

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>T.1 - Performance</p> <p>The change in performance from baseline conditions with respect to hydraulic performance and MOE water quality regulations.</p> <p>Measures</p> <ul style="list-style-type: none"> Achieves 20:1 initial dilution (based on CORMIX modelling results) Extent of change in mixing zone from baseline scenario (PWQO) for TP and UIA (based on MIKE3 Modelling Results) Achieves hydraulic performance 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p>	<p>Initial dilution: Since the plant does not bypass, this alternative cannot meet the MOE's initial dilution guideline target of 20:1 and would require relaxation of this dilution guideline.</p> <p>Extent of mixing zone: This alternative meets plant Certificate of Approval (CofA) effluent limits developed as part of the Stage 3 expansion of the plant. These effluent limits were established, in consultation with the MOE, considering the five policies and the numerical PWQO values described in the document <i>Water Management Policies, Guidelines, Provincial Water Quality Objectives (PWQO) of the MOE</i> (July, 1994). This alternative modelled at 630MLD demonstrates that the phosphorus mixing zone, due to lower effluent concentrations, is slightly smaller than the baseline (520 MLD) phosphorus mixing zone. The ammonia mixing zone is slightly larger than the baseline mixing zone. For both phosphorus and ammonia, mixing zones do not impinge on areas of beneficial uses and result in local water quality that meets the intent of the MOE Policies Guidelines PWQO document requirements.</p> <p>Hydraulic performance: The existing outfall will achieve hydraulic performance at peak flow with no bypass.</p>	<p>Perform a yearly outfall inspection to monitor the condition of the outfall diffusers over time.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the hydraulic performance of the diffuser system over time.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the York Durham Sewage System (YDSS).</p> <p>Conclusion: After mitigation, this alternative will require relaxation on the MOE 20:1 initial dilution guideline, achieve a slightly smaller mixing zone for TP and a slightly larger mixing zone for UIA from the baseline, and achieves hydraulic performance with no bypass. Overall this alternative will have a negative change in performance and the magnitude of the impact is moderate within the Regional Study Area.</p>	<p>3</p>
<p>Duration</p> <ul style="list-style-type: none"> Long-Term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional >Regional 	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Initial dilution: Installing variable diameter ports enables higher jet velocities under average flow conditions thereby providing more favourable initial dilution. As such, this alternative meets the 20:1 dilution guideline without bypassing.</p> <p>Extent of mixing zone: This alternative meets plant Certificate of Approval (CofA) effluent limits developed as part of the Stage 3 expansion of the plant. These effluent limits were established, in consultation with the MOE, considering the five policies and the numerical PWQO values described in the document <i>Water Management Policies, Guidelines, Provincial Water Quality Objectives (PWQO) of the MOE</i> (July, 1994). This alternative modelled at 630MLD demonstrates that the phosphorus mixing zone, due to lower effluent concentrations, is slightly smaller than the baseline (520 MLD) phosphorus mixing zone. The ammonia mixing zone is slightly larger than the baseline mixing zone relative to the overall nearshore area. For both phosphorus and ammonia, mixing zones do not impinge on areas of beneficial uses and result in local water quality that meets the intent of the MOE Policies Guidelines PWQO document requirements.</p> <p>Hydraulic performance: This alternative achieves hydraulic performance at peak flow with no bypass. During peak flow events, when head losses through the outfall are highest, the variable diffuser port opening increases in diameter thereby reducing the exit head losses.</p>	<p>Perform a yearly outfall inspection to monitor the condition of the outfall diffusers.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the performance of the variable orifice check valve. Performance would be measured seasonally and over time.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Require laboratory testing of one of the variable diffuser ports before the end of the warranty period to test performance.</p> <p>Conclusion: After mitigation, this alternative will meet MOE 20:1 initial dilution guideline, achieve a slightly smaller mixing zone for TP and a slightly larger mixing zone for UIA from the baseline, and achieves hydraulic performance with no bypass. Overall this alternative will have a negative change in performance but the magnitude of the impact is low within the Regional Study Area.</p>	<p>4</p>
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Initial dilution: Since the plant does not bypass, this alternative cannot meet the MOE's initial dilution guideline target of 20:1 and would require relaxation of this dilution guideline.</p> <p>Extent of mixing zone: This alternative meets plant ammonia and is better than phosphorus Certificate of Approval (CofA) effluent limits developed as part of the Stage 3 expansion of the plant. These effluent limits were established, in consultation with the MOE, considering the five policies and the numerical PWQO values described in the document <i>Water Management Policies, Guidelines, Provincial Water Quality Objectives (PWQO) of the MOE</i> (July, 1994). This alternative modelled at 630MLD demonstrates that the phosphorus mixing zone, due to lower effluent concentrations, is significantly smaller than the baseline (520 MLD) phosphorus mixing zone. The ammonia mixing zone is slightly larger than the baseline mixing zone. For both phosphorus and ammonia, mixing zones do not impinge on areas of beneficial uses and result in local water quality that meets the intent of the MOE Policies Guidelines PWQO document requirements.</p> <p>Hydraulic performance: Hydraulic requirements for a tertiary treatment phase will exceed available head at the plant and thus effluent pumping will be required.</p>	<p>To mitigate hydraulic limitations during peak flow events, bypass tertiary treatment (i.e. peak flows will continue to receive secondary treatment and disinfection, but by-pass the tertiary facilities). This is a common practice at wastewater treatment facilities.</p> <p>Perform a yearly outfall inspection to monitor the condition of the outfall diffusers.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the hydraulic performance of the diffuser system over time.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, this alternative will require relaxation on the MOE 20:1 initial dilution guideline, achieve a much smaller mixing zone for TP and a slightly larger mixing zone for UIA, and achieves hydraulic performance with no bypass. Overall this alternative will have a negative change in performance but the magnitude of the impact is low within the Regional Study Area.</p>	<p>4</p>

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	4. Extend Existing Outfall Diffuser + Alternative	<p>Initial dilution: Extending the outfall into deeper water allows this alternative to meet the 20:1 dilution guideline without bypassing.</p> <p>Extent of mixing zone: This alternative meets plant Certificate of Approval (CofA) effluent limits developed as part of the Stage 3 expansion of the plant. These effluent limits were established, in consultation with the MOE, considering the five policies and the numerical PWQO values described in the document <i>Water Management Policies, Guidelines, Provincial Water Quality Objectives (PWQO) of the MOE</i> (July, 1994). This alternative modelled at 630MLD demonstrates that the phosphorus mixing zone, due to lower effluent concentrations, is smaller than the baseline (520 MLD) phosphorus mixing zone, however, its shape is distorted due to the asymmetric diffuser configuration and extends closer to the shoreline. The ammonia mixing zone is significantly smaller than the baseline mixing zone and is confined to the near-field region surrounding the diffuser. For both phosphorus and ammonia, mixing zones do not impinge on areas of beneficial uses and result in local water quality that meets the intent of the MOE Policies Guidelines PWQO document requirements.</p> <p>Hydraulic Performance: There is increased hydraulic risk associated with this alternative from baseline conditions. The head losses associated with connecting the extension to the existing diffuser increases the hydraulic risk.</p>	<p>Perform a yearly outfall inspection to monitor the condition of the outfall diffusers.</p> <p>Mitigate increased head losses due to outfall extension by increasing the effective diameter of port diffusers, thereby reducing exit head losses.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the hydraulic performance of the diffuser system.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, this alternative will meet MOE 20:1 initial dilution guideline, achieve a slightly smaller mixing zone for TP from baseline, but has the highest hydraulic risk compared to other alternatives. Overall this alternative will have a negative change in performance and the magnitude of the impact is high over a long period of time affecting the Regional Study Area.</p>	1
	5. New Outfall + Alternative 1	<p>Initial dilution: A new outfall in deeper water can meet the 20:1 dilution guideline without bypassing.</p> <p>Extent of Mixing zone: This alternative meets plant Certificate of Approval (CofA) effluent limits developed as part of the Stage 3 expansion of the plant. These effluent limits were established, in consultation with the MOE, considering the five policies and the numerical PWQO values described in the document <i>Water Management Policies, Guidelines, Provincial Water Quality Objectives (PWQO) of the MOE</i> (July, 1994). This alternative modelled at 630MLD demonstrates that both the ammonia and phosphorus mixing zones are smaller than the baseline (520 MLD) and are confined to the near-field region surrounding the diffuser. These mixing zones do not impinge on areas of beneficial uses and result in local water quality that meets the intent of the MOE Policies Guidelines PWQO document requirements.</p> <p>Hydraulic Performance: A new outfall will be designed to provide long-term hydraulic capacity without need for a pumping station.</p>	<p>Perform a yearly outfall inspection to monitor the condition of the outfall diffusers.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the hydraulic performance of the diffuser system over time.</p> <p>Conclusion: This alternative will meet MOE 20:1 initial dilution guideline, achieve smaller TP and UIA mixing zones, and achieves hydraulic performance with no bypass. Overall this alternative will have a positive change in performance in the long term within the Regional Study Area.</p>	5
<p>T.2 Ease of Implementation Ease of an alternative solution to be implemented</p> <p>Measures</p> <ul style="list-style-type: none"> Ease of constructing the alternative solution Ease of getting approvals and permits for alternative solution <p>Duration</p> <ul style="list-style-type: none"> Short-term (during permitting and construction) 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Constructability: No heavy civil construction is required. All required infrastructure is in place and fully commissioned to meet enhanced phosphorous removal. Dual feed and iron salt metering pumps are included as part of Stages 1, 2 and 3 as well as a new polymer building for dosing to the secondary clarifiers.</p> <p>Permitting Requirements: MOE Environmental Compliance Approval, which may be difficult given that this would require relaxation of the dilution guideline by the MOE.</p>	<p>Constructability – Mitigation is not applicable.</p> <p>Permitting Requirements - Apply for a relaxation of the 20:1 initial dilution guideline.</p> <p>Conclusion: This alternative is easy to implement since there is no construction but requires a relaxation of the 20:1 initial dilution guideline which may be difficult to receive approval. Overall, this alternative has moderate permitting requirements.</p>	3
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Constructability: No heavy civil construction is required. A diver is required to install the check valves on the existing diffuser ports. The approach is similar to opening new ports on the existing diffuser. There is low risk that the existing port flanges are degraded and require underwater welding and/or repairs.</p> <p>Permitting Requirements: MOE Environmental Compliance Approval. The variable check valve technology has been approved in Ontario at the Sault St. Marie WWTP.</p>	<p>Constructability – Mitigation is not applicable.</p> <p>Permitting Requirements – Mitigation is not applicable.</p> <p>Conclusion: This alternative does not require construction and is easy to receive approval to implement. Overall, this alternative is very easy to implement.</p>	5

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Geographic Extent <ul style="list-style-type: none"> Local 	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Constructability: Heavy civil construction is required to construct the filter building, inlet/outlet channels, chemical systems, and install membrane equipment. The secondary effluent currently flows in a common channel for each Stage to three Chlorine Contact Chambers (CCC) before discharging to the final effluent channel. The inlet channels for the three CCC will be routed to the tertiary filters and the discharge from the filters will be connected back to the CCC inlet channel. Planned construction of a new hypochlorite disinfection facility for Stages 1/2 introduces uncertainty with respect to available footprint and tie-in points. Construction of Tertiary Treatment would be compatible with implementation of dual point chemical addition system.</p> <p>Permitting Requirements: MOE Environmental Compliance Approval; building permit; site plan approval; permit to take water; TRCA Application for Development</p>	<p>Constructability – Construct two filter buildings, one for Stages 1/2 and one for Stage 3. This would decrease the length of the inlet/outlet channels and would provide more flexibility when performing tie-ins. Adjust the location of the new hypochlorite disinfection facility for Stages 1/2 to accommodate tertiary treatment facility requirements.</p> <p>Permitting Requirements – Consult with agencies early in detailed design to get all required approvals before the construction phase.</p> <p>Conclusion: After mitigation, this alternative has a number of complex tie-ins to existing facilities, and requires relaxation of the 20:1 guideline. Overall, this alternative has additional implementation requirements but change from baseline is moderate. Overall, this alternative has moderate construction and implementation requirements.</p>	3
	4. Extend Existing Outfall Diffuser + Alternative	<p>Constructability: There is high risk associated with constructing the outfall extension. Heavy civil construction is required. The existing outfall would be live during the construction of the extension which increases the level of complexity when performing the tie-in. There is a risk in constructing close to the buried valley. Geotechnical conditions encountered during construction can differ significantly from conditions based on borehole explorations which could affect construction schedule and cost. Availability of skilled trades and specialized equipment could affect schedule and increase construction risk.</p> <p>Permitting Requirements: MOE Environmental Compliance Approval; MOE/EC/TC approval for disposal of dredged or augured materials; TRCA review under Fisheries Act of potential fish habitat impacts; TRCA work permit for diffuser section, MNR Public Lands Act work permit for geotechnical and diffuser construction program; MNR Crown waterlot required, Transport Canada Navigable Waters Protection Act approval.</p> <p>Given the high risks associated with construction and limited situation where this has been implemented, gaining approval from regulatory agencies will be difficult.</p>	<p>Constructability – Construct the outfall extension in the summer period under low flow conditions and during the allowable window for open cut construction to avoid fish spawning periods (e.g. construction may be limited to the period from about July 1 to September 15 of each year). Install the diffuser section first, followed by the riser. Finally, install a header to connect the diffuser section to the risers. Also, perform additional geotechnical investigations to determine more accurate delineation of the buried valley. Mitigate lake bottom disturbances as detailed in N.1.</p> <p>Permitting Requirements - Select a location for disposal of dredged/ augured material which does not impact fish habitat (depth greater than 35 meters). Consult early with MNR to plan the construction program to mitigate lake bottom disturbances as detailed in N.1. Perform geo-chemical tests on dredged/vertical augured materials for acceptance by the regulatory agencies. Obtain a Transport Canada permit for exemption from Navigable Water Act by restoring the lakebed to existing conditions.</p> <p>Conclusion: After mitigation, this alternative is very difficult to construct and will take some effort and time to receive approvals. Overall, this alternative is difficult construct and receive permits.</p>	2
	5. New Outfall + Alternative 1	<p>Constructability: Heavy civil construction is required. A tunnel boring machine is needed to construct the tunnel. A barge is needed to drill risers for the diffuser structure. Diffuser riser construction can be delayed by adverse weather conditions. Geotechnical conditions encountered during construction can differ significantly from conditions based on borehole explorations which could affect construction schedule and cost. Availability of skilled trades and specialized equipment could affect schedule and increase construction risk.</p> <p>Permitting Requirements: MOE Environmental Compliance Approval; MOE/EC/TC approval for disposal of dredged or tunnel materials (spoils); TRCA review under Fisheries Act of potential fish habitat impacts; TRCA work permit for shoreline shaft site and diffuser section, MNR Public Lands Act work permit for geotechnical and diffuser construction program; MNR Crown waterlot required, Transport Canada Navigable Waters Protection Act approval. Follow occupational health and safety requirements.</p>	<p>Constructability – First construct the on-shore shaft and tunnel section, followed by drilling the vertical risers into the tunnel from a barge in the lake.</p> <p>Permitting Requirements – Consult with agencies early in detailed design to get approvals as efficiently and quickly as possible. Select a location for disposal of dredged/ tunnelled material which does not impact fish habitat (depth greater than 35 meters), or at a suitable disposal site on land. Select a haulage route on land that is acceptable to regulatory agencies. Perform geo-chemical tests on dredged/tunnelled materials for acceptance by the regulatory agencies.</p> <p>Conclusion: After mitigation, this alternative is difficult to construct and will take effort and time to receive permits, but the tunnelling approach is a standard construction method for this application. Overall, this alternative has moderate construction and implementation requirements.</p>	3
T.3 Compatibility with Current Operation of the WPCP The compatibility of the alternative solution with the existing plant processes.	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Connecting to Existing Processes: There are no works required to connect to the existing processes that will impact operations of the plant during construction.</p> <p>Change in Processes During Operation: This alternative will utilize existing dual point iron and polymer addition systems already installed at the Duffin Creek WPCP. Current operations, however, only utilize single point addition and do not utilize the polymer addition. An updated Standard Operating Procedure would be required to operate the dual point and polymer addition systems.</p>	Mitigation is not applicable. <p>Conclusion: After mitigation, this alternative is very compatible with current operations. Overall, there is no change in compatibility with current operations from baseline.</p>	5

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Measures <ul style="list-style-type: none"> Extent of works needed to connect to existing processes Extent of change in existing processes during operation Duration <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) Geographic Extent <ul style="list-style-type: none"> Local 	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Connecting to Existing Processes: The check valves are installed on the existing outfall but will not impact operations of the plant during construction.</p> <p>Change in Processes During Operation: Modifying existing outfall diffuser will not impact operation of the plant during construction.</p> <p>All the impacts associated with Alternative 1 will apply to this alternative.</p>	<p>Mitigation is not applicable.</p> <p>Conclusion: After mitigation, this alternative is very compatible with current operations. Overall, there is no change in compatibility with current operations from baseline.</p>	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Connecting to Existing Processes: The tertiary treatment process is between secondary treatment and disinfection. During construction, the operations of the plant will be impacted by the tie-ins to the secondary effluent channels and the disinfection inlet channels. There will be a dedicated tertiary facility for Stages 1 and 2, and one for Stage 3. Stages 1, 2 and Stage 3 may need to be taken out of service at separate times to perform the tie-ins.</p> <p>Change in Processes During Operation: Membrane filtration requires operation of equipment that plant staff already have experience with: pumps, blowers and compressors. Operation of membranes will be new to plant staff as well as requirements to provide regular chemical cleaning of membranes through use of sodium hypochlorite and citric acid. Wet weather flows will be managed by overflow weirs.</p> <p>All the impacts associated with Alternative 1 will apply to this alternative.</p>	<p>Develop a construction sequence to minimize operations impact during construction.</p> <p>Conclusion: After mitigation, this alternative is not compatible with current operations and requires significant changes to existing operations. Overall, there is a negative change in compatibility with current operations of high magnitude.</p>	2
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Connecting to Existing Processes: The outfall extension would be installed on the existing live outfall and could impact the current operations at the plant during construction.</p> <p>Change in Processes During Operation: The outfall extension will not impact operation of current plant processes.</p> <p>All the impacts associated with Alternative 1 will apply to this alternative.</p>	<p>Develop a construction sequencing strategy to minimize operations impact during construction. Perform tie-ins during the summer season when there is a lower likelihood of a wet weather event.</p> <p>Conclusion: After mitigation, this alternative will affect operations of the existing outfall during construction, but there is no change in operations. Overall, there is a negative change in compatibility with current operations of moderate magnitude.</p>	3
	5. New Outfall + Alternative 1	<p>Connecting to Existing Processes: The new outfall will be constructed in a new drop shaft. There will be tie-ins to the existing effluent channel which would have low impact to current operations at the plant during construction.</p> <p>Change in Processes During Operation: The new outfall will not impact operation of current plant processes.</p> <p>All the impacts associated with Alternative 1 will apply to this alternative.</p>	<p>Develop a construction sequencing strategy to minimize operations impact during construction.</p> <p>Conclusion: After mitigation, this alternative is compatible with current operations and will affect current operations only during the tie-in to the existing channel. Overall, there is a negative change in compatibility with current operations of low magnitude.</p>	4
	T.4 Ability to Use Existing Infrastructure and Land The degree to which alternative uses existing infrastructure and land owned by the Regions.	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Use of existing infrastructure: This alternative uses the existing dual point iron addition and polymer addition systems, and uses the existing outfall.</p> <p>Use of existing land/ water lot: No additional land on the existing site is required for this alternative.</p>	<p>Mitigation is not applicable to this alternative since it uses existing infrastructure and land.</p> <p>Conclusion: This alternative uses existing infrastructure and does not require additional land. Overall, there is no change to use of existing infrastructure and no additional land is required.</p>
Measures <ul style="list-style-type: none"> Use of existing infrastructure Use of existing owned land/ water lot Duration	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Use of existing infrastructure: This alternative uses the existing outfall including drop shaft and conveyance channels.</p> <p>Use of existing land/ water lot: No additional land on the existing site is required for this alternative.</p>	<p>Mitigation is not applicable to this alternative since it uses existing infrastructure and land.</p> <p>Conclusion: This alternative uses existing infrastructure and does not require additional land. Overall, there is no change to use of existing infrastructure and no additional land is required.</p>	5

