

**Town of Hawkesbury Water Treatment Plant
20-Year Strategic Upgrades Plan**

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Prepared for:

TOWN OF HAWKESBURY
600 Higginson Street
Hawkesbury ON
K6A 1H1

Prepared by:

J.L. RICHARDS & ASSOCIATES LIMITED
864 Lady Ellen Place
Ottawa, ON
K1Z 5M2
Tel: 613-728-3571
Fax: 613-728-6012

JLR No.: 27560.000

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1.0 STRATEGIC UPGRADES PLAN

This letter summarizes our proposed 20-year Strategic Upgrades Plan (“The Plan”) for the Town of Hawkesbury Water Treatment Plant (WTP). The Plan was developed based on the findings and recommendations obtained from the Hawkesbury Water Treatment Plant Conditions Assessment (refer to Appendix B) and Preliminary Operational and Treatment Capacity Assessment (refer to Appendix C). The Plan also take into consideration the latest information made available from the Town of Hawkesbury and the recommendations contained in the MOECC Inspection Report from September 2015.

The Plan is based on nine (9) different packages including multi-disciplinary works that could be executed between year 2018 and year 2038. Refer to Table 1 below for a summary of the different packages envisioned.

Works already approved to move forward are not included within the plan (e.g. improvements to the flow metering system within/adjacent to the high lift pump room).

Work associated with upgrades to the chemical systems at the WTP are to be prioritized based on comments received from the Ministry of the Environment, Conservation and Parks (MOECP) within the MOECC Inspection Report from September 2015. The proposed works in Package 1 are envisioned to require a building expansion. We recommend that the building expansion be coordinated with the needs to replace the existing Accelator[®] clarifier with a new high rate clarification treatment process such as Actiflo[®]. It is also anticipated that the new caustic soda system will need to be integrated with the new clarification process for pH control. The building expansion should therefore consider the need for a new polymer preparation system for the clarification process.

We have included a number of life cycle replacement and minor repair works at the WTP and Raw Water Pumping Station (RWPS) in Package 2A and 2B. Package 2A includes items that have been identified for replacement between 2018 and 2023, whereas Package 2B includes components that may require replacement or upgrading in the medium (6-10 years) to longer term time periods (11-20 years). These components include components associated with all disciplines. Items identified within Package 2A and 2B could also be undertaken as part of other major upgrade packages. The level of efforts for the engineering phase associated with Package 2A is not expected to be extensive as most of the work involves replacement of existing components and the completion of the works would help secure the operations at both facilities. An increase level of effort for engineering work associated with process piping upgrades in Package 2B is anticipated based on our understanding of the Town’s preference to reroute/realign various process piping systems during replacement.

The replacement of the existing Accelator[®] clarifier by two (2) new high rate clarifier (i.e. Actiflo[®]) trains has been included in Package 3 to be completed in the 2019-2021 year horizon. This package will require significant work and present significant challenges to the current operations. Timing of this work is important due to the current condition of the Accelator[®] walls, and the current flows required by the Town and surrounding municipalities (i.e. Champlain, L’Orignal and Vankleek Hill). As potable water demand increases, relying exclusively on the operation of the Ultrapulsator[®] while replacing the Accelator[®] clarifier will become increasingly difficult. Based on

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a cursory review of Actiflo® clarifier sizing, it is our opinion that it would be feasible to install two (2) new Actiflo® units in the space currently occupied by the Accelator® clarifier.

We have included the construction of a fourth filter and additional backwash tank in Package 4A. It is our opinion that the construction of a fourth filter should be prioritized in the 6-10 year horizon. The construction of a fourth filter will be challenging as the existing setup does not allow the construction of a fourth filter in line with the existing filters. Replacement and upgrades associated with other packaged projects should consider opportunities to accommodate this additional filter (e.g. modification to high lift pump room). Package 4B includes upgrades and replacement of various existing filtration system components including some mechanical works, various repairs to existing concrete and masonry walls and various modifications to existing railings and guardrails. This package has been prioritized similar to the clarifier upgrades due to the current condition of the filter walls in the high lift pump room and filter pipe gallery.

