

Final Groundwater Protection and Well Monitoring Plan

Highway 400 – Highway 404 Link (Bradford Bypass)

Ontario Ministry of Transportation

60636190

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Ontario Ministry of Transportation

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1. Overview of Undertaking

1.1 **Project Overview**

The Ontario Ministry of Transportation (the Ministry) has retained AECOM Canada Ltd. (AECOM) to undertake a Preliminary Design and project-specific assessment of environmental impacts for the proposed Highway 400 – Highway 404 Link (Bradford Bypass). The Bradford Bypass (the project) is being assessed in accordance with Ontario Regulation 697/21 (the Regulation).

The Bradford Bypass is part of Ontario's plan to expand highways and public transit across the Greater Golden Horseshoe to fight congestion, create jobs and prepare for the massive population growth expected in the next 30 years. Simcoe County's population is expected to increase to 416,000 by 2031, with the Regional Municipality of York growing to 1.79 million by 2041. The Bradford Bypass has been proposed as a response to this dramatic growth in population and travel demand in the area and the forecasted increase in congestion on key roadways linking Highway 400 to Highway 404.

The project is a new 16.3 kilometre, controlled access freeway. The proposed highway will extend from Highway 400 between 8th Line and 9th Line in Bradford West Gwillimbury, will cross a small portion of King Township, and will connect to Highway 404 between Queensville Sideroad and Holborn Road in East Gwillimbury. There are proposed full and partial interchanges, as well as grade separated crossings at intersecting municipal roads and watercourses, including the Holland River and Holland River East Branch. This project also includes the design integration for the replacement of the 9th Line structure on Highway 400, which will accommodate the proposed future ramps north of the Bradford Bypass corridor. The Ministry is considering an interim four-lane configuration and an ultimate eight-lane design for the Bradford Bypass. The interim condition will include two general purpose lanes in each direction and the ultimate condition will include four lanes in each direction (one high-occupancy vehicle lane and three general purpose travel lanes in each direction). The interim and ultimate designs are being reviewed as the project progresses. Should the footprint change or be modified in any way, a review of the changes shall be undertaken, and this plan will be updated to reflect the changes, impacts, mitigation measures, and any commitments to future work.

This *Groundwater Protection and Well Monitoring Plan* was prepared for MTO in support of the Highway 400 – Highway 404 Link (Bradford Bypass) Project (the project) for the purpose of determining possible impacted local water wells, environmental features that are potentially within the active dewatering zone and recommending appropriate monitoring and/or mitigation measures, as required. This plan also details the water well survey program that shall be initiated before, during and after the project construction. This plan was prepared in accordance with the requirements of O. Reg. 697/21, Section 23. It is recommended that this plan be updated based on the dewatering assessment that will be completed during Detail Design of the project.

1.2 Study Area

The proposed Bradford Bypass is a new 16.3 kilometre, controlled access freeway. As illustrated in **Figure 1**, the proposed highway will extend from Highway 400 between 8th Line and 9th Line in Bradford West Gwillimbury, will cross a small portion of King Township, and will connect to Highway 404 between Queensville Sideroad and Holborn Road in East Gwillimbury. There are proposed full and partial interchanges, as well as grade separation crossings at intersecting municipal roads and watercourses, including the Holland River and Holland River East Branch. As noted in the *Hydrogeology Data Report* (AECOM, 2023A), monitoring is ongoing related to the assessment of the thirteen existing groundwater monitoring wells installed as part of this project. It is expected that all monitoring wells installed by WSP/Golder will be assessed and monitored during Detail Design, including if the monitoring wells are sufficient to represent the depths of excavation required. All preliminary geological and hydrogeological information related to the Study Area is found in the *Hydrogeology Data Report* (AECOM, 2023A).

1.3 Data Review

The following background information and reports were reviewed as part of this plan preparation:

- Hydrogeological Data Report Highway 400 to Highway 404 Link (Bradford Bypass) (GWP 2008-21-00) by AECOM Canada Ltd, 2023
- Door To Door Water Well Report Highway 400 to Highway 404 Link (Bradford Bypass) (GWP 2008-21-00) by AECOM Canada Ltd, 2023; and
- Ministry of the Environment, Conservation and Parks (MECPs) Water Well Information System (WWIS) Records and Permit to Take Water/ Environmental Activity and Sector Registry (PTTW/EASR) database.

2. Groundwater Protection Plan

Groundwater protection in the context of the project construction program is considered to include issues related to potential groundwater interference (changes in groundwater levels) and potential effects on groundwater quality.

This Final Groundwater Protection and Well Monitoring Plan is structured to provide an overview of groundwater protection plan issues, discuss specific recommended monitoring requirements, permit requirements and contingency planning including mitigation measures to be carried out during the subsequent Detail Design and construction phases of the project.

2.1 Groundwater Interference Overview

AECOM has completed an initial assessment of the groundwater and surficial soils within the Study Area and documented the review in the Highway 400 to Highway 404 Link (Bradford Bypass) Hydrogeological Data Report (AECOM, 2023a), however, a detailed groundwater interference assessment cannot be completed until the freeway alignment is finalized during the subsequent Detail Design phase. All groundwater plans shall assume the potential for groundwater interference to be limited to those areas where the deeper road alignment (trenches, ditches, and bridge support structures) will cut 1 m to 15 m into the subsurface locally and will extend below the existing groundwater table. In these excavations, a silt and silty clay glacial lacustrine deposit with silt sand seams, areas of sand and gravel or peat may be encountered depending on the area of excavation and require dewatering that would result in the lowering of the surrounding shallow groundwater level. Groundwater interference is considered to result when water levels in the adjacent residential domestic water wells are lowered by the dewatering process typically undertaken during construction activities to a point that adversely affects the residential water supply.

In the case of this project, potential well interference is anticipated to most likely be limited to shallow drilled or dug wells completed at similar depths to the respective excavation and dewatering depths. These water supply wells could potentially experience lowering of the water levels where they access permeable shallow surficial soils that are under active dewatering. The potential radius of influence (ROI) from the project needs to be determined during the subsequent Detail Design dewatering assessments for each excavation that extends below the water table.

The radius of influence is equivalent to the radial distance away from a trench at which dewatering no longer causes temporary water table drawdown. The radius of influence at the dewatering locations is to be calculated using Sichardt's approach (Sichardt and Kryieleis, 1930), assuming radial flow to a well:

$$\mathbf{R} = \mathbf{C} \left(\mathbf{H} - \mathbf{h}\right) \sqrt{\mathbf{k}}$$

Where: R = radius of influence (m)

- C = is a factor between 1500 and 2000 for line flow to trenches; the average value 1750 was used for the calculations of this assessment
- H = pre-construction saturated aquifer thickness (m)
- h = aquifer saturated thickness during dewatering (m)
- k = hydraulic conductivity in m/sec

The pre-construction saturated aquifer thickness value is to be estimated using the inferred water table elevation and the estimated elevation of the aquifer base (aquitard). The calculated radius of influence at each dewatering location shall be summarized and reported on by the subsequent Detail Design designer.

Deep wells completed in the deeper surficial soils (15 m or deeper) which represent the majority of drilled domestic water wells within the Study Area are not anticipated to experience any significant interference from dewatering

related to the project. However, if it is determined during subsequent Detail Design that such a potential exists, measures to address this issue shall be considered.

Based on a review of nearby domestic water wells (**Figure 2**), within the Study Area there are potentially 260 domestic, livestock, commercial, industrial, or public water supply wells within the Study Area that could be affected.

