



**Woodward 3rd Party
Review – Resourcing
Review**

November 21, 2023

Prepared for:

City of Hamilton

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WOODWARD 3RD PARTY REVIEW – PROCESS RISKS REVIEW

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WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

EXECUTIVE SUMMARY

Stantec Consulting Ltd. was retained by the City of Hamilton (City) to conduct a 3rd party review of the proposed Phase 2 upgrades at the Woodward WTP. Recently, the City has undertaken a number of studies related to the Phase 2 upgrades project.

This report presents a review and recommendations for dedicated City staff resources for the delivery of the Woodward Phase 2 upgrades project, both from a project management, design, and construction management perspective. An organization chart was developed to demonstrate a potential team structure, with a Gantt chart illustrating timeline for onboarding team members. The recommendations presented center around new positions that will need to be created to support the Phase 2 Upgrades project.

It is anticipated that the City will require the following support during the design period of the Phase 2 upgrades project (2024 – 2026):

Table E-1: Staff Requests for Phase 2 Upgrades (Design: 2024 - 2026)

Role	Availability During Design	Year Position Required
Manager / Project Sponsor	100%	2024
Senior Project Manager	100%	2024
Project Manager	100%	2025
Engineering Technologist	100%	2025
Operations Supervisor	50%	2025
Maintenance Supervisor	50%	2025
SCADA	50%	2025

It is recommended that the City request additional staff to support the design phase of the Phase 2 upgrades project for the roles in Table E-1.

Following design, it is anticipated that the City will require the following support during the construction phase of the Phase 2 upgrades project (2027 – 2034). The majority of these positions would have been created during the design phase and roles can be carried through construction.

Table E-2: Staff Requests for Phase 2 Upgrades (Construction: 2027 - 2034)

Role	Availability During Construction	Year Position Required
Manager / Project Sponsor	100%	Same as Design
Senior Project Manager	100%	Same as Design
Project Manager (Phase 2A)	100%	Same as Design



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Role	Availability During Construction	Year Position Required
Project Manager (Phase 2B)	100%	To be determined by City at later date
Engineering Technologist	100%	Same as Design
Operations Supervisor	50%	Same as Design
Operations Support Staff	100%	2027
Maintenance Supervisor	50%	Same as Design
Maintenance Support Staff	50%	2027
SCADA	50%	Same as Design

During the construction phase, based on the assumptions on staff continuity from the design phase as outlined above, it is that the City will not require additional project management and engineering staff with the exception of a Phase 2B project manager. Operations and maintenance impacts during the course of construction to support planned shutdowns, equipment start-ups and commissioning, operation of valves, training sessions, change requests, technical input, etc. have been considered. It is recommended that the City request additional staff to support the construction period (2027 – 2034) of the Phase 2 upgrades project as follows: one (1) full time-equivalent (FTE) operations support staff, and one (1) FTE maintenance support staff, in addition to their current work force as summarized in Table E-2.

Operations and maintenance staff hired for the design and construction of the Phase 2 upgrades project can be retained to operate and maintain the plant post-construction. The number of staff required to operate and maintain the plant will be determined during detailed design.



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1.0 INTRODUCTION

1.1 BACKGROUND

The Woodward Water Treatment Plant (WTP) provides potable water for the City of Hamilton and some communities in Halton and Haldimand. The plant was originally constructed in 1931 and expanded in the late 1950s. The treatment process includes intake chlorination for seasonal zebra mussel control and year-round pathogen inactivation, screening, pre-chlorination for pathogen inactivation ahead of pre-treatment, coagulation with polyaluminum chloride (PACl), flocculation, conventional gravity sedimentation, granular activated carbon (GAC) filtration, post-filter chlorination for primary and residual disinfection, ammoniation to form chloramines for residual maintenance, and fluoridation. The current rated capacity of the WTP is 909 MLD, though the current expected maximum capacity is approximately 500 MLD.

The AECOM 2022 Conceptual Design Report for Phase 2 of the upgrades includes the following:

- Low lift pumps: replace three of the four existing pumps in low lift pump spots #1 – 4 with three (two variable speed, one constant speed) pumps, replace the starters for the two existing large constant speed pumps with VFDs, relocate existing pump 1 to pump 5 or 6.
- Rapid mixing and flocculation tanks: raise the roof slab of the rapid mixing tanks and flocculation tanks No. 1 and 2, construct an additional third-stage flocculation tank within the sedimentation tank, relocate starters and mixers; install VFDs for all flocculation mixers.
- Sedimentation tanks: install plate settlers within sedimentation tanks no. 1 and 2, demolish roof slab of sedimentation tanks no. 1 and 2 and construct a superstructure above the plate settler zone, install automated sludge removal systems, construct and demolish a temporary sedimentation tank No. 5 with temporary relocation of existing access road.
- Filtration: replace the underdrains in 23 filters, replace the GAC and sand media in 24 filters, refurbish 23 filters, construct two backwash tanks and install backwash pumps within the UV building, install duty blowers within the UV building and air scour headers to the filter building, install a dechlorination system within the UV building.
- UV Building: construct a UV building to house a UV vault with up to six 1200 mm diameter UV trains, sized for future UV oxidation reactors, but installed with disinfection reactors, construct two new chlorine contact tanks with serpentine baffles, and incorporate the backwash and air scour systems within the new building.

1.2 PROBLEM STATEMENT

The proposed design and construction effort associated with Phase 2 upgrades at the Woodward WTP will put additional burden on the engineering, operations and maintenance teams. A review of the



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Introduction

structure of the engineering, operations and maintenance teams and flexibility for involvement with the Phase 2 Upgrades project is required.

