CITY OF
BAINBRIDGE ISLAND

UTILITY ADVISORY COMMITTEE
REGULAR MEETING
WEDNESDAY, SEPTEMBER 11, 2019
5:00 PM
CITY HALL
COUNCIL CONFERENCE ROOM
280 MADISON AVENUE NORTH
BAINBRIDGE ISLAND, WA 98110

AGENDA

1. **CALL TO ORDER / ROLL CALL / ACCEPT OR MODIFY AGENDA / CONFLICT OF INTEREST DISCLOSURE**
   5:00 PM

   CHAIR: ANDY MARON

   MEMBERS: CHARLES AVERILL, SHEINA HUGHES, TED JONES, NANCY NOLAN, MARTIN PASTUCHA, EMILY SATO

   LIAISON: RASHAM NASSAR

2. **SMALL WATER SYSTEMS (CONTINUE DISCUSSION)** – 30 MIN.

3. **FEEDBACK/DISCUSSION** – 45 MIN.
   A. **TERTIERY AND PRE-TREATMENT SCOPE OF WORK**
   B. **HIGH SCHOOL ROAD TANK REPLACEMENT PRE-DESIGN SCOPE OF WORK**
   C. **PENDING UAC RECOMMENDATIONS TO COUNCIL**

4. **COMMITTEE CHAIR(S) DICUSSION AND ELECTION** – 10 MIN.

5. **NEXT MEETING AGENDA PLANNING** – 5 MIN.

6. **ADJOURNMENT**

For special accommodations, please contact Roz Lassoff
206-780-8624 or at rlassoff@bainbridgewa.gov

September 6, 2019

Mr. Chris Hammer, P.E.
Engineering Manager
City of Bainbridge Island
280 Madison Ave N
Bainbridge Island, Washington 98110

Re: Proposal for Engineering Services – WWTP CEC Removal Evaluation and Pretreatment Program Support

Dear Mr. Hammer:

Murraysmith is pleased to present our proposal to provide engineering services for Wastewater Treatment Plant (WWTP) Contaminants of Emerging Concern (CEC) **Removal Evaluation and Pretreatment Program Support** for the Winslow Wastewater Treatment Plant. The following exhibits are included with this Proposal and are described in greater detail in the sections that follow:

Exhibit A	Scope of Work with Appendix for Analytical Testing
Exhibit B	Budget
Exhibit C	Project Schedule

SCOPE OF WORK

The Scope of Work included in Exhibit A includes four (4) major tasks:

- Task 1 Project Management includes the Project Kickoff Meeting and preparation of monthly project reports with invoices.
- Task 2 Existing WWTP CEC Testing and Regulatory Considerations includes background data collection and review, completing sampling and testing of WWTP influent and effluent, regulatory review, and literature review of the potential treatment technologies to address CECs.
- Task 3 WWTP Treatment Capacity Evaluation and Pretreatment Program Support includes an investigation of high WWTP influent BOD loading from local breweries, distilleries and wineries and providing support in evaluating WWTP capacity to accommodate higher influent BOD loadings and implementation of a pre-treatment program.

- **Task 4 Public Process** includes preparing the final report and attending one Utility Advisory Committee (UAC) meeting and one City Council meeting.

BUDGET

Exhibit B provides a detailed breakdown of our proposed labor hours for each phase and task summarized in the Scope of Work. Attachment A included in the Exhibit A Scope of Work includes a summary of the recommended analytical testing of WWTP influent and effluent. The overall budget breakdown by phases is summarized as follows:

Task 1 Project Management	$11,828
Task 2 Existing WWTP CEC Testing and Regulatory Considerations	$49,405
Task 3 WWTP Treatment Capacity Evaluation and Pretreatment Program Support	$54,720
Task 4 Public Process	$28,304
Total Budget, not including Analytical Testing	**$144,257**
Analytical Testing Allowance	$16,198
Total Budget, including Analytical Testing	**$160,455**

SCHEDULE

A preliminary project schedule is included as Exhibit C, which shows completion of the project by May 29, 2020.

CONTRACTUAL TERMS AND CONDITIONS

Murraysmith has provided comments on the City's standard contract form and looks forward to negotiating the final terms and conditions based on City feedback.

We look forward to working with the City on this important project. Please contact me at your convenience if you would like to discuss our proposal.

Sincerely,

MURRAYSMITH
Preston Van Meter, PE
Project Manager

PLVM: jjf

Enclosures:

Exhibit A	Scope of Work
Exhibit B	Budget
Exhibit C	Project Schedule

EXHIBIT A

SCOPE OF WORK
WWTP CEC Removal Evaluation and Pretreatment Program Support
City of Bainbridge Island, WA

Introduction

The Winslow Treatment Plant (Winslow WWTP) was originally constructed in 1978 and last upgraded in 2005. The City operates the WWTP under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Washington Department of Ecology (Ecology) with an effective date of August 1, 2017.

Currently, the Winslow WWTP provides primary and secondary wastewater treatment that includes a headworks with fine screen, grit chamber, two aeration basins, three secondary clarifiers, and UV disinfection. Final effluent is pumped approximately 5,370 feet to an outfall in Puget Sound just east of Wing Point. Solids handling processes include two aerated sludge holding tanks, a screw press for solids dewatering, and a sludge loadout area for solids hauling. Biosolids produced at the Winslow WWTP do not consistently meet Class B Biosolids requirements and are currently hauled to landfill for disposal.

City residents and elected officials are concerned about protecting water quality in Puget Sound and the potential effects of contaminants of emerging concern (CECs) such as nutrients, metals, pharmaceuticals and personal care products (PPCPs) and other trace organics that may be of impact to Puget Sound water quality. The study will investigate the presence of CECs in Winslow WWTP influent as well as treated effluent discharged to Puget Sound and propose potential treatment technologies that could be further investigated in a follow-up study.

In addition, the City is concerned about the high plant influent BOD loading from business such as wineries, breweries, and distilleries. The study will investigate the sources of high BOD loading from these dischargers and explore practical and cost-effective options for upgrading the Winslow WWTP capacity. In addition, the study will provide recommendations for the establishment of pretreatment local limits for dischargers of high strength waste (HSW) and provide 3rd party review of updates to the City's pretreatment and fats, oils and grease (FOG) ordinance.

The results of the study will be documented in a series of technical memoranda and communicated to the public and City Council through presentations at the City's regularly scheduled Utility Advisory Committee (UAC) and City Council meetings.

Scope of Work

The project will actively engage City staff throughout the process, taking maximum advantage of the previous work and City's input to develop consensus at key points in the evaluation process. The Scope of Work includes:

Task 1 – Project Management
Task 2 – Existing WWTP CEC Testing and Regulatory Considerations
Task 3 – WWTP Treatment Capacity Evaluation and Pretreatment Program Support
Task 4 - Public Process

Following is a detailed breakdown of the tasks and subtasks that comprise the Scope of Work.

Task 1 – Project Management

The purpose of this task is to provide management of the project team, schedule, and budget. The project manager (PM) will maintain communication with the City and the team throughout the duration of the project, lead meetings and workshop discussions, keep the City up to date on project issues, and incorporate the City's input into the work product as appropriate.

Subtask 1.1 – Project Kickoff Meeting and WWTP Site Visit

A project kickoff meeting will be held at City Hall to introduce the project team, establish project objectives, review consultant and City communication protocols, discuss the project scope and examine the project schedule including the key delivery dates. A WWTP site visit will be conducted following the kickoff meeting. Murraysmith's Project Manager, Project Engineer, Technology Lead, and subconsultants will attend the project kickoff meeting in person.

Subtask 1.2 – Monthly Project Status Reports and Invoices

Monthly project status reports will summarize the current project status, noting key outstanding issues that may impact the scope, schedule, or budget. Monthly invoices will be included with the monthly project status reports. The project will be managed to maintain the scope, schedule, and budget.

Subtask 1.3 – Team Coordination Activities

Murraysmith's Project Manager will coordinate efforts of Murraysmith's internal team and sub-consultants to keep the project on schedule, identify scope changes that may impact the project budget, and keep City staff up to speed on progress. Team coordination activities will include monthly conference calls involving City staff and Murraysmith's project team.

Task 1 Deliverables

1. One electronic (PDF) copy of the agenda and minutes from the Project Kickoff Meeting.
2. One electronic (PDF) copy of monthly Project Status Reports and invoices.

Task 1 Assumptions

A. The total project duration is assumed to be eight (8) months; therefore, 8 monthly progress reports are included in the scope.

Task 2 – Existing WWTP CEC Testing and Regulatory Considerations

This task includes collection and review of background information at the start of the project and development of the baseline information needed to complete the project, including characterization of wastewater influent and effluent as well as a review of near- and long-term regulatory requirements related to the Winslow WWTP discharge to Puget Sound.