2.2 Groundwater Quality Overview

There are two primary groundwater quality effects related to the project construction/road operation. The first is potential spills during construction and the second is the long-term operation of the road. Groundwater quality issues can potentially affect down-gradient shallow domestic water wells and/or surrounding wetland environments.

2.2.1 **Potential Construction Effects and Proposed Mitigation Measures**

The risk of spills during construction of the project will be primarily limited to petroleum products from machinery (fuels and lubricants). The use of best management practices for handling of hydrocarbons according to the Ministry of Environment, Conservation and Parks (MECP) and the Technical Standards and Safety Authority (TSSA) of the Ministry of Government Services will reduce the potential of environmental adverse effects associated with petroleum product handling and uses. Spillage of petroleum products must be immediately remediated according to these standards such that groundwater quality is not impacted.

2.2.2 Operational Effects and Proposed Mitigation

Longer-term effects of roadway operation on groundwater quality are typically associated with spillage associated with accidents that must be directly remediated, and the long-term use of road salt. Road salt dissolves in highway runoff and can then infiltrate into the underlying groundwater system from the roadside ditching. Where the ditching is constructed in low permeability glacial till soils, the potential influence is considered to be small. However, where the directly underlying soils are permeable (sand, sand and gravel), the influences of infiltration by salt-laden water may be more pronounced. The effect of road salt can result in the direct increase of shallow groundwater salinity, or in the case of deeper wells, an increase in water hardness over time. The susceptibility of the soils to infiltration is reflected by the Highly Vulnerable Aquifers (HVA) designation areas along the entire project construction area shown in **Figure 5**. Any runoff and dewatering discharge shall be directed away from these areas unless they meet the Provincial Water Quality Objectives (PWQO).

Mitigation plans shall be generated in Detail Design for any excavation and structure construction with areas of medium to high significant groundwater recharge areas (SGRA) as shown near the Holland River and Holland River East Branch as shown in **Figure 3**. Dewatering discharge shall be directed away from Well Head Protection (WHPA) areas if excavation and dewatering activities are occurring within them, as shown in **Figure 3**.

Based on AECOM's understanding of the regional hydrogeology, the potential effect of road salt runoff from the highway on the shallow groundwater system and shallow surficial materials is considered high. These areas of high aquifer vulnerability could potentially be impacted by saline runoff. As such, berms around the excavated areas are required during dewatering to limit runoff. Additional mitigation measures are identified in the Preliminary Design Stormwater Management Plan (AECOM, 2022C), which is recommended to be consulted during review of this plan in Detail Design.

2.2.3 Site Mitigation Measures

In addition to the mitigation measures listed above, the following mitigation measures shall be considered during the subsequent Detail Design phase of the project, and implemented where appropriate:

- Tilling of soils in non-vegetated areas prior to restoration to re-establish infiltration along access roads, storage areas, or other well-traveled areas where soil compaction has occurred in areas that previously permitted infiltration
- Backfilling of excavations that intercept existing groundwater flow with porous granular material to maintain existing groundwater linkage, particularly within wetland areas
- Well abandonment will be carried out in compliance with O. Reg. 903 Wells (as amended).

3. Dewatering Discharge

3.1 General Information – Return of Dewatering Water to the Natural Environment

Per initial data gathered during the Preliminary Design assignment, several inorganic/metal parameters exceeded the Provincial Water Quality Objectives (PWQO) in the groundwater samples collected from groundwater monitoring wells in the vicinity of the proposed groundwater taking locations.

A pre-construction groundwater sampling program shall be conducted for the groundwater monitoring wells located in the vicinity of the proposed dewatering locations (at least one well at one dewatering location) to confirm the groundwater quality in the areas. The collected groundwater samples must be analyzed for general inorganic parameters (including total suspended solids (TSS) and turbidity), metals, volatile organic compounds (VOCs), F1 to F4 petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene. Based on the pre-construction groundwater analytical results, there will be two anticipated options:

Option 1:

If the concentrations of the analyzed parameters in dewatering groundwater have been confirmed to be above the applicable standards (i.e., sewer by-law or PWQO), the groundwater needs to be pre-treated prior to being re-used or discharged to the municipal sewer system or nearby drainage ditch. Onsite groundwater treatment may require operating a mobile groundwater treatment unit. The mobile groundwater treatment unit usually consists of a series of containers/tanks containing different types of treatment media, which are customized to remove specific contaminants identified in the groundwater.

If the desired groundwater quality could not be met through the treatment processes, the collected water must be disposed properly off-site at an MECP approved facility by the Contractor.

Option 2:

If the treated groundwater meets the PWQO, the groundwater is recommended to be re-used on site for construction purposes (i.e., dust control etc.) as a water conservation measure. The excess groundwater may be discharged to the municipal sewer system or nearby drainage ditch. Erosion and sediment control measures and a groundwater monitoring program will be developed and implemented to ensure the environmental quality of the water discharged, both chemical parameters and physical parameters, meet the municipal sewer by-law (if discharged to the sewer), or the PWQO (if discharged to the natural environment), and the requirements provided in Ontario Regulation 387/04 and Ontario Regulation 63/16.

Deliverables:

A Construction Dewatering Plan (Water Discharge/Management) shall be prepared, as well as an Erosion and Sediment Control Plan and a Groundwater Quality Monitoring Program. The Construction Dewatering Plan, which shall include details on where and when all groundwater is obtained, stored, transferred, used and returned to the environment (if applicable) and the proper decommissioning of the dewatering wells upon the completion of the construction, must be implemented prior to the discharge to the natural environment. These three reports shall be prepared during Detail Design prior to the commencement of the dewatering activities and submitted to MECP when finalizing the draft permit to take water (if one is determined to be required during subsequent Detail Design and construction phases).

The preferable discharging method for the dewatering groundwater is to the municipal sewer system in the vicinity of the study area if one exists. However, given the nature of the study area, opportunities to connect to municipal sewer systems may be limited and challenging.

3.2 Dewatering Discharge in the Town of Bradford West Gwillimbury

Dewatering effluent shall be directed to the Town of Bradford West Gwillimbury's sanitary or storm sewer system for dewatering near existing roadways. Any discharge of water would be subject to the terms and conditions of all required permits obtained during Detail Design based on the actual conditions encountered during construction. Sewer discharge requires by-law authorization from the Town.

The results of the baseline water quality sampling completed within the Study Area indicates that dewatering effluent may not fulfill the water quality requirements under the Town of Bradford West Gwillimbury's Sewer Use Bylaw 2013-68 for Storm Sewer Discharge without pre-treatment for the exceeded parameters identified by AECOM sampling from 2021 to 2023 (AECOM, 2023A). As a result, it will be the responsibility of the dewatering contractor to ensure that any discharge to the local sewer system occurs in full compliance with the Town's Sewer Use By-Law (By-Law 2013-68). The Contractor shall make sure that all control measures implemented, and all materials collected or trapped by those measures are recovered and properly disposed of when they are no longer engaging in the activity or discharge to the sanitary sewer. Expected treatment options for the dewatering discharge potentially include sedimentation tanks and filtration.

3.3 Dewatering Discharge in the Town of East Gwillimbury

Dewatering effluent shall be directed to the Town of East Gwillimbury's sanitary sewer system for dewatering near existing roadways. Any discharge of water shall be subject to the terms and conditions of all required permits obtained during Detail Design based on the actual conditions encountered during construction. Sewer discharge requires by-law authorization from the Town.