1.3 OBJECTIVES

This report focuses on a review and recommendations for dedicated City staff resources for the delivery of the Woodward WTP Phase 2 Upgrades project, from a project management, design, construction management, and operational resources perspective. Operational impacts during the course of construction to support planned shutdowns, equipment start-ups and commissioning, training sessions, etc. were reviewed. The overall operational support available (Full Time Equivalent) for the WTP post-construction is presented, recognizing the new facilities and technologies integrated into the plant following completion of the project.

1.4 APPROACH

Projects of a similar scale at other Canadian WTPs are reviewed in Section 2.

A summary of the resourcing survey results is presented in Section 3.

A review of the expected impacts of the Phase 2 Upgrades project to engineering is presented in Section 4.

A review of the expected impacts of the Phase 2 Upgrades project to operations and maintenance, including post-construction effort, is summarized in Section 5.

Recommendations, including an overall resourcing chart and Gantt chart, are provided in Section 6.

Conclusions are provided in Section 7.



2.0 PROJECTS AT OTHER CANADIAN WTPS

This section presents a review of the project management, engineering, and operations structuring for the design and construction of three major water treatment plants or plant rehabilitation programs in Canada. Each project is unique in terms of staffing needs and complexity; staffing resources will vary based on the project scope. The examples listed below are not directly comparable to the Woodward Phase 2 Upgrades project, however, can be used to gain insight into how other municipalities have structured their teams for major water treatment plant construction and/or rehabilitation.

2.1 MONTREAL WTP REHABILITATION PROGRAM

The Montreal WTP Rehabilitation Program occurred between 2005 and 2013 and involved the rehabilitation of the City's three WTPs. The approximate capital investment for the project was \$300M.

The project was conducted using the Engineering, Procurement, and Construction Management (EPCM) delivery model, in which the EPCM contractor provides a professional service to undertake the design, plan the overall project, and then to procure and manage other contractors to implement the construction works. Within this model, the project was divided into multiple contracts with multiple engineers and contractors.

The City hired 5-6 dedicated full-time staff for the project, including the following:

- One (1) project manager
- One (1) construction manager
- One (1) financial officer
- Three (3) sub-project managers, overseeing engineering and construction at each of the three plants.

The project was also supported by approximately eight (8) technical resources who were not dedicated to the project full-time.

2.2 LAVAL CHOMEDEY WTP REHABILITATION

The Laval Chomedey WTP Rehabilitation occurred between 2007 – 2016. The approximate capital investment for the project was \$110M.

The project was also conducted using the EPCM delivery model, and separated into various design and construction projects per sector of the WTP (9 in total).

The City hired 3-4 dedicated full-time staff for the project, including the following:

- One (1) project manager



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 Projects at Other Canadian WTPs

- One (1) construction manager
- Sub-PMs overseeing the process for each contract.

The project was also supported by several technical resources who were not dedicated to the project full-time.

2.3 HAMILTON WUP

The Hamilton Woodward Wastewater Treatment Plant Upgrades Project (WUP) is a \$340M total budget project, consisting of upgrades to the main wastewater pump station, the power centre, chlorination upgrades, tertiary treatment, and biosolids management.

The City is currently preparing for the Phase 2 expansion and north secondary treatment plant rehabilitation. The Phase 2 expansion includes addition of a new third secondary treatment plant, expansion of the tertiary treatment facilities, upgrades to solids management through additional gravity belt thickeners, modifications to the south and north digester complexes, digester boiling system upgrades, electrical system upgrades, relocation or removal of some existing works, and a major renovation to the existing north secondary treatment plant.

The organization structure for the project management and operations staff is depicted in Table 2-1 below.

Table 2-1: Hamilton WUP Roles and Budgeted FTE

Role	Budgeted FTE
Director	1
Manager – Process Transition	1
Process Supervisor	1
Water/Wastewater Operator	3
Sr. Project Manager – Capital Works	2
Project Manager Construction	2
Technician	1



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Summary of Woodward WTP Survey Results

3.0 SUMMARY OF WOODWARD WTP SURVEY RESULTS

Stantec prepared a survey (Appendix A) that was distributed to the City project management and engineering team, as well as the Woodward WTP operations and maintenance team, to review current projected opinions on the resourcing demand for the Woodward WTP. The results of the survey, completed by representatives from Capital Delivery, Operations, and Maintenance teams, are summarized below.

3.1 ENGINEERING

There are currently four (4) staff expected to be heavily involved with the Phase 2 upgrades: Manager / Project Sponsor, Senior Project Manager, Project Manager, Engineering Technologist. The Senior Project Manager is expected to be dedicated 100% full-time to the project by Q3/Q4 2024 pending resource plan approval by council.

3.2 OPERATIONS

There are two (2) operators on-shift at all times at the WTP, and one (1) process supervisor available as required 24/7 from a remote location. During day shifts, there is one (1) process supervisor located at the WTP and one (1) superintendent available as required from a remote location. It is expected that the superintendent would have 10% availability, process supervisor 20% availability, operator 10% availability, and manager 10% availability during the Phase 2 Upgrades.

3.3 MAINTENANCE

The maintenance group services the WTP, WWTP (both Woodward and Dundas) and outstations – there are no trades dedicated to the WTP. The maintenance group is comprised of the following:

- 10 millwrights
- 7 instrument technicians
- 6 electricians
- 6 SCADA staff

In the past, the design phase has put a strain on maintenance supervisors to attend meetings and review drawings. Construction support can generally be accommodated if planned in advance.