Package 5A includes works within the high lift pumps room and existing clearwells including various repairs to existing concrete and masonry walls and structural steel components. This package focuses mainly on structural related repairs, and therefore, other structural upgrades/repairs throughout the plant identified in Package 2A and Package 3 could be regrouped or undertaken as part of a larger project. Package 5B includes work that is unlikely to be required within the next 11-15 year horizon based on anticipated growth, notably the installation of new high lift pumps and increasing the capacity of treated water storage by installing a third clearwell. This package involves significant work and would provide additional operational flexibility for peak hour pumping and fire protection.

Package 6 relates to work at the existing RWPS related to the raw water piping and intake(s). Some of the work involves maintenance of the raw water pipes including cleaning of sediment buildup within the shorter term, while other work may be considered within the longer term (11-20 year horizon) such as ability to utilize both raw water pipes for added redundancy.

The below table presents estimated order of magnitude costs for each package and the anticipated timing for the work. The following is noted regarding the costs provided:

- The estimated costs are order-of-magnitude only and are based on experience and current (2018) unit prices in the construction industry.
- Estimated order-of-magnitude costs are limited to components associated with the proposed work identified within the detailed breakdown presented in Appendix A.
- Estimated order-of-magnitude costs do not include assets or items that could not be reviewed or specifically addressed (inaccessible rooms or below-grade infrastructure, submerged assets, etc.) during the Conditions Assessment.
- All costs, including those for future years, are expressed in 2018 dollars. If these costs are to be used for long-range cash-flow projections, the implications for potential future trends of inflation and interest must be applied accordingly.

Refer to Appendix A for a detailed breakdown of the various proposed works envisioned within each package.

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Table 1: List of Major Projects and Estimated Order of Magnitude Costs

Package No.	Project Name	Anticipated Timing	Order of Magnitude Cost
1	Chemical Systems	2018-2020	\$800,000
2A	Miscellaneous Life-cycle Work and Replacement (Short Term)	2018-2022	\$1,100,000
2B	Miscellaneous Life-cycle Work and Replacement (Medium/Long Term)	2023 - 2038	\$1,400,000
3	Clarification	2018-2021	\$4,400,000
4a	Filtration and Backwash (Process Modifications)	2024-2028	\$2,000,000
4b	Filtration and Backwash (Process and Structural)	2018-2021	\$800,000
5a	High Lift Pumps and Treated Water Storage (Structural)	2018-2021	\$600,000
5b	High Lift Pumps and Treated Water Storage (Process Modifications)	2028-2033	\$6,500,000
6	Raw Water Supply	2023-2028	\$250,000

Notes:

1. Estimated Order of Magnitude Costs are limited to components associated with the proposed work identified within the detailed breakdown presented in Appendix A.
2. The Estimated Order of Magnitude Costs include a 30% contingency to account for unknowns associated with the replacement or upgrades to various components.
3. Engineering costs were not included within the costs identified.
4. Replacement costs for major sections of process piping has not been included; a detailed review of pipe lengths was not completed as part of the Conditions Assessment.

This Plan has been prepared for the exclusive use of The Town of Hawkesbury, for the stated purpose, for the named facility. Its discussions and conclusions are summary in nature and cannot be properly used, interpreted or extended to other purposes without a detailed understanding and discussions with the client as to its mandated purpose, scope and limitations. This Plan was prepared for the sole benefit and use of The Town of Hawkesbury and may not be used or relied on by any other party without the express written consent of J.L. Richards & Associates Limited.

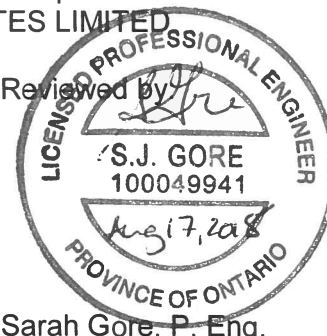
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Prepared by:



Jordan Morrisette, M. Eng., P. Eng.
Environmental Engineer

Reviewed by:



Sarah Gore, P. Eng.
Executive Director
Senior Environmental Engineer

Appendix A

Summary of Work for Each Listed Major Project

Project 1 - Chemical Systems							
ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Add secondary containment to the existing zinc chloride and phosphoric acid based storage and feed system	Chemicals	Compliance with guidelines	PM	0-2 years	Low	
	Install new caustic soda storage and metering pumps system for pH adjustment upstream of the new clarification process	Chemicals	Alternative to lime	PM, ST, EL and I&C	1-5 years	Medium	
	Install one additional fluoride metering pump and containment system	Chemicals	Redundancy	PM, EL and I&C	1-5 years	Low	Fluoridation room was not reviewed during condition assessment.
	Install piping provisions to allow pH adjustment prior to chemical addition	Chemicals	Increase pH and alkalinity	PM	1-5 years	Low	
	Removal of lime silo and repair/replace roof	Chemicals	Replacement	ST, PM, ARCH	1-5 years	Low	
	Repairs to the top of the concrete floor slab near the north wall of the sodium aluminate room	Chemicals	Peeling of the paint	ST	0-2 years	Low	
	Replace the existing rotameters at the chlorine gas system	Chemicals	Insufficient capacity	PM	1-5 years	Low	
	Safety showers	Chemicals	Various improvements	BM	0-2 years	Low	
	Truck off-loading area and filling station	Chemicals	Various improvements	PM and CI	1-5 years	Medium	
	Upgrades to activated silica system	Chemicals	Redundancy	PM, ST, EL	1-5 years	Low	
	Construction of a building extension for the chemical systems	Chemicals	Various improvements	BM, ST, EL	1-5 years	Low	

Project 2A - Miscellaneous Life Cycle Work and Replacement 0-5 Years							
ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Replace exhaust fans and other unit heaters	All rooms	Life-cycle work	EL	0-5 years	Low	
	Replace hydronic unit heaters	All rooms	Life-cycle work	EL	0-5 years	Low	
	Replace the hot water distribution pump	Boiler room	Life-cycle work	BM	0-2 years	Low	
	Repairs to the floor tiles in the compressor corridor	Building (compressor corridor)	Delaminating	ARCH	0-2 years	Low	
	Repairs to the grating above the storm drain and to the wall at the back of the storm drain in the compressor corridor	Building (compressor corridor)	Cracking and corrosion	ST	0-2 years	Low	
	Modify the access ladder to the higher roof section	Building (roof)	The ladder is not fastened	ARCH	0-2 years	Low	
	Replace the existing ladder below the floor grating	Residuals	Does not meet safety requirements	ARCH	1-5 years	Low	
	Modifications to the existing mezzanine	Workshop	Workplace security	ST	0-2 years	Low	Review of the design
	Modify the electrical grounding	Electrical Room	System is not compliant	EL	0-2 years	Low	
	Relocate Panel C and replace dry-transformer	Electrical Room	The panel is within the path of egress	EL	0-2 years	Low	
	Relocate Panel EM-3	Electrical Room	The panel is within the path of egress	EL	0-2 years	Low	
	Replace the existing power monitor and service entrance ground fault protection system	Electrical Room	Equipment are dated	EL	0-2 years	Low	
	Replace existing Panel B and dry-transformer	Filtration	Life-cycle work	EL	1-5 years	Low	