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<ul style="list-style-type: none"> Long-term (during operation) Geographic Extent <ul style="list-style-type: none"> Local 	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Use of existing infrastructure: Solids generated from the tertiary process could be conveyed to the existing RAS/WAS pumping building for management using the plants current solids management systems. To service the power requirements of the membrane facility, an additional generator would be required for standby power. The existing substation has enough power to supply tertiary treatment but would require additional breakers as well as 5 kV cabling. Additional fans would be required on the high voltage transformers. The existing duct bank network would need to be extended to the new facility.</p> <p>Use of existing land/ water lot: Tertiary treatment would require development of around 5,000 m² of land. This land may be available onsite in the vicinity of the disinfection process.</p>	<p>Locate the tertiary filtration building close to existing channels to reduce the length of new channel construction required.</p> <p>Conclusion: After mitigation, this alternative will require modification of existing infrastructure and will require additional footprint on the existing site. Overall, this is a negative change from baseline conditions but the impact is moderate.</p>	3
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Use of existing infrastructure: This alternative uses the existing outfall.</p> <p>Use of existing land/ water lot: The Regions own the waterlot for the existing outfall. The extension will require an easement or additional waterlot. No additional land onsite is required for this alternative since the extension uses the existing drop shaft.</p>	<p>Negotiate the acquisition of additional water lot land from the required agencies (i.e. MNR and Infrastructure Ontario).</p> <p>Conclusion: This alternative uses the existing outfall infrastructure but will require an additional water lot for the extension. Overall, this is a negative change from baseline conditions and the impact is high.</p>	2
	5. New Outfall + Alternative 1	<p>Use of existing infrastructure: This alternative requires new infrastructure and replaces the existing outfall, which still has useful life.</p> <p>Use of existing land/ water lot: Additional land within the current plant footprint onsite would be utilized to install a new drop shaft. The new outfall will require an easement or additional waterlot approximately 3km into the lake.</p>	<p>Negotiate the acquisition of additional water lot land from the required agencies (i.e. MNR and Infrastructure Ontario).</p> <p>Conclusion: This alternative does not fully utilize the remaining life of the existing outfall and will require an additional water lot. Overall, this is a negative change from baseline conditions and the impact is high.</p>	2
T.5 Flexibility to Meet Possible Future Capacity Requirements The flexibility of the alternative solution to meet possible future capacity requirements past 630MLD	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Ability to achieve 20:1 initial dilution and mixing zone requirement beyond 630MLD: This alternative does not meet 20:1 initial dilution or mixing zone requirements beyond 630MLD.</p> <p>Ability to meet hydraulic capacity requirements beyond 630MLD: This alternative cannot hydraulically meet the ultimate plant capacity requirements which are estimated to be around 890 MLD. A Municipal Class EA for the Duffin Creek WPCP would be required before flows exceed an average day flow of 630MLD.</p>	<p>Implement measures to manage and reduce plant flows to extend the life of the infrastructure. Such measures include: water efficiency/conservation programs; I&I reduction programs, YDSS operational management strategy.</p> <p>Conclusion: After mitigation, this alternative does not have flexibility to meet possible future capacity requirements.</p>	1
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Ability to achieve 20:1 initial dilution and mixing zone requirement beyond 630MLD: This alternative does meet the 20:1 initial dilution to 650MLD, but not at the ultimate plant capacity.</p> <p>Ability to meet hydraulic capacity requirements beyond 630MLD: This alternative does meet hydraulic capacity requirements above 630MLD but cannot hydraulically meet the ultimate capacity requirements which are estimated to be around 890 MLD. A Municipal Class EA for the Duffin Creek WPCP would be required before flows exceed an average day flow of 630MLD.</p>	<p>Mitigation measures are the same as Alternative 1.</p> <p>Conclusion: After mitigation, this alternative somewhat meets long-term capacity requirements for the 20:1 initial dilution guideline and hydraulic capacity but does not meet the ultimate plant capacity. After mitigation, this alternative has moderate flexibility to meet possible future capacity requirements.</p>	3
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Ability to achieve 20:1 initial dilution and mixing zone requirement beyond 630MLD: This alternative does not meet 20:1 initial dilution requirements beyond 630MLD but does meet the mixing zone requirements for TP.</p> <p>Ability to meet hydraulic capacity requirements beyond 630MLD: This alternative does not meet hydraulic capacity requirements above 630MLD or the ultimate capacity requirements which are estimated to be around 890 MLD. A Municipal Class EA for the Duffin Creek WPCP would be required before flows exceed an average day flow of 630MLD.</p>	<p>Mitigation measures are the same as Alternative 1.</p> <p>Conclusion: After mitigation, this alternative does not meet long-term capacity requirements for hydraulic performance beyond 630 MLD. After mitigation, this alternative has moderate flexibility to meet possible future capacity requirements.</p>	3

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	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Ability to achieve 20:1 initial dilution and mixing zone requirement beyond 630MLD: This alternative does meet the 20:1 initial dilution and mixing zone requirement beyond 630MLD, but not at the ultimate plant capacity.</p> <p>Ability to meet hydraulic capacity requirements beyond 630MLD: This alternative cannot hydraulically meet the ultimate plant capacity requirements which are estimated to be around 890 MLD. A Municipal Class EA for the Duffin Creek WPCP would be required before flows exceed an average day flow of 630MLD.</p>	<p>Mitigation measures are the same as Alternative 1</p> <p>Conclusion: After mitigation, this alternative does not have flexibility to meet possible future capacity requirements.</p>	1
	5. New Outfall + Alternative 1	<p>Ability to achieve 20:1 initial dilution and mixing zone requirement beyond 630MLD: This alternative does meet the 20:1 initial dilution and mixing zone requirement to the ultimate plant capacity.</p> <p>Ability to meet hydraulic capacity requirements beyond 630MLD: This alternative would be designed to hydraulically meet the ultimate capacity requirements which are estimated to be around 890 MLD. A Municipal Class EA for the Duffin Creek WPCP would be required before flows exceed an average day flow of 630MLD.</p>	<p>Mitigation measures are the same as Alternative 1.</p> <p>Conclusion: After mitigation, this alternative does have flexibility to meet all possible future capacity requirements.</p>	5
<p>T.6 Risks to Shoreline Infrastructure Features</p> <p>The level of risk from each alternative on the shoreline infrastructure features.</p> <p>Measures</p> <p>Risk to Pickering Nuclear Plant, Duffin WPCP, and the Ajax WSP from:</p> <ul style="list-style-type: none"> Sediments impact on intakes/outfalls during construction Facilities required for operation <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional >Regional 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Risks during construction: There are no risks during construction since there is no heavy construction associated with this alternative.</p> <p>Risks during operations: There are no risks to shoreline infrastructure features associated with the operation of this alternative since there are no significant changes to the operations.</p>	<p>Mitigation is not applicable to this alternative as no risk to shoreline infrastructure features has been identified.</p> <p>Conclusion: There is no change in risk to shoreline infrastructure features from the baseline.</p>	5
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Risks during construction: Modifying existing outfall diffuser using variable diameter ports poses no risk to shoreline infrastructure.</p> <p>Risks during operations: There are no risks to shoreline infrastructure features associated with the operation of this alternative.</p>	<p>Mitigation is not applicable to this alternative as no risk to shoreline infrastructure features has been identified.</p> <p>Conclusion: There is no change in risk to shoreline infrastructure features from the baseline, during construction and operation, over any geographic extent.</p>	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Risks during construction: Construction of a tertiary treatment facility at the Duffin Creek WPCP has low risk to shoreline infrastructure from runoff and sedimentation to the lake.</p> <p>Risks during operations: There are no risks to shoreline infrastructure features associated with the operation of this alternative.</p>	<p>Implement sediment control techniques during construction on-site to limit risk of runoff and sedimentation to lake.</p> <p>Conclusion: After mitigation, this alternative poses low risk to shoreline infrastructure, during construction and operation, over any geographic extent.</p>	4
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Risks during construction: During construction of this alternative, there is potential impact at Ajax Water Supply Plant intake due to increased sediment levels.</p> <p>Risks during operations: There are no risks to shoreline infrastructure features associated with the operation of this alternative.</p>	<p>To control sediment, use a drag-line water tight bucket to minimize sediment transport during open cut construction. For drilling risers, use a moon barge which has a curtain on the outside to prevent sediment transport.</p> <p>Conclusion: After mitigation, there remains high risk to shoreline infrastructure associated with this alternative during construction within the Regional Study Area.</p>	2
	5. New Outfall + Alternative 1	<p>Risks during construction: Construction of a new outfall has moderate risk to shoreline infrastructure from runoff and sedimentation to the lake from land storage of spoils, and sedimentation from in-lake diffuser drilling.</p> <p>Risks during operations: There are no risks to shoreline infrastructure features associated with the operation of this alternative.</p>	<p>Implement sediment control techniques during construction on-site to limit risk of runoff and sedimentation to lake.</p> <p>Conclusion: After mitigation, there remains moderate risk to shoreline infrastructure associated with this alternative during construction, within the Regional Study Area.</p>	3

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>T.7 Risks or susceptibility to changing long-term conditions The level of risk from long-term conditions.</p> <p>Measures</p> <ul style="list-style-type: none"> Risk of changing water levels from climate change Risk from changing regulatory requirements Cessation of Pickering Nuclear Plant operations <p>Duration</p> <ul style="list-style-type: none"> Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional >Regional 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p>	<p>Climate change: There is potential risk with changes in lake level. If the lake level decreases, the hydraulic capacity of the outfall increases but the mixing efficiency decreases. If the lake level increases, the hydraulic capacity of the outfall decreases, but the outfall achieves better mixing.</p> <p>National Regulations: No impacts are anticipated as the Duffin Creek WPCP is already in compliance with the proposed national wastewater regulations.</p> <p>Cessation of Pickering Nuclear Plant operations: The cessation of the Pickering Nuclear plant does not significantly impact the mixing patterns in the vicinity of the existing outfall.</p>	<p>Hydroelectric dams downstream of Lake Ontario are used by the International Joint Commission (IJC) to regulate water levels. This decreases the risk of high lake water levels but does not mitigate the risk of low lake levels. The diameter of the port opening should be adjusted to achieve mixing performance while achieving hydraulic performance.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, there remains moderate risk that climate change could lead to impacts on water quality and the ability of the outfall to achieve hydraulic performance within the Local Study Area.</p>	3
	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Climate change: There is potential risk with changes in lake level. If the lake level decreases, the hydraulic capacity of the outfall increases but the mixing efficiency decreases. If the lake level increases, the hydraulic capacity of the outfall decreases, but the outfall achieves better mixing. There is also risk of extreme wet weather event.</p> <p>National Regulations: No impacts are anticipated as the Duffin Creek WPCP is already in compliance with the proposed national wastewater regulations.</p> <p>Cessation of Pickering Nuclear Plant operations: The cessation of the Pickering Nuclear plant does not significantly impact the lake current patterns in the vicinity of the existing outfall.</p>	<p>Hydroelectric dams downstream of Lake Ontario are used by the International Joint Commission (IJC) to regulate water levels. This decreases the risk of high lake water levels but does not mitigate the risk of low lake levels. The size and number of variable port openings should be adjusted to achieve mixing and hydraulic performance.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, there remains moderate risk that climate change could lead to impacts on water quality and the ability of the outfall to achieve hydraulic performance within the Local Study Area.</p>	3
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Climate change: There is potential risk with changes in lake level. If the lake level decreases, the hydraulic capacity of the outfall increases but the mixing efficiency decreases. If the lake level increases, the hydraulic capacity of the outfall decreases, but the outfall achieves better mixing. There is also risk of extreme wet weather event.</p> <p>National Regulations: No impacts are anticipated as the Duffin Creek WPCP is already in compliance with the proposed national wastewater regulations.</p> <p>Cessation of Pickering Nuclear Plant operations: The cessation of the Pickering Nuclear plant does not significantly impact the lake current patterns in the vicinity of the existing outfall.</p>	<p>Hydroelectric dams downstream of Lake Ontario are used by the International Joint Commission (IJC) to regulate water levels. This decreases the risk of high lake water levels but does not mitigate the risk of low lake levels. The diameter of the port opening should be adjusted to achieve mixing performance while achieving hydraulic performance.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, there remains moderate risk that climate change could lead to impacts on water quality and the ability of the outfall to achieve hydraulic performance within the Local Study Area.</p>	3
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Climate change: There is potential risk with changes in lake level. If the lake level decreases, the hydraulic capacity of the outfall increases but the mixing efficiency decreases. If the lake level increases, the hydraulic capacity of the outfall decreases, but the outfall achieves better mixing. There is also risk of extreme wet weather event.</p> <p>National Regulations: No impacts are anticipated as the Duffin Creek WPCP is already in compliance with the proposed national wastewater regulations.</p> <p>Cessation of Pickering Nuclear Plant operations: The cessation of the Pickering Nuclear plant does not significantly impact the lake current patterns in the vicinity of the proposed new outfall extension.</p>	<p>Hydroelectric dams downstream of Lake Ontario are used by the International Joint Commission (IJC) to regulate water levels. This decreases the risk of high lake water levels but does not mitigate the risk of low lake levels. The diameter of the port opening should be adjusted to achieve mixing performance while achieving hydraulic performance.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows in the YDSS sewer network.</p> <p>Conclusion: After mitigation, there remains moderate risk that climate change could lead to impacts on water quality and the ability of the outfall to achieve hydraulic performance within the Local Study Area.</p>	3
	<p>5. New Outfall + Alternative 1</p>	<p>Climate change: There is low risk with changes in lake level. The new outfall would be designed to perform under long-term change conditions.</p> <p>National Regulations: No impacts are anticipated as the Duffin Creek WPCP is already in compliance with the proposed national wastewater regulations.</p> <p>Cessation of Pickering Nuclear Plant operations: The cessation of the Pickering Nuclear</p>	<p>Hydroelectric dams downstream of Lake Ontario are used by the International Joint Commission (IJC) to regulate water levels. This decreases the risk of high lake water levels. A new outfall in deeper waters mitigates the risk of low lake levels. The diameter of the port opening should be adjusted to achieve mixing performance while achieving hydraulic performance.</p> <p>Implement the recommendations of an Operational Flow Management Project to manage peak flows</p>	5

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		plant does not impact the lake current patterns in the vicinity of the proposed new outfall.	in the YDSS sewer network. Conclusion: After mitigation, there is no change in risk or susceptibility to changing long-term conditions within the Local Study Area.	
<p>T.8 Ease of Operation and Maintenance</p> <p>The level of ease to operate and maintain the alternative once implemented/constructed and additional staff requirements.</p> <p>Measures</p> <ul style="list-style-type: none"> Degree of change in operation requirements Degree of change in maintenance requirements <p>Duration</p> <ul style="list-style-type: none"> Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Ease of operation: An additional staff dedicated to the enhanced Total Phosphorus (TP) removal system may be required. Operation of the plant to achieve enhanced TP removal involves a moderately higher degree of complexity and operator intervention. There would be increased operational requirements to monitor the existing outfall for performance.</p> <p>Ease of maintenance: On the outfall, there is low risk of zebra mussels plugging the fixed diffuser ports and air release vents in the manholes.</p>	<p>Implement a Standard Operating Procedure and provide training for operators to optimize the enhanced TP removal system.</p> <p>Implement a Standard Operating Procedure for collecting water level data in the outfall shaft to monitor the hydraulic performance of the diffuser system.</p> <p>Conclusion: After mitigation, this alternative is easy to operate but with some changes to existing operations and maintenance. Overall, there are more O&M requirements than baseline, and the magnitude is low.</p>	4
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Ease of operation: All O&M requirements associated with Alternative 1 apply to this alternative.</p> <p>Ease of maintenance: The risk of diffuser ports being blocked is very low since zebra mussels prefer hard, stable surfaces and the check valves are rubber with high exit velocities.</p> <p>All O&M requirements associated with Alternative 1 apply to this alternative</p>	<p>Mitigation measures in Alternative 1 apply to this alternative.</p> <p>Conduct inspections twice per year in the first two years of installation and decrease to yearly inspections once monitoring yields reliable performance. The inspections can be aligned with the port opening schedule to reduce mobilization costs for procuring the diving contractor.</p> <p>Conclusion: After mitigation, this alternative is easy to operate but with some changes to existing operations and maintenance. Overall, there are more O&M requirements than baseline, and the magnitude is low.</p>	4
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Ease of operation: There are significant increases in O&M requirements for this alternative, notably with respect to:</p> <ul style="list-style-type: none"> Cleaning in place (Hypochlorite and Citric Acid) Pump, blower and compressor maintenance <p>Operations of the tertiary treatment process will require at least 2 additional operators and 1 additional maintenance staff.</p> <p>Ease of maintenance: Maintenance of a membrane filtration facility involves a relatively high degree of complexity.</p> <p>All O&M requirements associated with Alternative 1 apply to this alternative</p>	<p>Mitigation measures in Alternative 1 apply to this alternative.</p> <p>Create Standard Operating Procedures and train plant staff on the operation of the membrane filtration facility including process optimization, operation of mechanical equipment, in-place cleaning of membranes.</p> <p>By-pass the membrane filtration system during wet weather events.</p> <p>Conclusion: After mitigation, this alternative still has a higher degree of difficulty in operating and maintenance from baseline condition. Overall, there are more O&M requirements than baseline, and the magnitude is high with long-term implications.</p>	1
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Ease of operation: All O&M requirements associated with Alternative 1 apply to this alternative.</p> <p>Ease of maintenance: All O&M requirements associated with Alternative 1 apply to this alternative.</p>	<p>Mitigation measures in Alternative 1 apply to this alternative.</p> <p>Conduct inspections twice per year in the first two years of installation and decrease to yearly inspections once monitoring yields reliable performance.</p> <p>Conclusion: After mitigation, this alternative is easy to operate but with some changes to existing operations and maintenance. Overall, there are more O&M requirements than baseline, and the magnitude is low.</p>	4
	5. New Outfall + Alternative 1	<p>Ease of operation: A new outfall would be sized for an ultimate plant capacity of 890 MLD with sufficient hydraulic capacity. This would minimize the O&M requirements.</p> <p>Ease of maintenance: All O&M requirements associated with Alternative 1 apply to this alternative.</p>	<p>Mitigation measures in Alternative 1 apply to this alternative.</p> <p>Conclusion: After mitigation, this alternative is easy to operate and maintain. Overall, there are less O&M requirements than baseline.</p>	5
N.1 Impact on Nearshore Aquatic	1. Existing Upgraded Plant	Construction: No impacts anticipated given that no construction component is identified for	Construction: No mitigation is prescribed given that no construction component is identified for this	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>Systems and Habitat</p> <p>The potential of the alternative solution to impact valued ecosystem components (VECs) as they pertain to aquatic biota in the nearshore (< 15m water depth)</p> <p>Measures</p> <p>Changes in the habitat function and production capacity in the nearshore aquatic habitat compared to the baseline condition based on:</p> <ul style="list-style-type: none"> • Size of construction/ operational footprint and extent of disturbance. • Location of construction/ operational activity in relation to available habitat; • Potential for changes to non-modeled water quality parameters (e.g. suspended sediments, contaminants) during construction; • Construction method; and, • Change in size and location of TP and UIA mixing zones during operation¹. <p>Duration</p> <ul style="list-style-type: none"> • Short-term (during construction) • Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> • Local • Regional 	<p>and Optimized Operations (Stages 1, 2, and 3) + Alternative 1</p>	<p>this alternative. Therefore, impact rating relating to construction is 5.</p> <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> • Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. <p>The mixing zone compared to the baseline condition at 630 MLD will be larger for Unionized Ammonia (UIA) and slightly smaller for TP. UIA within the mixing zone is of concern to the natural environment because of its link to toxicity in fish and other biota. The baseline condition of the UIA mixing zone was considered small in comparison to the overall area of the nearshore zone. An increase of 39% in the size of the UIA mixing zone is predicted as a result of this alternative (from a baseline condition of 4.1 ha to a predicted 5.7 ha). The larger mixing zone still represents a small area in comparison to the area available to biota in the nearshore zone of the LSA. The magnitude of impact as a result of this alternative is considered to be low for the following reasons:</p> <ol style="list-style-type: none"> The size of the mixing zone for UIA is small in relation to the size of the nearshore zone within LSA; The UIA mixing zone does not provide specialized habitat; and, The UIA mixing zone is used by fish on a transient basis. <ul style="list-style-type: none"> • Impacts during operation have been identified as negative, low in magnitude, long in duration, and local in geographic extent to result in a rating of 4. 	<p>alternative.</p> <p>Operation: No mitigation measures are prescribed given that potential for impacts is directly linked to changes in water quality. Mitigation measures related to water quality during operation are described in criterion N3.</p> <p>Conclusion: The residual impact related to this alternative is identified as the increased size in the mixing zone for UIA in the nearshore zone. For the reasons outlined in the impact assessment, the increase is considered incremental and the residual impact is considered low.</p>	
	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: Modification of the existing diffuser is not expected to disturb lake bed materials as no physical construction is necessary. The pathway of effect considered relating to disturbances from construction is as follows:</p> <ul style="list-style-type: none"> • In-water works will cause general disturbance through noise, vibration and human activity in nearshore and offshore zones → disturbance deters fish from using habitat in the area. The Natural Environment report (Appendix C) documents the bed material in the area near the outfall discharge as sand with abundant algal mats. It is unlikely that this type of bed material would be suitable as spawning, nursery or foraging habitat for fish; therefore, the resulting impact to fish habitat use is considered low in magnitude. Underwater construction work to modify the diffuser is assumed to require limited equipment and be short in duration (i.e. one season). Therefore, impacts are identified as negative, low in magnitude, and short in duration to result in a rating of 4. <p>Operation: No additional operational footprint is required for this alternative; therefore, operational impacts relate to the increase in discharge to 630MLD.</p> <p>The pathway of effect considered:</p> <ul style="list-style-type: none"> • Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. <p>The mixing zone compared to the baseline condition at 630 MLD will be larger for Unionized Ammonia (UIA) and smaller for TP. UIA within the mixing zone is of concern to the natural environment because of its link to toxicity in fish and other biota. The baseline condition of the UIA mixing zone was considered small in comparison to the overall area of the nearshore zone. An increase of 39% in the size of the UIA mixing zone is predicted as a result of this alternative (from a baseline condition of 4.1 ha to a predicted 5.7 ha). The larger mixing zone still represents a small area in comparison to the area available to biota in the nearshore zone of the LSA. The magnitude of impact as a result of this alternative is considered to be low for the following reasons:</p>	<p>Construction: Mitigation is not applicable.</p> <p>Operation: No mitigation measures are prescribed given that potential for impacts is directly linked to changes in water quality. Mitigation measures related to water quality during operation are described in criterion N3.</p> <p>Conclusion: Given that in-water installation of the check valves will be undertaken by divers using limited equipment, over a short-period (e.g. 1 month period) and won't require the use of heavy construction machinery or the removal of lake substrate, impact to the natural environment is limited to the minor disruption to transient aquatic species caused by the presence of divers. Therefore, impacts during in-water works as they relate to disturbance of fish habitat are rated as 4. Similarly, the impact to water quality during operation of the modified diffuser as it relates to health of biota is considered low (4). The residual impact is identified as the increased size of the mixing zone for UIA in the nearshore zone. However, given that the increase in extent of area affected by the UIA mixing zone (from 4.1 to 5.7 ha) is considered incremental in comparison to the overall area of the nearshore zone, this impact is considered low .</p>	<p>4</p>

¹ Water quality criteria available through modelling results that were identified as a particular concern to biota were that of total phosphorus (TP), because of its link to nutrient enrichment and subsequent changes to the food chain, and unionized ammonia (UIA) because of its toxicity to fish and other aquatic biota.