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Staffing Requirements to Support Phase 2 Upgrades Design and Construction

4.0 STAFFING REQUIREMENTS TO SUPPORT PHASE 2 UPGRADES DESIGN AND CONSTRUCTION

The following roles are expected to be heavily involved with the design phase of the Phase 2 upgrades project (2024 – 2026). The percentage burdens are viewed as commitment above and beyond current responsibilities.

Table 4-1: Recommended Roles for the Phase 2 Upgrades Project – Design Phase (2024 – 2026)

Role	Responsibility	Availability During Design	Year Position Required
Manager / Project Sponsor	Oversees overall program management, attends all meetings, fills in for PM when required	100%	2024
Senior Project Manager	Oversees project management	100%	2024
Project Manager	Based on-site, heavy construction experience required	100%	2025
Engineering Technologist	Works with the Operations Supervisor to review procedures during abnormal operating conditions, provide RFIs and site tours, liaises with stakeholders and agencies for approvals and permitting, liaises with various City departments. This team member should be very familiar with the plant.	100%	2025
Operations Supervisor	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring Operational support. This team member should be a Process Supervisor.	50%	2025
Maintenance Supervisor	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring Maintenance support. This team member should be a Maintenance Supervisor.	50%	2025
SCADA	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring SCADA support. This team member should be a SCADA Technologist	50%	2025

The following roles are expected to be heavily involved with the construction phase of the Phase 2 upgrades project (2027 – 2034). The percentage burdens are viewed as commitment above and beyond current responsibilities. The breakdown of maintenance support by is expected to be as follows:



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Staffing Requirements to Support Phase 2 Upgrades Design and Construction

- SCADA: 16 hours weekly
- Electrician: 8 hours weekly
- Millwright: 8 hours weekly
- Instrument Technician: 8 hours weekly

**Table 4-2: Recommended Roles for the Phase 2 Upgrades Project – Construction Phase
(2027 – 2034)**

Role	Responsibility	Availability During Construction	Year Position Required
Manager / Project Sponsor	Oversees overall program management, attends all meetings, fills in for PM when required	100%	Same as Design
Senior Project Manager	Oversees project management	100%	Same as Design
Project Manager (Phase 2A)	Based on-site, heavy construction experience required	100%	Same as Design
Project Manager (Phase 2B)	Based on-site, heavy construction experience required	100%	To Be Determined by City at Later Date
Engineering Technologist	Works with the Operations Supervisor to review procedures during abnormal operating conditions, provide RFIs and site tours, liaises with stakeholders and agencies for approvals and permitting, liaises with various City departments. This team member should be very familiar with the plant.	100%	Same as Design
Operations Supervisor	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring Operational support. This team member should be a Process Supervisor.	50%	Same as Design
Operations Support Staff	Operate valves, respond to questions and RFI requests, attend workshops, additional effort required to maintain plant operations with reduced sedimentation and filtration capacity, training.	100%	2027



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Staffing Requirements to Support Phase 2 Upgrades Design and Construction

Role	Responsibility	Availability During Construction	Year Position Required
Maintenance Supervisor	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring Maintenance support. This team member should be a Maintenance Supervisor.	50%	Same as Design
Maintenance Support Staff	Attend workshops, review drawings, respond to questions and RFI requests, support electrical shutdowns and SCADA upgrades, training. Maintain upgraded processes post-construction.	50%	To Be Determined by City
SCADA	Acts as a go-between for engineering and operations, helps plan upcoming activities requiring SCADA support. This team member should be a SCADA Technologist	50%	Same as Design



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Review of Phase 2 Impacts to Operations and Maintenance

5.0 REVIEW OF PHASE 2 IMPACTS TO OPERATIONS AND MAINTENANCE

5.1 STRATEGIES TO MANAGE DESIGN PHASE O&M EFFORTS

There are several strategies available to manage design phase operations and maintenance efforts. “OPMAN”, operability and maintainability, can be implemented to improve efficiency of O&M reviews throughout the design process.

The OPMAN process involves four (4) main steps:

1. Follow P&ID (3D model, or other drawing) using a five-question checklist.
2. Answer on a scale of 1-5.
3. Identify concerns that are not acceptable.
4. Assign unacceptable concerns to an individual on the design team.

Typically, the review is most effective when completed as a group study. Following completion of the review, an OPMAN report is generated with the following concerns:

- Acceptable but could be improved.
- Unacceptable, requires modification.
- Totally unacceptable, requires redesign.

An example of an OPMAN evaluation table is provided below (Table 5-1). The review team would review the drawings, determine how acceptable the situation is, and whether the design could place staff at risk of developing long term problems. A rating between 1 to 5 is then selected for each category and populated in the table, with explanation as to why the design may place staff at risk. If evident, the review team could provide the design team with a recommendation on how the concern may be addressed. A pre-populated worksheet could also be developed, with dropdown menus for selection of scoring and criteria (Figure 5-1).