Subtask 2.1 – Background Data Collection and Review

Murraysmith will prepare a request for background data and information that would be helpful for completing the project. It would be helpful for the background data to be provided in advance of the Project Kickoff Meeting.

Task 2.1 Deliverables

1. One electronic (PDF) copy of the Background Data Request for project information required to complete the project.

Task 2.1 Assumptions

A. City will provide requested background data and information for review prior to the Project Kickoff Meeting.

Subtask 2.2 – WWTP Water Quality Sampling and Testing Program and Regulatory Review

Murraysmith's team will develop a WWTP Water Quality (WQ) Sampling and Testing Protocol identifying CECs, PPCPs, nutrients, and other compounds for which concentrations are desired for completion of the study. In addition, the sampling protocol will include extensive sampling to identify COD and BOD fractions to improve process model development. The testing protocol will include a list of constituents to be tested, standard test method and method detection limits, sampling and testing schedule, and estimated testing fees. A summary of the recommended analytical testing of WWTP influent and effluent is included in Attachment A to this Exhibit.

Following completion of the final protocol, the sampling and testing program will be implemented with City's support.

In addition, Murraysmith will review the regulatory requirements in the City's current NPDES Permit as well as emerging regulations related to the Puget Sound, including the Puget Sound Nutrient Form, WA legislature rulemaking, WA 303(d) list of water quality impairments, and other emerging regulatory considerations being considered by Ecology and the Environmental Protection Agency (EPA). As part of this task, Murraysmith staff will meet with Ecology representatives to discuss both near- and long-term regulatory considerations related to the Puget Sound Nutrient Form and the City's NPDES Permit.

Once the data collection and regulatory review is complete, Murraysmith will prepare a technical memorandum summarizing the results of the WWTP WQ Sampling and Testing Program as well as the regulatory review.

Task 2.2 Deliverables

1. One electronic (PDF) copy of the Draft and Final WWTP WQ Sampling and Testing Protocol (TM-01A).

2. One electronic (PDF) copy of the Draft WWTP WQ Sampling and Testing Program Data Report and Regulatory Review Technical Memorandum (TM-01B).

Task 2.2 Assumptions

A. City will complete review of TM-01A and TM-01B within 10 working days.

B. Sampling and testing will be completed at 2 locations: 1) downstream of the headworks (screened influent); and 2) downstream of disinfection (final effluent).

C. City staff will collect WQ samples in bottles provided by the preferred WQ testing laboratory, and package and hand deliver or mail samples as instructed by the laboratory.

D. Murraysmith staff will provide coordination of the sampling and testing program with the City's preferred WQ laboratory.

E. Cost for analytical testing services will be included in Murraysmith's contract.

F. The regulatory evaluation will identify potential near- and long-term concerns related to the City's NPDES Permit.

G. A summary of emerging regulations and considerations in other regions of the United States will be included in TM-01B.

Subtask 2.3 – Technology Options and Treatment Performance Literature Review

Conduct a literature review of current research and other publications summarizing treatment technologies that could be implemented at the Winslow WWTP identifying estimated treatment removal performance for nutrients, metals, pharmaceuticals, and personal care products. As part

of the literature review, provide a summary of current technology commercialization efforts as well as capital and O&M cost considerations, a high-level qualitative assessment of feasibility, and other information important for consideration by the City if implemented at the Winslow WWTP. Based on the results of the literature review, Murraysmith will identify specific alternatives which could be considered for further investigation.

Task 2.3 Deliverables

1. One electronic (PDF) copy of the Draft Treatment Technologies and Performance Literature Review Technical Memorandum 02 (TM-02).

Task 2.3 Assumptions

1. City will complete review of TM-02 within 10 working days.

Subtask 2.4 – WWTP CEC Sampling and Testing Program Data and Regulatory Considerations Review Workshop

Conduct a meeting with City staff to review and discuss results from the Winslow WWTP WQ sampling and testing program as well as the information summarized in Draft TM-01B and TM-02. Following the workshop, TM-01B and TM-02 will be finalized incorporating City comments.

Task 2.4 Deliverables

1. One electronic (PDF) copy of the workshop agenda and minutes.
2. One electronic (PDF) copy of the Final WWTP WQ Sampling and Testing Program Data Report and Regulatory Review Technical Memorandum (TM-01B).
3. One electronic (PDF) copy of the Final Treatment Technologies and Performance Literature Review Technical Memorandum 02 (TM-02).

Task 2.4 Assumptions

A. The workshop will be approximately 3 hours, attended by Murraysmith's Project Manager, Project Engineer, and Technology Lead with others joining by phone, if required.

Task 3 – WWTP Treatment Capacity Evaluation and Pretreatment Program Support

In this task, the Murraysmith team will investigate the high influent BOD at the Winslow WWTP and identify potential practical and cost-effective opportunities to re-rate the influent capacity and/or upgrade the WWTP to treat higher strength waste from local breweries, distilleries and wineries. Support will also be provided to investigate and quantify local HSW sources and implementation of an industrial pretreatment program and establishment of local limits, including review of the City's draft pretreatment and FOG ordinances.

Subtask 3.1 – Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation

Review Winslow WWTP design criteria provided in record drawings from the most recent plant expansion, NPDES Permit requirements related to influent BOD and TSS loading and historical plant performance data to assess treatment performance as compared to original design criteria. Evaluate alternatives for practical and cost-effective upgrades to increase WWTP capacity to accommodate HSW from local breweries, distilleries and wineries. Options will be evaluated using a biological process model.

Evaluations and recommendations will be documented in a technical memorandum along with recommendations for next steps related to facility re-rating and cost estimates for recommended plant upgrades to treat HSW from local breweries, distilleries and wineries.

Task 3.1 Deliverables

1. One electronic (PDF) copy of the Draft Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation Technical Memorandum 03 (TM-03).

Task 3.1 Assumptions

A. The City will provide Winslow WWTP record drawings with design criteria, current NPDES Permit and DMRs for the past 5 years for completion of the evaluation. Additional process testing data for the aeration basins will also be helpful for the study.

B. The City will provide the original plant design record drawings and any other plant upgrade design documents.

C. City will complete review of TM-03 within 10 working days.

Subtask 3.2 –HSW Discharger Site Visit & Documentation

Murraysmith staff will conduct a site visit to tour local breweries, wineries and distilleries discharging HSW to the City's wastewater collection system. It is anticipated that 4-5 facilities will be toured during the site visit, where opportunities for installation of sampling manholes on individual dischargers as well as opportunities for the installation of pretreatment systems. Following the site visit, it is anticipated the City will collect and test samples from HSW dischargers for use in completing the pre-treatment evaluation.

Task 3.2 Deliverables

1. Field notes with pictures documenting the potential locations of sampling manholes and pretreatment systems for HSW dischargers.

Task 3.2 Assumptions

A. The site visit to 4-5 local business will be conducted in one day and attended by Murraysmith's Project Manager and Technology Lead.

B. Sampling and testing of HSW from local breweries, distilleries, and wineries will be conducted by City staff, including sample collection and testing for BOD and TSS.

Subtask 3.3 – HSW Discharger Pretreatment Recommendations

Based on the findings of Winslow WWTP capacity evaluation and the WQ sampling and testing of HSW dischargers completed by City staff, Murraysmith will prepare a technical memorandum summarizing pretreatment recommendations for HSW dischargers along with recommendations for pretreatment local limits.

Pretreatment Local Limits will be recommended for two potential WWTP capacity scenarios:

1. Current Winslow WWTP rated capacity; and
2. Re-rated Winslow WWTP capacity incorporating practical and cost-effective upgrades identified in Task 3.1.

Pretreatment program recommendations and local limits will be documenting in a technical memorandum for City review. The memorandum will include the practical pretreatment alternatives, as well as the inspection, monitoring and enforcement techniques for breweries, wineries, and distilleries. The site visits documentation prepared in Task 3.2 will be included as an appendix.

Task 3.3 Deliverables

1. One electronic (PDF) copy of the Draft HSW Discharger Pretreatment Recommendations Technical Memorandum 04 (TM-04).

Task 3.3 Assumptions

A. City will complete review of TM-04 within 10 working days.

Subtask 3.4 – Pretreatment/FOG Ordinance 3rd Party Review Support

Review the City's draft pretreatment and FOG ordinance and provide comments to City staff. The review will include recommendations for incorporation of local limits recommended in Task 3.3.

Task 3.4 Deliverables

1. One electronic (MS Word and PDF) copy of the draft comments on the City's pretreatment and FOG ordinance(s). Recommended modifications will be provided using "tracked changes" mode in MS Word.

Task 3.4 Assumptions

A. Murraysmith's support for the Pretreatment and FOG ordinance will be limited to 3rd party review of the City's proposed ordinance.