The results of the baseline water quality sampling completed within the Study Area indicates that dewatering effluent may not fulfill the water quality requirements under the York Region Sewer Use By-Law (2021-102) as required in the Town of East Gwillimbury's Sewer Use By-Law 2008-54 for Storm Sewer Discharge without pretreatment for the exceeded parameters identified by AECOM sampling from 2021 to 2023 (AECOM, 2023A). As a result, it will be the responsibility of the dewatering contractor to ensure that any discharge to the local sewer system occurs in full compliance with York Region Sewer Use By-Law (By-Law 2021-102). The Contractor shall make sure that all control measures implemented, and all materials collected or trapped by those measures are recovered and properly disposed of when they are no longer engaging in the activity or discharge to the sanitary sewer. Expected treatment options for the dewatering discharge potentially include sedimentation tanks and filtration.

3.4 Dewatering Discharge in King Township

Dewatering effluent shall be directed to the King Township's sanitary sewer system for dewatering near existing roadways. Any discharge of water shall be subject to the terms and conditions of all required permits obtained by the Detail Design designer based on the actual conditions encountered during construction. Sewer discharge requires by-law authorization from the Township.

The results of the baseline water quality sampling completed within the Study Area indicates that dewatering effluent may not fulfill the water quality requirements under the York Region Sewer Use By-Law (2021-102) as required in the King Township's Sewer Use By-Law 2014-072 for Storm Sewer Discharge without pre-treatment for the exceeded parameters identified by AECOM sampling from 2021 to 2023 (AECOM, 2023A). As a result, it will be the responsibility of the dewatering Contractor to ensure that any discharge to the local sewer system occurs in full compliance with York Region Sewer Use By-Law (By-Law 2021-102). The Contractor shall make sure that all control measures implemented, and all materials collected or trapped by those measures are recovered and properly disposed of when they are no longer engaging in the activity or discharge to the sanitary sewer. Expected treatment options for the dewatering discharge potentially include sedimentation tanks and filtration.

If the collected groundwater from dewatering activities is expecting to be discharged to the natural environment (only in areas of no previous development) this water must be tested for Provincial Water Quality Objectives (PWQO) and be in compliance with these objectives. Given the variability in geological material encountered throughout the proposed ROW, it is suggested that the dewatering Contractor be prepared to potentially deal with treatment for suspended solids prior to discharge to the sanitary sewer. Given the Highly Vulnerable Aquifer (HVA), Significant Groundwater Recharge Areas (SGRA), and Wellhead Protection Areas (WHPA) present within the Study Area, discharge to the natural environment is unlikely to be an option.

The results described above are representative of the condition at the sampled monitoring well at the time of sampling and do not necessarily reflect conditions that will be present at the time of construction. Confirmation of local groundwater levels and groundwater quality shall be completed during Detail Design prior to construction activities.

Prior to discharging any dewatering effluent, the Contractor will be required to check that all necessary discharge permits have been secured and that the Water Taking Plan, Discharge Plan, a Water Treatment Process and Sampling Plan has been designed and implemented in accordance with the terms and conditions of any such permits and the contract documents.

4. Groundwater Monitoring

The following proposed Groundwater Monitoring Program includes groundwater level monitoring and groundwater quality monitoring to establish the pre-construction baseline conditions for comparison of data collected during and post-construction.

During the Preliminary Design study, Golder Associates Ltd./WSP (Golder/WSP) installed monitoring wells during the ongoing geotechnical investigations. Monitoring is expected to be completed within these same monitoring wells during project construction dewatering. Residential monitoring wells will also be part of this program if they fall within the ROI of the excavation dewatering and permission to enter is granted to gain access to monitor the well.

4.1 Residential Well Survey

As shown in **Figure 2**, there are potentially at least 260 domestic, livestock, commercial, industrial or public water supply wells within the Study Area and these shall be visited prior to construction beginning to determine if the well is still used for the residence. AECOM completed an initial Door to Door Water Well Survey in 2021 and 2022 (AECOM, 2023B) that contacted all MECP domestic water well owners within 500 m of the Study Area. There was limited response to this survey and the homeowners shall be contacted again during subsequent Detail Design as required after the dewatering assessment is completed. 143 domestic water well owners were contacted via mail in 2021 as part of AECOM's Water Well Survey Report (AECOM, 20232B) and 17 responses were received. Since the completion of the residential water well survey, AECOM has received requests from the following properties that shall be included in Detail Design:



These residential properties could act as outlying monitoring wells to confirm there are not connections that may develop during short-term dewatering operations. The frequency of private well water level and water quality monitoring will be the same as the monitoring wells listed in Section 4.2 and 4.3. Prior to the initiation of the monitoring and sampling of the residential properties listed above, the Detail Design designer will contact local public health (Simcoe Muskoka Public Health, York Region Public Health) to allow for involvement as requested/required.

4.2 Groundwater Level Monitoring

Monitoring wells have been installed as part of the Preliminary Design project by Golder. These wells are shown on **Figure 1**. Should the location of any existing monitoring wells be in conflict with the location(s) of project construction or damaged as a result of project construction activities, it is required that an MECP licensed water well Contractor be retained to decommission those locations in accordance with Ontario Regulation 903 (Wells), as amended. It is further required that replacement well(s) be installed by a licensed environmental drilling Contractor to replace any decommissioned monitoring wells and/or piezometers.

The wells monitored (**Figure 1**) during the Preliminary Design hydrogeological field program (AECOM, 2022A) are considered as part of the proposed monitoring program within the dewatering ROI, and is to be used during Detail Design, for each excavation and proposed structure. The proposed frequency of groundwater level measurement within the existing monitoring well network is as noted in **Table 4-1**. Each monitoring well will have groundwater level

data loggers installed to measure the spring freshet, with monthly water level monitoring and downloads commencing after the data loggers have been installed.

	Dewatering Period	Measurement Frequency				
Pre-Construction	One Month Prior	Weekly				
During Construction	1 st Week	Daily				
	2 nd Week to End of 1 st Month	Weekly				
	End of 1 st Month to Program Completion Bi-Weekly					
Post-Construction	Monthly monitoring will be completed for six months after construction has					
	completed or until baseline conditions are observed.					

Table 4-1: Groundwater Level Monitoring Program Details

The monitoring of surface water shall be considered prior to, during and post construction should any dewatering discharge to a local surface water feature be required for any reason.

Where the monitoring completed above identifies a significant amount of water level drawdown (i.e., in excess of 0.3 m at a monitored location more than 40 m ROI from the dewatering area), immediate action shall be taken by the Contractor to assess and potentially modify their dewatering approach / methodology, and/or rate / duration of pumping, so as to limit the dewatering radius of impact (R) and alleviate the observed groundwater level impact. It is recommended that dataloggers be installed during Detail Design in each identified residential water well and monitoring well and left for the duration of the dewatering period listed in **Table 4-1**.

Monthly hydrographs will be provided to the MTO, MECP, Simcoe Muskoka Public Health, and York Region Public Health showing the changes to the local groundwater levels as a result of the proposed construction by the Contractor.

4.3 Confirmatory Sampling Program

It is required that the Contractor pursue permission for sanitary sewer discharge from the Town of Bradford West Gwillimbury, the Town of East Gwillimbury and King Township. The following sections have been prepared outlining proposed requirements for the discharge of dewatering effluent that shall be modified, if required, based on the discharge permit obtained. It also includes residential wells.