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Install ground/bonding on the existing transfer switch	High Lift Pumps Room	Improve reliability of the installation	EL	0-2 years	Low	
Relocate water valves located near the top of the electrical connections to the existing backwash pump motor	High Lift Pumps Room	Improve motor protection	BM	0-2 years	Low	
Replace existing ladder	High Lift Pumps Room	Workplace security	ST	1-5 years	Low	
Replace existing Panel A and dry-transformer	High Lift Pumps Room	Life-cycle work	EL	1-5 years	Low	
Replace the back-up generator	High Lift Pumps Room	The existing alternator is a synchronous machine and should be replaced with a asynchronous machine	EL	1-5 years	High	
Replace the existing backflow preventer system at the water service	High Lift Pumps Room	Existing system does not meet Building Code	BM	1-5 years	Low	
Replace the existing fuel piping	High Lift Pumps Room	Life-cycle work	BM	1-5 years	Low	
Circuit panel 'EM2' and emergency power MCC #2	Lab/MCC#2	Failure/end of life	EL	0-2 years	Low	
Concrete foundation and foundation wall repairs	Raw water pumping station	Some cracking and delamination	ST	0-2 years	Low	
Fuel secondary containment replacement	Raw water pumping station	Sign of corrosion	BM	0-2 years	Low	
Removable guardrail replacement	Raw water pumping station	Workplace security	ARCH	0-2 years	Low	
Repair the grounding protection of the existing transformers	Raw water pumping station	Immediate work	EL	0-2 years	Medium	
Replace the existing back-up generator	Raw water pumping station	The existing alternator is a synchronous machine and should be replaced with a asynchronous machine	EL	1-5 years	High	
Replace the existing communication system from a land-line system to a private fibre-optic system	Raw water pumping station	Long-term savings and improve reliability	I&C	1-5 years	Medium	
Replace the existing overhead low voltage service conductors between the transformers and the outdoor service entrance	Raw water pumping station	Immediate work	EL	0-2 years	High	
Replace the low-lift pumps (2 pumps), motors	Raw water pumping station	The motors are not inverter-duty for VFD application	EL	1-5 years	Medium	Testing of the motors is recommended.
Replace variable frequency drives (VFDs)	Raw water pumping station	The existing VFDs are considered "Legacy" devices	EL	1-5 years	Medium	
Review and replacement of the existing overhead power supply poles, as needed.	Raw water pumping station	Life-cycle replacement	EL	0-2 years	Medium	Recommend review by qualified linesmen.
Wet well repairs	Raw water pumping station	Some cracking	ST	0-2 years	Medium	Was not reviewed during condition assessment. No cost has been included for this item.

Project 2B - Miscellaneous Life Cycle Work and Replacement 5-20 Years

ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Other building repairs (windows, doors, fans, unit stacks, other HVAC, grating)	All rooms	Life-cycle work	PM, ST, EL, BM and I&C	5-10 years	Low	
	Replace Air Compressors	All rooms	Life-cycle work	PM, EL and I&C	5-10 years	Medium	
	Replace exhaust fans and other unit heaters	All rooms	Life-cycle work	EL	5-10 years	Low	
	Replace hydronic unit heaters	All rooms	Life-cycle work	EL	5-10 years	Low	
	Sludge Pump Replacement (3 pumps)	Backwash Room	Life-cycle work	PM, EL and I&C	5-10 years	Medium	
	Supernatant Pump Replacement (2 pumps)	Backwash Room	Life-cycle work	PM, EL and I&C	5-10 years	Medium	
	Replace boiler, duct, sink, hot water tank and expansion tank	Boiler Room	Life-cycle work	PM, ST, EL, BM and I&C	5-10 years	Low	
	Replace the existing 2 ply modified bitumen roof assembly	Building (roof)	Life-cycle work	ARCH	11-20 years	Low	
	Replace the existing 4 ply build up roof assembly	Building (roof)	Life-cycle work	ARCH	11-20 years	Low	
	Replace/repair process piping	Chemicals	Life-cycle replacement	PM	11-20 years	High	No cost has been included for this item
	Replace/repair process piping	Filtration	Life-cycle replacement	PM	11-20 years	High	No cost has been included for this item
	Replace/repair process piping	Raw water pumping station	Life-cycle replacement	PM	11-20 years	High	No cost has been included for this item
	Replace/repair process piping	Residuals	Life-cycle replacement	PM	11-20 years	High	No cost has been included for this item
	Replace/repair process piping	Treated Water	Life-cycle replacement	PM	11-20 years	High	No cost has been included for this item