Subtask 3.5 – WWTP Capacity and Pretreatment Recommendations Review Workshop

Conduct a workshop with City staff to review and discuss findings of the Winslow WWTP BOD capacity and upgrades evaluation (TM-03) and HSW discharger pretreatment recommendations (TM-04) as well as comments on the City's Pretreatment and FOG ordinance. Following the meeting, TM-03 and TM-04 will be finalized incorporating City comments.

Task 3.5 Deliverables

1. One electronic (PDF) copy of the workshop agenda and minutes.
2. One electronic (PDF) copy of the Final Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation Technical Memorandum 03 (TM-03).
3. One electronic (PDF) copy of the Final HSW Discharger Pretreatment Recommendations Technical Memorandum 04 (TM-04).

Task 3.5 Assumptions

A. The workshop will be approximately 2 hours, attended by Murraysmith's Project Manager, Project Engineer, and Technology Lead.

Task 4 – Public Process

In this task, the Murraysmith's team will prepare a powerpoint slideshow for presentation to the City's Utility Advisory Committee (UAC) and City Council. The presentation will include findings and recommendation for both the CEC evaluation completed in Task 2 and the WWTP capacity and pretreatment program evaluations completed in Task 3.

Subtask 4.1 – Prepare Powerpoint Presentations

Prepare a PowerPoint presentation summarizing the project and recommendations for delivery to the City's UAC and City Council.

Task 4.1 Deliverables

1. One electronic (PDF and PowerPoint) copy of the Draft and Final powerpoint presentations for the UAC and City Council presentations.

Task 4.1 Assumptions

A. No final report consolidating the individual technical memoranda will be prepared as part of Task 4.

B. The City will provide hard copies of presentation materials for distribution to the UAC, City Council, and public attendees at the meetings.

C. It is anticipated the UAC presentation will be modified and potentially reduced in length for the City Council meeting.

D. The final presentations will be attended by Murraysmith's Project Manager, Technology Lead, and Public Outreach Lead.

Subtask 4.2 – UAC and City Council Presentations

Attend one (1) UAC meeting and one (1) City Council meeting to present findings and recommendations from the Existing WWTP CEC Testing and Regulatory Considerations completed in Task 2 and the WWTP Treatment Capacity Evaluation and Pretreatment Program Support provided in Task 3.

Attachment A

Preliminary Sampling and Testing Costs

For the sampling and testing program, two CEC samples and three samples for wastewater characterization are proposed. The following tables summarizes the cost for each compound tested and the estimated total cost for each sampling event. The total testing cost would be **$16,198** (2 samples @ $6,974 x 2 plus 3 samples @ $750).

CEC Compounds	**Cost**
Phenolic Compounds	$ 715
Phthalates	$ 495
PFAS	$ 550
Organohalogen flame retardents	$ 1,320
PCB	$ 264
PPCPs	$ 2,640
Organochlorine Pesticides	$ 495
Organophosphate Pesticides	$ 495
Cost Per Sample Event[1]	$ 6,974

Note:

1. Cost includes Influent and Effluent Samples

Wastewater Characterization Compounds	**Cost**
Influent Flocculated-Filtered COD	$ 55
Influent Filtered COD (field filtered)	$ 35
Influent COD	$ 35
Influent Filtered BOD_5 (field filtered)	$ 83
Influent Total Kjeldahl Nitrogen (TKN)	$ 83
Influent Filtered TKN (field filtered)	$ 83
Influent Ammonia-Nitrogen (NH_3)	$ 28
Influent Nitrate-Nitrogen (NO_3)	$ 22
Influent Alkalinity – as $CaCO_3$	$ 28
Influent Total Phosphorus (P)	$ 33
Influent Orthophosphate (Ortho-P)	$ 25
Influent Calcium and Magnesium	$ 25
Effluent Filtered COD (field filtered)	$ 35
Effluent Ammonia-Nitrogen (NH3)	$ 28
Effluent Nitrate-Nitrogen (NO3)	$ 22
Effluent Nitrite-Nitrogen (NO2)	$ 22
Effluent Alkalinity – as CaCO3	$ 28
Effluent TKN	$ 83
Cost Per Sample Event	**$ 750**

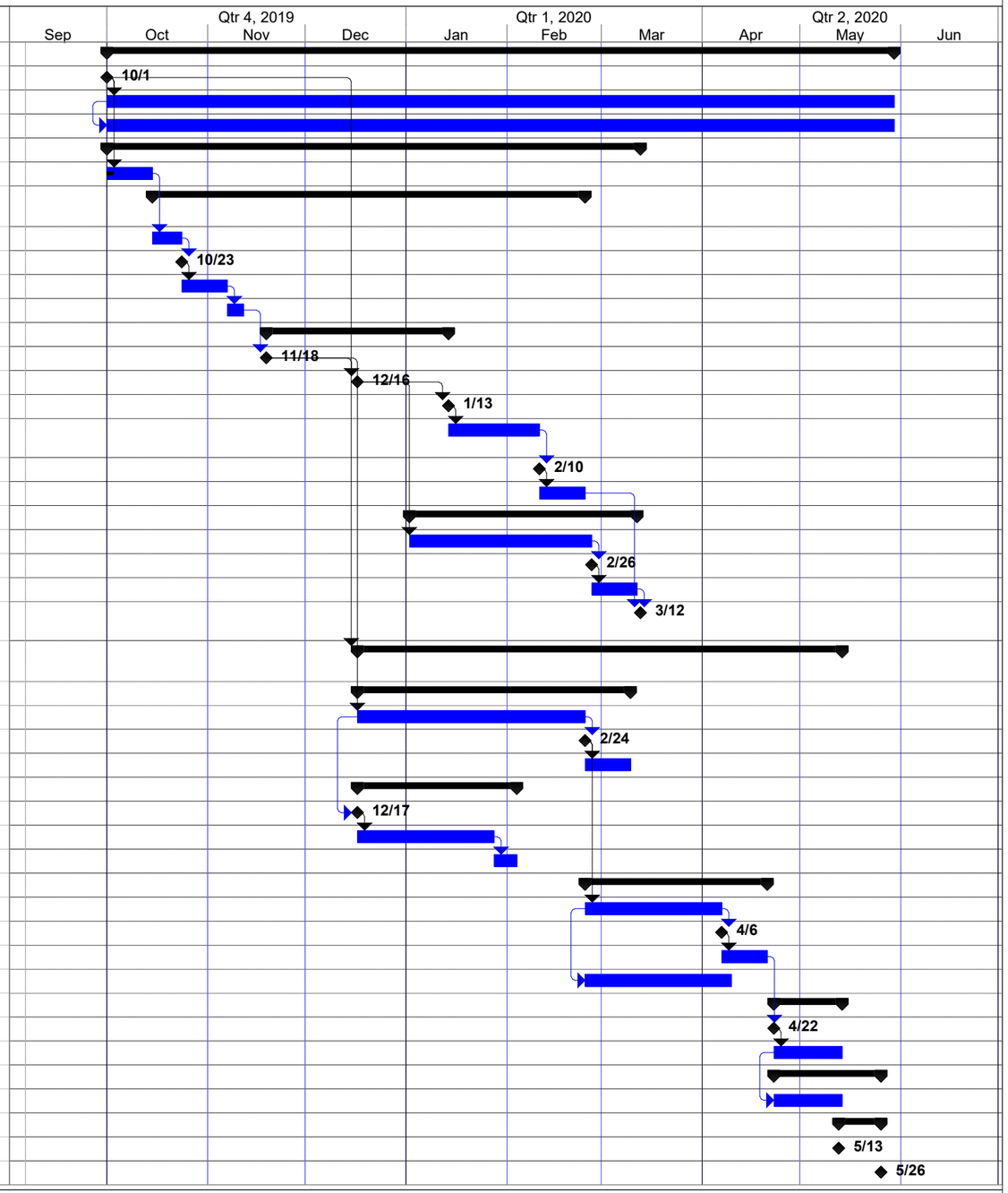
EXHIBIT B
WASTEWATER TREATMENT PLANT CONTAMINANTS OF EMERGING CONCERN REMOVAL EVALUATION AND PRETREATMENT PROGRAM SUPPORT
CITY OF BAINBRIDGE ISLAND, WA
PROPOSED FEE ESTIMATE