4.3.1 Water Quality / Treatment Standards

Dewatering effluent is proposed to meet the following Water Quality Standards prior to discharging into the municipal storm and/or sanitary sewer systems:

- Town of Bradford West Gwillimbury's Sewer Use By-Law (By-Law 2013-68)
- York Region Sewer Use By-Law (2021-102).

Residential wells shall be sampled for a representative raw (untreated) water sample for analysis of general water quality (pH; total hardness; total alkalinity; calcium, magnesium, sodium; potassium; iron, manganese; chloride; sulphate; nitrate [NO₃-N]; nitrite [NO₂-N], ammonia / ammonium [NH₃-N]; electrical conductivity; total dissolved solids [TDS]; total suspended solids [TSS]; tannins and lignins);microbiological parameters (*E. coli,* faecal coliforms, total coliforms); F1 to F4 petroleum hydrocarbons, benzene, toluene, ethylbenzene, and xylene

Sodium sampling results will be provided to local Public Health Agencies (Simcoe Muskoka Public Health, York Region Public Health) as received by the Contractor. Adequate pre-treatment shall be provided by the Contractor at each dewatering location to achieve compliance prior to any off-site discharge occurring. Establishing treatment

methodology (settling tank) is the responsibility of the Contractor and may be further informed by the raw (pumped) water quality and confirmatory sampling results obtained by the Contractor during Construction.

4.3.2 Proposed Confirmatory Sampling Program

Pre-assessment sampling of the water that is planned to be discharged is to be completed by the Contractor and submitted to an accredited environmental analytical laboratory for quality testing against applicable parameter concentration limits (e.g., Town of Bradford West Gwillimbury's Sewer Use By-law (By-law 2013-68), York Region Sewer Use By-Law (2021-102)). The intent of this sampling is to confirm both the background (raw) and Contractor's treated water quality prior to the commencement of any dewatering discharge activities.

Regular sampling and testing of the discharge and residential wells by the Contractor will be required during construction to verify that the effluent quality continues to comply. The frequency of confirmatory sample collection is summarized in **Table 4-2**.

Dewatering Period	Sampling Frequency (Effluent)	Sampling Frequency (Residential)
One Month Prior to Program Commencement	Once	Once
1 st Week	Twice	Not Required
2 nd Week to End of 1 st Month	Weekly	Once
End of 1 st Month to Program Completion	Monthly	Every Three Months

Table 4-2: Confirmatory Sampling Frequency*

Notes: *To be modified as appropriate based on the discharge permit received.

A visual inspection must be completed by the Contractor along with the collection of in-field turbidity and temperature measurements (both untreated and treated effluent discharge streams) on a <u>daily</u> basis during periods of active discharge for the duration of the dewatering system(s) operation. A visual inspection of terrestrial changes or sedimentation within the HVA area and surface water features within the proposed construction area are also required.

In the event that a sample is determined to be 'unacceptable' based on the applicable water quality standards, field turbidity and/or temperature monitoring activities, additional effluent samples must be obtained by the Contractor immediately upon receipt of the initial laboratory results for verification purposes. In the event of "unacceptable' results, the local Public Health agencies (Simcoe Muskoka Public Health, York Region Public Health) will be notified immediately.

Where the verification sampling is confirmed, immediate action shall be taken by the Contractor to assess and potentially modify their dewatering approach / methodology, rate / duration of pumping, and/or provide additional / alternative pre-treatment prior to resuming any further discharge. Prior to resuming any effluent discharge, a confirmatory sample shall be obtained by the Contractor confirming adherence with the applicable water quality standards.

Where the verification sampling is determined to be anomalous, the confirmatory sampling program is expected to resume at the staged sampling frequency outlined in **Table 4-2**.

5. Permitting Requirements

Where construction dewatering volumes between 50,000 and 400,000 L/day are expected, filing of the project on MECP's Environmental Activity and Sector Registry (EASR) system is required in accordance with Ontario Regulation 63/16 (as amended). Where expected construction dewatering volumes that exceed 400,000 L/day, a PTTW (Category 3) will be required from MECP in accordance with Section 34 of the Ontario Water Resources Act (RSO, 1990). Permitting requirements will be determined during the subsequent Detail Design phase.

5.1 Water-Taking Volumes

A daily record of the timing, total volumes, and average rate of water-taking at each excavation location shall be maintained by the Contractor daily during completion of the project. The flow meter(s) shall be calibrated prior to use and installed / operated in accordance with manufacturer specifications.

6. Contingency Measures

6.1 Spill Response Plan

Contingency plans are to be in place to address groundwater protection associated with the project during construction. The uncontrolled release of dewatering effluent is considered a spill, along with any construction chemical release, and must be managed using the Contractor's Spill Prevention and Response Plan.

If the effluent is released to the natural environment and causes a significant impact¹ on the surrounding soil or waters, this shall be reported to the MECP Local District office in Barrie, ON, MECP Spills Action Centre, and/or the Town of Bradford West Gwillimbury/Town of East Gwillimbury/King Township. If the effluent results in a significant impact or a disturbance to aquatic habitat (i.e., debris/tools/equipment falling into a watercourse, sediment spill, deleterious substance spill, etc.), it must also be managed in accordance with mitigation measures listed in the Detail Design Erosion and Sediment Control Plan.

If the effluent is released to the Town of Bradford West Gwillimbury/Town of East Gwillimbury's municipal sewer system (sanitary or storm), there may be a requirement to report the release to the Town, subject to the terms of the Discharge Permit. Additional reporting may be required based on the quality and quantity of the spilled effluent and the affected receptors.

6.2 Well Interference Complaint

In the event that a well interference complaint is received, the following procedure shall be implemented in a timely manner:

- Upon receipt of a well complaint (either quality or quantity), either via phone call to the project, or in person to a staff member in the field, it is to be addressed, recorded and handled in a timely manner.
- Complainant will be informed of the response time frame and be provided with staff contact names and information.
- MTO, MECP, Simcoe Muskoka Public Health and York Region Public Health will be notified immediately. If it occurs during normal business hours, the MECP local district office (Barrie: 1-800-890-8511) will be contacted and the Spills Action Centre (1-800-268-6060) is to be contacted after business hours. MTO and Simcoe Muskoka Public Health will also be emailed
- A well complaint investigation will be conducted as per the MECP policies and a qualified expert (P.Geo. or P. Eng.) will undertake and/or oversee the following:
 - 1. Collect a water well sample at the complainant's water well, prior to any treatment systems ("raw"), after allowing the distribution system to flow for approximately 5 minutes and submit the water sample to a qualified laboratory for an analysis of the general chemistry suite of water quality parameters completed during pre-construction analysis
 - 2. Compare the results of the analysis of the water sample to any pre-construction water sampling analysis (if available) for the residential well
 - 3. Investigate and provide a professional opinion regarding the claimed impact to the well or well water, and

^{1.} Significance of impact to be evaluated by biologist identified as the Suitably Qualified Consultant for the project.

- 4. Provide a detailed written opinion as to whether the water sampling analysis results demonstrate that the construction or dewatering activities may have caused an adverse effect on the well's water supply.
- If the well issue is confirmed to be a result of the project's activities, MTO will provide a letter to the property owner explaining the outcome of the well investigation and detail the recommended mitigation measures (including lowering / replacement of pump inlet, well rehab, new well installed or local watermain connection if available) to remediate the issue. A temporary drinking water supply will be provided and connected to the resident if the project activities are found to be responsible, at the expense of the MTO, until remediation measures have resolved the issue
- If the well issue is found to be unrelated to the project activities, MTO will provide a letter to the property owner explaining the outcome of the well investigation and the rationale for the decision, and
- Notification and a copy of any lab results, letters or communication records will be provided at each step of the above process to the MTO, MECP, Simcoe Muskoka Public Health and York Region Public Health.