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<ul style="list-style-type: none"> a) The size of the mixing zone for UIA is small in relation to the size of the nearshore zone within LSA; b) The UIA mixing zone does not provide specialized habitat; and, c) The UIA mixing zone is used by fish on a transient basis. <ul style="list-style-type: none"> • Impacts during operation have been identified as negative, low in magnitude, long in duration, and local in geographic extent to result in a rating of 4. 		
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: No in-water infrastructure is planned for this alternative. Impacts are anticipated to occur primarily within the existing WPCP footprint. Given the setback from the lake and application of appropriate mitigation as described herein, no discernible impact is anticipated as a result of construction activities to near shore aquatic systems and habitats. Therefore, impact rating relating to construction is 5.</p> <p>Operation: Given that this alternative does not entail any physical change or footprint within the nearshore zone, operational impacts would be limited to effects resulting from changes to water quality.</p> <p>The pathway of effect considered:</p> <ul style="list-style-type: none"> • Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. <p>The mixing zone compared to the baseline condition at 630 MLD will be larger for Unionized Ammonia (UIA) and smaller for TP. UIA within the mixing zone is of concern to the natural environment because of its link to toxicity in fish and other biota. The baseline condition of the UIA mixing zone was considered small in comparison to the overall area of the nearshore zone. An increase of 39% in the size of the UIA mixing zone is predicted as a result of this alternative (from a baseline condition of 4.1 ha to a predicted 5.7 ha). The larger mixing zone still represents a small area in comparison to the area available to biota in the nearshore zone of the LSA. The magnitude of impact as a result of this alternative is considered to be low for the following reasons:</p> <ul style="list-style-type: none"> a) The size of the mixing zone for UIA is small in relation to the size of the nearshore zone within LSA; b) The UIA mixing zone does not provide specialized habitat; and, c) The UIA mixing zone is used by fish on a transient basis. <ul style="list-style-type: none"> • Impacts during operation have been identified as negative, low in magnitude, long in duration, and local in geographic extent to result in a rating of 4. 	<p>Construction: No mitigation is prescribed given that no impacts relating to construction are identified for this alternative.</p> <p>Operation: No mitigation measures are prescribed given that potential for impacts is directly linked to changes in water quality. Mitigation measures related to water quality during operation are described in criterion N3.</p> <p>Conclusion: Given that the area to be impacted by an increase in the size of UIA mixing zone is located in an area where fish are transient and no known specialized fish habitat occurs, adverse impacts to fish health are considered low. The residual impact is identified as the increased size of the mixing zone for UIA in the nearshore zone. However, given that the increase in extent of area affected by the UIA mixing zone (from 4.1 to 5.7 ha) is considered incremental in comparison to the overall area of the nearshore zone, this impact is considered low .</p>	4
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: With this alternative, construction equipment and materials are assumed to be loaded onto a barge at a nearby docking facility (such that no on-site staging area is required). Open water disposal of excavated substrates was assumed in the assessment of impacts for this alternative. This assumption included that the open water disposal site would be sited in deep water and that the excavated materials would meet environmental criteria for open water disposal.</p> <p>Pathways of effect that pertain to construction of this alternative relate to open trench construction in the nearshore zone, the need for disposal of spoils and changes to water quality. Many of the pathways pertain to entrainment of sediments and subsequent alteration of lake bed conditions as they relate to habitat for fish and benthic invertebrates. The area in the vicinity of the existing outfall diffuser is predominately sand, as was much of the nearshore zone. This type of material is expected to produce a localized, relatively short lived plume as a result of dredging activity, such that the concentration of suspended sediments is likely to return to background levels shortly after the dredging activity is completed. As well, given the first response of fish to increased levels of suspended sediment is generally that of avoidance the number of fish with potential to be utilizing the area during construction is considered to be low. Deposition of sediments would be</p>	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> • Use a nearby docking facility and barge to manage materials and equipment necessary for construction. • Store any stockpiled materials well away from the lake edge to prevent substances from inadvertently entering the nearshore zone. • Use a turbidity curtain around drilling equipment during the installation of risers. • Use a dragline water tight bucket on excavation equipment to reduce release of suspended sediments during water column transport. • Remove substrates from the lake bottom prior to starting excavation with a submarine excavator thereby reducing use of the area by fish since a potential food resource (invertebrates) is removed. • Use deterrents or barriers to temporarily discourage fish from using area during construction (e.g. repelling charges, bubble curtain). • Limit duration of in-water work to avoid fish spawning periods (e.g. construction may be limited to the period from about July 1 to September 15 of each year). 	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>expected to occur over a relatively large area (through wind and wave action) such that the deposited material would consist of a thin layer through which benthic invertebrates would be able to burrow. All of these factors were considered in the rating of this alternative and in the pathways of effect described below:</p> <ul style="list-style-type: none"> In-water construction activities will disturb lake bed materials and entrain sediment → entrainment of sediments results in increased concentrations of suspended sediment → exposure to increased suspended sediments can result in lethal to sub-lethal effects to fish and benthic invertebrates → stress can cause a decrease in abundance of fish and benthic invertebrates. Open trench construction will result in entrainment of sediments. Mitigation (e.g. timing windows and use of turbidity curtain) is intended to reduce this impact. Given that sand is the predominant lakebed material, the duration of time for which elevated suspended sediments would occur is considered to be relatively short in duration (with background conditions returning to that of background levels shortly after completion of dredging) and deposited sediments are not considered to be of a depth that would pose an impediment to most benthic invertebrates. As well, for reasons documented above it is anticipated that few fish would utilize the area, particularly during dredging. Therefore, this impact is considered to be negative, low in magnitude, local in geographic extent, and short in duration, such that a rating of 4 was applied. In-water construction activities will disturb lake bed materials and entrain sediment → entrainment results in increased concentrations of suspended sediments in the water column → deposition of suspended sediments can result in a change in composition of substrate in the area where deposition occurs → change in substrate composition leads to change in habitat structure and food supply for fish. Link is valid. The bed materials within the lake at the outfall location consist of predominately sand. Substrate composition is expected to be similar to baseline conditions and deposition is not anticipated to impact the number or composition of benthic invertebrates (potential food source for fish) expected to inhabit this area. This negative impact is considered to be low in magnitude (based on the limitations of the bed materials to provide habitat and food supply, mostly sand), local in geographic extent and short in duration, such that a rating of 4 was applied. In-water construction activities will disturb lake bed materials and entrain sediment → entrainment results in increased concentrations of suspended sediments in the water column → deposition of entrained sediments has the potential to change the composition of substrate in the area where deposition occurs → changes in substrate composition can result in changes to composition and abundance of the benthos community. The materials in the vicinity of the lakebed at the outfall location consist of predominately sand. Resulting composition of lake bed materials after settling of suspended sediments is expected to be similar to baseline conditions and not anticipated to adversely impact the number or composition of benthic invertebrates expected to inhabit this area. No impact is anticipated, such that a rating of 5 was applied. In-water construction activities will remove lake bed materials → removal of habitat for fish and benthic invertebrates. The materials in the vicinity of the lakebed at the outfall location consist of predominately sand. No specialized habitat for benthic invertebrates or fish is documented in this area, such that fish encountered are likely to be transient. This negative impact is considered to be low in magnitude (based on the limitations of the substrate to provide habitat and the small area to be affected compared to the area of similar habitat available), local in geographic extent and short in duration (with subsequent re-colonization of much of the area), such that a rating of 4 was applied. 	<ul style="list-style-type: none"> Use excavated materials to restore disturbed lakebed in the footprint of construction to the degree possible. Dispose of excess excavated material in offshore zone where substrates are predominantly sand and lakebed is not likely to comprise spawning habitat. <p>Operation: Work with agencies to enhance and restore habitat within the construction footprint where fish habitat is identified.</p> <p>Conclusion: Impacts due to construction are considered to be low in the short-term, while operational impacts range from low negative to positive. The overall rating was determined to be 4.</p> <p>There are residual impacts associated with the new extended outfall diffuser occupying previously existing fish habitat. However, fish utilization within the diffuser mixing zone footprint is expected to be limited because habitat in the vicinity of the diffuser is unspecialized. Even with the application of mitigation measures during construction, there is potential for in-water works to cause incidental harm to fish and benthic invertebrates. The residual impacts are considered to be low.</p>	

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<ul style="list-style-type: none"> In water detonation of explosives causes a rapid rise to high peak pressures in the water column followed by a rapid decay below ambient hydrostatic pressure → fish can experience damage to swim bladders and other internal organs where these types of pressure changes occur to result in mortality of fish. Mitigation includes deterrents for fish (e.g. bubble curtain) and consideration of timing and duration of activity intended to minimize mortality. Also, given that utilization of the area by fish is considered incidental impacts are anticipated to be on an individual basis rather than at a community or population level. Therefore, the impact is considered to be negative, low in magnitude, local in geographic extent and of short duration such that a rating of 4 was applied. <p>Operation: Pathways of effect considered:</p> <ul style="list-style-type: none"> Operation of extended or new outfall will result in permanent removal of lake bed materials → removal of habitat for fish and benthic invertebrates in nearshore (Alternative 4) or offshore (Alternative 5). Permanent infrastructure will replace a portion of bed material in the footprint of the extended outfall; however given that bed material in the area is not associated with suitable habitat as spawning, nursery or foraging for fish, and that the loss represents a small portion of available habitat impacts are considered to be low in magnitude. Therefore, the negative impact is considered to be low, local in geographic extent and of long duration such that a rating of 4 was applied. Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. However, modelling results at 630 MLD predict that the mixing zone for UIA is reduced compared to the baseline condition with levels above the PWQO for this parameter limited to a near field mixing zone in direct vicinity of the diffusers. The operation of the diffuser extension would result in better effluent dilution which would also reduce the mixing zone for TP which is beneficial for fish species and their associated habitats. Overall, there is no effect which constitutes a rating of 5 for this impact. 		
	<p>5. New Outfall + Alternative 1</p>	<p>Construction: Construction impacts of this alternative relate to the construction of tunnel shafts in close proximity to the waterfront, a need for on-shore staging and storage of spoils.</p> <p>Pathways of effect considered:</p> <ul style="list-style-type: none"> Staging and construction activities on-shore (including storage of spoils) may result in vegetation removal/damage → vegetation removal/damage will result in exposed soils → Exposure of soils results in increased erosion and sedimentation of the nearshore zone → exposure to increased suspended sediments can result in sub-lethal to lethal effects to fish → stress and sub-lethal or lethal effects causes a decrease in abundance of fish. Storage and transportation of spoils have the potential to result in increased erosion and sedimentation of the nearshore habitat. Impacts related to erosion and sedimentation can be mitigated through the development of a Sediment and Erosion Control Plan. This impact is considered to be negative and low in magnitude (with the application of mitigation measures) , local in geographic extent, and short in duration, such that a rating of 4 was applied. Operation of construction equipment on-shore can result in spills of deleterious materials (e.g. oil, gasoline) → spills will result in impaired water quality → impairment of water quality can result in lethal to sub-lethal effects to fish and other biota → sub-lethal or lethal effects to biota will reduce abundance. Operation of heavy equipment and staging of materials has the potential to result in the release of deleterious substances to the nearshore zone. Impacts related to spills can be mitigated through the development of a Spill Contingency Plan. This impact is considered to be negative 	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> For on-shore construction of the new shaft, select an area with minimal impacts to shoreline terrestrial features (e.g. on the tablelands, well away from the shoreline of the lake). Implement an Erosion and Sedimentation Control Plan to contain sediments and manage stormwater and groundwater flows during construction. Keep sediment and erosion control measures in place until disturbed areas have been stabilized. Confine area of construction to avoid incidental damage to vegetation due to use of construction equipment. Re-vegetate disturbed areas after construction. Perform regular inspection of sediment and erosion control measures during the construction period and subsequently remedy any identified problems. Utilize a turbidity curtain around drilling equipment during the installation of risers. Implement treatment of dewatering discharge through use of settling ponds/tanks and monitoring water quality prior to release. <p>Operation: Work with agencies to enhance and restore habitat within the lakebed footprint where fish habitat is identified.</p>	<p>4</p>

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>and low in magnitude (with the application of mitigation measures) , local in geographic extent, and short in duration, such that a rating of 4 was applied.</p> <ul style="list-style-type: none"> Release of groundwater from tunnel shaft (dewatering) back to aquatic environment → dewatering discharge impairs water quality → impairment of water quality can result in sub-lethal to lethal effects to fish → sub-lethal or lethal effects to fish reduce fish abundance. Mitigation to include treatment of dewatering discharge through use of settling tanks to remove suspended sediment is intended to reduce impacts to water quality. Given the application of mitigation measures and the large open water component of the lake available to accept and assimilate the treated water this impact is considered to be negative, low in magnitude, regional in geographic extent and short in duration, resulting in a rating of 4. <p>Operation: Pathways of effect considered.</p> <ul style="list-style-type: none"> Operation of extended or new outfall will result in permanent removal of lake bed materials → removal of habitat for fish and benthic invertebrates offshore. The portion of the outfall with a surface component (diffuser) will begin in the furthest reaches of the nearshore zone and extend into the offshore zone. Permanent infrastructure will replace bed material in the footprint of the diffuser, however the footprint of the diffuser ports is limited and spaced every 10-20m and no specialized habitat is identified in the area of the footprint. The footprint of the operational diffuser represents a small portion of available habitat of similar type in the area. Therefore the negative impact is considered to be low in magnitude, local in geographic extent and of long duration such that a rating of 4 was applied. Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. Since the new outfall will convey effluent away from the nearshore to the offshore zone, there is no effect on the nearshore zone and has a rating of 5. 	<p>Conclusion: Potential for impacts during construction are generally considered low with mitigation measures in place and range from positive to a low negative effect during operation. Overall rating is considered a 4.</p> <p>There is a residual impact associated with the new outfall diffuser occupying an area of potential fish habitat. However, fish utilization within the diffuser footprint is expected to be limited because habitat in the vicinity of the diffuser is unspecialized. Even with the application of mitigation measures during construction, there is potential for in-water works to cause incidental harm to fish and benthic invertebrates. The residual impacts are considered to be low.</p>	
<p>N.2 Impact on Offshore Aquatic Systems and Habitat</p> <p>The potential of the alternative solution to impact valued ecosystem components (VECs) as they pertain to aquatic biota in the offshore (> 15m water depth)</p> <p>Measures</p> <p>Changes in the habitat function and production capacity in the offshore aquatic habitat compared to the baseline condition based on:</p> <ul style="list-style-type: none"> Size of construction/ operational footprint and extent of disturbance. Location of construction/ operational activity in relation to available habitat; Potential for changes to non-modeled water quality parameters (e.g. suspended sediments, contaminants) during construction; Construction method; and, 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1</p>	<p>Construction: No impacts given that no construction component is identified for this alternative. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: This alternative does not include an in-water footprint and the mixing zone does not extend into the offshore zone. Consequently, no residual impacts to offshore zone during operation are identified. Therefore, impact rating relating to Operation is 5 (no effect).</p>	<p>No mitigation measures proposed given that there are no impacts to offshore habitats identified.</p> <p>Conclusion: No impacts identified in the offshore zone given that this alternative does not have a construction or operational component that extends to the offshore zone. No residual impacts to the offshore zone are identified.</p>	5
	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: Modification of the existing diffuser in the nearshore zone is not expected to disturb lake bed materials, and no construction component is identified for the offshore as part of this alternative, therefore no impacts are identified. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: This alternative does not include an in-water footprint and the mixing zone does not extend into the offshore zone. Consequently, no residual impacts to offshore zone during operation are identified. Therefore, impact rating relating to Operation is 5 (no effect).</p>	<p>No mitigation measures proposed given that there are no impacts to offshore habitats identified.</p> <p>Conclusion: No impacts identified in the offshore zone given that this alternative does not have a construction or operational component that extends to the offshore zone. No residual impacts to the offshore zone are identified.</p>	5
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: No impacts given that no construction component is identified for this alternative. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: This alternative does not include an in-water footprint and the mixing zone does not extend into the offshore zone. Consequently, no residual impacts to offshore zone during operation are identified. Therefore, impact rating relating to the operational phase is</p>	<p>No mitigation measures proposed given that there are no impacts to offshore habitats identified.</p> <p>Conclusion: No impacts identified in the offshore zone given that this alternative does not have a construction or operational component that extends to the offshore zone. No residual impacts to the offshore zone are identified.</p>	5