	LABOR CLASSIFICATION (HOURS)																
	Principal Engineer V $251 Van Meter	Principal Engineer III $234 Zhang	Professional Engineer VII $191 Flowers	Engineering Designer III $154 Cawley	Admin. I $91 Rajendran	Technician IV $150 Marx	Principal Engineer VI $260 Perry	Hours	Labor	Subconsultants: Primodal	Subconsultants: Stensel	Subconsultants: Enviroissues	Subconsultant Total	Expenses	CADD Units $18/hr	GIS Units $10/hr	Total
Task 1 - Project Management																	
Task 1.1 - Project Kickoff Meeting and WWTP Site Visit	6	6	6					18	$ 4,056	$ 1,100	$ 1,155		$ 2,255	$ 500	$ -	$ -	$ 6,811
Task 1.2 - Monthly Project Status Reports and Invoices (7 reports)	4		8		8			20	$ 3,260				$ -	$ -	$ -	$ -	$ 3,260
Task 1.3 - Team Coordination Activities	7							7	$ 1,757				$ -	$ -	$ -	$ -	$ 1,757
Task 1 Subtotal	**17**	**6**	**14**	**0**	**8**	**0**	**0**	**45**	**$ 9,073**	**$ 1,100**	**$ 1,155**	**$ -**	**$ 2,255**	**$ 500**	**$ -**	**$ -**	**$ 11,828**
Task 2 - Existing WWTP CEC Testing and Regulatory Considerations																	
Task 2.1 - Background Data Collection and Review	1	6	16	16	1	0	0	40	$ 7,266				$ -	$ -	$ -	$ -	$ 7,266
Task 2.2 - WWTP Water Quality Sampling and Testing Program and Regulatory Review	2	8	20	46	4		2	82	$ 14,162	$ 1,540	$ 963		$ 2,503	$ -	$ -	$ -	$ 16,665
Task 2.3 - Technology Options and Treatment Performance Literature Review	4	12	36	34	4		2	92	$ 16,808	$ 1,320	$ 1,540		$ 2,860	$ -	$ -	$ -	$ 19,668
Task 2.4 - WWTP CEC Sampling and Testing Program Data and Regulatory Considerations Review Workshop	4	6	6	4	1			21	$ 4,261	$ 660	$ 385		$ 1,045	$ 500	$ -	$ -	$ 5,806
Task 2 Subtotal	**11**	**32**	**78**	**100**	**10**	**0**	**4**	**235**	**$ 42,497**	**$ 3,520**	**$ 2,888**	**$ -**	**$ 6,408**	**$ 500**	**$ -**	**$ -**	**$ 49,405**
Task 3 - WWTP Treatment Capacity Evaluation and Pretreatment Program Support																	
Task 3.1 - Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation	8	16	32	40	2	4	2	104	$ 19,326	$ -	$ -		$ -	$ 72	$ -	$ -	$ 19,398
Task 3.2 - HSW Discharger Site Visit & Documentation	12	4	12	8	2			38	$ 7,654	$ -	$ -		$ -	$ -	$ -	$ -	$ 7,654
Task 3.3 - HSW Discharger Pretreatment Recommendations	12	16	16	40	4		2	90	$ 16,856	$ -	$ -		$ -	$ 500	$ -	$ -	$ 17,356
Task 3.4 - Pretreatment/FOG Ordinance 3rd Party Review Support	8	4	4	8	1		2	27	$ 5,551	$ -	$ -		$ -	$ -	$ -	$ -	$ 5,551
Task 3.5 - WWTP Capacity and Pretreatment Recommendations Review Workshop	4	6	6	4	1			21	$ 4,261	$ -	$ -		$ -	$ 500	$ -	$ -	$ 4,761
Task 3 Subtotal	**44**	**46**	**70**	**100**	**10**	**4**	**6**	**280**	**$ 53,648**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,072**	**$ -**	**$ -**	**$ 54,720**
Task 4 - Public Process																	
Task 4.1 - Prepare Powerpoint Presentation	8	12	12	20	6	0	2	60	$ 11,254		$ -		$ -	$ -	$ -	$ -	$ 11,254
Task 4.2 - UAC and City Council Presentations	16	4	16	8	4	0	0	48	$ 9,604			$ 5,446	$ 5,446	$ 2,000	$ -	$ -	$ 17,050
Task 4 Subtotal	**24**	**16**	**28**	**28**	**10**	**0**	**2**	**108**	**$ 20,858**	**$ -**	**$ -**	**$ 5,446**	**$ 5,446**	**$ 2,000**	**$ -**	**$ -**	**$ 28,304**
SUB-TOTAL	***96***	***100***	***190***	***228***	***38***	***4***	***12***	***668***	***$ 126,076***	***$ 4,620***	***$ 4,043***	***$ 5,446***	***$ 14,109***	***$ 4,072***	***$ -***	***$ -***	***$ 144,257***
PLUS: ANALYTICAL TESTING ALLOWANCE									***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 16,198***	***$ -***	***$ -***	***$ 16,198***
TOTAL BUDGET INCL. ANALYTICAL TESTING ALLOWANCE									***$ 126,076***	***$ 4,620***	***$ 4,043***	***$ 5,446***	***$ 14,109***	***$ 20,270***	***$ -***	***$ -***	***$ 160,455***

PRELIMINARY PROJECT SCHEDULE

WWTP CEC REMOVAL EVALUATION AND PRETREATMENT PROGRAM SUPPORT
CITY OF BAINBRIDGE ISLAND, WA

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Task 1 – Project Management**	**174 days**	**Tue 10/1/19**	**Fri 5/29/20**	
2	**1.1 Project Kick-off Meeting and WWTP Site Visit**	**0 days**	**Tue 10/1/19**	**Tue 10/1/19**	
3	**1.2 Monthly Project Status Reports and Invoices**	174 days	Tue 10/1/19	Fri 5/29/20	2
4	**1.3 Team Coordination Activities**	174 days	Tue 10/1/19	Fri 5/29/20	3SS
5	**Task 2 – Existing WWTP CEC Testing and Regulatory Considerations**	**118 days**	**Tue 10/1/19**	**Thu 3/12/20**	
6	**2.1 Background Data Collection and Review**	**10 days**	**Tue 10/1/19**	**Mon 10/14/19**	2
7	**2.2 WWTP Water Quality Sampling and Testing Program and Regulatory Review**	**95 days**	**Tue 10/15/19**	**Mon 2/24/20**	
8	Prepare Draft TM-01A WWTP WQ Sampling and Testing Protocol	7 days	Tue 10/15/19	Wed 10/23/19	6
9	TM-01A Draft Submittal to City	0 days	Wed 10/23/19	Wed 10/23/19	8
10	TM-01A City Review Period	10 days	Thu 10/24/19	Wed 11/6/19	9
11	TM-01A Incorporate City comments and Prepare Final TM	3 days	Thu 11/7/19	Mon 11/11/19	10
12	**WWTP Sampling and Testing Program**	**40 days**	**Mon 11/18/19**	**Mon 1/13/20**	
13	Sample Event #1: CEC and Influent Characterization	0 days	Mon 11/18/19	Mon 11/18/19	11FS+5 days
14	Sample Event #2: CEC and Influent Characterization	0 days	Mon 12/16/19	Mon 12/16/19	13FS+20 days
15	Sample Event #3: Influent Characterization only	0 days	Mon 1/13/20	Mon 1/13/20	14FS+20 days
16	Prepare Draft TM-01B WWTP WQ Sampling and Testing Program Data Report and Regulatory Review	20 days	Tue 1/14/20	Mon 2/10/20	15
17	TM-01B Draft Submittal to City	0 days	Mon 2/10/20	Mon 2/10/20	16
18	TM-01B City Review Period	10 days	Tue 2/11/20	Mon 2/24/20	17
19	**2.3 Technology Options and Treatment Performance Literature Review**	**50 days**	**Thu 1/2/20**	**Wed 3/11/20**	
20	Prepare Draft TM-02 Treatment Technologies and Performance Literature Review	40 days	Thu 1/2/20	Wed 2/26/20	14FS+12 days
21	TM-02 Draft Submittal to City	0 days	Wed 2/26/20	Wed 2/26/20	20
22	TM-02 City Review Period	10 days	Thu 2/27/20	Wed 3/11/20	21
23	**2.4 WWTP CEC Sampling and Testing Program Data and Regulatory Considerations Review Workshop**	**0 days**	**Thu 3/12/20**	**Thu 3/12/20**	22FS+1 day,18
24	**Task 3 - WWTP Treatment Capacity Evaluation and Pretreatment Program Support**	**107 days**	**Tue 12/17/19**	**Wed 5/13/20**	**2FS+1 day**
25	**3.1 Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation**	**60 days**	**Tue 12/17/19**	**Mon 3/9/20**	
26	Prepare Draft Winslow WWTP BOD Treatment Capacity and Upgrades Evaluation (TM-03)	50 days	Tue 12/17/19	Mon 2/24/20	13FS+20 days
27	TM-03 Draft Submittal to City	0 days	Mon 2/24/20	Mon 2/24/20	26
28	TM-03 City Review Period	10 days	Tue 2/25/20	Mon 3/9/20	27
29	**3.2 HSW Discharger Site Visit & Documentation**	**35 days**	**Tue 12/17/19**	**Mon 2/3/20**	
30	HSW Discharger Site Visit with City Staff	0 days	Tue 12/17/19	Tue 12/17/19	26SS
31	City Sampling of HSW Dischargers	30 days	Tue 12/17/19	Mon 1/27/20	30
32	HSW Discharger Site Visits Documentation	5 days	Tue 1/28/20	Mon 2/3/20	31
33	**3.3 HSW Discharger Pretreatment Recommendations**	**40 days**	**Tue 2/25/20**	**Mon 4/20/20**	
34	Prepare Draft HSW Discharger Pretreatment Recommendations TM-04	30 days	Tue 2/25/20	Mon 4/6/20	27
35	TM-04 Draft Submittal to City	0 days	Mon 4/6/20	Mon 4/6/20	34
36	TM-04 City Review Period	10 days	Tue 4/7/20	Mon 4/20/20	35
37	**3.4 Pretreatment/FOG Ordinance 3rd Party Review Support**	**33 days**	**Tue 2/25/20**	**Thu 4/9/20**	**34SS**
38	**3.5 WWTP Capacity and Pretreatment Recommendations Review Workshop**	**15 days**	**Wed 4/22/20**	**Wed 5/13/20**	
39	WWTP Capacity and Pretreatment Recommendations Review Workshop	0 days	Wed 4/22/20	Wed 4/22/20	36FS+2 days
40	Incorporate City Comments and Finalize TM-03 and TM-04	15 days	Thu 4/23/20	Wed 5/13/20	39
41	**Task 4 - Public Process**	**23 days**	**Thu 4/23/20**	**Tue 5/26/20**	
42	**4.1 Prepare Powerpoint Presentations**	15 days	Thu 4/23/20	Wed 5/13/20	40SS
43	**4.2 UAC and City Council Presentations**	**9 days**	**Wed 5/13/20**	**Tue 5/26/20**	
44	UAC Meeting Presentation (2nd & 4th Wednesdays of the month)	0 days	Wed 5/13/20	Wed 5/13/20	
45	City Council Presentation (2nd and 4th Tuesdays of the month)	0 days	Tue 5/26/20	Tue 5/26/20	



Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM 17614-7

TO:	CHARLES KRUMHEUER, PUBLIC WORKS MANAGER CHRIS MUNTER, P.E., PROJECT ENGINEER
FROM:	KEITH STEWART, P.E. RUSSELL PORTER, P.E.
DATE:	SEPTEMBER 5, 2018
SUBJECT:	WATER SYSTEM IMPROVEMENTS SUMMARY CITY OF BAINBRIDGE ISLAND, KITSAP COUNTY, WASHINGTON G&O #17614.00

INTRODUCTION

The City of Bainbridge Island (City) contracted with Gray & Osborne to complete the 2018 Water System Improvements project. The first phase of this project included an assessment of various water system issues including the following:

- Water quality issues associated with groundwater wells and treatment facilities,
- Existing storage tank seismic and coating issues,
- Water system pressure at select locations within the service area, and
- Standby power requirements for select facilities.

During the course of this project, Gray & Osborne personnel completed several site visits to City water system facilities and authored six individual technical memoranda that address the topics described above. The purpose of this memorandum is to summarize the findings of the previous memos and to provide additional insights on how recommendations in the individual technical memoranda may fit within the overall goals of the City, which include improving water quality, addressing low system pressure and storage tank deficiencies, and providing cost-effective, long-lasting water system infrastructure facilities.

BACKGROUND AND EXISTING FACILITIES

The City owns and operates four unique municipal water systems. One of these water systems, the Winslow Water System, is the subject of this evaluation. The Winslow system serves the downtown core, a strip of properties across the center of the island

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along New Brooklyn Road, and the Fletcher Bay region on the western side of the island. The Winslow Water System is comprised of two pressure zones, High and Low. City-owned water facilities within the Winslow water system are shown on Figure 1. Individual components of the Winslow Water System are further described in the associated technical memoranda summarized below.

TECHNICAL MEMORANDA SUMMARY

Technical Memorandum 17614-1 – Water Quality

This memorandum analyzed publicly available water quality data for source water from the Fletcher Bay, Head of the Bay, and Sands well sites. Gray & Osborne compiled and tabulated historical data in an attempt to identify trends or values that exceed current water quality standards. At all three locations, hydrogen sulfide was present in the source water; however, it appears that this compound is oxidized through the existing chlorine injection systems and is not present in finished water samples. Water from the Sands source exhibits high chlorine demand, which may contribute to low chlorine residuals within the distribution system. Water from the Head of the Bay source exhibits high levels of manganese.

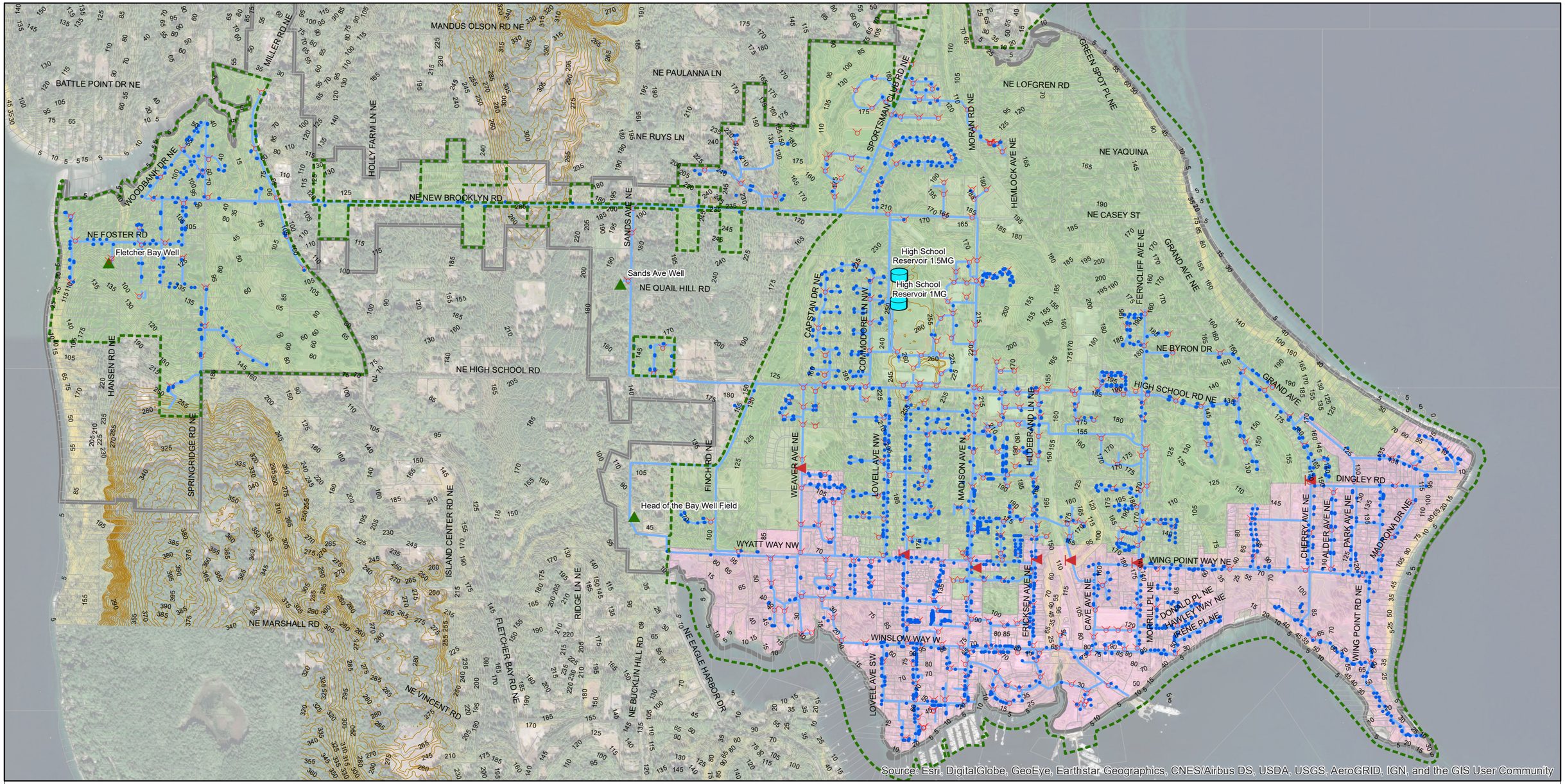
As a result of this memorandum, additional testing was performed from various water sources and the findings from this additional testing helped guide the selection of treatment alternatives described in Technical Memorandum 17614-2.