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Review of Phase 2 Impacts to Operations and Maintenance

Table 5-1: Example OPMAN Table

	INDEX →	1	2	3	4	5
		ACCEPTABLE	ACCEPTABLE but could be improved	UNACCEPTABLE requires some design modifications	UNACCEPTABLE requires significant redesign	INSUFFICIENT INFORMATION needs further investigation
A	Access for Operation	Acceptable and appropriate access for operators.	Access possible but could be improved.	Access for operation very difficult. Some minor modifications required.	No access for operation of plant.	
B	Access for Maintenance	Acceptable and appropriate access provided for plant maintenance, including lifting facilities	Access possible but could be improved	Access for maintenance unacceptable. Impossible to remove/replace plant.	Access for maintenance unacceptable. No facilities to remove/replace plant	
C	Mechanical Isolation of individual components	Acceptable provision has been made for mechanical isolation. Standby/ duplicate system installed.	Mechanical isolation possible but causes disruption to process.	Mechanical isolation not possible. Design modification required	Mechanical isolation not possible. Significant redesign required.	
D	Electrical Isolation	Electrical isolator provided suitable for application.	Electrical isolator provided but inconveniently located. Acceptable disruption to process.	Electrical isolator provided but common to other plant or poorly labelled. Design modification required.	Electrical isolator provided but completely unsuitable for application.	
E	Equipment removal	Acceptable and appropriate removal	Acceptable removal but could be improved	Difficult removal. Minor design changes required.	Removal not feasible.	
F	Process Implication	Process unaffected by isolation.	Process can continue to operate but at reduced capacity or difficult reconfiguration required.	Isolation causes unacceptable disruption to process. Design modification required.	Isolation causes significant disruption to process. Possible safety implications.	

NODE NUMBER	1		
NODE NAME	WAS Tank System		
AREA OF PLANT			
DRAWING REF	P&IDs	IT100 WAS Tank System P&ID	<Not Used>
	Process Flow	MT000 Process Flow Diagram - WAS Withdrawal Network	<Not Used>
	Piping	<Not Used>	<Not Used>
	Mechanical	<Not Used>	<Not Used>

OpMan Ref	Plant Ref	Item Description	A	B	C	D	E	F
1	TAB-STR-V-5012	Manual isolation valve	<Blank>	<Blank>	<Blank>	<Blank>	<Blank>	<Not used>

Dropdown Menu

- Access for Operation
- <Blank>
- Not Applicable
- 1. Acceptable/Appropriate access for operators.
- 2. Access possible/Could be improved.
- 3. Access difficult/Minor modifications required.
- 4. No access
- 5. Insufficient information

Figure 5-1: OPMAN Process Worksheet Example



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Review of Phase 2 Impacts to Operations and Maintenance

5.2 REQUIRED O&M SUPPORT FOR UPGRADED PROCESSES

A high-level estimate of operations and maintenance support required to operate and maintain the upgraded processes at the Woodward WTP is provided. These estimates should be re-assessed and confirm during detailed design. Team members added during the design and construction phases of the project may continue in their roles to support operations and maintenance of the plant post-construction.

5.2.1 Sedimentation – Plate Settlers

If designed and installed correctly, the O&M effort associated with plate settlers is expected to be minimal. Automatic bubbler systems could be considered during the detailed design phase; the bubbler system can improve performance by keeping plates clean. A bubbler system would, however, be expected to require additional mechanical maintenance and annual cleaning.

The use of plate settlers may require an additional chemical operating system for polymer dosing to optimize plate settler performance, particularly in cold water conditions. Additional O&M effort would be associated with the polymer system.

Semi-annual plate and basin cleaning, conducted by industrial cleaners, is recommended. There is an estimated \$50k fee associated with the industrial cleaning service.

It is expected that plate settlers could result in an additional eight (8) hours of operations effort weekly, and eight (8) hours of maintenance effort weekly. The majority of the maintenance effort is expected to fall on millwrights.

5.2.2 Sedimentation – Dissolved Air Flotation

DAF is likely to require additional operator support when compared to plate settlers. Operators will be required to perform additional duties such as adjustment of saturator nozzles. However, DAF is not expected to require polymer dosing.

DAF is likely to require additional maintenance support to maintain additional mechanical equipment, including but not limited to saturators and compressors. Annual maintenance shutdowns for each train are expected.

It is expected that DAF could result in an additional 12 hours of operations effort weekly, and 12 hours of maintenance effort weekly. The majority of the maintenance effort is expected to fall on millwrights.

5.2.3 Filtration

The filtration upgrades are not expected to result in significant changes to current O&M effort. In general, there is expected to be improved operational flexibility as a result of more reliable filter technology, longer filter run times and reduced concern regarding condition of filter underdrains. Additional maintenance can be expected for the air scour and filter-to-waste equipment.



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Review of Phase 2 Impacts to Operations and Maintenance

It is expected that the filtration upgrades could result in an additional four (4) hours of operations effort weekly, and eight (8) hours of maintenance effort weekly. The majority of the maintenance effort is expected to fall on millwrights.

5.2.4 Chlorination

The current conceptual design for the new chlorine building consists of a railcar and tonner hybrid system. Railcars are expected to be the primary source of chlorine the majority of the time, however, regular use of tonners (1 week per quarter) is recommended to maintain a supply contract with the vendor and increase operator comfort level. The railcar system is automated, and does not require significant operator involvement. When the tonner system is operational under average flows at both the WTP and WWTP, a bank of four (4) tonners is expected to last approximately two (2) days. Every other day, two (2) operators would be required to change out a bank of tonners. Under peak flow events or wet weather conditions, the frequency at which tonner replacement and delivery are required would increase.

It is expected that the new chlorine building would result in an additional 24 hours of operations effort weekly, and eight (8) hours of maintenance effort weekly. The majority of the maintenance effort is expected to fall on millwrights.

5.2.5 UV Disinfection

The UV building will consist of the filter backwash pumps and UV disinfection system. The backwash pumps are expected to operate automatically, and it is anticipated that they will require annual maintenance. The UV system is also expected to operate automatically, with automatic lamp cleaning, however bulb breaks will occur and lamps will require replacement as necessary. The City should plan for 30% of lamps to require replacement annually. There is the potential for additional instrumentation burden associated with the UV system as it is likely that UVT analyzer(s) will be installed.