7. Summary of Environmental Commitments

7.1 2002 Approved Environmental Assessment Commitments

The 2002 Approved Environmental Assessment identified a number of proposed mitigation and commitments to future work for the project. **Table 7-1** below identifies the groundwater commitments carried forward through to Preliminary Design and describes any applicable changes to the 2002 Approved Environmental Assessment commitment. Commitments identified in the 2002 Approved Environmental Assessment are to be carried forward to Detail Design phase unless otherwise stated in **Table 7-1** below.

Factor / Criterion	Issue	Concerned Group / Agency	Potential Net Environmental Effect (as taken from 2002 Approved Environmental Report)	Proposed Mitigation / Commitments to Future Work (as taken from 2002 Approved Environmental Report)	Changes to Mitigation/ Protection/ Monitoring (Yes/No/NA)	Description of Commitment Carried Forward through Preliminary Design for Mitigation, Protection and Monitoring
Groundwater	Potential well impacts and contamination of/interference with groundwater resources	Ministry of Transportation, local municipalities, property owners	24 domestic wells are potentially affected either directly (i.e., removal) or indirectly (i.e., potential interference) by the proposed Link. In the area of sandy soils associated with the Holland River, shallow perched groundwater system is susceptible to contamination and/or interference. The Bradford municipal well west of the Holland River will be avoided and otherwise unaffected by the proposed roadway.	 Tilling of soil in non-vegetated areas prior to restoration to re- establish infiltration along access roads, storage areas, or other well travelled areas where soil compaction has occurred in areas that previously permitted infiltrating Backfilling of excavations that intercept existing groundwater flow with porous granular material to maintain existing groundwater linkage particularly at river crossings Detailed stormwater management plans which address both quantity and quality A well monitoring program which will involve pre-construction testing, investigation of complaints during construction, and provision of an alternate water supply, and Use of appropriate dewatering and spills avoidance management techniques. 	Ves	 The Ministry shall complete and prepare a Stormwater Management Plan and a Groundwater Protection and Well Monitoring Plan per the Regulation, and As a result of the project-specific assessment of environmental impacts, Detail Design, design and construction plans will consider erosion and sediment control requirements, access management, clearing and grubbing, earth management and landscape and ecological restoration.

Table 7-1: 2002 Approved Environmental Assessment Commitments and Description of Changes Carried Forward Through Preliminary Design

7.2 Preliminary Design Commitments

Impacts to groundwater and the hydrogeological system and proposed mitigation measures, monitoring activities and commitments identified in this Groundwater Protection and Well Monitoring Plan assessment are summarized in **Table 7-2** below.

Table 7-2: Summary of Environmental Concerns and Commitments

ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitme	
Groundw	vater and Hydrogeology				
GW-1.00	 Dewatering Effluent Discharge Ministry of Environment Conservation and Parks, and Lake Simcoe Conservation Authority 	 Dewatering Effluent Discharge Ministry of Environment Conservation and Parks and Lake Simcoe Conservation Authority 	GW-1.01	 It is recommended that dewatering effluent be directed to the local Town sanitary or storm sewer, if applicable conditions of all required permits obtained by the Contractor based on the actual conditions encountered durin authorization from the Town. Due to the close proximity of the construction to agricultural drains, it is suggestereduce overland flow and promote infiltration, and Discharge the natural environment will be allowed with previously undeveloped areas assuming that the disch based on proximity within or nearby SGRA and WHPAs. Supplemental sampling during dewatering will be reduced as a statement of the section. 	
			GW-1.02	 Prior to discharging any dewatering effluent, the Contractor will be required to check that all necessary discharge Plan, Discharge Plan, a Water Treatment Process and Sampling Plan has been designed and implemented in permits and the contract documents, and Regular sampling and testing of the discharge and residential wells by the Contractor will be required during of comply. 	
			GW-1.03	 A visual inspection must be completed by the Contractor along with the collection of in-field turbidity and temp discharge streams) on a daily basis during periods of active discharge for the duration of the dewatering syste sedimentation within the HVA area and surface water features within the proposed construction area are also In the event that a sample is determined to be 'unacceptable' based on the applicable water quality standards additional effluent samples must be obtained by the Contractor immediately upon receipt of the initial laborator "unacceptable" results, the local Public Health agencies (Simcoe Muskoka Public Health, York Region Public Where the verification sampling is confirmed, immediate action shall be taken by the Contractor to assess and rate / duration of pumping, and/or provide additional / alternative pre-treatment prior to resuming any further duration sample shall be obtained by the Contractor confirming adherence with the applicable water quality and the public water quality is a stream of pumping. 	
GW-2.00	Potential conflicts with monitoring wells	 Ministry of Environment Conservation and Parks Ministry of Transportation Lake Simcoe 	GW-2.01	Should the location of any existing monitoring wells be in conflict with the location(s) of project construction or recommended that a Ministry of the Environment, Conservation and Parks licenced water well contractor be r accordance with Ontario Regulation 903 (Wells), as amended. It is further recommended that replacement we contractor to replace any decommissioned monitoring wells and/or piezometers.	
		Conservation Authority, and Nottawasaga Valley Conservation Authority	GW-2.02	A pre-construction groundwater sampling program shall be conducted for the groundwater monitoring wells to least one well at one dewatering location) to confirm the groundwater quality in the areas. The collected grour parameters (including total suspended solids (TSS) and turbidity), metals, hydrocarbons (F1 to F4 petroleum xylene)and VOCs.	
			GW-2.03	The wells monitored during the Preliminary Design hydrogeological field program are considered as part of th and is to be used during Detail Design, for each excavation and proposed structure. All monitoring wells insta monitoring pre, during and post construction.	
GW-3.00	Potential impacts to private wells	 Potential impacts to private wells Ministry of Environmen Conservation and Par Lake Simcoe and Muskoka Public Health and 	 Ministry of Environment Conservation and Parks Lake Simcoe and Muskoka Public Health, and 	GW-3.01	Prior to any construction dewatering occurring the properties listed Door to Door Water Well Survey Report sh residential well during and after construction to ensure that there is no effect on the water quality from the bas provides a baseline for the water wells prior to the proposed construction to determine existing water quality a all properties within 500 m of the study limits is recommended to ensure all concerned homeowners are monipotential well issues are addressed and monitored.
		York Region Public Health	GW-3.02	Prior to the initiation of the monitoring and sampling of the residential properties listed above, the Contractor v Health, York Region Public Health) to allow for involvement as requested/required.	
		GV	GW-3.03	 Where the monitoring completed above identifies a significant amount of water level drawdown (i.e., in excess the dewatering area), immediate action shall be taken by the Contractor to assess and potentially modify their of pumping, so as to limit the dewatering radius of impact (R) and alleviate the observed groundwater level im Detail Design in each identified residential water well and monitoring well and left for the duration of the dewater of the dewater by the Contractor. Monthly hydrographs will be provided to the MTO, MECP, Simcoe Muskoka Public Health, and York Region F levels as a result of the proposed construction by the Contractor. 	
			GW-3.04	 Residential wells shall be sampled for a representative raw (untreated) water sample for analysis of general w magnesium, sodium; potassium; iron, manganese; chloride; sulphate; nitrate [NO3-N]; nitrite [NO2-N], ammor dissolved solids [TDS]; total suspended solids [TSS]; tannins and lignins), hydrocarbons (F1 to F4 petroleum and microbiological (E. coli, faecal coliforms, total coliforms) parameters, and Sodium sampling results will be provided to local Public Health Agencies (Simcoe Muskoka Public Health, Yo Designer. Adequate pre-treatment shall be provided by the Contractor at each dewatering location to achieve 	