Technical Memorandum 17614-2 – Water Treatment Assessment

This memorandum built on the follow-up testing completed as part of Technical Memorandum 17614-1. Various treatment alternatives were investigated for all three water source facilities.

Because no significant water quality issues were identified at Fletcher Bay, no additional treatment was recommended for this location.

For the Sands source, the removal of excess organic material utilizing both powdered and granular activated carbon, as well as the removal of sodium utilizing reverse osmosis was investigated. Our recommendation included additional monitoring/testing and the completion of a pilot study for removal of organic material using granular activated carbon. The removal of sodium through reverse osmosis was not cost effective and no additional treatment was recommended at this time.



LEGEND

- WATER SERVICE AREA
- PARCELS
- HIGH PRESSURE ZONE
- LOW PRESSURE ZONE
- PIPES
- 5FT CONTOUR
- ELEVATION > 250FT
- RESERVOIR
- WATER METER
- WATER HYDRANT
- WELL
- PRV
- WINSLOW RWSA

N

0 750 1,500 3,000 Feet

CITY OF BAINBRIDGE ISLAND
WATER SYSTEM IMPROVEMENTS PLAN

2017 WATER SYSTEM IMPROVEMENTS ANALYSIS
FIGURE 1
EXISTING WATER SYSTEM FACILITIES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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At Head of the Bay, media filtration including Birm®, Greensand/Greensand Plus®, and pyrolusite were investigated. Our recommendation for manganese removal included conducting a pilot study using pyrolusite technology.

Technical Memorandum 17614-3 – Auxiliary Generator Predesign

This memorandum summarized an electrical assessment of the existing Head of the Bay well site and provided recommendations for a new auxiliary generator. The generator would be a permanent unit housed at the facility and would provide backup power for this source of supply during power outages. For this facility, a 250-kilowatt generator was proposed which would support current loads as well as future loads from potential manganese treatment equipment. The generator would also include a subbase fuel tank, sound-reducing enclosure, and an automatic transfer switch. The memorandum also discussed additional modifications to existing facilities that would be required to meet current electrical codes and accommodate a pyrolusite manganese treatment system.

Technical Memorandum 17614-4 – Existing Reservoir Evaluation

This memorandum investigated the two existing reservoirs, Reservoir 1 and Reservoir 2, which are located just west of the High School and east of Commodore Lane. The physical condition, seismic design parameters, and coating system were assessed by Gray & Osborne engineers and this memorandum summarizes the findings of this investigation. Reservoir 1 was found to be seismically deficient per current building codes and the coating system on the exterior of Reservoir 1 appears to be failing. Reservoir 2 was also found to be seismically deficient; however, the existing exterior coating system is in serviceable condition. The memorandum summarized the modifications and associated costs for coating recommendations as well as recommendations required to bring each reservoir up to current seismic code.

Technical Memorandum 17614-5 – Pressure Zone Evaluation

This memorandum evaluated the existing pressure zones for the Winslow Water System and provided alternatives to address specific areas of low pressure within the service area. Alternatives discussed include the addition of booster stations, interties with neighboring water systems, construction of a new storage reservoir, or a combination of these three components. Ultimately, our recommendation was to construct a new, taller storage reservoir with a hydraulic grade line of approximately 385 feet which would address the seismic deficiencies of Reservoirs 1 and 2, address low water pressure within the distribution system, address water system storage deficiencies identified in the City's Draft Water System Plan (Carollo, 2015), and improve water quality within both the reservoirs and the distribution system.

Technical Memorandum 17614-6 – Reservoir Mixing Analysis

This memorandum identified several existing water quality issues within both storage reservoirs as well as within the distribution system. Both thermal stratification and high water age within the reservoirs lead to low chlorine residual readings within the distribution system. Several alternatives for mixing the water within the reservoir were identified, including both mechanical and passive mixing systems. Recommendations to improve distribution system water quality include the completion of seasonal testing of each reservoir to verify the level of thermal stratification within the reservoirs, installation of reservoir mixing equipment, and additional reservoir and system testing to verify that chlorine residuals within the distribution system have increased. If an increase cannot be verified, a chlorine injection system could be installed at either of the existing reservoirs. This injection system will combat the high chlorine demand of Sands source water and will increase the chlorine residual within the distribution system.

WATER SYSTEM IMPROVEMENTS SUMMARY

Although there are several permutations of the alternatives identified in the technical memoranda summarized above, the following recommendations will help the City efficiently and holistically meet their stated project goals of improving water quality, addressing low system pressure, and correcting storage tank deficiencies:

1. Complete a Formal Predesign Report for New Storage Reservoir

- A predesign report will include a storage analysis, development of preliminary design criteria, and an evaluation of the existing source booster pumps to ensure that they are large enough to accommodate a new, taller Reservoir 1.
- The predesign report will be provided to DOH for review and comment and once approved, will provide the basis of design for a new reservoir.

2. Construct a New Water Storage Reservoir

- A new reservoir should be constructed to raise the hydraulic grade line of the existing High Zone, which would eliminate areas of low pressure within the distribution system, most notably along Commodore Lane, Grizdale Drive, and Mandus Olson Road.
- The new reservoir should provide at least 1 million gallons of water above an elevation of 341 feet. A volume above this elevation will ensure that the City's storage facilities meet DOH standard design guidelines for

operational, equalizing, and fire suppression storage through the year 2035.

- The new reservoir should have separate inlet and outlet piping in order to promote high turnover within the tank, which will reduce the water age and improve chlorine residuals within the distribution system.
- The new reservoir should be constructed at or near the existing High School Reservoir 1, and may involve additional property acquisition or easements during and/or after construction.
- To ensure sufficient mixing within the reservoir and that water delivered to the distribution system has consistently high-quality water, the City should consider providing a passive mixing system, such as a Tideflex® system on the reservoir inlet piping.
- Modifications to the existing source well pumps will likely be required. The upgrades are necessary to successfully move water from the well sites to the new, taller Reservoir 1.
- Initially, Reservoir 2 should be cleaned, maintained, and used for temporary storage during periods when Reservoir 1 must be taken offline. The City may elect to remove Reservoir 2 at a later date and utilize this property for other purposes at its discretion.

3. Complete a Pilot Study to Verify the Effectiveness of Pyrolusite in Removing Iron and Manganese from Head of the Bay Source Water

- The pilot study should be conducted by the filter supplier and should utilize source water from Head of the Bay. The testing should verify the effectiveness of the pyrolusite media and should provide an estimate of filter media life for operational planning and budgeting purposes.

4. Complete a Formal Predesign Report for New Manganese Treatment Equipment

- A predesign report will include a summary of historical water quality data and will describe the effectiveness of pyrolusite at removing manganese from source water from Head of the Bay. The report will identify preliminary design criteria and further refine the estimated cost for this facility.
- The predesign report will be provided to DOH for review and comment and once approved, will provide the basis of design for the new treatment system and facility modifications.

5. Design and Construct a Manganese Treatment System as Well as an Auxiliary Generator System at Head of the Bay

- Assuming that pyrolusite is effective at removing iron and manganese from Head of the Bay source water, the well site facility should be modified to include a pyrolusite treatment system and other building upgrades. Pyrolusite treatment equipment is desirable because it is cost effective and the City already operates a similar treatment system at the Rockaway Beach well facility.
- In conjunction with this project, the City should install an auxiliary generator and automatic transfer switch in order to provide power to the Head of the Bay well facility during power outages.
- Other electrical upgrades required to bring the overall electrical system up to current code and to operate the system at maximum efficiency should also be completed at this time.

6. Complete Additional Water Quality Monitoring

- Additional water quality monitoring for chlorine residual, manganese, and other parameters should be conducted on a regular basis to ensure high-quality water and identify trends as they develop.

7. Design and Install Additional Reservoir Water Quality Equipment

- If construction of a new reservoir and continued water quality monitoring do not verify an improvement in distribution system water quality, the City should then pursue installation of additional reservoir mixing equipment or supplemental chlorination equipment.

The recommendations listed above are summarized in Table 1 below, along with estimated project costs.

TABLE 1

Bainbridge Island Water System Improvement Recommendations Summary

Project	Capital Cost
Reservoir 1 Predesign Analysis	$40,000–$50,000
New Reservoir 1	$3.7–$4.0 million
Reservoir 1 Well/Booster Pump Modifications	$1.0–$1.5 million
Manganese Pilot Study	$15,000–$20,000
Manganese Predesign Analysis	$40,000–$50,000
Manganese Treatment Equipment	$1.2–$1.5 million
Auxiliary Generator	$150,000–$250,000
Water Quality Monitoring	$5,000–$10,000 annually
Additional Reservoir Water Quality Equipment	$100,000–$120,000
Subtotal (1)	$6.25–$7.49 million
Contingency (25%)	$1.56–$1.87 million
Washington State Sales Tax (9.0%)	$0.70–$0.84 million
Design and Project Administration (25%)	$2.13–$2.55 million
Total	**$10.64–$12.76 million**

(1) Subtotal does ***NOT*** include annual water quality monitoring.