Project 3 - Clarification 1-5 Years

ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Repairs to the north masonry block wall	Boiler room	Step cracking and peeling of paint	ST	0-2 years	Low	
	Repairs to the underside of the concrete roof slab in the compressor corridor	Building (compressor corridor)	Cracking and peeling paint	ST	0-2 years	Low	
	Repairs to the concrete on the ACCELATOR® west wall	Building (compressor room)	Staining and peeling of paint	ST	0-2 years	Low	
	Remove the existing activated silica system including the sodium aluminate and sodium silicate storage tanks and metering pumps	Chemicals	Not required with the introduction of a new clarification process	PM, ST, EL and I&C	1-5 years	Low	To be reviewed based on requirements for ULTRAPULSATOR®
	Repairs to the north wall within the sodium aluminate room	Chemicals	Peeling of paint and active leakage	ST	0-2 years	Low	
	Hand Slide Gates - ULTRAPULSATOR®	Clarification	Life-cycle work	PM	5-10 years	Medium	
	Repairs to the existing roof decking (severe peeling was observed)	Clarification	Life-cycle work	ARCH	1-5 years	Low	
	Repairs to the walls in the existing clarifier rooms (ACCELATOR® clarifier and ULTRAPULSATOR® clarifier)	Clarification	Life-cycle work	ARCH	1-5 years	Low	The replacement of the existing clarifiers will allow for the reconfiguration of the clarifier room and the reconstruction of the perimeter walls.
	Replace the existing mixer in the flash-mix chamber	Clarification	Compliance with guidelines for retention time and mixing velocity gradient	PM, ST, EL and I&C	1-5 years	Medium	Might not be required if new high rate clarifiers are installed.

Replacement of the existing clarifiers by two (2) new high rate clarification units	Clarification	Modernization of the process and improvements to water quality	PM, ST, EL, BM and I&C	1-5 years	High	Consider installation of the first unit inside the footprint of the existing ACCELATOR® and install the process equipment for both units inside the available footprint.
Construction of a building extension for the new high rate clarifiers	Clarification	Modernization of the process and improvements to water quality	BM, ST, EL	1-5 years	High	
Installation of new polymer system (storage, preparation and feed system)	Chemicals	Modernization of the process and improvements to water quality	PM, ST, EL, BM and I&C	1-5 years	Low	
Install one additional sludge pump in the existing clarification process sludge treatment cell	Residuals	Redundancy	PM, EL and I&C	1-5 years	Low	
Various modifications to the existing SCADA system (Hardware and Network)		Upgrading SCADA component	EL and I&C	1-5 years	High	
Replace existing clarified water piping between the clarifiers and the filters	Clarification	Compliance with guidelines	PM	-	Medium	No cost has been included for this item

Project 4A - Filtration and Backwash (Process Modifications)

Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
Construction of a new filter (Filter No. 4)	Filtration	Compliance with guidelines	PM, ST, EL, BM and I&C	6-10 years	High	Location of new filter upgrades to be reviewed.
Construct an additional backwash water tank for filter backwash	Filtration	Compliance with guidelines. The backwash time is currently below the recommended minimum of 15 minutes.	PM, ST, EL and I&C	6-10 years	Medium	Review based on performance of backwash and air scour. Location for backwash upgrades to be reviewed. No cost has been included for this item.

Project 4B - Filtration and Backwash (Process and Structural)

ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Installation of new guardrail systems	Filtration	Workplace security	ARCH	1-5 years	Low	
	Modify flow measurement at the outlet of Filter Nos 1, 2 and 3	Filtration	Improve accuracy	PM	1-5 years	Medium	
	Repairs to the existing exterior masonry block walls	Filtration	Life-cycle work	ARCH	1-5 years	Low	
	Repairs to the existing guardrails	Filtration	Life-cycle work	ARCH	1-5 years	Low	
	Repairs to the existing metal roof decking	Filtration	Life-cycle work	ARCH	1-5 years	Low	
	Repairs to the exterior north wall of the filters located within the pipe gallery	Filtration	Severe cracking, Severe peeling of paint and active leakage around pipe penetration	ST	1-5 years	Low	
	Repairs to the exterior west wall of filter No. 3 located within the pump room	High Lift Pump Room	Severe peeling of paint, significant efflorescence and active leaking	ST	1-5 years	Low	
	Replace the existing 40 Hp motor mounted on the existing blower	Filtration	Life-cycle work	PM and EL	1-5 years	Low	Testing is recommended.
	Replace the existing overflow pipes	Filtration	Sever corrosion	PM	1-5 years	Low	
	Replacement of the existing filter underdrains for Filter No. 3 and structural repairs to the existing filter boxes for Filter Nos 1, 2 and 3	Filtration	Compliance with guidelines	PM, ST, EL, BM and I&C	1-5 years	High	Additional investigation is recommended.
	Repairs to the existing backwash tank	Residuals	Hairline cracking, vertical cracks and scaling	ST	1-5 years	Low	Additional investigation is recommended.