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e. Any discharge of water would be subject to the terms and ing construction. Sewer discharge requires by-law red that the discharge be directed away from the drains to

harge meets PWQO. Further discharge restrictions may occur quired to ensure discharge compliance.

arge permits have been secured and that the Water Taking in accordance with the terms and conditions of any such

construction to verify that the effluent quality continues to

perature measurements (both untreated and treated effluent em(s) operation. A visual inspection of terrestrial changes or required

s, field turbidity and/or temperature monitoring activities, bry results for verification purposes. In the event of Health) will be notified immediately, and

d potentially modify their dewatering approach / methodology, discharge. Prior to resuming any effluent discharge, a ity standards.

damaged as a result of project construction activities, it is etained by the Contractor to decommission those locations in ell(s) be installed by a licenced environmental drilling

bocated in the vicinity of the proposed dewatering locations (at indwater samples have to be analyzed for general inorganic hydrocarbons, benzene, toluene, ethylbenzene, and

e proposed monitoring program within the dewatering ROI, illed by Golder/WSP will have dataloggers installed for hourly

hall be contacted for monitoring and sampling of the seline assessed. The Door-to-Door Water Well Survey and quantity of each property. Additional mailing of letters to tored during and after construction to capture and ensure

will contact local public health (Simcoe Muskoka Public

s of 0.3 m at a monitored location more than 40 m ROI from ir dewatering approach / methodology, and/or rate / duration npact. It is recommended that dataloggers be installed during atering period listed in **Table 4-1**, and Public Health showing the changes to the local groundwater

Public Health showing the changes to the local groundwater

vater quality (pH; total hardness; total alkalinity; calcium, nia / ammonium [NH3-N]; electrical conductivity; total hydrocarbons, benzene, toluene, ethylbenzene, and xylene)

ork Region Public Health) as received by the Detail Design compliance prior to any off-site discharge occurring.

Ontario Ministry of Transportation

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ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitmer
				Establishing treatment methodology (settling tank) is the responsibility of the Contractor and may be further in sampling results obtained by the Contractor during construction.

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nformed by the raw (pumped) water quality and confirmatory

Final Groundwater Protection and Well Monitoring Plan

Highway 400 – Highway 404 Link (Bradford Bypass)

ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitme
GW-4.00	Assumed Excavation Parameters and Radius	 Ministry of Environment Conservation and Parks, and Ministry of Transportation 	GW-4.01	All groundwater plans shall assume the potential for groundwater interference to be limited to those areas whe support structures) will cut 1 m to 15 m into the subsurface locally and will extend below the existing groundwater
	of Influence		GW-4.02	The calculated radius of influence at each dewatering location shall be provided with detailed calculations and monitoring wells (over 15 m) are at risk of being affected during Detail Design reporting, additional mitigation r monitoring, caissons, etc.).
			GW-4.03	Mitigation plans shall be generated for any excavation and structure construction with areas of medium to high near the Holland River and Holland River East Branch as shown in Figure 3. Dewatering discharge shall be of excavation and dewatering activities are occurring within them, as shown in Figure 3.
			GW-4.04	Based on AECOM's understanding of the regional hydrogeology, the potential effect of road salt runoff from th surficial materials is considered high. These areas of high aquifer vulnerability could potentially be impacted b are required during dewatering to limit runoff.
GW-5.00	Potential Groundwater Contamination	 Ministry of Environment Conservation and Parks Ministry of Transportation 	GW 5.00	The former and current land uses of the entire Study Area will be reviewed to identify potential contaminating Contaminant Overview Study. All monitoring well will have water quality sampling completed for hydrocarbons ethylbenzene, and xylene) as part of Detail Design.
		 Lake Simcoe Conservation Authority, and 	GW-5.01	The use of best management practices for handling of hydrocarbons according to the Ministry of Environment Standards and Safety Authority (TSSA) of the Ministry of Government Services will reduce the potential of environment product handling and uses. Spillage of petroleum products must be immediately remediated according to thes
		 Nottawasaga Valley Conservation Authority 	GW-5.02	The effect of road salt can result in the direct increase of shallow groundwater salinity, or in the case of deepe susceptibility of the soils to infiltration is reflected by the Highly Vulnerable Aquifers (HVA) designation areas a dewatering discharge shall be directed away from these areas unless they meet the Provincial Water Quality
GW-6.00	Site Mitigation Measures	 Ministry of Environment Conservation and Parks, and Ministry of Transportation 	GW-6.01	 Suggested Mitigation Measures: Tilling of soils in non-vegetated areas prior to restoration to re-establish infiltration along access roads, stora has occurred in areas that previously permitted infiltration Backfilling of excavations that intercept existing groundwater flow with porous granular material to maintain e and Well abandonment will be carried out in compliance with O. Reg. 903 Wells (as amended).
GW-7.00 Construction Dewatering Plan	 Ministry of Environment Conservation and Parks Ministry of Transportation Lake Simcoe Conservation Authority, 	GW-7.01	A Construction Dewatering Plan (Water Discharge/Management) shall be prepared, as well as an Erosion and Monitoring Program. The Construction Dewatering Plan, which shall include details on where and when all gro to the environment (if applicable) and the proper decommissioning of the dewatering wells upon the completion discharge to the natural environment. These three reports shall be prepared by the Contractor prior to the com MECP when finalizing the draft permit to take water (if one is determined to be required during subsequent Devices).	
		and Nottawasaga Valley Conservation Authority	GW-7.02	Any discharge of water would be subject to the terms and conditions of all required permits obtained by the Construction. Sewer discharge requires by-law authorization from the Town of Bradford West Gwillimbury Sew Gwillimbury's Sewer Use By-Law (2008-54), York Region Sewer Use By-Law (By-Law 2021-102), or PWQO a
GW-8.00	Permitting Requirements	 Ministry of Environment Conservation and Parks Ministry of Transportation 	GW-8.01	Where construction dewatering volumes between 50,000 and 400,000 L/day are expected, filing of the project Ontario Regulation 63/16 (as amended). Where expected construction dewatering volumes that exceed 400,0 in accordance with Section 34 of the Ontario Water Resources Act (RSO, 1990). Permitting requirements will
		 Lake Simcoe Conservation Authority, and Nottawasaga Valley Conservation Authority 	GW-8.02	A daily record of the timing, total volumes, and average rate of water-taking at each excavation location shall I the project. The flow meter(s) shall be calibrated prior to use and installed / operated in accordance with manu
GW-9.00	Spill Response Plan	 Ministry of Environment Conservation and Parks Ministry of Transportation Lake Simcoe Conservation Authority, and Nottawasaga Valley Conservation Authority 	GW-9.01	 Contingency plans are to be in place to address groundwater protection associated with the project during corconsidered a spill, along with any construction chemical release, and must be managed using the Contractor's If the effluent is released to the natural environment and causes a significant impact on the surrounding soil of office in Barrie, ON, MECP Spills Action Centre, and/or the Town of Bradford West Gwillimbury/Town of East disturbance to aquatic habitat (i.e., debris/tools/equipment falling into a watercourse, sediment spill, deleteriou accordance with mitigation measures listed in the Contractor Sediment and Erosion Control Plan, and If the effluent is released to the Town of Bradford West Gwillimbury/Town of East Gwillimbury's municipal sew report the release to the Town, subject to the terms of the Discharge Permit. Additional reporting may be required and the affected receptors.
GW-10.0	Well Interference Complaint	 Ministry of Environment Conservation and Parks Ministry of Transportation 	GW-10.01	 In the event that a well interference complaint is received, the following procedure shall be implemented in a ti Upon receipt of a well complaint (either quality or quantity), either via phone call to the project, or in person and handled in a timely manner