It is expected that the UV building would result in an additional 12 hours of operations effort weekly, and 12 hours of maintenance effort weekly. The majority of the maintenance effort is expected to fall on millwrights and electricians.

During the workshop, it was requested that Stantec investigate further the maintenance requirements for UV systems. Stantec consulted with Operations at Region of Peel to request an estimate of maintenance support requirements for the in-line UV system at the Arthur P. Kennedy Lakeview WTP. The OCWA operator informed Stantec that typical maintenance requirements are as follows:

- Monthly reference sensor checks – two days for two electricians to complete eight reactors
- Semi-annual maintenance – completed by Trojan Technologies, including inspection, replacement of gel, gaskets, etc.
- Lamps and quartz sleeves replaced as necessary. The WTP bulbs are rated for 15,000 hours; failures are uncommon, estimated at 2 – 5 lamps and 1 – 3 quartz sleeves per year.



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Review of Phase 2 Impacts to Operations and Maintenance

5.2.6 Summary

Table 5-2 presents a summary of the anticipated O&M effort required by the plant, on top of current operations and maintenance requirements, following completion of the Phase 2 upgrades based on estimated additional weekly effort by Operations and Maintenance. It is anticipated that Operations will require an additional two (2) FTE, while maintenance will require an additional one (1) FTE. The majority of the maintenance effort is expected to fall on millwrights and electricians.

Table 5-2: Anticipated Phase 2 Post-Construction O&M Effort

Process	Operations (hrs/week)	Maintenance (hrs/week)
DAF	12	12
Filtration	4	8
Chlorine Building	24	8
UV Building	12	12
Total	52	40
Total as FTE	2 FTE	1 FTE



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
 Recommendations

6.0 RECOMMENDATIONS

The Stantec team has evaluated the resourcing opportunities associated with the current proposed Phase 2 upgrades. An organization chart has been developed that proposes a management and support staff structure for the design and construction phases of the project (Figure 6-1) based on the current conceptual design schedule (AECOM, 2022).

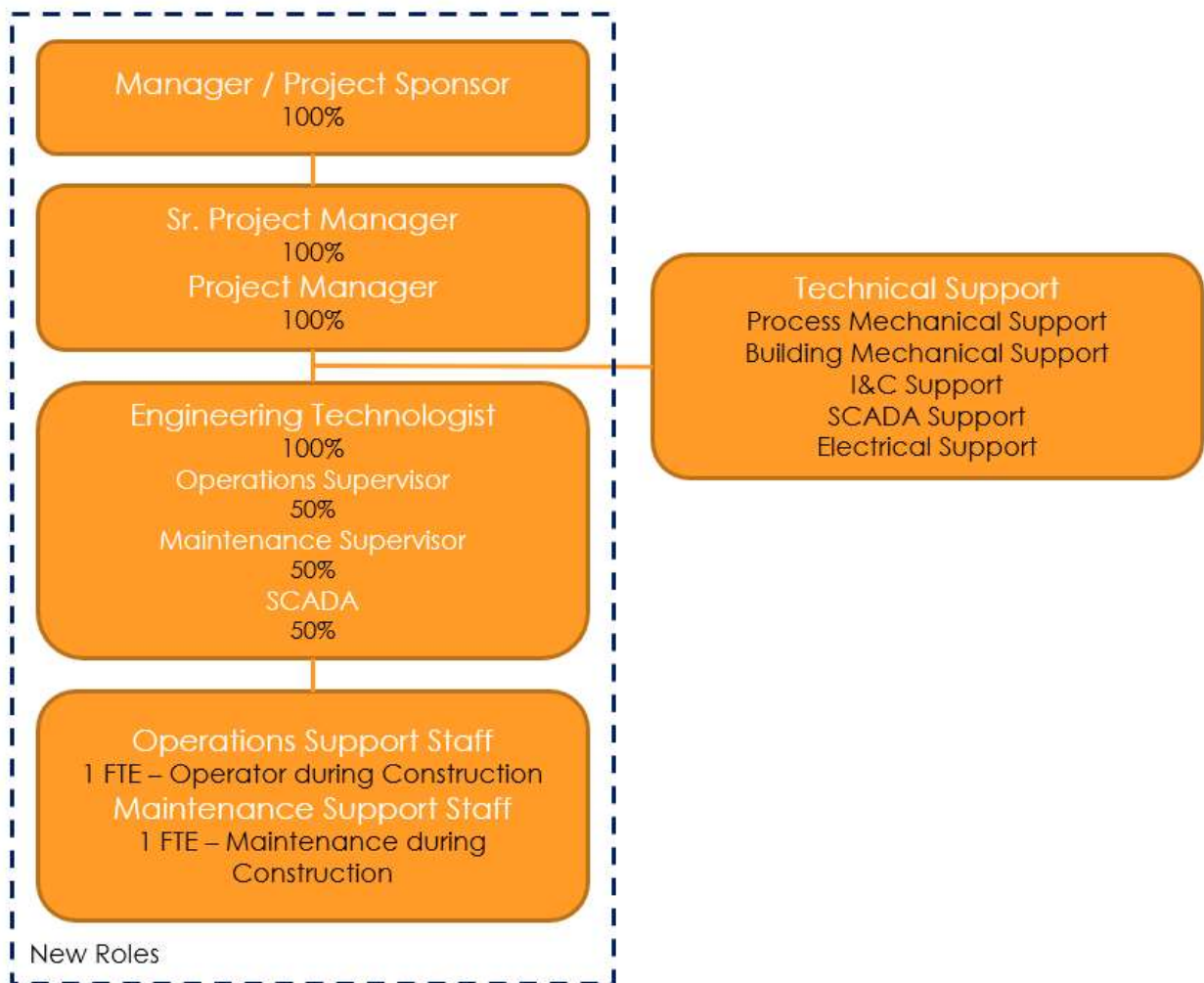


Figure 6-1: Organization Chart; One Construction Contract

It is recommended that the City split the construction contracts into two phases, a Phase 2A and a Phase 2B. An alternative organization chart was developed based on this structure. Generally, the support required by liaisons, discipline technical support and operations and maintenance is not expected to change significantly compared to structuring the project under one contract, however, the project



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
 Recommendations

management structure will vary. With a split construction contract, the City may wish to consider one construction manager for each phase, with shared technical and O&M resources.