Project 5a - High Lift Pumps and Treated Water Storage (Structural)							
ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Repairs to existing Clearwell No. 1	Clearwell	Life-cycle work (underside of the concrete roof slab, perimeter concrete walls, baffles, columns, concrete base slab, ladders and hatches)	ST	1-5 years	High	Additional investigation is recommended.
	Repairs to existing Clearwell No. 2	Clearwell	Potential similar repairs to Clearwell No. 1	ST	1-5 years	High	Additional investigation is recommended (not reviewed). No cost has been included for this item.
	Modifications to some of the railing	High Lift Pumps Room	Workplace security	ARCH	1-5 years	Low	
	Repair existing structural steel components	High Lift Pumps Room	Rust	PM	1-5 years	Low	
	Repair the masonry block walls on the west side	High Lift Pumps Room	Medium cracking and active leaking	ST	1-5 years	Low	
	Repair the south exterior above grade concrete and masonry block wall	High Lift Pumps Room	Vertical cracking and severe active leakage	ST	1-5 years	Low	
	Repairs to existing pipe penetrations below grade	High Lift Pumps Room	Leakage	ST	1-5 years	Low	
	Replace the existing exhaust pipes on the exterior of the room	High Lift Pumps Room	Equipment is in poor condition	BM	1-5 years	Low	
	Replace the existing floor grating below grade	High Lift Pumps Room	Inadequate support around the pipe penetrations and large deflections	ST	1-5 years	Low	

Project 5b - High Lift Pumps and Treated Water Storage (Process Modifications)							
ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Replace the existing backwash pump	High Lift Pumps Room	The existing motor is Open Drip Proof design and is susceptible to failure due to humidity and dust	PM, EL and I&C	1-5 years	High	Testing of the motor is recommended.
	Addition of a second filter backwash pump complete with piping and valves	Filtration	Additional operational flexibility	PM, EL and I&C	6-10 years	Low	This would replace the existing back-up system installed on the high lift pumps header.
	Addition of two (2) new high lift pumps (for peak hour pumping and fire protection) and additional piping and valves	High Lift Pumps Room	Additional operational flexibility	PM, EL and I&C	6-10 years	High	A larger pumping capacity would allow the utilization of a larger volume of water in the clearwells and would allow peak hour pumping and fire protection supply in case of a failure of the water tower.
	Replace the existing high lift pumps (three (3) dual diesel and electric pumps, and one (1) electric only)	High Lift Pumps Room	Life-cycle replacement	PM, EL and I&C	11-20 years	High	
	Build a third treated water clearwell	Treated Water	Compliance with guidelines and growth	CI, PM, ST, EL and I&C	11-20 years	Medium	
	Construction of a new building extension for the new pumps	Treated Water	Compliance with guidelines and growth	CI, PM, ST, EL and I&C	11-20 years	High	

Project 6 - Raw Water Supply							
ID	Proposed Work	Sector	Reason	Discipline	Horizon	Impact on operation	Notes
	Install alternative treatment method for zebra mussels control (in place of chlorination)	Raw water supply	Chlorine applied on raw water containing high levels of naturally organic matter can cause DBPs	PM and EL	1-5 years	Low	No cost has been included for this item. Zebra mussels have not been a concern for the Town.
	Install man to washout sediment buildup in the raw water pipe (could use counter flow with high velocity)	Raw water supply	Additional operational flexibility	PM	1-5 years	Low	No cost has been included for this item. Cleanout of the pipe should be considered as part of next inspection.
	Replace existing raw water intake(s)	Raw water supply	Intake separated from piping; other structural deficiencies	ST	1-5 years	Medium	Replacement of one intake only.
	Upgrades to allow use of the second raw water intake.	Raw water supply	Additional operational flexibility	CI	6-10 years	Medium	