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ere the deeper road alignment (trenches, ditches, and bridge ater table.

d reported on by the subsequent Contractor. If the deep measures may need to be considered (domestic well

h significant groundwater recharge areas (SGRA) as shown directed away from Well Head Protection (WHPA) areas if

he highway on the shallow groundwater system and shallow by saline runoff. As such, berms around the excavated areas

activities, including those listed in AECOM's 2020 s (F1 to F4 petroleum hydrocarbons, benzene, toluene,

t, Conservation and Parks (MECP) and the Technical vironmental adverse effects associated with petroleum se standards such that groundwater quality is not impacted.

er wells, an increase in water hardness over time. The along the entire project construction area. Any runoff and Objectives (PWQO).

age areas, or other well traveled areas where soil compaction

existing groundwater linkage, particularly within wetland areas,

Ind Sediment Control Plan and a Groundwater Quality roundwater is obtained, stored, transferred, used and returned on of the construction, must be implemented prior to the mmencement of the dewatering activities and submitted to retail Design and construction phases).

ontractor based on the actual conditions encountered during ver Use By-Law (By-Law 2013-68), Town of East as applicable

t on MECP's EASR system is required in accordance with 000 L/day, a PTTW (Category 3) will be required from MECP be determined during subsequent Detail Design.

be maintained by the Contractor daily during completion of ufacturer specifications.

nstruction. The uncontrolled release of dewatering effluent is s Spill Prevention and Response Plan

r waters, this shall be reported to the MECP Local District Gwillimbury. If the effluent results in a significant impact or a us substance spill, etc.), it must also be managed in

ver system (sanitary or storm), there may be a requirement to irred based on the quality and quantity of the spilled effluent

imely manner: to a staff member in the field, it is to be addressed, recorded Final Groundwater Protection and Well Monitoring Plan

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ID	Issues / Concerns / Potential Effects	Concerned Agencies	ID	Mitigation, Protection, Monitoring, and Commitme
		 Lake Simcoe Conservation Authority Nottawasaga Valley Conservation Authority Simcoe Muskoka Public Health, and York Region Public Health 		 Complainant will be informed of the response time frame and be provided with staff contact names and info The MTO, MECP, Simcoe Muskoka Public Health and York Region Public Health will be notified immediate district office (Barrie: 1-800-890-8511) will be contacted and the Spills Action Centre (1-800-268-6060) is t Public Health and York Region Public Health will also be emailed. A well complaint investigation will be conducted as per the MECP policies and a qualified expert (P.Geo. or P. Collect a water well sample at the complainant's water well, prior to any treatment systems ("raw"), after minutes and submit the water sample to a qualified laboratory for an analysis of the general chemistry suite or analysis Compare the results of the analysis of the water sample to any pre-construction water sampling analysis (if Investigate and provide a professional opinion regarding the claimed impact to the well or well water Provide a detailed written opinion as to whether the water sampling analysis results demonstrate that th adverse effect on the well's water supply If the well issue is confirmed to be a result of the project's activities, the MTO will provide a letter to the pro and detail the recommended mitigation measures (including lowering / replacement of pump inlet, well rehat to remediate the issue. A temporary drinking water supply will be provided and connected to the resident if th of the MTO, until remediation measures have resolved the issue If the well issue is found to be unrelated to the project activities, MTO will provide a letter to the property or rationale for the decision, and Notification and a copy of any lab results, letters or communication records will be provided at each step Public Health and York Region Public Health.

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ormation, and

tely. If it occurs during normal business hours, the MECP local to be contacted after business hours. MTO, Simcoe Muskoka

Eng.) will undertake and/or oversee the following:
 r allowing the distribution system to flow for approximately 5 of water quality parameters completed during pre-construction

available) for the residential well

he construction or dewatering activities may have caused an

roperty owner explaining the outcome of the well investigation b, new well installed or local watermain connection if available) he project activities are found to be responsible, at the expense

wner explaining the outcome of the well investigation and the

of the above process to the MTO, MECP, Simcoe Muskoka

8. Recommendations and Conclusions

This Groundwater Protection and Well Monitoring Plan was completed for the intended purpose of characterizing and assessing possible impacts to local water wells and groundwater dependent environmental features, and to recommend appropriate discharge, mitigation, and monitoring measures, as required. This Plan was prepared in accordance with the requirements of O. Reg. 697/21, Section 23. It is recommended that this Plan be updated based on the dewatering assessment that will be completed during subsequent Detail Design of the project.

As part of the Plan, AECOM conducted a water well survey and reviewed the MECP Water Well Database that identifies water wells within the Bradford Bypass corridor that may be impacted by the project. Approximately 260 domestic, livestock, commercial, industrial, or public water supply wells within the Study Area were identified.

Construction dewatering activities have been identified as the primary risk to groundwater fed water wells in the Study Area. Mitigation measures will be implemented to manage adverse effects on adjacent domestic water wells and to avoid reducing groundwater levels to the degree that residential water supply is affected.

A series of groundwater monitoring wells have been installed along the highway corridor within the Study Area to track groundwater quality and quantity before and after construction. A pre-construction groundwater sampling program will be conducted to establish baseline data which will enable effective monitoring of changes within groundwater levels and quality related to construction activities. Contingency plans will be in place for groundwater protection during construction. The Ministry will work with owners of water wells who experience issues during and after construction to determine if the issue is the result of Bradford Bypass project activities. If it is confirmed that the issues are related to the project, the Ministry will take immediate steps to remediate the issue, implementing mitigation measures as required.

The recommendations in the Plan include that residential well water shall be sampled for a representative raw (untreated) water sample analyzed to establish general water quality and microbiological parameters prior to the start of construction.

A Construction Dewatering Plan will be prepared. It will include a Contractor's Spill Prevention and Response Plan, as well as details on where and when all groundwater is obtained, stored, transferred, used and returned to the environment (if applicable), as well as a plan for the proper decommissioning of the dewatering wells upon the completion of the construction.

MTO will seek appropriate dewatering permits from MECP, depending on water volumes, in accordance with Section 34 of the Ontario Water Resources Act (RSO, 1990).

Dewatering discharge will be managed consistent with best management practices employed by the Ministry and applied to all highway construction projects. Any runoff or dewatering discharge from construction will be directed away from any environmentally sensitive areas identified along the entire length of the highway unless on-site testing indicates that satisfactory provincial water quality standards are met. Any uncontrolled release of dewatering effluent during construction will be treated with the same urgency as a chemical spill and managed using best practices, as well as protocols in the contractor's Spill Prevention and Response Plan. If the spill impacts the natural environment, it will also be reported to the MECP Spills Action Centre.

In addition to construction dewatering, there are two other potential risks to primary groundwater quality effects related to the construction and road operation phases of the project;

- potential for spills during construction
- potential for spills and salt runoff during the long-term operation of the road.

