHC F3 (C16-C34)	µg/L	<200	<200	0.0
	13-May-2021	PHC F4 (C34-C50)	µg/L	<200	<200	0.0
MW-162-7	13-May-2021	Benzene	µg/L	<0.2	<0.2	0.0
	13-May-2021	Ethylbenzene	µg/L	<0.2	<0.2	0.0
	13-May-2021	Toluene	µg/L	<0.2	<0.2	0.0
	13-May-2021	Total xylenes	µg/L	<0.4	<0.4	0.0
	13-May-2021	PHC F1 (C6-C10)	µg/L	<25	<25	0.0
	13-May-2021	PHC F2 (C10-C16)	µg/L	<100	<100	0.0
	13-May-2021	PHC F3 (C16-C34)	µg/L	<200	<200	0.0
	13-May-2021	PHC F4 (C34-C50)	µg/L	<200	<200	0.0

Notes:
< denotes that result is below the laboratory method detection limit