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<ul style="list-style-type: none"> Change in size and location of TP and UIA mixing zones during operation. <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional 		5 (no effect).		
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction: The construction footprint of this alternative is restricted to the nearshore zone. Entrainment and re-suspension of sediments and general disturbance from construction activities in the nearshore zone are not anticipated to impact offshore aquatic systems and habitat given that the distance of construction activity from the offshore zone is approximately 1km. In addition, bed materials associated with the offshore zone are not considered suitable for use as spawning habitat. As well, given that net transport is along shore rather than away from shore, disturbance of sediments within the nearshore zone would not result in transport of sediments toward the offshore zone. Therefore, the impact rating relating to construction is 5 (no effect).</p> <p>Operation: The construction footprint and the mixing zone do not extend into the off-shore for this alternative. Consequently, no residual impacts to offshore zone during operation are identified. Therefore, impact rating relating to Operation is 5 (no effect).</p>	<p>No mitigation measures proposed given that there are no impacts to offshore habitats identified.</p> <p>Conclusion: No impacts identified in the offshore zone given that this alternative does not have a construction or operational component that extends to the offshore zone. No residual impacts to the offshore zone are identified.</p>	5
	5. New Outfall + Alternative 1	<p>Construction: Construction activities for this alternative as they pertain to an offshore footprint are limited to the installation of 0.5m diameter diffuser ports along a 700m portion of the outfall. This entails use of a drill operated from a barge to drill into the outfall approximately every 10-20m to insert the diffuser ports. The spoils from the drilling would be transferred to the barge (approximately 550m³) and would require open water disposal.</p> <p>Pathways of effect considered are:</p> <ul style="list-style-type: none"> In-water construction activities will disturb lake bed materials and entrain sediment → entrainment of sediments results in increased concentrations of suspended sediment → exposure to increased suspended sediments can result in lethal to sub-lethal effects to fish and benthic invertebrates → stress can causes a decrease in abundance of fish and benthic invertebrates. However, the water column of the offshore zone with potential to be impacted by elevated levels of suspended sediments during construction of the individual diffuser ports represents a small portion of available offshore habitat. The sandy lake bed in the vicinity of the outfall is unsuitable for specific life stages or life history functions of fish species and it is unlikely this area supports a large biomass of benthos. Fish will generally avoid areas of elevated suspended sediments which will further reduce the number of fish utilizing the area. Mitigation measures are intended to further discourage use of the area by fish, thereby reducing the magnitude of this impact. The negative impact associated with this alternative is considered to be low , regional in geographic extent and of short duration, resulting in an overall rating of 4. In-water construction activities will disturb lake bed materials and entrain sediment → entrainment results in increased concentrations of suspended sediments in the water column → deposition of suspended sediments can result in a change in composition of substrate in the area where deposition occurs → change in substrate composition leads to change in habitat structure and food supply for fish. The bed materials within the offshore zone consist primarily of sand. Any entrainment of sediments is anticipated to result in similar substrate composition to baseline conditions, as the material with potential to be entrained appears to be similar to the bed material in the area where deposition would occur. Depth of deposition of sediments may affect benthos on an individual level but is not anticipated to occur at a scale that would affect large numbers of the population. In addition, the area of the construction footprint represents a small area compared to the overall area of unaffected habitat of similar type available in the offshore zone. The impact associated with this alternative is considered to be of very low magnitude, regional in geographic extent and of short duration, resulting in a rating of 4. 	<p>Construction: Mitigation measures include the following: use of deterrents or barriers to discourage fish from using area during drilling of risers and installation of diffuser (e.g. repelling charges, bubble curtain); limit duration of in-water work to avoid fish spawning periods (e.g. construction may be limited to the period from about July 1 to September 15 of each year); and restore habitat in construction footprint if warranted.</p> <p>Operation: N/A</p> <p>Conclusion: A combination of low impacts identified during construction results in an overall rating of 4 for this alternative.</p> <p>There is a residual impact associated with the new outfall diffuser occupying an area of potential fish habitat. However, fish utilization within the diffuser footprint is expected to be limited because habitat in the vicinity of the diffuser is unspecialized and represents a small portion of similar habitat available within the lake.</p>	4

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<ul style="list-style-type: none"> In-water construction activities will remove lake bed materials → removal of habitat for fish and benthic invertebrates. The materials in the vicinity of the lakebed at the outfall location consist of predominately sand. No specialized habitat for benthic invertebrates or fish is documented in this area. The area of the lake bed affected by installation of the diffuser is considered low in comparison to the area of similar unaffected habitat available in the offshore zone. The impact associated with this alternative is considered to be negative, low in magnitude, local in geographic extent and of short duration (as re-colonization of the area is expected after construction is completed), resulting in a rating of 4. In-water works of the diffuser will cause general disturbance through noise, vibration and human activity in nearshore and offshore zones → disturbance deters fish from using habitat in the area. The extent of disturbance will be small relative to the size of available offshore habitat and mitigation measures are intended to discourage use of the area by fish; however, use of drilling to install diffuser ports represents an increased disturbance in the area compared to the baseline condition. Although the offshore zone is used on a transitory basis, no specialized habitat for fish is documented in this area. Consequently, the presence of large concentrations of fish is unlikely at most times of year. Therefore, the resulting impact to fish habitat use is considered low in magnitude, regional in geographic extent and of short duration, resulting in an overall rating of 4. <p>Operation: The footprint of the new outfall will occupy a portion of the lake bed for the duration of the operational phase of the project. The habitat in the area is not unique and not used by the fish species likely to be present for any specialized life history function. The amount of habitat that the footprint of the outfall represents is small in comparison to the amount of similar habitat available. All of these factors were used to assess impacts of this alternative on the offshore zone.</p> <p>Pathways of effect considered are:</p> <ul style="list-style-type: none"> Operation of extended or new outfall will result in permanent removal of lake bed materials → removal of habitat for fish and benthic invertebrates in nearshore (Alternative 4) or offshore (Alternative 5). However the footprint of the diffuser ports in the offshore suggests that the extent of disturbance will be small relative to the size of available offshore lake bed substrate. Also, lake bed substrate of the offshore habitat is not known to provide habitat for any specialized life history function, nor is it suitable to host large concentrations of benthos. Therefore the negative impact as a result of this alternative is considered low in magnitude, local in geographic extent and long in duration with an overall rating of 4. Release of effluent of 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. Effluent from new outfall will extend into the offshore zone; however, there is a reduction in the size of the mixing zones for UIA and TP. This represents no effect and an overall rating of 5. 		
<p>N.3 Impacts on Water Quality The potential of the alternative to impact lake water quality²</p> <p>Measures Changes in the water quality compared to the baseline condition based on:</p>	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1</p>	<p>Construction: There are no water quality impacts during construction since there is no heavy construction.</p> <p>Operation: The PWQOs are criteria which serve as chemical and physical surrogates of healthy populations of aquatic biota. Regulated substances include ammonia (unionized and total), total phosphorus, and E. Coli. Lake Ontario is a Policy 1 receiver where ambient conditions are better than the PWQO. The effluent limits were established in the Stage 3 EA to achieve high quality effluent that is consistent with MOE water quality policies. The mass loading for total phosphorus stays constant but the mass loading for ammonia slightly increases from baseline conditions. The mixing zones for the regulated substances do not</p>	<p>Mitigation is not applicable.</p> <p>Conclusion: After mitigation, there is a slight increase in the mass loading for ammonia, and no increase in mass loading for TP. Overall, there is a negative change in water quality, but the magnitude is low in the long term within the Regional Study Area.</p>	<p>4</p>

² Impacts relating to nutrient enrichment were largely addressed under criteria N3 (Impact on Water Quality), and carried over into other criteria (N.1, N.2, and N.5) only when an additional impact on health of biota was evident.

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<ul style="list-style-type: none"> Turbidity during construction PWQOs (TP, UIA, e-coli) and non-regulated emerging contaminants of concern during operation <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional >Regional 		<p>interfere with beneficial uses.</p> <p>For unregulated substances (i.e. emerging contaminants of concern), operation of the secondary treatment process with a high solids retention time is a best practice for removing emerging contaminants of concern.</p>		
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Construction: There are no water quality impacts during construction since there is no heavy construction.</p> <p>Operation: The PWQOs are criteria which serve as chemical and physical surrogates of healthy populations of aquatic biota. Regulated substances include ammonia (unionized and total), total phosphorus, and E. Coli. Lake Ontario is a Policy 1 receiver where ambient conditions are better than the PWQO. The effluent limits were established in the Stage 3 EA to achieve high quality effluent that is consistent with MOE water quality policies. The mass loading for total phosphorus stays constant but the mass loading for ammonia slightly increases from baseline conditions. The mixing zones for the regulated substances do not interfere with beneficial uses.</p> <p>For unregulated substances (i.e. emerging contaminants of concern), operation of the secondary treatment process with a high solids retention time is a best practice for removing emerging contaminants of concern.</p>	<p>Mitigation is not applicable.</p> <p>Conclusion: After mitigation, there is a slight increase in the mass loading for ammonia, and no increase in mass loading for TP. Overall, there is a negative change in water quality, but the magnitude is low in the long term within the Regional Study Area.</p>	4
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Construction: There are no water quality impacts during construction since there is no construction in the lake.</p> <p>Operation: Tertiary treatment improves the removal of TP and maintains the same removal of ammonia and E.coli. Overall there are no effects.</p>	<p>Mitigation is not applicable.</p> <p>Conclusion: After mitigation, there is a slight increase in the mass loading for ammonia, but there is a decrease in the mass loading for TP. Overall, there is a positive change in water quality in the long term within the Regional Study Area.</p>	5
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction: Increased turbidity, re-suspension of sediments, and construction debris can be expected in the nearshore area during construction activities since there is open cut construction.</p> <p>Operation: The PWQOs are criteria which serve as chemical and physical surrogates of healthy populations of aquatic biota. Regulated substances include ammonia (unionized and total), total phosphorus, and E. Coli. Lake Ontario is a Policy 1 receiver where ambient conditions are better than the PWQO. The effluent limits were established in the Stage 3 EA to achieve high quality effluent that is consistent with MOE water quality policies. The mass loading for total phosphorus stays constant but the mass loading for ammonia slightly increases from baseline conditions. The mixing zones for the regulated substances do not interfere with beneficial uses.</p> <p>For unregulated substances (i.e. emerging contaminants of concern), operation of the secondary treatment process with a high solids retention time is a best practice for removing emerging contaminants of concern..</p>	<p>Construction: Utilize turbidity curtain around drilling equipment during the installation of risers. Utilize a dragline water tight bucket on excavation equipment to prevent the release of suspended sediments during transport to the barge.</p> <p>Operation: Mitigation is not applicable.</p> <p>Conclusion: After mitigation, there will be increased turbidity in the lake. Overall, there is a negative change in water quality, and the magnitude is moderate over short period of time within the Regional Study Area.</p>	4
	5. New Outfall + Alternative 1	<p>Construction: There is minimal increase in turbidity and re-suspension of sediments during construction using the tunneling and riser construction approach. There is potential for increased turbidity levels from dewatering activities in the drop shaft.</p> <p>Operation: Increased dilution achieved as a result of a longer outfall would reduce the size of the mixing zone. Impacts associated with Alternative 1 also apply to this alternative.</p>	<p>Construction: Utilize turbidity curtain around drilling equipment during the installation of risers. Install a treatment system to treat the discharge from the dewatering process prior to its release back into the aquatic environment.</p> <p>Operation: Mitigation is not applicable.</p> <p>Conclusion: After mitigation, there will be increased turbidity in the lake. Overall, there is a negative change in water quality, and the magnitude is moderate over short period of time within the Regional Study Area.</p>	4
N.4 Impacts on Terrestrial Environment	1. Existing Upgraded Plant and Optimized Operations	<p>Construction: No impacts given that no onshore construction component is identified for this alternative. Therefore, impact rating relating to construction is 5 (no effect).</p>	There are no mitigation measures since there are no terrestrial impacts identified.	5

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>The potential of the alternative solution to impact terrestrial wildlife and habitats during construction and operations</p> <p>Measures</p> <p>Changes in the terrestrial habitat structure, condition and use from baseline condition based on the:</p> <ul style="list-style-type: none"> • Location of construction activity in relation to available habitat. • Size of construction/ operational footprint and extent of disturbance. <p>Duration</p> <ul style="list-style-type: none"> • Short-term (during construction) • Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> • Local • Regional 	(Stages 1, 2, and 3) + Alternative 1	<p>Operation: There is not additional footprint or operations with this alternative. Consequently there are not impacts on terrestrial systems. Therefore, impact rating relating to operation is 5 (no effect).</p>	<p>Conclusion: Given that no impacts are identified the rating of this alternative is 5. No residual impact to terrestrial habitat is identified.</p>	
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Construction: No impacts given that no onshore construction component is identified for this alternative. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: There is not additional footprint or operations with this alternative. Consequently there are not impacts on terrestrial systems. Therefore, impact rating relating to operation is 5 (no effect).</p>	<p>There are no mitigation measures since there are no terrestrial impacts identified.</p> <p>Conclusion: Given that no impacts are identified the rating of this alternative is 5. No residual impact to terrestrial habitat is identified.</p>	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Construction: Pathways of effected considered are:</p> <ul style="list-style-type: none"> • Construction activities will cause a reduction of available vegetation with potential to provide habitat for wildlife → reduction in habitat results in decline in available nesting sites and cover available for incidental wildlife → decline in breeding success to result in reduced bird populations and reduction in cover leads to mortality of incidental wildlife. Areas identified for construction of facility, are currently situated in cleared and manicured areas, such that habitat for nesting and cover is very limited to non-existent. More suitable and diverse habitat is associated with the shoreline and waterfront trail, such that habitat use in the proposed area of construction is not likely. Given that the direction of impact is negative, magnitude is considered low, local in geographic extent, and duration is short an overall rating of 4 was determined for this impact. • Use of heavy equipment will cause general disturbance through noise, vibration, and human activity during construction → disturbance results in displacement of wildlife from the area and reduced use of wildlife linkages. Areas identified for construction of facility, are currently situated in cleared and manicured areas, such that habitat for nesting and cover is very limited to non-existent. More suitable and diverse habitat is associated with the shoreline and waterfront trail, such that habitat use in the proposed area of construction is not likely. Linkage is generally associated with the shoreline and waterfront trail, such that disruption is considered minimal given distance from area of construction activity. Operational activities on the WPCP site currently include some use of heavy equipment; therefore increased level of disturbance is anticipated to be low compared to the baseline condition. Given that the direction of impact is negative, magnitude is considered low, regional in geographic extent, and duration is short an overall rating of 4 was determined for this impact. • Construction activities will cause vegetation removal → damage/ removal of terrestrial vegetation. Removal of vegetation will generally include manicured lawn, but may extend to limited tree/shrub removal. Given that the direction of impact is negative, magnitude is considered low based on the composition of vegetation, local in geographic extent, and duration is short an overall rating of 4 was determined for this impact. • Construction activities will cause vegetation removal → vegetation removal will result in exposed soils → Exposure of soils results in increased sedimentation and erosion of surrounding habitat → sedimentation of surrounding area leads to degradation of habitat → degradation of habitat results in displacement of wildlife from the surrounding area. Mitigation will limit the effects of sedimentation and erosion through implementation of a Sediment and Erosion Control Plan and best management practices. Potential for erosion is considered low given the flat topography in the area. Given that the direction of impact is negative, magnitude is considered low, local in geographic extent, and duration is short an overall rating of 4 was determined for this impact. <p>Operation: The operational disturbance of this alternative is anticipated to be similar to operation of surrounding WPCP facility. In addition, although the footprint of the facility will cause reduction of available vegetation, the areas identified for construction of facility are currently situated in cleared and manicured areas, such that habitat for nesting and cover is</p>	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> • Time construction of additional infrastructure outside of sensitive timing windows for wildlife (e.g. breeding bird timing window is typically May 1 to July 31). • Confine area of construction to avoid incidental damage to vegetation due to use of construction equipment. • Implement erosion and sedimentation control plan to contain sediments and manage stormwater flows during construction. • Re-vegetate disturbed areas after construction. • Regular inspection of sediment and erosion control measures during the construction period and subsequent remedy of any identified problems. <p>Operation: No mitigation measures during operation.</p> <p>Conclusion: Impacts during construction have been identified as negative, low in magnitude, and short in duration (4) and no operational impacts have been identified.</p> <p>Residual impacts identified relate to the permanent loss of vegetation. This residual impact is considered to be negligible given the manicured nature of the vegetation that comprises most of the area identified for construction of the tertiary treatment facilities.</p>	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		very limited to non-existent. Consequently, no additional impacts to the terrestrial environment are anticipated. Therefore, impact rating relating to operation is 5 (no effect).		
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction: This alternative assumes that a nearby docking facility will be used as a staging area and that a barge will be used to house the necessary equipment and also to dispose of spoils in open water. Given that no onshore construction component is identified for this alternative, no impacts are assessed. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: There is not additional footprint or operations with this alternative. Consequently there are not impacts on terrestrial systems. Therefore, impact rating relating to operation is 5 (no effect).</p>	<p>There are no mitigation measures since there are no terrestrial impacts identified.</p> <p>Conclusion: Given that no impacts are identified the rating of this alternative is 5. No residual impact to terrestrial habitat is identified.</p>	5
	5. New Outfall + Alternative 1	<p>Construction: The area identified for shaft construction occurs on the tablelands in the existing WPCP property in a disturbed meadow/scrub that provides a buffer to the lake and linkages to nearby natural lands. A minimum of 50m x 50m of vegetation removal will be required for construction laydown and spoil storage. Additional area will be required for crane operation. Pathways of effected considered are:</p> <ul style="list-style-type: none"> • Construction activities will cause a reduction of available vegetation with potential to provide habitat for wildlife → reduction in habitat results in decline in available nesting sites and cover available for incidental wildlife → decline in breeding success to result in reduced bird populations and reduction in cover leads to mortality of incidental wildlife. Areas of nesting and cover exist in the form of trees, shrubs and meadow community. Given that the footprint of disturbance represents a relatively small portion of available habitat of similar type along the waterfront and that mitigation includes means of avoiding disturbance to breeding wildlife, the magnitude of the impact was determined to be low; the direction of impact is negative; the geographic extent is local; and the duration is short; therefore, an overall rating of 4 was determined for this impact. • Use of heavy equipment will cause general disturbance through noise, vibration, and human activity during construction → disturbance results in displacement of wildlife from the area and reduced use of wildlife linkages. Area identified for shaft construction occurs on the tablelands in the vicinity of the existing shaft in a disturbed meadow/scrub that provides a buffer to the lake and linkages to nearby natural lands Linkage is generally associated with the shoreline and waterfront trail, such that disruption to linkage function is likely given the proximity to the area of construction. Wildlife documented in the area, with potential to use the linkage is considered common and secure (Species at Risk are addressed under Criterion N5) and mitigation includes planning to ensure some degree of passage is maintained. However, given that construction of this type is considered to generate noise levels above the baseline condition and that mitigation is not anticipated to fully address this impact, a rating of 3 has been applied to reflect a negative impact of moderate magnitude and regional in geographic extent that is short in duration. • Construction activities will cause vegetation removal → damage/ removal of terrestrial vegetation. Removal of vegetation will generally include trees, shrubs and meadow communities. The area identified for use as a laydown and construction area represents a previously disturbed cultural vegetation community. Mitigation includes restoration of vegetation post construction. Given that the direction of impact is negative, the magnitude is considered low (based on the composition of vegetation and implementation of mitigation), the geographic extent is local and the duration is short, an overall rating of 4 was applied. • Construction activities will cause vegetation removal → vegetation removal will result in exposed soils → Exposure of soils results in increased sedimentation and erosion of surrounding habitat → sedimentation of surrounding area leads to degradation of habitat → degradation of habitat results in displacement of wildlife from the surrounding area. Mitigation will limit the effects of sedimentation and erosion through implementation of a Sediment and Erosion Control Plan and best management 	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> • Time construction of additional infrastructure outside of sensitive timing windows for wildlife and breeding birds with potential to utilize the area (e.g. breeding bird timing window is typically May 1 to July 31).. • Pre-plan to allow for some degree of wildlife passage to occur along the tablelands during construction. • Re-vegetate area disturbed by construction activities. • Implement an Erosion and Sedimentation Control Plan including the regular inspection of sediment and erosion control measures during the construction period and subsequent remedy of any identified problems. • Develop a spoils disposal plan with approved haul roads and disposal sites. Confine area of construction to avoid incidental damage to vegetation due to use of construction equipment. <p>Operation: No mitigation measures during operation.</p> <p>Conclusion: Impacts have been identified as negative, short in duration and ranging from low to moderate in magnitude; therefore an overall rating of 3 was applied. Residual impact of vegetation removal at shaft location is considered minimal given that it represents a very small portion of non-specialized habitat available in the area.</p>	3