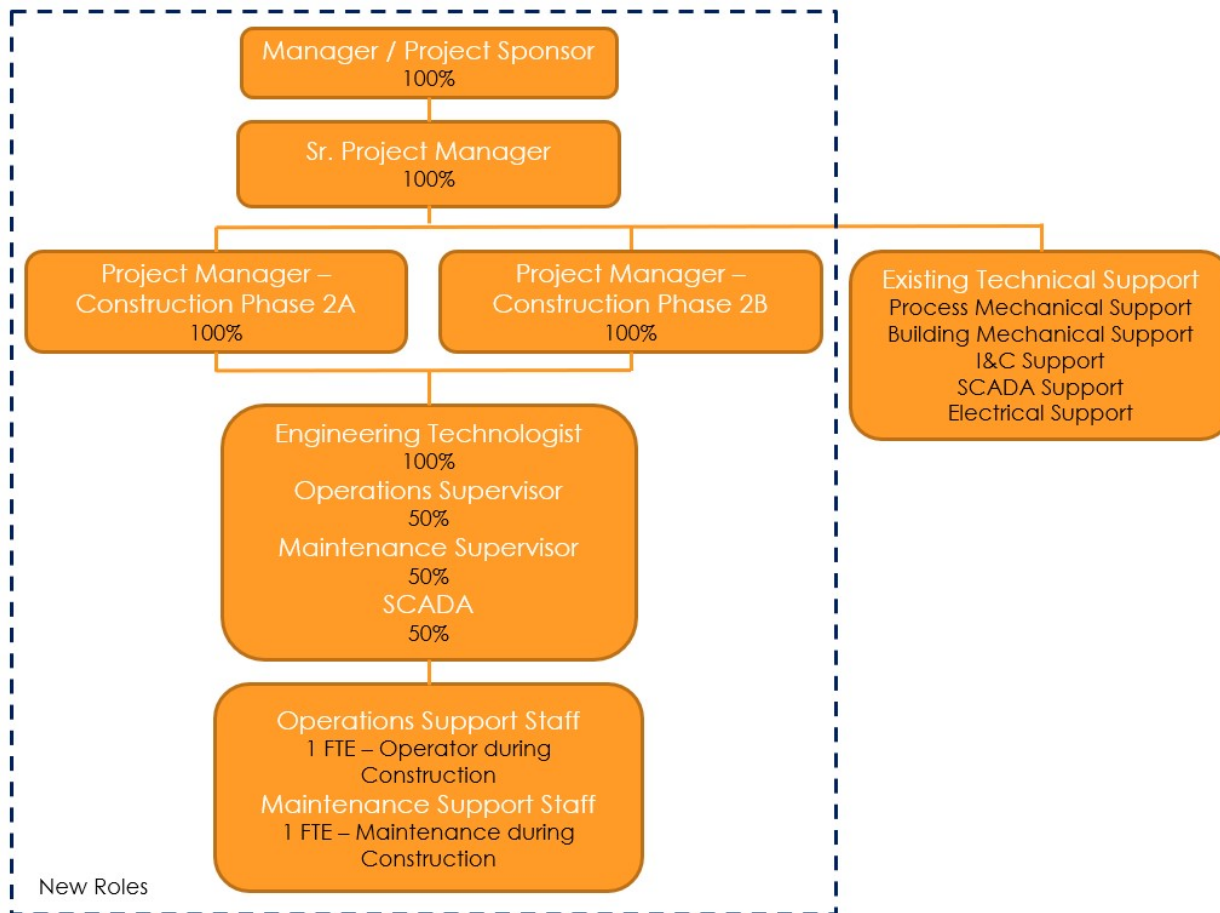


Figure 6-2: Organization Chart; Two Construction Contracts

The amount of support required by each role will vary throughout the phases of the project. The Gantt chart provided below recommends a timeline for onboarding staff to the project team.