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For potential spill cleanup, the Ministry employs best management practices for handling of hydrocarbons according to MECP and the Technical Standards and Safety Authority (TSSA) of the Ministry of Government Services to reduce the potential of environmental impacts.

Detailed measures to be implemented on the project regarding salt management are included in the Stormwater Management Plan as required under Section 22 of O. Reg. 697/21.

The subsequent Detail Design phase shall carryout all necessary and required works as outlined in this Report as a minimum.

The results of Golder's Geological Investigation were relied upon by AECOM in the completion of this Preliminary Design Plan. AECOM has assumed that all information provided was factual and accurate. Judgement has been used by AECOM in the interpretation of the field information collected. However, it is recognized that subsurface physical and chemical characteristics may vary between or beyond borehole locations given the variability observed in local geological and hydrogeological conditions. If variability in geologic and/or hydrogeologic conditions is observed at the time of construction, in comparison to the information presented in this Report, AECOM shall be contacted to review the conditions present and assess the potential implications. Additionally, should further works be completed by Golder for the Bradford Bypass project, or other project components be added which were not factored into this Report, they shall be considered beyond the scope of this Report and be assessed and documented in the subsequent Detail Design phase.

Final Groundwater Protection and Well Monitoring Plan Highway 400 – Highway 404 Link (Bradford Bypass)

9. References

AECOM Canada Ltd. 2023A:

Hydrogeological Data Report – Highway 400 to Highway 404 Link (Bradford Bypass) (GWP 2008-21-00).

AECOM Canada Ltd. 2023B:

Door To Door Water Well Report – Highway 400 to Highway 404 Link (Bradford Bypass) (GWP 2008-21-00).

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Figures



a 5 sideroad	Fennell Yonge 2 Blacktor	Holland Landing Newmarket
Legend Well Loc Bradford Bradford Bradford Bradford Separate Study Ar Roads Provincia Other Municipa Waterbo Waterco	ation Bypass - MTO R Bypass Prelimina Bypass/Detail De MTO EA Study ea (500m) al Highway ality Boundary dy urses	ight-Of-Way ary Design esign (by Others)
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	V: Study Area	Figure 1a
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MECP Water Wells, PTTWs and		
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	V: Study Area	
AECOM		Figure 2a
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ME	CP Water W	/ells, PTTWs and
	EP	ISKS
Apr, 2023	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	
AECOM		Figure 2b
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ME	CP Water V	Vells, PTTWs and
	EA	SRs
Apr, 2023	1:12,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	
AEC	MO	Figure 2c
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	Bradford Bypass - MTO Right-Of-Way
	Bradford Bypass Preiminary Design
	Study Area (500m)
Road	s
	Provincial Highway
_	Other
	Municipality Boundary
	Waterbody
	Watercourses
	Monitoring Well Location
\land	EASR
ΡΤΤΜ	/ Purpose
	Agricultural
	Commercial
	Water Supply
MECI	P Water Wells
+	Commerical
\bigcirc	Domestic
\bigcirc	Livestock
•	Monitoring
\bigcirc	Not Used
	Unknown
0 L	145 290 580 870

MECP Water Wells, PTTWs and			
	EASRs		
Apr, 2023	1:12,500	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS FAO, NPS, NRCAN, GenBase IGN	
	* when printed 11"x17"		
	V: Study Area		
AECOM		Figure 2d	
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Lege	end
	Bradford Bypass - MTO Right-Of-Way
	Bradford Bypass Preiminary Design
	Separate MTO EA Study
	Study Area (500m)
Road	s
	Provincial Highway
	Other
	Municipality Boundary
	Waterbody
	Watercourses
•	Monitoring Well Location
\land	EASR
ΡΤΤΥ	V Purpose
	Agricultural
	Commercial
	Water Supply
MECI	P Water Wells
\bigcirc	Domestic
\bigcirc	Livestock
•	Monitoring
\bigcirc	Not Used
	Other
\bigcirc	Unknown
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	Meters

MECP Water Wells, PTTWs and			
	EASRs		
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	V: Study Area		
AECOM		Figure 2e	
This drawing has be used, reproduced c and its client, as rec AECOM accepts no	een prepared for th or relied upon by th quired by law or for o responsibility, and	e use of AECOM's client and may not be ird parties, except as agreed by AECOM use by governmental reviewing agencies. d denies any liability whatsoever, to any	



October, 2023	1:22,230 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	
AECOM		Figure 3a
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ead
Legend
ROW - Bradford Bypass (Highway 400-404)
Study Area (500m)

Roads

- Provincial Highway
- Other

Municipality Boundary

Waterbody

Watercourses

Significant Groundwater Recharge Area

Wellhead Protection Area A (vulnerability score = 10)
Wellhead Protection Area B (vulnerability score = 6)
Wellhead Protection Area C1 (vulnerability score = 4)
Wellhead Protection Area D (vulnerability score = 2)



Bradford Bypass Project

Wellhead Protection Areas and Significant Groundwater Recharge Areas Within the Groundwater and Hydrogeology Study Area

October, 2023	1:22,230 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	
AECOM		Figure 3b
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October, 2023	1:22,230 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
	V: Study Area	
AECOM		Figure 3c



October, 2023	1:22,230 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,				
	V: Study Area					
AEC	MO	Figure 3d				
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- ROW Bradford Bypass (Highway 400-404)
- Bradford Bypass Recommended Plan
- Bradford Bypass/Detail Design (by Others)
- Separate MTO EA Study
- Municipality Boundary
- Watercourses

Intake Protection Zone Vulnerability Score

5.6

0		255		510	1			1,0	20				1,530
	1		1	1	1		1	1		1	1	1	
Meters													

Bradford Bypass Project

Intake Protection Zones Vulnerability Scores and the Bradford Bypass ROW

Oct, 2023	1:22,230 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: LSRCA Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,				
	V: Study Area					
AEC	MO	Figure 4a				
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Legend

- ROW Bradford Bypass (Highway 400-404)
- Bradford Bypass Recommended Plan
- Municipality Boundary
- Waterbody
- Watercourses

Intake Protection Zone Vulnerability Score

5.6 6.3



Bradford Bypass Project

Intake Protection Zones Vulnerability Scores and the Bradford Bypass ROW







location: D:/Projects/60636190/900-CAD_GIS/920-929 (GIS-Graphics)/920-ENVDesign 01_Reports/GWCOSM/XD/MXD-BBP_GW_IP23_202310





location: DiProjects160636190900-CAD_GIS920-928 (GIS-Graphics)920-ENVIDesign/01_Reports(GWCOSMXDIMXD-BBP_GN_HVA_2023101





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ead Fennell Yonge Street Bra for	Rher Drive Park Ourensville Park Sharon							
Legend								
Highly Vulnerable Agu	ifer (Vulnerability score = 6)							
BOW - Bradford Byna	POW Prodford Pypage (Highway 400, 404)							
Bradford Bypa	Bradford Burges Becommended Blan							
Municipality Boundary								
Waterbody								
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0 255 510	1,020 1,530							
L I I I I I Me	eters							
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Bradford By	pass Project							
Highly Vulnerable A	Aquifer Areas Vulnerability							
Scoresand the	Bradford Bypass ROW							
4.00.000	Datum: NAD 1983 UTM Zone 17N Source: LSRCA							
Oct, 2023	Imagery Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,							
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Δ=ςομ	Figure 5c							
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Brian Holden, P.Geo. Hydrogeologist, Environment Brian.Holden@aecom.com

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