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>practices. It is likely that a large volume of highly saturated spoils will be generated given the size of the excavation and proximity to the lake. Control of runoff from saturated soils may be challenging given the number of unknowns (e.g. saturation level of soil, exact volumes of soil, rate of evaporation and rate of dewatering). Therefore, impacts relating to erosion are considered moderate. Overall, the direction of impact is negative, the magnitude is considered moderate, the geographic extent is local, and duration is short such that a rating of 3 was applied.</p> <p>Operation: The operations of this alternative will be the similar to operation of existing WPCP facility. Consequently, no additional impacts on the terrestrial environment will occur. However, given that additional facilities will be operating the following pathway of effect was considered:</p> <ul style="list-style-type: none"> Footprint of facility will cause a reduction of available vegetation with potential to provide habitat for wildlife → reduction in habitat results in decline in available nesting sites and cover available for incidental wildlife → decline in breeding success to result in reduced bird populations and reduction in cover leads to displacement of incidental wildlife. Footprint of remaining shaft is estimated at 10m in diameter. Minimal size of the outfall shaft within the meadow community compared to the overall habitat of a similar type available is considered to represent a negative, local, low magnitude impact of long duration to result in an overall rating of 4. 		
<p>N.5 Impact on Species at Risk and Significant Habitats</p> <p>The potential of the alternative solution to impact Species at Risk (SAR) and significant habitats (Environmentally Significant/Sensitive Areas, Provincially Significant Wetlands (PSWs), Areas of Natural and Scientific Interest (ANSIs) and Important Bird Areas as defined by Bird Studies Canada)</p> <p>Measures</p> <p>Change from baseline in the extent, and quality of significant habitats based on:</p> <ul style="list-style-type: none"> Potential of area to accommodate rare species Size of construction/operational footprint and extent of disturbance. Potential for changes to non-modeled water quality parameters (e.g. suspended sediments, contaminants) during construction; Construction method; and, Change in size and location of TP and UIA mixing zones during operation. <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) 	<p>Two aquatic SAR have potential to occupy the waters of Lake Ontario in proximity to the Duffin Creek WPCP, namely the American Eel and the Atlantic Salmon. American Eel (listed provincially as END and federally as SC) and Atlantic Salmon (listed as extirpated both provincially and federally) are documented in fish records for the regional study area. Efforts to restore wild populations of Atlantic Salmon to Lake Ontario are ongoing, with Duffins Creek as one of the habitats targeted for restoration. The immediate shoreline of Lake Ontario from Frenchman's Bay to Duffins Creek has been identified by TRCA as habitat for American Eel in TRCA SAR mapping (April 2012). Specific habitat has not been confirmed or delineated within the local study area for either of these species as they occupy a wide range of habitats, within a broad range of conditions throughout their life cycle.</p> <p>Duffins Creek Marsh is located approximately 600m from the eastern footprint of the WPCP and approximately 1 km from the alignment of the existing outfall. The marsh is designated as a provincially significant wetland (PSW) and Area of Natural and Scientific Interest (ANSI).</p> <p>A search of the NHIC Biodiversity database documents records of SAR from 1877 (Spring Salamander), 1940 (Green-striped Darner), 1962 (Henslow's Sparrow), 1968 (Eastern Ribbonsnake), 1973 (Burning Bush), and 1983 (Redside Dace). All of these records are considered historical and unlikely to occur within the local study area defined for the project.</p> <p>Additional screening for SAR specific to each alternative would be required before the implementation of the preferred alternative, the extent and form of which would depend on the location of the preferred alternative identified. For the purpose of this report impacts to significant habitat (Environmentally Significant Areas, Provincially Significant Wetlands (PSWs), Areas of Natural and Scientific Interest (ANSIs) and Important Bird Areas) within the regional study area were used as an indicator of possible presence of SAR to identify where potential for impacts to SAR exist.</p>	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1</p> <p>Construction: No impact given that no construction component is identified for this alternative. Therefore, impact rating relating to construction is 5 (no effect).</p> <p>Operation: No significant habitats were identified in the nearshore area where the mixing zones for UIA and TP are predicted to occur. Significant habitat for aquatic SAR is identified as the area of Duffins Creek and Duffins Creek Marsh which function as spawning and nursery habitat. That habitat is not predicted to experience change in UIA or TP above that of the baseline condition, therefore the impact rating relating to operation is 5 (no effect).</p> <p>2. Modify Existing Outfall Diffuser + Alternative 1</p> <p>Construction: Modification of the existing diffuser will not disturb lake bed materials in nearshore and offshore zones, therefore installation of the variable ports by the divers will not impact species at risk or significant habitats. The impact rating relating to construction is 5 (no effect).</p> <p>Operation: No additional infrastructure footprint is included in this alternative. Significant habitat for aquatic SAR is identified as the area of Duffins Creek and Duffins Creek Marsh which function as spawning and nursery habitat. That habitat is not predicted to experience change in UIA or TP above that of the baseline condition, therefore the impact rating relating to construction is 5 (no effect).</p> <p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative</p> <p>Construction: Construction of this alternative will occur on land within the existing disturbed footprint of the WPCP areas proposed for construction of the tertiary treatment facility are currently situated in cleared and manicured areas where no significant habitats have been</p>	<p>No mitigation measures are prescribed given that baseline conditions are maintained within significant habitats.</p> <p>Conclusion: Given that no impacts are identified the rating of this alternative is 5. This alternative does not have a construction or operational component that extends to significant habitats for aquatic SAR identified for the area. No residual impact to significant habitats or SAR is identified .</p> <p>No mitigation measures are prescribed given that baseline conditions are maintained within significant habitats.</p> <p>Conclusion: Given that no impacts are identified the rating of this alternative is 5. This alternative does not have a construction or operational component that extends to significant habitats for aquatic SAR identified for the area. No residual impact to significant habitats or SAR is identified .</p> <p>Construction: If this option is carried forward, additional screening of terrestrial SAR in the construction footprint prior to construction is required. Mitigating measures as they relate to construction impacts to terrestrial habitat (N4) are intended to address linkage impacts that are</p>	<p>5</p> <p>5</p> <p>4</p>

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<ul style="list-style-type: none"> Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional 	1	<p>identified for terrestrial SAR. However, given that the area provides connection to the Duffins Creek Marsh (PSW and ANSI), the following pathway of effect relating to the disturbances associated with construction was considered:</p> <ul style="list-style-type: none"> Use of heavy equipment will cause general disturbance through noise, vibration, and human activity during construction → disturbance results in displacement of wildlife from the area and reduced use of wildlife linkages. Disturbance relating to noise can carry over into linkage areas associated with the shoreline and waterfront trail. This linkage provides connection to the Duffins Creek Marsh, designated as a PSW and ANSI. Operational activities on the WPCP site currently include some use of heavy equipment; therefore increased level of disturbance is anticipated to be low compared to the baseline condition, especially when the distance between the area of construction and waterfront is considered. Given that the direction of impact is negative, magnitude is considered low, and regional in geographic extent over a short duration an overall rating of 4 was determined. <p>Operation: The operational disturbance is anticipated to be similar to operation of the existing WPCP. No additional impacts are expected with operation.</p>	<p>identified here. Mitigation for specific SAR would be prescribed in the event that SAR are identified.</p> <p>Operation: No mitigation measures prescribed given that no discernible impacts to significant habitat are identified.</p> <p>Conclusion: Impacts to areas that function as wildlife linkage for Species at Risk and significant habitats are considered to be low given the available mitigation and level of regulatory protection. Surveys for terrestrial SAR in the footprint of the proposed facility are necessary to will confirm this impact.</p> <p>Residual impacts to aquatic SAR are not anticipated given that the operational conditions and result in no effect. Residual impacts to linkage areas used by SAR are not anticipated as the area will revert to a similar condition to support the function as linkage to the extent it currently exists.</p>	
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction: This alternative assumes that staging areas will be primarily located offsite at an existing docking facility. In-water construction activities will disturb lake bed materials and entrain sediment which may affect a broader area beyond that of the immediate construction footprint to impact aquatic SAR moving through the area. The area identified to host the outfall extension does not appear to be used by SAR for any specialized life history function; however, the sandy substrates are appropriate habitat for Yellow Eel. The pathways of effect considered are as follows:</p> <ul style="list-style-type: none"> In-water construction activities will disturb lake bed materials and entrain sediment → entrainment of sediments results in increased concentrations of suspended sediment → exposure to increased suspended sediments can result in lethal to sub-lethal effects to fish and benthic invertebrates → stress can causes a decrease in abundance of fish and benthic invertebrates. The proposed location for the construction of the outfall extension is located within the nearshore zone approximately 1 km from the shore line where habitat for aquatic SAR has been identified As sandy substrates. The area may also experience incidental use as a transitory pathway for SAR, therefore there is potential for fish SAR to be exposed to elevated suspended sediments. As described in this table under Criterion N1for Alternative 4 the level of exposure and duration of exposure to elevated levels of suspended sediment is considered minimal. This negative impact is considered low in magnitude, regional in geographic extent and short in duration to determine an overall rating of 4. In-water construction activities will remove lake bed materials → removal of habitat for fish and benthic invertebrates. The materials in the vicinity of the lakebed at the outfall location consist of predominately sand. Habitat for SAR fish is documented in this area as sandy substrates with the potential to be used by the life stage of American Eel most commonly observed in Ontario (Yellow Eel). Yellow Eel is known to burrow in soft substrates (<i>MNR Draft Recovery Strategy for the American Eel in Ontario</i>, MacGregor et. al. 2010), therefore this species has potential to occur within the outfall footprint. The area of the lake bed affected by installation of the diffuser is considered small in comparison to the area of similar unaffected habitat available. The impact associated with this alternative is considered to be negative, low in magnitude, local in geographic extent and of short duration, resulting in a rating of 4. In-water works will cause general disturbance through noise, vibration and human activity in nearshore and offshore zones → disturbance deters fish from using habitat in the area. The area required for construction of the outfall extension represents a small portion of similar habitat available in the area such that the magnitude of impact is 	<p>Construction: Avoid sensitive timing windows for Atlantic Salmon and American Eel. Timing windows for area of construction will be determined in consultation with the MNR.</p> <p>Measures as prescribed in N1 for mitigating impacts to habitat conditions during construction of the outfall extension (e.g. use of barriers/deterrents, onshore erosion and sedimentation controls, etc.) apply as well.</p> <p>Operation: No mitigation measures prescribed given that no discernible impacts to significant habitat are identified.</p> <p>Conclusion: Habitat for aquatic SAR in the vicinity of the outfall extension is limited to sandy substrates suitable for the sexually immature adult stage of American Eel (Yellow Eel). Atlantic Salmon are assumed to be transitory to the area and not using the lakebed in this area as specialized habitat. Impacts to fish SAR relating to this alternative are considered minimal during construction given that the area of construction is considered to be small in comparison to the overall area of sandy substrates available in Lake Ontario.</p> <p>The residual impact associated with operation of the new outfall diffuser relates to its position on the lakebed in that it will occupy an area of potential fish habitat. However, given the relatively small footprint of the outfall diffuser compared to the area of similar lakebed available, this residual impact is considered low. An overall rating of low impact to SAR and significant habitats was applied to this alternative.</p>	4

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>considered low. This negative impact is considered low, regional in geographic extent and short in duration to determine an overall rating of 4.</p> <p>Operation: The extended outfall will result in permanent removal of lake bed materials in an area within the nearshore zone approximately 1 km from the shore line and extending 400m where lakebed habitat for aquatic SAR is identified as sandy substrate for Yellow Eel. The following pathways of effects were considered:</p> <ul style="list-style-type: none"> • Operation of extended or new outfall will result in permanent removal of lake bed materials → removal of habitat for fish and benthic invertebrates in nearshore (Alternative 4) or offshore (Alternative 5). The lakebed substrates at the outfall location consist of predominately sand. Habitat for SAR fish is documented in this area as sandy substrates with the potential to be used by the life stage of American Eel most commonly observed in Ontario (Yellow Eel). Yellow Eel is known to burrow in soft substrates (<i>MNR Draft Recovery Strategy for the American Eel in Ontario</i>, MacGregor et. al. 2010), therefore this species has potential to occur within the diffuser footprint. The area of the lake bed affected by installation of the diffuser is considered small in comparison to the area of similar unaffected habitat available. The impact associated with this alternative is considered to be negative, low in magnitude, local in geographic extent and of short duration, resulting in a rating of 4. • Release of effluent at 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. The mixing zones for TP and UIA will be greatly reduced from baseline condition with no net effect for SAR fish. Therefore, impact rating relating to this pathway of effect is 5 (no effect). 		
	<p>5. New Outfall + Alternative 1</p>	<p>Construction: <u>Terrestrial SAR</u> - Construction of this alternative includes the construction of a tunneling shaft, an on-shore staging area, and storage of spoils within the tablelands adjacent to the linkage of natural areas associated with the waterfront trail which extends to the Duffins Creek Marsh. No significant habitat has been identified within the immediate tableland area identified for construction; however, SAR have the potential to occur based on the habitat available. Impacts on wildlife linkages could result through the following pathway of effect:</p> <ul style="list-style-type: none"> • Use of heavy equipment will cause general disturbance through noise, vibration, and human activity during construction → disturbance results in displacement of wildlife from the area and reduced use of wildlife linkages. Linkage is generally associated with the shoreline and waterfront trail. Wildlife linkages will be impacted given the proximity of the shaft location on tablelands to the waterfront trail. Construction of this type is considered to generate noise levels above the baseline condition as a result of the use of heavy equipment for tunnel shaft construction and installation of the tunnel. The degree to which terrestrial SAR use this corridor as linkage is unknown; however, given that significant areas associated with Duffins Marsh (PSW and ANSI) and Duffins Creek provide more suitable habitat and linkage for SAR it is anticipated to experience low use as linkage specific to SAR. Further, mitigation includes planning for some degree of passage to be maintained. Other habitat for SAR in the vicinity of the construction footprint includes the banks and bluffs of the shoreline area and grassland/meadow area of the tablelands. The degree to which SAR utilize these areas is unknown, however the presence of suitable habitat for individuals of several species exists. The habitat to be impacted by the footprint of construction represents a small proportion of tableland habitat of similar type. As well, with the application of mitigation in the form of timing windows for construction this impact is considered to represent a low magnitude, negative impact that is , regional in geographic extent and short in duration such that an overall rating of 4 was applied. <p><u>Aquatic SAR</u> – On-shore construction activity impacts on nearshore water quality are</p>	<p>Construction: Avoid sensitive timing windows for Atlantic Salmon and American Eel for in-water works. Timing windows for area of construction will be determined in consultation with the MNR. Measures as prescribed in N1 for mitigating impacts to habitat conditions in the nearshore zone and offshore area proposed for diffuser installation apply as well.</p> <p>If this option is carried forward, additional screening of terrestrial SAR in the construction and staging footprint prior to construction would be required. Mitigating measures specific to SAR identified would be prescribed at that time.</p> <p>Operation: No mitigation measures prescribed given that no discernible impacts to significant habitat are identified.</p> <p>Conclusion: Habitat for aquatic SAR in the vicinity of the new outfall diffuser is limited to sandy substrates suitable for the sexually immature adult stage of American Eel (Yellow Eel). Atlantic Salmon are assumed to be transitory to the area and not using the lakebed in this area as specialized habitat. Impacts to fish SAR relating to this alternative are considered minimal during construction given that the area of construction is considered to be small in comparison to the overall area of sandy substrates available in Lake Ontario. The residual impact associated with operation of the new outfall relates to the installation of the diffuser on the lakebed, in that it will occupy an area of potential fish habitat. However, given the relatively small footprint of the outfall diffuser compared to the area of similar lakebed available, this residual impact is considered low. An overall rating of low impact to SAR and significant habitats was applied to this alternative.</p>	<p>4</p>

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>identified in N1, and include impacts from sedimentation, potential spills, and release of groundwater from the construction site. Given that the extent of these impacts are not anticipated to include significant aquatic habitat identified as Duffins Creek Marsh approximately 1km away, no impact on aquatic SAR is expected from on-shore construction. The following links concerning entrainment of sediments and general disturbance due to in-water construction have the potential to affect a broader area beyond that of the immediate construction footprint.</p> <ul style="list-style-type: none"> In-water construction activities will disturb lake bed materials and entrain sediment → entrainment of sediments results in increased concentrations of suspended sediment → exposure to increased suspended sediments can result in lethal to sub-lethal effects to fish and benthic invertebrates → stress can cause a decrease in abundance of fish and benthic invertebrates. In-water construction activities will disturb lake bed materials and entrain sediment → entrainment results in increased concentrations of suspended sediments in the water column → deposition of suspended sediments can result in a change in composition of substrate in the area where deposition occurs → change in substrate composition leads to change in habitat structure and food supply for fish. In-water works will cause general disturbance through noise, vibration and human activity in nearshore and offshore zones → disturbance deters fish from using habitat in the area. The proposed location for installation of the diffuser begins within the nearshore zone and extends into the offshore zone. The lakebed substrates in this area consist of predominately sand. Habitat for SAR fish is documented in this area as sandy substrates with the potential to be used by the life stage of American Eel most commonly observed in Ontario (Yellow Eel). Yellow Eel is known to burrow in soft substrates (<i>MNR Draft Recovery Strategy for the American Eel in Ontario</i>, MacGregor et. al. 2010), therefore this species has potential to occur within the diffuser footprint. The area of the lake bed affected by installation of the diffuser is considered small in comparison to the area of similar unaffected habitat available. The impact associated with this alternative is considered to be negative, low in magnitude, affecting local and regional study areas, and of short duration, resulting in a rating of 4. <p>Operation: The new outfall diffuser will result in permanent removal of lake bed materials in an area that extends from the edge of the nearshore zone into the offshore zone where lakebed habitat for aquatic SAR is identified as sandy substrate for Yellow Eel. The following pathways of effects were considered:</p> <ul style="list-style-type: none"> Operation of extended or new outfall will result in permanent removal of lake bed materials → removal of habitat for fish and benthic invertebrates in nearshore (Alternative 4) or offshore (Alternative 5). The lakebed substrates at the outfall location consist of predominately sand. Habitat for SAR fish is documented in this area as sandy substrates with the potential to be used by the life stage of American Eel most commonly observed in Ontario (Yellow Eel). Yellow Eel is known to burrow in soft substrates (<i>MNR Draft Recovery Strategy for the American Eel in Ontario</i>, MacGregor et. al. 2010), therefore this species has potential to occur within the diffuser footprint. The area of the lake bed affected by installation of the diffuser is considered small in comparison to the area of similar unaffected habitat available. The impact associated with this alternative is considered to be negative, low in magnitude, local in geographic extent and of short duration, resulting in a rating of 4. Release of effluent of 630 MLD has potential to impair water quality → impairment of water quality can result in sub-lethal to lethal effects to fish and other biota → sub-lethal or lethal effects reduce abundance of biota. The mixing zones for TP and UIA will be greatly reduced from baseline condition with no net effect for SAR fish. Therefore, impact rating relating to this pathway of effect is 5 (no effect). 		
N.6 Geotechnical Impact	1. Existing Upgraded Plant	There are no geotechnical risks with this alternative. The existing outfall will be used in this	Mitigation is not applicable to this alternative since there are no geotechnical works.	5