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM 17614-8

TO: CHARLES KRUMHEUER, PUBLIC WORKS MANAGER
CHRIS MUNTER, P.E., PROJECT ENGINEER
FROM: KEITH STEWART, P.E.
RUSSELL PORTER, P.E.
DATE: MARCH 14, 2019
SUBJECT: SELECTED PRESSURE ZONE ALTERNATIVES ANALYSIS, WATER SYSTEM IMPROVEMENTS
CITY OF BAINBRIDGE ISLAND, KITSAP COUNTY, WASHINGTON
G&O #17614.00

INTRODUCTION

The City of Bainbridge Island (City) contracted with Gray & Osborne to assess areas of low water pressure within the existing High Pressure Zone of the Winslow Water System. This task is part of a larger water system improvement project designed to address water quality issues for treated groundwater, investigate existing storage tank seismic and coating issues, address water system pressure at select locations within the service area, and identify standby power requirements for select facilities.

To date, a total of seven technical memoranda have been developed and submitted to the City as follows:

- Technical Memorandum 17614-1 – Water Quality Analysis Conclusions
- Technical Memorandum 17614-2 – Water Treatment Analysis
- Technical Memorandum 17614-3 – Standby Generator Predesign
- Technical Memorandum 17614-4 – High School Reservoir Evaluation
- Technical Memorandum 17614-5 – Pressure Zone Alternatives Analysis
- Technical Memorandum 17614-6 – Storage Reservoir Mixing Analysis
- Technical Memorandum 17614-7 – Water System Improvements Summary

Technical Memorandum 17614-5 highlighted eight different alternatives for addressing seismic deficiencies, pressure issues, and water quality issues within the City's Winslow Water System. Of these eight alternatives, three were selected for further consideration. This memorandum provides a more complete analysis of these alternatives and provides

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specific design criteria so that the City can identify and proceed with a cost-effective solution that addresses both short- and long-term goals for the Winslow system.

The purpose of this memorandum is to optimize the configuration of a new reservoir in order to increase the system pressure to specific areas of the water system, limit the impacts of excessive pressure throughout the remaining water system, and minimize dead storage within the system which will help improve overall system water quality.

BACKGROUND AND EXISTING FACILITIES

The City owns and operates four unique municipal water systems, one of which is the Winslow Water System. The Winslow system serves the downtown core, a strip of properties across the center of the island along New Brooklyn Road, and the Fletcher Bay region on the western side of the island. The Winslow Water System is comprised of two pressure zones, High and Low. City-owned water facilities as well as the Winslow Water System are shown on Figure 1 (Exhibit A).

Reservoirs

Reservoirs 1 and 2 were fully described in previous memoranda; however, design information for the reservoirs is summarized in Table 1. A coating and seismic analysis of both reservoirs was completed by Gray & Osborne and the results of this analysis are included in Technical Memorandum 17614-4.

TABLE 1

Bainbridge Island Storage Reservoir Summary

Parameter	Reservoir 1	Reservoir 2
Type	Aboveground	Aboveground
Composition	Welded Steel	Welded Steel
Diameter (ft)	46	53
Typical Water Height (ft)	79.5	79.5
Side Wall Height (ft)	82.5 (1)	89.3
Base Elevation (ft)	253.3	246.3
Overflow Elevation (ft)	334.0	335.6 (2)
Overflow Height (ft)	80.7	89.3
Operational Storage (gal) (3)	99,440	132,010
Equalizing Storage (gal) (4)	0	0
Fire Flow Storage (gal) (5)	285,890	379,550
Dead Storage (gal) (6)	658,790	990,120
Volume (gal)	1,003,180	1,473,650
Volume per Foot (gal/ft)	12,430	16,500
Year Constructed	1973	1989
Pump On Set Point (ft)	71.5	— (7)
Pump Off Set Point (ft)	79.5	— (7)
Inlet Type	Common with Outlet	Common with Outlet
Outlet Type	Common with Inlet	Common with Inlet

(1) Estimate based on available information.
(2) Effective overflow height is 334.0 feet in order to match operations within Reservoir 1.
(3) Calculated using pump operational set points and the estimated volume per foot.
(4) Calculated as the total volume less operational, fire flow, and dead storage.
(5) Calculated as total volume stored between elevation at 30 psi (329 feet) and 20 psi (306 feet) using a maximum service elevation of 260 feet.
(6) Calculated as total volume stored below elevation at 20 psi above the maximum service elevation of 260 feet.
(7) Set points are controlled based on the elevation of water within Reservoir 1.

Pressure Zones

The Winslow Water System is divided into two pressure zones, High and Low. The High Zone serves most of the system north of Wyatt Way and has a hydraulic grade line (HGL) of 334 feet. The Low Zone is served by six active pressure reducing valve (PRV) stations and has an HGL of approximately 230 feet.

Distribution System

The distribution system consists of approximately 47 miles of pipe ranging in size from 2 to 12 inches in diameter with most of the pipe greater than 8 inches in diameter. Generally, the system is well looped. Distribution system piping is approximately 74 percent ductile iron (DI), 17 percent asbestos-cement (AC), 7 percent polyvinyl chloride (PVC), 1 percent galvanized iron, and 1 percent high-density polyethylene (HDPE). The highest development within the existing High Zone lies near the intersection of New Brooklyn Road and Mandus Olsen Road at an elevation of approximately 275 feet. The elevation of the highest water meter at this location is 258.6 feet. The highest development within the existing Low Zone is at an elevation of approximately 150 feet.

Low System Pressure

Following the Washington State Department of Health (DOH) storage volume requirements (WAC 246-290-235(3)) and the DOH *Water System Design Manual* (Manual), five components of storage, including operational, equalizing, standby, fire flow, and dead, must be considered for any water system. Operational and equalizing storage must be available to all customers at a residual pressure of at least 30 pounds per square inch (psi) during periods of peak hour demand while standby and/or fire flow storage must be available to all customers at a residual pressure of at least 20 psi during periods of maximum day demand. Furthermore, the Manual states that water system pressure should not exceed 100 psi, except under qualifying circumstances. Above 80 psi, the Uniform Plumbing Code (UPC) requires pressure reducing valves to be installed on individual services.

Given the natural topography of the Winslow Water System and the operational levels within Reservoirs 1 and 2, there are specific areas within the Winslow system that are susceptible to water pressures below 30 psi during peak hour demand and 20 psi during maximum day demand. To avoid costly and unnecessarily tall reservoirs – which may negatively impact system pressure, system operation, and water quality throughout the existing High Zone – the City has designated an elevation of 260 feet as the elevation for which it will provide the minimum required service pressures. This elevation is roughly equal to the elevation of the highest service meter along New Brooklyn Road. Figure 1 highlights topographic contours above this baseline elevation and their proximity to New Brooklyn Road and the area immediately adjacent to the existing High School Reservoirs. Any development above the baseline elevation of 260 feet will require an individual system analysis to ensure that pressure requirements are met. The City has determined that any booster stations required to provide additional pressure for services above 260 feet would be constructed by the individual property owner/developer.

A maximum service meter elevation of 260 feet will be used for all subsequent analysis and calculations of pressure and reservoir height requirements. Given this baseline elevation, fire flow storage must be above an elevation of 306 feet, which is equal to 260 feet plus 46 feet (20 psi). Equalizing and operational storage must be above an elevation of 329 feet, which is equal to 260 feet plus 69 feet (30 psi).

ALTERNATIVES ANALYSIS

As noted above from Technical Memorandum 17614-5, the City has selected three alternatives for further consideration. These alternatives include construction of a new reservoir and transmission main, construction of a new reservoir and booster station, and construction of a new reservoir that will raise the HGL for the existing High Zone. These alternatives were selected based on their overall feasibility, cost, and their effectiveness at addressing water quality, pressure, storage, and seismic issues with the existing water system.

As identified in Technical Memorandum 17614-4, Reservoir 1 has significant seismic deficiencies. Furthermore, the exterior coating system has failed or is failing across the entire surface of the reservoir. These issues, coupled with the high cost of the modifications required to seismically retrofit and recoat Reservoir 1, suggest that replacing Reservoir 1 with a new reservoir is the most cost-effective solution for the City. Furthermore, replacing Reservoir 1 with a new, larger reservoir would allow the City to address projected storage deficiencies identified in the Water System Plan. It would also allow the City to enact process and piping changes that would help improve the water quality within both reservoirs as well as the distribution system. The cost to replace Reservoir 1 in-kind with a similar reservoir that includes the following components is estimated at $3,540,000. A complete budgetary cost estimate is provided in Exhibit B:

- 1.0-million-gallon (MG) Welded Steel Reservoir
- Access Ports, Stairs, Landing, Platforms, etc.
- Valve Vault and Electrical
- Sitework and Site Restoration
- Contingency (30 percent)
- Washington State Sales Tax (9.0 percent)
- Design and Administration (25 percent)

The reservoir listed above, as well as each of the reservoirs in the alternatives that follow, would include a thick circular concrete footing, seismic anchorage and bracing, roof vent(s), at least two large roof access hatches, multiple 36-inch-diameter base access

ports, a full-circumference walkway with large work area near the access hatch, access stairs or ladders, and would be painted according to the City's standards.