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW

Recommendations

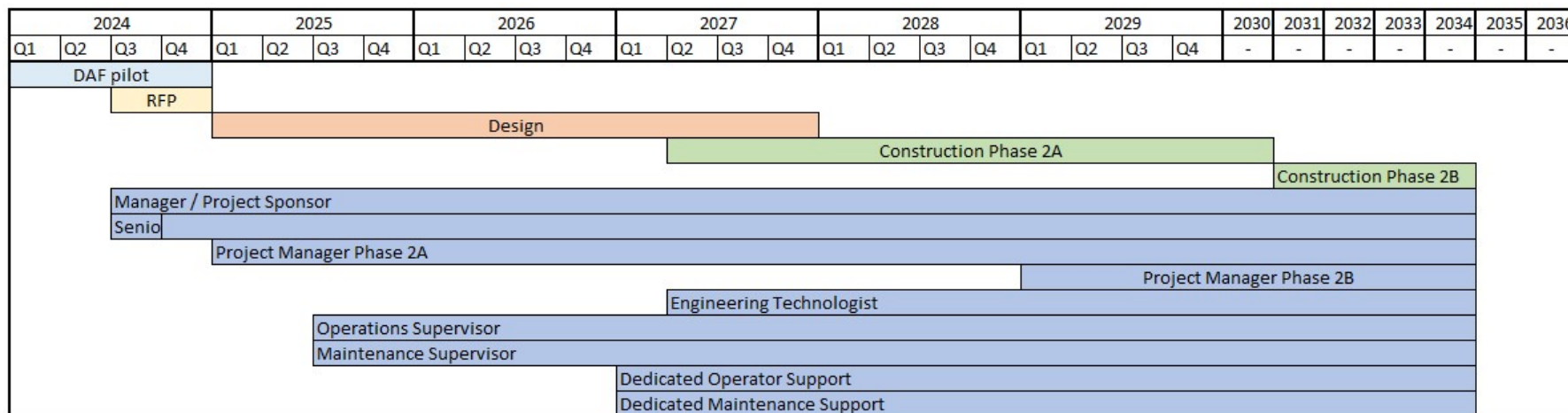


Figure 6-3: Resourcing Gantt Chart; Two Construction Contracts



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Conclusions

7.0 CONCLUSIONS

The Stantec team has evaluated the resourcing requirements associated with the Phase 2 upgrades project at Woodward WTP.

This report presents a review and recommendations for dedicated City staff resources for the delivery of the Woodward Phase 2 upgrades project, both from a project management, design, and construction management perspective. An organization chart was developed to demonstrate a potential team structure, with a Gantt chart illustrating timeline for onboarding team members. The recommendations presented center around new positions that will need to be created to support the Phase 2 Upgrades project.

It is anticipated that the City will require the following support during the design period of the Phase 2 upgrades project (2024 – 2026):

Table 7-1: Staff Requests for Phase 2 Upgrades (Design: 2024 - 2026)

Role	Availability During Design	Year Position Required
Manager / Project Sponsor	100%	2024
Senior Project Manager	100%	2024
Project Manager	100%	2025
Engineering Technologist	100%	2025
Operations Supervisor	50%	2025
Maintenance Supervisor	50%	2025
SCADA	50%	2025

It is recommended that the City request additional staff to support the design phase of the Phase 2 upgrades project for the roles in Table 7-1.

Following design, it is anticipated that the City will require the following support during the construction phase of the Phase 2 upgrades project (2027 – 2034). The majority of these positions would have been created during the design phase and roles can be carried through construction.

Table 7-2: Staff Requests for Phase 2 Upgrades (Construction: 2027 - 2034)

Role	Availability During Construction	Year Position Required
Manager / Project Sponsor	100%	Same as Design
Senior Project Manager	100%	Same as Design
Project Manager (Phase 2A)	100%	Same as Design
Project Manager (Phase 2B)	100%	To be determined by City at later date



WOODWARD 3RD PARTY REVIEW – RESOURCING REVIEW
Conclusions

Role	Availability During Construction	Year Position Required
Engineering Technologist	100%	Same as Design
Operations Supervisor	50%	Same as Design
Operations Support Staff	100%	2027
Maintenance Supervisor	50%	Same as Design
Maintenance Support Staff	50%	2027
SCADA	50%	Same as Design

During the construction phase, based on the assumptions on staff continuity from the design phase as outlined above, it is that the City will not require additional project management and engineering staff with the exception of a Phase 2B Project Manager. Operations and maintenance impacts during the course of construction to support planned shutdowns, equipment start-ups and commissioning, operation of valves, training sessions, change requests, technical input, etc. have been considered. It is recommended that the City request additional staff to support the construction period (2027 – 2034) of the Phase 2 upgrades project as follows: one (1) full time-equivalent (FTE) operations support staff, and one (1) FTE maintenance support staff, in addition to their current work force as summarized in Table 7-2.

Operations and maintenance staff hired for the design and construction of the Phase 2 upgrades project can be retained to operate and maintain the plant post-construction. The number of staff required to operate and maintain the plant will be determined during detailed design.



**APPENDIX A
RESOURCING REVIEW WORKSHOP
MEETING MINUTES**



Meeting Notes

Woodward WTP 3rd Party Review – Resourcing Review Worksop

Project/File: 165640394
 Date/Time: April 12, 2023 / 9:00 am – 11:00 am
 Location: MS Teams
 Next Meeting: April 21, 2023 / 10:00 am – 12:00 pm

Attendees:	<u>City of Hamilton</u> Stuart Leitch (SL) Bill Docherty (BD) Deborah Goudreau (DG) Trevor Marks (TM) Danny Locco (DL)	<u>Stantec</u> Michael Kocher (MK) Hailey Holmes (HH) Joel Thompson (JT)
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Absentees: None

Distribution: Attendees

	Item	Action
1	<ul style="list-style-type: none"> • Personnel and the assignment were introduced. 	
2	Stantec reviewed large capital projects over the past 10 years to share project management and engineering structure. <ul style="list-style-type: none"> • Montreal WTP Rehabilitation program <ul style="list-style-type: none"> ○ City hired 5-6 dedicated full-time staff including, PM, construction manager, financial officer, and sub-PMs. ○ SL inquired whether the financial officer was dedicated solely to the project. MK confirmed that in 	