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>The geotechnical risk during construction.</p> <p>Measures</p> <ul style="list-style-type: none"> Risk of settlement on land Risk of lakebed disturbances Risk of encountering hazardous gases underground <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local 	and Optimized Operations (Stages 1, 2, and 3) + Alternative 1	alternative.	Conclusion: No risk of adverse geotechnical impacts.	
	2. Modify Existing Outfall Diffuser + Alternative 1	There are no geotechnical risks with this alternative. The existing outfall will be used in this alternative.	Mitigation is not applicable to this alternative since there are no geotechnical works. Conclusion: No risk of adverse geotechnical impacts.	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	Settlement on Land - The geotechnical risks are low with this alternative. The preliminary tertiary treatment location is predicted to be suitable for construction. The overburden material adjacent to the proposed location of the tertiary building is hard till of sufficient strength to support the buildings and tanks without the need for piling construction.	Land Substrate Stability - Perform additional geotechnical investigations during detailed design at the proposed location to confirm that overburden material is hard till of sufficient strength to support the tertiary treatment infrastructure. Conclusion: After mitigation, there is low risk of adverse geotechnical impacts, but the impacts are short-term.	4
	4. Extend Existing Outfall Diffuser + Alternative 1	Lakebed Disturbances - The buried valley adjacent to the existing outfall where construction would take place has soft organic till which cannot support the weight of an outfall structure. There may be additional valleys not detected by lakebed survey. Underground Gases - There are known gas pockets in shale rock which is a risk during construction in connecting to the existing tunnel.	Lakebed Disturbances – Undertake additional geophysical investigations to confirm the location of buried valley(s). Construct the extension in the south-western direction to avoid the buried valley south of the existing outfall. By avoiding the buried valley, the outfall extension would be excavated in till and weathered rock material. Existing lakebed material tests are available from previous and present geotechnical investigations to determine the lakebed overburden quality, such as bearing strength. Underground Gases - Riser boring equipment must be designed for gaseous conditions. Conclusion: After mitigation, there is high risk of adverse impacts, but the risks do not extend beyond the construction period.	2
	5. New Outfall + Alternative 1	Lakebed Disturbances - The lakebed is generally stable with a gradual grade and no vertical drops. Rock is classified as fair to good rock quality which is suitable for tunnel construction. The two known buried valleys on the existing outfall alignment have soft organic till which cannot support the weight of an outfall structure. There may be additional valleys not detected by lakebed survey. Depending on quality of rock, there is potential for ground loss during tunnelling. Underground Gases - There are known gas pockets in shale rock which is a risk during construction.	Lakebed Disturbances – The tunneling construction method will mitigate risk of lakebed disturbances by locating the tunnel below the identified valleys, with two to three tunnel diameter rock cover to be provided. To mitigate ground loss, contractor will propose rock stabilization methods which will be reviewed by the client/contract administrator. Methods may include rock bolts, safety netting, shotcrete, grouting where fissures or poor material are located. Underground Gases - During construction use a pilot hole in the tunnel to detect the presence of gas. Tunnelling equipment must be designed for gaseous conditions. Conclusion: After mitigation, the magnitude of the risk of adverse geotechnical impacts are moderate or typical for tunneling operations.	3
<p>N.7 Carbon Footprint and Energy Use</p> <p>The energy requirements of the strategy during construction and operation compared to the existing system.</p> <p>Measure</p> <ul style="list-style-type: none"> Change in carbon footprint from baseline Change in energy requirements during construction and operation 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1	Carbon Footprint - The carbon footprint of this alternative is negligible compared to other alternatives (<5 million kgCO ₂ e). Energy Requirements: There is no energy requirement during construction since there is no heavy construction. There are no additional energy requirements associated with this alternative during operations.	Mitigation is not applicable to this alternative as there are no additional energy requirements. Conclusion: After mitigation, there is a negligible increase in carbon footprint and energy use during construction and operation. Overall, there is no effect.	5
	2. Modify Existing Outfall Diffuser + Alternative 1	Carbon Footprint - The carbon footprint of this alternative is negligible compared to other alternatives (<5 million kgCO ₂ e). Energy Requirements: There is no energy requirement during construction since there is no heavy construction. There are no additional energy requirements associated with this alternative during operations.	Mitigation is not applicable to this alternative as there are no additional energy requirements. Conclusion: After mitigation, there is a negligible increase in carbon footprint and energy use during construction and operation. Overall, there is no effect.	5
	3. Provide Tertiary	Carbon Footprint - The carbon footprint of this alternative is the highest compared to other	Construction and Operations: Specify energy efficient equipment for construction and operations.	1

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
Duration <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) Geographic Extent <ul style="list-style-type: none"> >Regional 	Treatment at the Duffin Creek WPCP + Alternative 1	alternatives due to concrete use during construction and energy use during operation (>100 million kgCO ₂ e) Energy Requirements: There is energy use during construction but it would be low (excavation equipment and crane for installing equipment). Significant increase in electricity use for blowers and permeate pumping, up to 10 million kWh/year which is a 10% increase from the baseline.	Conclusion: After mitigation, there is a negative change in carbon footprint and energy requirements, and the magnitude is high over an extended period of time	
	4. Extend Existing Outfall Diffuser + Alternative 1	Carbon Footprint - The carbon footprint of this alternative is small compared to other alternatives (<10 million kgCO ₂ e). Energy Requirements: Energy use during construction would be low (0.25 million kWh for a 300 day construction period). No additional energy requirements are associated with this alternative during operations.	Construction: Specify energy efficient equipment for construction. Conclusion: After mitigation, there is a negative change carbon footprint and energy requirements, and the magnitude is low over a short period of time	4
	5. New Outfall + Alternative 1	Carbon Footprint - The carbon footprint of this alternative is moderate compared to other alternatives (>50 million kgCO ₂ e but <100 million kgCO ₂ e). Energy Requirements: Energy use during construction would be high (4.5 million kWh for a 300 day tunnelling period). No additional energy requirements are associated with this alternative during operations.	Construction: Specify energy efficient equipment for construction Conclusion: After mitigation, there is a negative change in carbon footprint and energy requirements, and the magnitude is moderate of a short period of time.	3
S.1 Tourism, Recreational Uses of Lake and Lakefront The potential of the alternative solution to impact touristic and recreational uses of lake and lakefront during construction/operation for visitors and residents. Measures Change from baseline in recreational uses access and/or enjoyment of the lake and lakefront based on: <ul style="list-style-type: none"> Potential of alternative to impact recreational activities Type, extent and/or footprint of construction Proximity of TP mixing zone to beaches during operation Proximity of UIA mixing zone to areas of sport fishing during operation Change in E. coli levels at beaches during operations Duration <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) Geographic Extent <ul style="list-style-type: none"> Local 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	Construction: No construction is necessary therefore no changes in boater access to the lake and no change in access to the Waterfront Trail are anticipated. Operation: No additional operational equipment or facilities are required with this alternative. Therefore the pathway of effect considered is: <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Effluent from the WPCP currently achieves <i>E.coli</i> levels below the 100 counts per 100mL, which is the recreational water quality guideline from the Ministry of Health and the PWQO for Lake Ontario. Prevailing plume moves in the lateral direction with minimal effect to nearshore beach and lakefront recreational uses. The mixing zone compared to the baseline condition at 630 MLD will be slightly larger for Unionized Ammonia (UIA) and smaller for TP. UIA within the mixing zone is of concern to the natural environment because of its link to toxicity in fish and other biota, which may in turn impact recreational fishing uses. These impacts while negative are expected to be very low, with a minimal change from the base conditions. Impacts during operation have been identified as negative, low in magnitude, and long in duration, to result in a rating of 4. 	Construction and Operation: No mitigation measures have been prescribed. Conclusion: There is minimal effect to the touristic and recreational uses of lake and lakefront. Conditions will be similar to the baseline conditions with the exception of a slight increased size of UIA mixing zone, which while very low, may be considered negative to recreational users. Overall this alternative will have a negative change in effect and the magnitude of the impact is low in the long term within the Regional Study Area.	4
	2. Modify Existing Outfall Diffuser + Alternative 1	Construction: Variable port openings will be installed by a diver and no construction will occur at the lakefront therefore: no change in access to the Waterfront Trail. The effective pathway is: <ul style="list-style-type: none"> Location and extent of construction → Restriction of access to site and surrounding area→ causes disruption and conflicts with surrounding land/water users. Access to the area of the diffuser while the variable ports are being installed will be temporarily limited, having a short-term minimal impact on boaters in the area. Therefore the rating is a 4. Operation: No additional operational equipment or facilities are required with this alternative. Therefore the pathway of effect considered relate to effluent quality as follows: <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Effluent from the WPCP currently achieves <i>E.coli</i> levels below the 100 counts per 100mL, which is the recreational water quality guideline from the Ministry of Health and the PWQO for Lake Ontario. Prevailing plume moves in the lateral direction with minimal effect to nearshore 	Construction: During installation buoys will be set up to limit access to the area during installation. In addition, the Coast Guard will be made aware of the timing for installation. Operation: No additional mitigation measures beyond proper inspection of the ports on a yearly basis (which is already part of the yearly plant operations and maintenance activities). Conclusion: There is minimal effect to the touristic and recreational uses of lake and lakefront. Baseline conditions are maintained during construction with the use of mitigation measures. Conditions during operation will be similar to the baseline conditions with the exception of a slight increased size of UIA mixing zone, which while very low, may be considered negative to recreational users. Overall this alternative will have a negative change in effect and the magnitude of the impact is low in the long term within the Regional Study Area.	4

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<ul style="list-style-type: none"> Regional 		<p>beach and lakefront recreational uses. The mixing zone compared to the baseline condition at 630 MLD will be slightly larger for Unionized Ammonia (UIA) and smaller for TP. UIA within the mixing zone is of concern to the natural environment because of its link to toxicity in fish and other biota, which may in turn impact recreational fishing uses. These impacts while negative are expected to be very low, with a minimal change from the base conditions. Impacts during operation have been identified as negative, low in magnitude, and long in duration, to result in a rating of 4.</p>		
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: The construction of tertiary treatment facilities will require site preparation and excavation on the WPCP property. It is expected that access to the waterfront trail will be maintained and that erosion and sedimentation to the lake will be controlled through proper mitigation techniques. It is also expected that the transport routes for supply of construction materials and disposal of spoils will be through industrial areas and not impact tourism or recreation (similar to the routes used for the Stage 3 expansion). The only pathway of effect considered is as follows:</p> <ul style="list-style-type: none"> Construction activities require use of heavy equipment → will cause noise, vibration, emissions and increased human activity → results in disruption and enjoyment of surrounding community features. The noise, vibration, and emissions may temporarily impact the enjoyment of the waterfront trail by recreational users. Therefore the rating is a 4. <p>Operation: It is expected that operational impacts associated with this alternative will be the same as those currently experienced and will not increase impacts to recreational users or tourism. In addition, it is expected that the transport routes for supply of operational materials will be through industrial areas and not impact tourism or recreation (similar to the routes used for the Stage 3 expansion). The only pathway of effect considered that impact tourism, and recreation therefore relates to water quality impacts as follows:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment → effluent quality impacts water quality → water quality impacts recreational and other lake users. Tertiary treatment improves the removal of TP and maintains the same removal of ammonia and E.coli. An overall improvement to effluent water quality, with an associated rating of 5. 	<p>Construction: Measures to mitigate impacts include:</p> <ul style="list-style-type: none"> Hoarding will be installed to maintain access to the waterfront trail Development and implementation of an erosion control plan will be applied. Disposal of construction spoils on-site where appropriate to reduce truck traffic. <p>Operation: Facilities will be designed and constructed to meet all applicable standards to control noise, vibrations and emissions.</p> <p>Conclusion: There will be minimal disruption to recreational uses of the waterfront trail during construction, but it is short-term. During operations, there is no net effect. Overall this alternative will have a negative change in effect and the magnitude of the impact is low and for a short period of time during construction within the Local Study Area.</p>	<p>4</p>
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: This alternative assumes that staging areas will be primarily located offsite at a docking facility. Consequently, it is expected that access to the waterfront trail will be maintained and that erosion and sedimentation to the lake will be controlled. The pathways of effect therefore considered for this alternative relate primarily to in-water works and in include:</p> <ul style="list-style-type: none"> Location and extent of construction → Restriction of access to site and surrounding area → causes disruption and conflicts with surrounding land/water users. There will be several years of restricted access for some sections of the lake during construction because underwater trenching times are limited to avoid fish spawning periods (e.g. construction may be limited to the period from about July 1 to September 15 of each year). During this time there may be: changes to boater access to the lake. The impact will be moderate over several seasons, and therefore is rated as a 3. Site preparation (in-water) → removal of lakebed, marine excavation → causes re-suspension of sediment and silt → re-suspension of sediment and silt degrade the quality of the lake and lakefront → degradation of lake impacts other lake users. Mitigation for entrainment (e.g. dragline water tight bucket and turbidity curtain) is intended to reduce this impact. Given these considerations, this impact is considered to be negative, moderate on the recreational uses in the area and short in duration, 	<p>Construction: Measures to mitigate impacts include:</p> <ul style="list-style-type: none"> Plan and phase construction activities to reduce the impacts of limited boater and trail user. During construction buoys will be set up to limit access to the area during installation. In addition, the Coast Guard will be made aware of the timing for construction and location/timing of offshore disposal sites. Use existing docking facility and barge to manage materials and equipment necessary for construction. Utilize a turbidity curtain around drilling equipment during the installation of risers. <p>Operation: No mitigation measures have been prescribed since no impacts have been identified.</p> <p>Conclusion: After application of mitigation measures during construction, moderate impacts that are short in duration would remain. Alternate accesses for boaters and trail users will be provided but users will likely experience detours. No mitigation measures are required during operations. Overall this alternative will have a negative change in effect and the magnitude of the impact is moderate (typical of</p>	<p>3</p>

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>such that a rating of 3 was applied.</p> <ul style="list-style-type: none"> Construction activities require use of heavy equipment → will cause noise, vibration, emissions and increased human activity → results in disruption and enjoyment of surrounding community and recreational features. In water construction may include excavation which will cause noise and vibrations that will disrupt the enjoyment of recreational users on the lake or lakefront trail. While short term the magnitude of the impact will be moderate to low, resulting in a rating of 3. Construction requires supply construction materials and/or transport construction spoils → results in increased truck and/or marine traffic → will cause increased noise, emissions, dust → results in disruption of surrounding community and recreational features. It is assumed that the construction spoils will be disposed of via barge into the lake. The transport of these materials may temporarily disrupt recreational boaters on the lake. However, the impacts are low in magnitude and short-term resulting in an impact rating of 4. <p>Operation: No additional operational equipment or facilities are required with this alternative. Therefore the pathway of effect considered relate to effluent quality as follows:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment → effluent quality impacts water quality → water quality impacts recreational and other lake users. Effluent from the WPCP currently achieves <i>E.coli</i> levels below the 100 counts per 100mL, which is the recreational water quality guideline from the Ministry of Health and the PWQO for Lake Ontario. Prevailing plume moves in the lateral direction with minimal effect to nearshore beach and lakefront recreational uses. The mixing zone compared to the baseline condition at 630 MLD will also be smaller for UIA and TP. It is expected that there will be no change in recreational activities with this alternative. Therefore, a rating of 5 is applied for this impact. 	<p>construction) and for a short period of time during construction within the Local Study Area.</p>	
	<p>5. New Outfall + Alternative 1</p>	<p>Construction: Construction impacts of this alternative relate to the construction of tunnel shafts in close proximity to the waterfront, a need for on-shore staging and disposal of spoils. Impacts are also associated with the tunnelling of the outfall and drilling of the diffuser risers. Pathways of effect therefore considered are as follows:</p> <ul style="list-style-type: none"> Location and extent of construction → Restriction of access to site and surrounding area → causes disruption and conflicts with surrounding land/water users. There will be several years of restricted access for recreational boaters during construction of the tunnel and diffuser risers. These activities will result in: changes to boater access to the lake; and redirection of traffic along a portion of the Waterfront Trail to allow for onshore construction staging, and therefore is rated as a 3. Site preparation (in-water) → removal of lakebed, marine excavation → causes re-suspension of sediment and silt → re-suspension of sediment and silt degrade the quality of the lake and lakefront → degradation of lake impacts other lake users. Mitigation for entrainment (e.g. turbidity curtain around drill) is intended to reduce this impact. Given these considerations this impact is considered to be negative, moderate (considering the extent of the effect, the application of mitigation and the recreational uses in the area) and short in duration, such that a rating of 3 was applied. Construction activities require use of heavy equipment → will cause noise, vibration, emissions and increased human activity → results in disruption and enjoyment of surrounding community and recreational features. In water construction will involve tunnelling the outfall and drilling the diffuser risers. Although not as significant as 	<p>Construction: Measures to mitigate impacts include:</p> <ul style="list-style-type: none"> Careful planning and phasing of construction activities will reduce the impacts of limited boater and trail user. During construction buoys will be set up to limit access to the area during installation. In addition, the Coast Guard will be made aware of the timing for construction and location/timing of offshore disposal sites. Utilize a turbidity curtain around drilling equipment during the installation of risers. Hoarding will be installed to buffer on-shore construction areas from the waterfront trail. Development and implementation of an erosion control plan will be applied. Disposal of on-site construction spoils to remain on-site where appropriate to reduce truck traffic. <p>Operation: No mitigation measures have been prescribed since no impacts have been identified.</p> <p>Conclusion: After application of mitigation measures during construction, moderate impacts that are short in duration would remain. No mitigation measures are required during operations. Overall this alternative will have a negative change in effect and the magnitude of the impact is moderate (typical of construction) and for a short period of time during construction within the Local Study Area.</p>	<p>3</p>

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>excavation as potentially needed for Alternative 4, noise and vibrations will disrupt the enjoyment of recreational users on the lake or lakefront trail. These impacts are short term and the magnitude of the impact will be low, resulting in a rating of 4.</p> <ul style="list-style-type: none"> Construction requires supply construction materials and/or transport construction spoils → results in increased truck and/or marine traffic → will cause increased noise, emissions, dust → results in disruption of surrounding community and recreational features. It is assumed that the construction spoils will be disposed of via barge into the lake. The transport of these materials may temporarily disrupt recreational boaters on the lake. However, the impacts are low in magnitude and short-term resulting in an impact rating of 4. <p>Operation: No additional operational equipment or facilities are required with this alternative. Therefore the pathway of effect considered relate to effluent quality as follows:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment → effluent quality impacts water quality → water quality impacts recreational and other lake users. Effluent from the WPCP currently achieves <i>E.coli</i> levels below the 100 counts per 100mL, which is the recreational water quality guideline from the Ministry of Health and the PWQO for Lake Ontario. Prevailing plume moves in the lateral direction with minimal effect to nearshore beach and lakefront recreational uses. The mixing zone compared to the baseline condition at 630 MLD will also be almost to the offshore and much smaller for UIA and TP. The operation of the diffuser extension has no net effect. Therefore, a rating of 5 is applied for this impact. 		
<p>S.2 Impact on Archaeological/cultural Features The risk of the alternative solution impacting archaeological/cultural features in terrestrial and marine environments.</p> <p>Measures</p> <ul style="list-style-type: none"> Potential of the construction area to impact terrestrial or marine archaeological/cultural resources <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local Regional 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p> <p>2. Modify Existing Outfall Diffuser + Alternative 1</p> <p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p> <p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: This alternative does not require construction. Therefore, there are no anticipated impacts on archaeological/cultural features on land or in-lake.</p> <p>Construction: This alternative does not require heavy construction. Therefore, there are no anticipated impacts on archaeological/cultural features on land or in-lake.</p> <p>Construction: Excavation of the additional lands on the existing WPCP site are required for this alternative south of the existing secondary clarifiers for the two tertiary treatment buildings. This results in the following pathway of effect:</p> <ul style="list-style-type: none"> Site preparation → land excavation → encountering archaeological resources. During the Stage 2 Archaeological Assessment completed for the Stage 3 Expansion, no archeological features/artifacts of significance were identified; therefore, risks of encountering further archaeological resources are minimal. However, given that the site and surrounding area is classified as having potential for archaeological resources as it was a settlement area for aboriginals and First Nations, a rating of 4 is assumed. <p>Construction: Excavation of lakebed south of the existing outfall will be required. This results in the following pathway of effect:</p> <ul style="list-style-type: none"> Site preparation → lakebed excavation → encountering archaeological resources. The area is not classified by the Ministry of Cultural as a marine archaeological site. In addition, during geotechnical surveys and investigations no evidence of marine archaeological resources was detected. The probability of finding features of marine 	<p>Construction: Mitigation is not applicable to this alternative as no terrestrial or marine archaeological features have been identified.</p> <p>Conclusion: There is no effect on terrestrial or marine archaeological/cultural features in the Local or Regional Study Area.</p> <p>Construction: Mitigation is not applicable to this alternative as no terrestrial or marine archaeological features have been identified.</p> <p>Conclusion: There is no effect on terrestrial or marine archaeological/cultural features in the Local or Regional Study Area..</p> <p>Construction: Stage 2 archaeological assessment on the proposed location of the new tertiary treatment building. If archaeological resources are discovered, the Regions will work with the Ministry of Culture to protect the resources either through excavation or avoidance.</p> <p>Conclusion: The risk of finding unknown archaeological resources is low. Therefore there is a low negative potential impact during construction in the Local or Regional Study Area.</p> <p>Construction: Mitigation is not applicable.</p> <p>Conclusion: The risk of finding unknown archaeological resources is low. Therefore there is a low negative potential impact during construction in the Local or Regional Study Area.</p>	<p>5</p> <p>5</p> <p>4</p> <p>4</p>

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		archaeological significance is low.		
<p>S.3 Community health and safety The potential of the alternative solution to increase risk to community health and safety.</p> <p>Measures Change in risk to community health and safety from baseline conditions from:</p> <ul style="list-style-type: none"> • Use and operation of construction equipment and chemicals • Truck/Marine Traffic for supply of construction materials and/or disposal of construction spoils • Use of operating equipment and chemicals • Truck Traffic for supply of operational materials <p>Duration</p> <ul style="list-style-type: none"> • Short-term (during construction) • Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> • Local • Regional 	<p>5. New Outfall + Alternative 1</p>	<p>Construction: Excavation along the shoreline will be necessary for the shaft, and disruption of the lakebed will occur through construction of the diffuser. This results in the following pathways of effect:</p> <ul style="list-style-type: none"> • Site preparation → land excavation → encountering archaeological resources. During the Stage 2 Archaeological Assessment completed for the Stage 3 Expansion, no archeological features/artifacts of significance were identified; therefore, risks of encountering further archaeological resources are minimal. However, given that the site and surrounding area is classified as having potential for archaeological resources as it was a settlement area for aboriginals and First Nations, a rating of 4 is assumed. • Site preparation → lakebed excavation → encountering archaeological resources. The area is not classified by the Ministry of Cultural as a marine archaeological site. In addition, during geotechnical surveys and investigations no evidence of marine archaeological resources was detected. The probability of finding features of marine archaeological significance is low. 	<p>Construction: Stage 2 archaeological assessment on the proposed location of the shaft along the lakefront. If archaeological resources are discovered, the Regions will work with the Ministry of Culture to protect the resources either through excavation or avoidance.</p> <p>Conclusion: The risk of finding unknown archaeological resources is low. Therefore there is a low negative potential impact during construction in the Local or Regional Study Area.</p>	4
	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p>	<p>Construction: Since there is no heavy construction, there are no risks to community health and safety in terms of: truck/marine traffic; chemical storage and use; and storage and disposal of construction sediments.</p> <p>Operation: In the baseline condition, there is a yearly outfall inspection in the lake and there is truck traffic for the delivery of iron salts to site, both of which have low risk to community health and safety. There is no change in risk to community health and safety from existing conditions.</p>	<p>Construction and Operation: Additional mitigation beyond the existing plant program is not applicable to this alternative as no community health and safety impacts aside from baseline conditions have been identified.</p> <p>Conclusion: There is no effect on the risk to community health and safety. The level of community health and safety will remain the same without the application of mitigation measures during construction and operation, over any geographic extent.</p>	5
	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: Since there is no heavy construction, there are no risks to community health and safety in terms of: truck/marine traffic; chemical storage and use; and storage and disposal of construction sediments.</p> <p>Operation: In the baseline condition, there is a yearly outfall inspection in the lake and there is truck traffic for the delivery of iron salts to site, both of which have low risk to community health and safety. There is no change in risk to community health and safety from existing conditions.</p>	<p>Construction and Operation: Additional mitigation beyond the existing plant program is not applicable to this alternative as no community health and safety impacts aside from baseline conditions have been identified.</p> <p>Conclusion: There is no effect on the risk to community health and safety. The level of community health and safety will remain the same without the application of mitigation measures during construction and operation, over any geographic extent..</p>	5
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: The construction of tertiary treatment facilities will require site preparation and excavation on the WPCP property. The construction area will be confined to the site with proper hoarding to protect the community and recreational users of the trail system. Noise and vibrations will be controlled as indicated in Criterion S5. The only pathway of effect considered that impact community impacts therefore relates to nuisance impacts through transportation of construction materials and disposal of spoils:</p> <ul style="list-style-type: none"> • Construction requires supply construction materials and/or transport construction spoils → results in increased truck and/or marine traffic → will cause increased noise, emissions, dust → results in disruption of surrounding community and risks to human health and safety. Transport routes for supply of construction materials and disposal of spoils will be through industrial areas to minimize risk to the community (similar to the routes used for the Stage 3 expansion). Consequently, the risk of impact to community health and safety from transportation of construction materials, fuel and other potential hazardous materials is considered low and short-term. 	<p>Construction: Measures to mitigate impacts include:</p> <ul style="list-style-type: none"> • Hoarding will be installed around construction area to protect users of the waterfront trail. • Development and implementation of an erosion control plan will be applied. • Disposal of construction spoils on-site where appropriate to reduce truck traffic. <p>Operation: Mitigation is not applicable to this alternative as no community health and safety impacts aside from baseline conditions have been identified.</p> <p>Conclusion: Mitigation measures apply mainly to construction activities. Overall risk of negative impacts to community health and safety will be low and in short duration within the Local and Regional Study Areas even after the application of mitigation measures. The safety record of the Stage 3 Expansion project is testament to this conclusion.</p>	4

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>Operation: In the baseline condition, there is a yearly outfall inspection in the lake and there is truck traffic for the delivery of iron salts to site, both of which have low risk to community health and safety. There is no change in risk to community health and safety from existing conditions. The chemicals used for tertiary treatment process are common with chemicals being applied to the existing treatment processes.</p>		
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: The in-water construction area will be marked to limit the risks to recreational boaters. This alternative also assumes that staging areas will be primarily located offsite at an existing docking facility. Consequently, it is expected that the risk to health and safety of the local community will not change as a result of this operation. However, risks are associated with the transport and assembly of the barge and equipment for use in the local area. The pathway of effect therefore considered for this alternative include:</p> <ul style="list-style-type: none"> • Construction requires supplying construction materials and/or transporting construction spoils → results in increased truck and/or marine traffic → will cause increased noise, emissions, dust, use of roadways → results in disruption and health and safety risks to surrounding community. Transporting and assembling the barge and construction equipment will negatively impact safety of the local communities along the transportation routes. However, it is assumed that the barge will be transported mainly by water, and construction spoils will be disposed of via barge into the lake. This will limit the risks to the local community, but may increase risks to recreational boaters. The impacts are, however, low in magnitude and short-term resulting in an impact rating of 4. <p>Operation : In the baseline condition, there is a yearly outfall inspection in the lake and there is truck traffic for the delivery of iron salts to site, both of which have low risk to community health and safety. There is no change in risk to community health and safety from existing conditions.</p>	<p>Construction: Mitigation measures include:</p> <ul style="list-style-type: none"> • Develop a marine construction environmental management plan that will minimize marine traffic hazards. • A spoils management plan will be in place for the proper transport and disposal of excavated materials. <p>Operation: Mitigation is not applicable to this alternative as no community health and safety impacts aside from baseline conditions have been identified.</p> <p>Conclusion: Mitigation measures apply mainly to construction activities. Overall risk of negative impacts to community health and safety will be low and in short duration within the Local and Regional Study Areas after the application of mitigation measures. The safety record of the Stage 3 Expansion project is testament to this conclusion.</p>	<p>4</p>
	<p>5. New Outfall + Alternative 1</p>	<p>Construction: The tunnel shaft and staging area will be located on the shoreline. The construction area will be confined to the site with proper hoarding to protect the community and recreational users of the trail system. In addition the in-water construction area will be marked to limit the risks to recreational boaters. Noise and vibrations will be controlled as indicated in Criterion S5. The pathway of effect considered that impact community therefore relates to transportation of construction materials and disposal of spoils:</p> <ul style="list-style-type: none"> • Construction requires supplying construction materials and/or transporting construction spoils → results in increased truck and/or marine traffic → will cause increased noise, emissions, dust → results in disruption of surrounding community and recreational features. It is assumed that the construction spoils will be disposed of via barge into the lake. The transport of these materials may temporarily risk the safety of recreational boaters on the lake. In addition, the assembly and transportation of the barge and equipment may impact local communities along transportation routes. However, the impacts are low in magnitude and short-term resulting in an impact rating of 4. <p>Operation : In the baseline condition, there is a yearly outfall inspection in the lake and there is truck traffic for the delivery of iron salts to site, both of which have low risk to community health and safety. There is no change in risk to community health and safety from existing conditions.</p>	<p>Construction: Measures to mitigate impacts include:</p> <ul style="list-style-type: none"> • Hoarding will be installed around construction area to protect community. • Development and implementation of an erosion control plan will be applied. • Disposal of construction spoils on-site where appropriate to reduce truck traffic. Productive use of spoils will be considered for nearby industries depending on type of spoils. • Develop a marine construction environmental management plan to minimize marine traffic hazards. • Develop a truck routing plan that minimizes transport through high pedestrian/residential areas and implements hours of operation that do not interfere with high pedestrian volume. • A spoils management plan will be in place for the proper transport and disposal of excavated materials. <p>Operation: Mitigation is not applicable to this alternative during operation as no impacts are associated with the community health and safety.</p> <p>Conclusion: An insignificant risk of impact. Mitigation measures apply mainly to construction activities over a short time frame within the Local and Regional Study Areas. Overall risk of impacts to community health and safety will be low over a short period of time after the application of mitigation measures.</p>	<p>4</p>

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>S.4 Worker health and safety</p> <p>The potential of the alternative solution to increase risk to worker and/or operator health and safety.</p> <p>Measures</p> <p>Change in risk to worker and/or operator health and safety from baseline conditions from:</p> <ul style="list-style-type: none"> On-site and in-water construction activities Operation of works 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p>	<p>Construction: As no construction is required, there is no risk of on-site and in-water construction activities.</p> <p>Operation: There are low risks to operations staff in operating chemical systems. There are low risks to divers performing underwater inspections. There would be no additional risks associated with operation of this alternative from the baseline; therefore a rating of 5 applies.</p>	<p>Construction: Mitigation is not applicable to this alternative during construction since there are no construction activities.</p> <p>Operation: Mitigation measures are similar to that currently being implemented, including:</p> <ul style="list-style-type: none"> Follow standard operating procedures (SOPs) for equipment use and chemical handling. Follow diver safety plan for outfall inspections to verify proper procedures are carried out in accordance with <i>Occupational Health and Safety Act</i> (OHSA). <p>Conclusion: There is no effect on the risk to worker health and safety aside from baseline conditions. Standard risk mitigation measures are already being applied during operations within the Local Study Area.</p>	<p>5</p>
<p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> Local 	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: Divers are required to install the new diffuser ports with this alternative. Although in-water works, particularly on a live outfall, have associated risks, evidence from past outfall works indicates that risks are minimized by following safety procedures. Therefore there is a low risk for divers during the installation of check-valves while the existing outfall is in operation. This impact therefore rates a 4.</p> <p>Operation: There are low risks to operations staff in operating chemical systems. There are low risks to divers performing underwater inspections. There would be no additional risks associated with operation of this alternative from the baseline; therefore a rating of 5 applies.</p>	<p>Construction: Mitigation measures are:</p> <ul style="list-style-type: none"> Prepare a diver safety plan for installation of the check-valves on the diffuser, in accordance with the <i>Occupational Health and Safety Act</i> (OHSA). <p>Operation: Mitigation measures are similar to that currently being implemented, including:</p> <ul style="list-style-type: none"> Follow standard operating procedures (SOPs) for equipment use and chemical handling Follow diver safety plan for outfall inspections to verify proper procedures are carried out in accordance with <i>Occupational Health and Safety Act</i> (OHSA). <p>Conclusion: There is a short period of time when worker health and safety risk is slightly increased during construction and operation. The application of mitigation measures for diver installation of check-valves will reduce but not eliminate all risk to worker health and safety. An inherent level of risk exists for divers during operations and maintenance which does not differ from baseline conditions. Overall there is a low risk over a short period of time within the Local Study Area.</p>	<p>4</p>
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: The pathway of effect is:</p> <ul style="list-style-type: none"> Operation of construction equipment and performance of construction activities → results in worker exposure to noise, vibrations, emissions, heavy equipment, and other hazards → results in increased occupational health and safety risk. Although any construction works have associated risks, evidence from the Stage 3 works indicates that risks are minimized by following safety procedures (i.e. no recordable incidents of accidents have occurred on the site through construction of the Stage 3 works). Therefore there is a low risk for construction works with a rating of 4. <p>Operation: The pathway of effect:</p> <ul style="list-style-type: none"> Operation and maintenance of facilities → results in worker exposure to noise, vibrations, emissions, heavy equipment, operating facilities/outfall → results in increased occupational health and safety risk. There will be additional chemical use during operation of the tertiary facilities (e.g. citric acid). With more chemical handling, there will be a small increased risk to operations staff. Consequently, this rates as a 4. 	<p>Construction: Mitigation measures include:</p> <ul style="list-style-type: none"> Prepare and implement a health and safety (H&S) plan. <p>Operation: Mitigation measures are similar to that currently being implemented, including:</p> <ul style="list-style-type: none"> Follow standard operating procedures (SOPs) for equipment use and chemical handling. Follow diver safety plan for outfall inspections to verify proper procedures are carried out in accordance with <i>Occupational Health and Safety Act</i> (OHSA). <p>Conclusions: There is a short period of time when worker health and safety risk is slightly increased during the construction of the facility and the handling of chemicals during operations within the Local Study Area. Following the correct H&S procedures significantly reduces risks during the construction of the tertiary treatment facility as demonstrated during Stage 3 Expansion construction activities. Following proper chemical handling procedures will mitigate risk to staff during operations.</p>	<p>4</p>
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: The pathway of effect is:</p> <ul style="list-style-type: none"> Operation of construction equipment and performance of construction activities → results in worker exposure to noise, vibrations, emissions, heavy equipment, and other hazards → results in increased occupational health and safety risk. There are fairly significant risks with the operation of heavy machinery on a barge and underwater activities during this type of construction. The outfall will be operating 	<p>Construction: Mitigation measures include:</p> <ul style="list-style-type: none"> Contract documents will include special provisions for marine construction H&S plan for workers and equipment. Schedule the tie-in to the existing outfall during a low flow season (based on historical data). <p>Operation: Mitigation measures are similar to that currently being implemented, include:</p>	<p>2</p>

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>when construction is occurring, the substrate immediately adjacent to the outfall is not stable. In addition, there are not very many instances where this type of work has been completed in the past, so health and safety standards are not as fully developed as other types of work. Consequently, the worker health and safety risks of extending the outfall may be considered high over a short period of time; with an associated rating of 2.</p> <p>Operation: The operation and maintenance of the outfall diffusers would be similar to existing worker conditions.</p>	<ul style="list-style-type: none"> Follow standard operating procedures (SOPs) for equipment use and chemical handling. Follow diver safety plan for outfall inspections to verify proper procedures are carried out in accordance with <i>Occupational Health and Safety Act</i> (OHSA). <p>Conclusion: Overall, this construction approach poses high risks to worker health and safety even after the application of mitigation measures. Operational risks are similar to existing. Therefore there is a short period of time (2-3 years) during construction when worker health and safety risk is greatly increased within the Local Study Area.</p>	
	5. New Outfall + Alternative 1	<p>Construction: The pathway of effect is:</p> <ul style="list-style-type: none"> Operation of construction equipment and performance of construction activities → results in worker exposure to noise, vibrations, emissions, heavy equipment, and other hazards → results in increased occupational health and safety risk. The risks of in-water tunnelling work are well documented and include working with variable substrate (i.e. fractures and gas deposits have been noted through the geotechnical investigation), confined space in tunnel, working in compressed air, operating the tunnelling equipment and drilling the diffusers. However, there is more and more experience in constructing deep tunnels, and health and safety procedures are well developed. If an incident does occur through this type of work it can be severe; however the probability of incidences occurring is reduced with proper mitigation. Therefore, a rating of 3 has been applied. <p>Operation: The operation and maintenance of the outfall diffusers openings would be similar to existing worker conditions.</p>	<p>Construction: Mitigation measures include:</p> <ul style="list-style-type: none"> Contract documents will include special provisions for equipment and marine construction in potential gas environment. During construction a pilot hole will be drilled in the tunnel to release gas from pockets. Forward pilot drilling to be used to detect rock fractures and need for grout to stabilize rock condition for drilling. Tunnelling equipment will be designed for gaseous conditions. <p>Operation: Mitigation measures are similar to that currently being implemented, include:</p> <ul style="list-style-type: none"> Follow standard operating procedures (SOPs) for equipment use and chemical handling. Follow diver safety plan for outfall inspections to verify proper procedures are carried out in accordance with <i>Occupational Health and Safety Act</i> (OHSA). <p>Conclusion: Overall, this construction approach poses moderate risks to worker health and safety during the operation of computerized tunnel boring machines even after the application of mitigation measures. Operational risks are similar to existing. Therefore there is a short period of time (2-3 years) during construction when worker health and safety risk is moderately increased within the Local Study Area.</p>	3
<p>S.5 Noise and vibration impacts The level of noise and vibration impacts.</p> <p>Measures Change in noise and vibration impacts from baseline conditions from:</p> <ul style="list-style-type: none"> Truck/Marine Traffic Construction equipment Operating equipment <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-term (during operation) <p>Geographic Extent</p>	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	<p>Construction: No additional construction is necessary with this alternative. Therefore there will be no noise and vibration impacts from: truck/marine traffic; construction equipment.</p> <p>Operation: Noise and vibration levels on the plant site will not change from existing. None or minimal noise impacts are anticipated from operating equipment.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified.</p> <p>Conclusion: There is no effect on the level of noise and vibration. Baseline conditions are maintained during operation without the application of mitigation measures within the Local Study Area.</p>	5
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Construction: For this underwater work there are no anticipated noise impacts from marine traffic or construction equipment.</p> <p>Operation: No noise and vibration impacts are anticipated during operation. Levels will be the same as existing.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified.</p> <p>Conclusion: There is no effect on the level of noise and vibration as work is primarily underwater. Baseline conditions are maintained during construction and operation without the use of mitigation measures within the Local Study Area.</p>	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Construction: Construction supplies will be trucked to the site increasing traffic along designated routes. Construction spoils will be utilized on-site where appropriate and if there is not enough space on-site additional spoils will be trucked to appropriate off-site areas (also leading to increased truck traffic). This truck traffic will increase noise and vibrations in areas along the transport routes, which are in an industrial area. Although the impact of this truck traffic on noise and vibrations will be negative, the magnitude is consider low and</p>	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> Use spoils on-site where possible, and designate appropriate trucking routes through industrial area if off-site disposal is needed <p>Operation: Mitigation measures during operation include:</p> <ul style="list-style-type: none"> Design the blower building with acoustical treatment to mitigate noise impacts (e.g. new 	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<ul style="list-style-type: none"> • Local • Regional • > Regional 		<p>short-term, resulting in an impact rating of 4.</p> <p>Noise and vibrations from construction activities will also increase, but the magnitude is considered low and limited to the construction time period; thereby resulting in a rating of 4. Mitigation measures will be applied to limit the timing and magnitude for these construction impacts.</p> <p>Operation: Additional blowers for tertiary treatment have a noise impact, but impact can be easily mitigated. The overall noise and vibrations impact from the facilities will likely not change from baseline conditions.</p>	<p>equipment designed to less than 50 decibels at the property boundary).</p> <p>Conclusion: Some minor noise and vibration impacts during construction will exist after the application of mitigation measures. These impacts will be a low, negative change from existing conditions, for a short period of time (2-3 years) within the Local and Regional Study Areas and perhaps beyond along designated traffic routes.</p>	
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction: This alternative assumes that staging areas will be primarily located on an in-water barge so noise and vibrations impacts on land will be low. A high level of noise and vibrations however is expected due to barge movement, diesel generators and equipment and spoils transport. This impact is therefore rated as a 3.</p> <p>Operation: No noise and vibration impacts are anticipated during operation. Levels will be the same as existing.</p>	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> • Use nearby docking facility and barge to manage materials and equipment necessary for construction. • A marine construction environmental management plan with traffic control measures <p>Operation: Mitigation is not applicable to this alternative during operation as no impacts have been identified.</p> <p>Conclusion: Moderate noise/vibration impacts will result mainly from construction even with the employment of mitigation measures. There will be a moderate, negative change from existing conditions for a short period of time during construction (2-3 years) within the Regional Study Area.</p>	3
	5. New Outfall + Alternative 1	<p>Construction: Tunnel boring equipment is not anticipated to generate a lot of noise as it will be deep within lake bedrock. Construction of the tunnel boring machine intake shaft onshore and the removal and transfer of spoils from the shaft will be a source of noise and vibrations. Drilling the diffuser risers deep in the lake will produce low levels of noise and vibrations. It is assumed that construction spoils from drilling risers will be disposed of deep in the offshore by barge, reducing noise and vibration impacts. Overall, noise and vibration impacts are low in magnitude and limited to the construction period. This impact is therefore rated as a 4.</p> <p>Operation: No noise or vibration impacts are anticipated as the outfall will be anchored deep into the bedrock. Levels will be the same as existing.</p>	<p>Construction: Mitigation measures during construction include:</p> <ul style="list-style-type: none"> • Designate appropriate trucking routes through industrial area for construction equipment. • Truck haul routes to transfer spoils from the onshore shaft to the barge or land disposal site will be selected to mitigate noise impacts in residential neighborhoods. • A marine construction environmental management plan with traffic control measures. • Construction activities to occur during the permitted hours outlined in the local noise by-law. <p>Operation: Mitigation is not applicable to this alternative during operation as no impacts have been identified.</p> <p>Conclusion: Low noise and vibration impacts in the short-term from construction will exist after the application of mitigation measures. This change from existing conditions will be a low negative change for a short period of time (2-3 years) within the Regional Study Area.</p>	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
<p>S.6 Impact on Aesthetic Conditions along the shoreline</p> <p>The potential of the alternative solution to cause additional aesthetically undesirable conditions.</p> <p>Measures</p> <p>Change in aesthetics conditions from baseline on:</p> <ul style="list-style-type: none"> • Visual – construction equipment, facilities, storage of material • Turbidity – sedimentation • Odour – construction equipment, operations <p>Change in total phosphorus mixing zone from baseline condition during operations as a basis for impacts on growth of nuisance algae</p> <p>Duration</p> <ul style="list-style-type: none"> • Short-term (during construction) • Long-Term (during operation) <p>Geographic Extent</p> <ul style="list-style-type: none"> • Local • Regional • > Regional 	<p>1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)</p>	<p>Construction: Aesthetic conditions will not change from the baseline as no construction is required.</p> <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> • Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Nuisance plants such as <i>Cladophora</i> have been observed along the shoreline in the study area. The cause of <i>Cladophora</i> in the nearshore has not been confirmed based on current research. There is no change in the mass loading and mixing zone for total phosphorus from the baseline conditions. No change from baseline aesthetic conditions is anticipated. <p>No other visual, odour, and turbidity impacts are anticipated from the operation of this alternative.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative since no change in impact from baseline conditions has been identified.</p> <p>Conclusion: There is no change from baseline aesthetic conditions. Overall, there is no effect within any geographic extent.</p>	5
	<p>2. Modify Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: No impacts to aesthetic conditions along the shoreline as implementation activities are underwater. Aesthetic conditions will not change from the baseline.</p> <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> • Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Nuisance plants such as <i>Cladophora</i> have been observed along the shoreline in the study area. The cause of <i>Cladophora</i> in the nearshore has not been confirmed based on current research. There is no change in the mass loading and mixing zone for total phosphorus from the baseline conditions. No change from baseline aesthetic conditions is anticipated. <p>No other visual, odour, and turbidity impacts are anticipated from the operation of the check-valves.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative since no change in impact from baseline conditions has been identified.</p> <p>Conclusion: There is no change from baseline aesthetic conditions. Overall, there is no effect within any geographic extent.</p>	5
	<p>3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1</p>	<p>Construction: No change in impacts are anticipated for the following reasons:</p> <ul style="list-style-type: none"> • Change in visual aesthetics limited to the plant site but may be visible along the shoreline. • Erosion and sedimentation controls will be implemented during construction such that the nearshore turbidity is not increased. • Odours from construction machinery will be limited to the plant site. <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> • Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Nuisance plants such as <i>Cladophora</i> have been observed along the shoreline in the study area. The cause of <i>Cladophora</i> in the nearshore has not been confirmed based on current research. There is a decrease in the mass loading and mixing zone for total phosphorus from the baseline conditions. Tertiary treatment will further reduce insoluble forms of phosphorus. No change from baseline aesthetic conditions is anticipated. <p>Also, tertiary filtration building will be visible along the shoreline and from the Waterfront Trail, but will be consistent with other plant facilities.</p> <p>No other odour and turbidity impacts are anticipated from the operation of the tertiary treatment facility</p>	<p>Construction and Operation: Mitigation measures are as follows:</p> <ul style="list-style-type: none"> • Develop an erosion/sediment control plan to manage stormwater flows during construction. • Design the tertiary filtration facility with landscaping to mitigate aesthetic impacts. <p>Conclusion: After mitigation, there is no change from baseline aesthetic conditions. Overall, there is no effect within any geographic extent.</p>	5
	<p>4. Extend Existing Outfall Diffuser + Alternative 1</p>	<p>Construction: Construction activities will result in the following impacts:</p> <ul style="list-style-type: none"> • Visual: Impacts include sightings of barges/platforms, and large material stockpiles that are not visually attractive. There is a risk of spills and other materials that may wash ashore. 	<p>Construction – Mitigation measures are as follows:</p> <ul style="list-style-type: none"> • Choose an appropriate excavation and backfilling techniques such as silt curtains to contain the barge and excavating/drilling equipment as to avoid turbidity and sediment re-suspension. 	4