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	Item	Action
	<p>this case, it was a dedicated role and required additional effort due to EPCM delivery.</p> <ul style="list-style-type: none"> • Laval WTP Rehabilitation was presented. <ul style="list-style-type: none"> ○ City developed 9 contracts by area of the WTP, and hired 3-4 dedicated full-time staff. • Hamilton WUP org chart was presented. Project structure has a director and three sub-PMs. <ul style="list-style-type: none"> ○ SL NOTED WUP was three separate projects, with each having a separate PM. 	
3	<p>The resourcing survey results were reviewed, grouped according to engineering, operations, and maintenance.</p> <ul style="list-style-type: none"> • DG noted that the two operators on shift are also watching the SCADA screens for all of the outstations. If there is an issue at an outstation, the outstation operator would be mobilized. If issue occurs after day-shift, process supervisor would likely send a wastewater operator to respond (who also carry water licenses). • MK inquired whether hydro shutdowns are planned to continue for the future. DG confirmed that the energy office notifies the plant when there is a suspected hydro peak to avoid running the HLPs during the peak hours. The plant is run overnight instead. This operating strategy is expected to continue until demand cannot be met. • JT inquired whether the plant sees an effect on the filters from the shutdowns/start-ups. DG noted filters are conventional, and not seeing an impact of the frequent start/stops on filtration. • MK noted a filter quadrant will be offline for significant periods of time during the upgrades, shutdown strategy may not be feasible. DG noted they understand that during construction operating strategy may need to change, and that they have excess storage in the distribution system which helps provide a buffer. • Shutdowns are not overly resource intensive – occur very frequently. • Maintenance services are shared between the water and wastewater systems. Noted design phase can put some strain on the supervisors but construction can generally be accommodated as long as there are no maintenance emergencies. • MK noted strategies are available to manage the effort required from O&M for the design phase; these will be 	Stantec to share Pat Coleman OPMAN webinar with the City

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	Item	Action
	provided to the City in the TM, along with a recorded webinar prepared by Stantec in 2022.	
4	<p>The suggested engineering roles for the Phase 2 upgrades project was reviewed.</p> <ul style="list-style-type: none"> • SL noted that their project management structure already has time dedication suggestions for alternate PMs on large capital projects. • SL noted the Operations Liaison role could potentially report through DG. • SL noted the Sr. Construction PM could be a consultant activity – dedicated staff approved for the role if the City is not able to accommodate so many staff dedicated to the project. • SL requested to review what the consultant team on-site looked like for the example projects shared. • The anticipated percentage burdens were reviewed as commitment above and beyond current responsibilities. • SL noted currently alternate PM would be expected to have 20% availability, but could be increased for a project of this size. • DG inquired whether the Operations Liaison should be two different people during design and construction. To support design, 50% time from a superintendent would likely be required, but more support would be required from an operator for construction, with some support from supervisors. Maintenance requirements during design would likely be more from a supervisor, but more heavily relying on trades during construction. • DL noted primary maintenance support is SCADA with some electrical support required for electrical shutdowns for WUP. • MK clarified that the Liaison role is expected to be more like a supervisor or superintendent role. Feedback on City's terminology is useful and will be incorporated into the report. • JT noted importance of involving supervisors from the design stage. DG noted experience with WUP has helped get acceptance and buy-in from the operators on the various work associated with large projects. 	Stantec to request consultant team structure on-site in example projects – key roles for consultant
5	<ul style="list-style-type: none"> • SL noted they are doing 3D modelling for WUP and worked with consultant to develop an approach for reviews of 3D models. This has improved the reviewing process. 	

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	Item	Action
6	<p>O&M support during design and construction was reviewed.</p> <ul style="list-style-type: none"> • DG noted the design phase support may be more ad-hoc – 0.2 FTE may be high. DG agrees with 1 FTE during construction, but expects training may have a higher burden on supervisors than front-line operators. For WUP, the City hired 4 additional operators so that one additional per shift is available. An attempt was made to hire was a year before commissioning started to provide ample training time. • DG expects bigger impact on maintenance side with the UV building. DL expects a dedicated SCADA support for both WUP and this project. • MK inquired whether Stantec should develop an overall staffing table showing the timeline for hiring these individuals. SL is expecting design phase to occur between Q4 2024 – Q2 2027. SL requested Stantec develop a resourcing schedule for the project and post-construction operations. DG noted restriction of who can be hired and when hiring may occur will need to be approved by council. • DG noted contracts are renewed every 2 years – the City cannot hire for an 8-year contract. Operational support during the project needs to be someone who knows the plant well. • SL requested Stantec prepare org charts showing which roles are new, which are existing and the overall structure. Provide a Gantt chart for hiring and resourcing. 	<p>Stantec to prepare org charts and Gantt charts</p>
7	<ul style="list-style-type: none"> • DG noted bulb breaks and lamp replacements should be specified as a maintenance activity. • DG noted maintenance estimate for UV seems lower than expected. • MK noted Stantec could confirm maintenance performed at Region of Peel WTP to gain a potentially more accurate estimate. 	<p>Stantec to request UV maintenance estimate from Region of Peel</p>
8	<ul style="list-style-type: none"> • DG clarified that if each shift needs an additional FTE – then that is 5 FTE total. • When operating tonners – additional operator support would likely be covered by overtime. <ul style="list-style-type: none"> ○ MK noted additional support would only be required during deliveries, and switching between banks of tonners • SL requested Stantec put DAF into the resourcing summary table as O&M effort is higher than plates. 	<p>Stantec to update summary table with DAF</p> <p>Stantec to provide additional detail for maintenance requirements</p>

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Item	Action
<ul style="list-style-type: none"> DG and DL requested additional granularity for maintenance requirements – i.e. what type of trade will be required 	

The meeting adjourned at 10:40AM.

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Best regards,

STANTEC CONSULTING LTD.

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Attachment: Workshop presentation