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<ul style="list-style-type: none"> Turbidity: Disturbance of lake bed from open cut will likely re-suspend sediment and nutrients Odours: Diesel generators may generate fumes from barge/platform resulting in odours and additional visual impact <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Nuisance plants such as <i>Cladophora</i> have been observed along the shoreline in the study area. The cause of <i>Cladophora</i> in the nearshore has not been confirmed based on current research. There is no change in the mass loading and mixing zone for total phosphorus from the baseline conditions. No change from baseline aesthetic conditions is anticipated. <p>No other visual, odour, and turbidity impacts are anticipated from the operation of the check-valves.</p>	<p>Operation - Mitigation is not applicable to this alternative during operation since no change in impact from baseline conditions has been identified.</p> <p>Conclusion: After mitigation, there is a negative change in aesthetic conditions, and the magnitude is low over a short period of time during construction within the Regional Study Area.</p>	
	5. New Outfall + Alternative 1	<p>Construction: Construction activities will result in the following impacts:</p> <ul style="list-style-type: none"> Visual: Impacts include sightings of barges/platforms, the drop shaft on land structure near the waterfront trail, and large material stockpiles that are not visually attractive. There is a risk of spills and other materials that may wash ashore. Turbidity: Disturbance of lake bed from the drilling of risers will have a minimal re-suspension of sediment and nutrients Odours: Diesel generators may generate fumes from barge/platform resulting in odours and additional visual impact <p>Operation: The pathway of effect considered is:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. Nuisance plants such as <i>Cladophora</i> have been observed along the shoreline in the study area. The cause of <i>Cladophora</i> in the nearshore has not been confirmed based on current research. There is no change in the mass loading and mixing zone for total phosphorus from the baseline conditions. No change from baseline aesthetic conditions is anticipated. <p>No visual, odour and turbidity impacts are anticipated from the operation of the new outfall.</p>	<p>Construction - Mitigation measures are as follows:</p> <ul style="list-style-type: none"> Select a location for the construction of the tunnel boring machine launch shaft on the tablelands, well away from the shoreline of the lake. <p>Contain sediment to a localized area during drilling for riser construction. Operation - Mitigation is not applicable to this alternative during operation since no change in impact from baseline conditions has been identified.</p> <p>Conclusion: After mitigation, there is a negative change in aesthetic conditions, and the magnitude is low over a short period of time during construction within the Regional Study Area.</p>	4
<p>S.7 Impact on Lake Shipping Routes/Transportation</p> <p>The potential of the alternative solution to impact shipping and transportation through Lake Ontario during construction and operation.</p> <p>Measures</p> <ul style="list-style-type: none"> Level of interferences with shipping routes based on location of the routes <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) Long-Term (during operation) 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1	<p>Construction and Operation: No interference with shipping routes as downbound shipping lane is approximately 20km offshore.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified.</p> <p>Conclusion: No impacts to commercial shipping routes.</p>	5
	2. Modify Existing Outfall Diffuser + Alternative 1	<p>Construction and Operation: No interference with shipping routes as downbound shipping lane is approximately 20km offshore.</p>	<p>Construction and Operation: The area where the divers will be installing the new diffuser ports will be marked using buoys. Transportation Canada (the Coast Guard) will be made aware of diver activities.</p> <p>Conclusion: No impacts to commercial shipping routes.</p>	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	<p>Construction and Operation: No interference with shipping routes as downbound shipping lane is approximately 20km offshore.</p>	<p>Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified.</p> <p>Conclusion: No impacts to commercial shipping routes.</p>	5
	4. Extend Existing Outfall Diffuser + Alternative 1	<p>Construction and Operation: No interference with shipping routes as downbound shipping lane is approximately 20km offshore. The in-water disposal of construction spoils via barge</p>	<p>Construction and Operation: The area of construction will be marked using buoys. Transportation Canada (the Coast Guard) will be made aware of construction activities and locations/routes for</p>	5

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
Geographic Extent <ul style="list-style-type: none"> Local Regional >Regional 		is expected to be in depths of approximately 35 metres based on experience with other project sites. The depth at the downbound shipping lane is approximately 100 meters.	barging spoils to offshore sites. Conclusion: No impacts to commercial shipping routes.	
	5. New Outfall + Alternative 1	Construction and Operation: No interference with shipping routes as downbound shipping lane is approximately 20km offshore. The in-water disposal of construction spoils via barge is expected to be in depths of approximately 35 metres based on experience with other project sites. The depth at the downbound shipping lane is approximately 100 meters.	Construction and Operation: The area of construction will be marked using buoys. Transportation Canada (the Coast Guard) will be made aware of construction activities and locations/routes for barging spoils to offshore sites. Conclusion: No impacts to commercial shipping routes.	5
S.8 Impact on the Ajax WSP Intake The potential of the alternative solution to impact the Ajax WSP Intake during construction/operation. Measures <ul style="list-style-type: none"> Change in turbidity levels at the Ajax WSP intake during construction Change in Total Ammonia Nitrogen (TAN) levels at the Ajax intake from baseline conditions during operation Duration <ul style="list-style-type: none"> Short-term (during construction) Long-Term (during operation) Geographic Extent <ul style="list-style-type: none"> Regional 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3) + Alternative 1	Construction: No construction is necessary. Therefore there will be no change in turbidity levels at the Ajax WSP intake Operation: The pathway of effect is: <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. The Lake modelling predicted that the average total ammonia nitrogen (TAN) level increased from 0.021 mg/L to 0.022 mg/L. All model predictions for TAN at the Ajax WSP intake were below the source water protection objective of 0.5 mg/L. Therefore the impact is low, and a rating of 4 is applied. 	Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified. Conclusion: After mitigation, water quality guidelines are maintained during construction and operation. Overall there is a negative change at the Ajax WSP intake, and the magnitude is low.	4
	2. Modify Existing Outfall Diffuser + Alternative 1	Construction: Divers will install the new diffuser ports with no interference with the lakebed. Therefore there will be no change in turbidity levels at the Ajax WSP intake Operation: The pathway of effect is: <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. The Lake modelling predicted that the average total ammonia nitrogen (TAN) level increased from 0.021 mg/L to 0.023 mg/L. All model predictions for TAN at the Ajax WSP intake were below the source water protection objective of 0.5 mg/L. Therefore the impact is low, and a rating of 4 is applied. 	Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified. Conclusion: After mitigation, water quality guidelines are maintained during construction and operation. Overall there is a negative change at the Ajax WSP intake, and the magnitude is low.	4
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	Construction: No in-water construction is necessary, and erosion and sedimentation from on-site activities will be controlled. Therefore there will be no change in turbidity levels at the Ajax WSP intake Operation: The pathway of effect is: <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. The tertiary treatment provides improved effluent water quality by reducing TP. Ammonia levels will however remain the same. so there is no adverse impact to the intake. The Lake modelling predicted that the average total ammonia nitrogen (TAN) level increased from 0.021 mg/L to 0.022 mg/L. All model predictions for TAN at the Ajax WSP intake were below the source water protection objective of 0.5 mg/L. Therefore the impact is low, and a rating of 4 is applied. 	Construction and Operation: Mitigation is not applicable to this alternative as no impacts have been identified. Conclusion: After mitigation, water quality guidelines are maintained during construction and operation. Overall there is a negative change at the Ajax WSP intake, and the magnitude is low.	4
	4. Extend Existing Outfall Diffuser + Alternative 1	Construction: This alternative assumes that staging areas will be primarily located on an in-water barge so the pathway of effect therefore relates to the in-water work: <ul style="list-style-type: none"> Site preparation (in-water) → removal of lakebed, marine excavation, → causes re-suspension of sediment and silt → re-suspension of sediment and silt degrade the quality of the lake and lakefront → degradation of lake impacts other lake users. Sediment from construction (trenching and risers) could potentially increase turbidity 	Construction: Mitigation measures are as follows: <ul style="list-style-type: none"> In the environmental management plan, include best management practices for containing sediment during construction as detailed in N.1. Include a spills action plan with the Ajax WTP to mitigate the risk of spills. Operation: Mitigation is not applicable to this alternative during operation as no impacts have been	3

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Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
		<p>levels around the intake. Also there is a risk of spills and re-suspension of lakebed materials, there a rating of 3 is applied.</p> <p>Operation: The pathway of effect is:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. The Lake modelling predicted that the average total ammonia nitrogen (TAN) level increased from 0.021 mg/L to 0.023 mg/L. All model predictions for TAN at the Ajax WSP intake were below the source water protection objective of 0.5 mg/L. Therefore the impact is low, and a rating of 4 is applied. 	<p>identified.</p> <p>Conclusion: After mitigation, there is moderate impact to the Ajax WSP intake for a short period of time during construction. Water quality guidelines are maintained during operation. Overall there is a negative change at the Ajax WSP intake, especially during construction and the magnitude is moderate (e.g. slightly elevated levels of turbidity within natural variability).</p>	
	5. New Outfall + Alternative 1	<p>Construction: On-shore erosion and sedimentation will be controlled as to not impact the nearshore or the Ajax intake. The pathway of effect therefore relates to the in-water work:</p> <ul style="list-style-type: none"> Site preparation (in-water)→ removal of lakebed, marine excavation, → causes re-suspension of sediment and silt → re-suspension of sediment and silt degrade the quality of the lake and lakefront → degradation of lake impacts other lake users Sediment from construction (trenching and risers) could potentially increase turbidity levels around the intake. Also there is a risk of spills and re-suspension of lakebed materials, therefore a rating of 3 is applied. <p>Operation: The pathway of effect is:</p> <ul style="list-style-type: none"> Plant and outfall operations results in effluent quality discharged to the nearshore and offshore lake environment →effluent quality impacts water quality→ water quality impacts recreational and other lake users. The Lake modelling predicted that the average total ammonia nitrogen (TAN) level increased from 0.021 mg/L to 0.029 mg/L. All model predictions for TAN at the Ajax WSP intake were below the source water protection objective of 0.5 mg/L. Therefore the impact is low, and a rating of 4 is applied. 	<p>Construction: Mitigation measures are as flows:</p> <ul style="list-style-type: none"> In the environmental management plan, include best management practices for containing sediment during construction as detailed in N.1. <p>Operation: In Phase 3 of this Outfall EA, select an outfall length and diffuser alignment that mitigates impacts on the Ajax WSP</p> <p>Conclusion: After mitigation, there is moderate impact to the Ajax WSP intake for a short period of time during construction. Water quality guidelines are maintained during operation. Overall there is a negative change at the Ajax WSP intake, and the magnitude is moderate (e.g. slightly elevated levels of turbidity within natural variability).</p>	3
<p>F.1 Capital Costs Comparative costs for capital works.</p> <p>Measures</p> <ul style="list-style-type: none"> Dollar value of capital cost (including mitigation measures) resulting in possible impact on water user rates <p>Duration</p> <ul style="list-style-type: none"> Short-term (during construction) <p>Geographic Extent</p> <ul style="list-style-type: none"> >Regional 	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	No capital costs as all the required infrastructure is in place and fully commissioned to meet enhanced phosphorous removal.	Mitigation is not applicable to this alternative as no cost changes have been identified. Conclusion: Low capital cost	5
	2. Modify Existing Outfall Diffuser + Alternative 1	Total capital costs: \$1M - \$1.5M Cost components include: ~ Material costs for check valves ~ Installation costs	Mitigation is not applicable to this alternative as no cost changes have been identified. Conclusion: Low capital cost	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	Total capital costs: \$175M-\$230M Cost components include: ~ Vendor supplied membranes and equipment ~ Building ~ Design and Construction	Mitigation costs have been included Conclusion: High capital cost	1
	4. Extend Existing Outfall Diffuser + Alternative 1	Total capital costs: \$105M - \$140M Cost components include design and construction of: ~ two 1200mm risers to connect to existing outfall ~ A 400m extension to the existing outfall ~ Installation of diffusers at spacing equal to existing diffuser	Mitigation costs have been included Conclusion: Moderately high capital cost	2
	5. New Outfall + Alternative 1	Total capital costs: \$185M - \$240M. Cost components include design and construction of: ~ 3000m long and 4 diameter outfall ~ 100 diffuser ports ~ vortex drop and de-aeration chamber with vent	Mitigation costs have been included Conclusion: High capital cost	1

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating	
		~ spoils disposal			
F.2 Operating and maintenance costs Comparative cost for annual operating costs for staff resources, energy and chemical needs, and ongoing operation and maintenance (O&M) activities.	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	Total yearly operating costs: <\$1M. Cost components include: ~ 1 additional operations staff for Enhanced Chemical TP Removal ~ Chemical costs ~ Yearly outfall inspection	Mitigation costs have been included Conclusion: Moderately low O&M cost	4	
	Measures				
	<ul style="list-style-type: none"> Dollar value of annual O&M costs resulting in possible impact on water user rates 				
	Duration				
	<ul style="list-style-type: none"> Long-term (during operation) 				
Geographic Extent <ul style="list-style-type: none"> >Regional 	2. Modify Existing Outfall Diffuser + Alternative 1	Total yearly operating costs: <\$1M. Cost components include: ~ 1 additional operations staff for Enhanced Chemical TP Removal ~ Chemical costs ~ Yearly outfall inspection	Mitigation costs have been included Conclusion: Moderately low O&M cost	4	
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	Total yearly operating costs: \$2.5M. Cost components include: ~ Electricity (for average day flow) ~ Clean in Place chemicals ~ 4 additional O&M staff ~ Replacement of Membranes	Mitigation costs have been included Conclusion: High O&M cost	1	
	4. Extend Existing Outfall Diffuser + Alternative 1	Total yearly operating costs: <\$1M. Cost components include: ~ 1 additional operations staff for Enhanced Chemical TP Removal ~ Chemical costs ~ Yearly outfall inspection	Mitigation costs have been included. Conclusion: Moderately low O&M cost	4	
	5. New Outfall + Alternative 1	Total yearly operating costs: <\$1M. Cost components include: ~ 1 additional operations staff for Enhanced Chemical TP Removal ~ Chemical costs ~ Yearly outfall inspection	Mitigation costs have been included Conclusion: Moderately low O&M cost	4	
F.3 Lifecycle cost The total lifecycle costs associated with an alternative solution	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	\$17M NPV (20-year)	Mitigation costs have been included Conclusion: Moderately low life cycle cost	4	
	Measures				
	<ul style="list-style-type: none"> Dollar value of lifecycle cost represented as 20 year net present value using average capital cost within the range 				
	Duration				
	<ul style="list-style-type: none"> Short-term (during construction) Long-Term (during operation) 				
Geographic Extent <ul style="list-style-type: none"> >Regional 	2. Modify Existing Outfall Diffuser + Alternative 1	\$18.0M NPV (20-year)	Mitigation costs have been included Conclusion: Moderately low life cycle cost	4	
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	\$243M NPV (20-year)	Mitigation costs have been included Conclusion: High life cycle cost	1	
	4. Extend Existing Outfall Diffuser + Alternative 1	\$140M NPV (20-year)	Mitigation costs have been included Conclusion: Moderately high life cycle cost	2	
	5. New Outfall + Alternative 1	\$229M NPV (20-year)	Mitigation costs have been included Conclusion: High life cycle cost	1	
F.4 Write-Off Cost The cost for not utilizing existing infrastructure to the end of its useful	1. Existing Upgraded Plant and Optimized Operations (Stages 1, 2, and 3)	There is no write-off cost since the existing outfall is being utilized.	Mitigation is not applicable to this alternative as there is no write-off cost. Conclusion: Low write-off cost	5	

Phase 2 - Impact Assessment Table

Criteria	Alternative	Impact Assessment	Mitigation Measures	Rating
life Measures <ul style="list-style-type: none"> Dollar value of write-off cost represented as straight line depreciation Duration <ul style="list-style-type: none"> Short-term (during construction) Geographic Extent <ul style="list-style-type: none"> >Regional 	2. Modify Existing Outfall Diffuser + Alternative 1	There is no write-off cost since the existing outfall is being utilized.	Mitigation is not applicable to this alternative as there is no write-off cost. Conclusion: Low write-off cost	5
	3. Provide Tertiary Treatment at the Duffin Creek WPCP + Alternative 1	There is no write-off cost since the existing outfall is being utilized.	Mitigation is not applicable to this alternative as there is no write-off cost. Conclusion: Low write-off cost	5
	4. Extend Existing Outfall Diffuser + Alternative 1	There is no write-off cost since the existing outfall is being utilized.	Mitigation is not applicable to this alternative as there is no write-off cost. Conclusion: Low write-off cost	5
	5. New Outfall + Alternative 1	\$45M (straight-line depreciation with 75 year lifespan)	If the existing outfall is used for redundancy purposes, there will not be a write-off cost. Conclusion: Moderately low write-off cost since there is a possibility of using the existing outfall for redundancy purposes.	4