Technical Memorandum 17614-4 presented the marginal costs for each of the reservoir replacement alternatives in order to more equitably compare the estimated costs. However, for this analysis, estimated project construction costs are provided with the assumption that the City intends to replace Reservoir 1 for the reasons listed above.

Alternative 1 – Reservoir Serves Higher Pressure Zones with Transmission Main

This alternative includes the creation of two new pressure zones, each with an HGL of 349 feet. The new zones would be served by a new reservoir and a new dedicated transmission main while the existing High Zone would continue to be served by Reservoir 2. Additional valves and fittings to isolate the newly created zones from the existing High Zone would be required.

The proposed reservoir would be located at the existing Reservoir 1 site and design criteria for this new reservoir are summarized in Table 2.

TABLE 2

Alternative 1 – Proposed Welded Steel Reservoir 1 Preliminary Design Criteria

Parameter	Value
Type	Welded Steel
Location	Existing Reservoir 1 Site
Diameter (ft)	50
Maximum Water Height (ft)	94
Side Wall Height (ft)	101
Base Elevation (ft)	253
Overflow Elevation (ft)	349
Overflow Height (ft)	96
Operational Storage (gal) (1)	102,800
Equalizing Storage (gal) (2)	161,500
Fire Flow Storage (gal) (3)	337,800
Dead Storage (gal) (4)	778,400
Volume (gal)	1,409,950
Volume per Foot (gal/ft)	14,687
Inlet Type	Top; Fed from Reservoir 1 Booster Station
Outlet Type	Bottom; Connects to Dedicated 8-inch Transmission Main

(1) Based on estimated volume of 100,000 gallons, final pump operational set points, and gallons per foot.
(2) Based on the estimated required volume of 224,000 gallons for the Winslow Water System in 2035 in accordance with the 2017 Water System Plan. Includes an estimated existing volume of 66,000 gallons in Reservoir 2.
(3) Based on the volume between 306 feet (20 psi) and 329 feet (30 psi) elevation within the proposed reservoir.
(4) Total volume stored below elevation 306 feet (20 psi).

As noted in Table 2, a large amount (55 percent) of the total storage would not be available above the design elevation of 260 feet at the minimum required value of 20 psi. The portion of a storage reservoir that is not available at 20 psi to the highest service elevation is called dead storage. Large volumes of dead storage within a reservoir can contribute to low water turnover, stratification, and other water quality issues both within the reservoir and within the distribution system. As such, reservoir designers typically try to minimize the volume of dead storage to the maximum extent possible.

As discussed in Technical Memorandum 17614-5, one alternative to providing water storage while minimizing the dead storage volume is an elevated storage tank, or Hydropillar®. These elevated tanks consist of a slender cylindrical support column with a storage tank on top, and can be fabricated to store between 100,000 and

1,000,000 gallons or more. Because the majority of the water is stored on top of the support column, Hydropillars typically contain minimal dead storage.

Hydropillars are typically slightly more expensive than standard welded steel tanks, but have the advantage of minimizing dead storage and also may eliminate the need for additional buildings or facilities. This is because the support column of a Hydropillar contains open space that is suitable for pumps, chemical dosing equipment, or storage. Preliminary design criteria for an elevated storage tank comparable to the reservoir described previously in this section are highlighted in Table 3. It should be noted that many of the geometrical values are estimates and may be subject to change based on final parameters.

TABLE 3

Alternative 1 – Proposed Hydropillar Preliminary Design Criteria

Parameter	Value
Type	Elevated, Hydropillar
Location	Existing Reservoir 1 Site
Base Column Diameter (ft)	40
Top Tank Diameter (ft)	36
Total Height (ft)	100
Base Elevation (ft)	253
Overflow Elevation (ft)	350
Overflow Height (ft)	97
Operational Storage (gal) (1)	72,000
Equalizing Storage (gal) (2)	158,000
Fire Flow Storage (gal) (3)	180,000
Dead Storage (gal) (4)	1,000
Volume (gal)	400,000
Volume per Foot, Top Section (gal/ft) (4)	13,000
Inlet Type	Top; Fed from Reservoir 1 Booster Station
Outlet Type	Bottom; Connects to Dedicated 8-inch Transmission Main

(1) Based on volume for standard elevated tank, less required equalizing and fire flow storage volume.
(2) Based on the estimated required volume of 224,000 gallons for the Winslow Water System in 2035 in accordance with the 2017 Water System Plan. Includes an estimated existing volume of 66,000 gallons in Reservoir 2.
(3) Based on the volume between 306 feet (20 psi) and 329 feet (30 psi) elevation within the proposed reservoir.
(4) Estimated value.

Regardless of whether a welded steel tank or a Hydropillar tank is utilized, the fire flow volume shown for the proposed reservoir includes only the fraction of total fire flow storage that is not provided by Reservoir 2. As such, Reservoirs 1 and 2 would need to be interconnected and equipped with specialized filling valves in order to provide the necessary system fire flow of 540,000 gallons to the High Zone. The proposed reservoir would provide adequate fire flow for the proposed service zone, which is 180,000 gallons (1,500 gpm for 120 minutes).

The High Zone would continue to be served by Reservoir 2 as well as the booster pumps at Fletcher Bay, Sands, and Head of the Bay (HOB). Additionally, Reservoir 2 would require selected seismic upgrades identified in Technical Memorandum 17614-4. The seismic recommendations listed in the memo included adding vertical ribs to address buckling failures, additional anchor bolts to address excessive bolt tension, and foundation modifications to address seismic overturning forces. The existing coating system is also in need of repair, but is suitable for at least 5 to 7 years and is not included with cost estimates provided in this analysis.

Newly created pressure zones are shown on Figure 2 and would have a hydraulic grade line of 350 feet. New transmission main piping would connect the new reservoir with both areas and would be 8-inch-diameter ductile iron or HDPE piping. This alternative would also require the installation of additional piping, valves, and appurtenances in order to separate the newly created 350 Zones from the existing High Zone.

Reservoir 1 would be filled by a dedicated booster station that would move water from Reservoir 2 to Reservoir 1. The Reservoir 1 Booster Station would consist of three pumps (two duty/one standby). For the welded steel reservoir, the pumps would be housed in a concrete masonry unit (CMU) building located near Reservoir 2. The enclosure would include lighting, heating and ventilation, electrical service, alarms, access doors, and would be installed on a concrete slab. For the Hydropillar, the pumps would be housed within the tank support structure. The support structure has open space that would be heated and ventilated to provide freeze protection and suitable operating conditions. The operation of these pumps would be controlled by the level in Reservoir 1 – either by floats, an ultrasonic level sensor, or submersible pressure transmitter. An auxiliary diesel generator would also be provided if desired. The addition of this booster station will help improve water quality within both Reservoirs 1 and 2 by improving water turnover and mixing within both tanks.

The estimated construction cost for this alternative with a welded steel reservoir is $15,204,000 while the estimated cost for this alternative with a Hydropillar is $12,879,000. Each of these estimates includes the items listed below. Complete

budgetary cost estimates are provided in Exhibit B. These estimates assume that the existing well site booster pumps do not need to be modified for this alternative:

- 1.40 MG Welded Steel Reservoir or 0.4 MG Hydropillar
- All Required Sitework and Appurtenances
- Connection to the Existing System
- Dedicated 8-inch Ductile Iron Transmission Main
- 500 gallons per minute (gpm) Reservoir 1 Booster Station
- Reservoir 2 Seismic Upgrades
- Additional Isolation Valves, Blowoff/Pressure Relief Assembly
- Pressure Monitoring Equipment
- Electrical, Telemetry, and Integration
- Contingency (30 percent)
- Washington State Sales Tax (9.0 percent)
- Design and Administration (25 percent)

Because the proposed welded steel reservoir contains a large volume of dead storage and serves only two small residential zones, it may be susceptible to low turnover and/or higher water age. A mechanical mixer may be effective in circulating the water and providing consistent water quality from the reservoir. Alternatively, the inlet piping could be fitted with a passive mixing manifold which would provide circulation of the reservoir contents when the Reservoir 1 Booster Station is in operation. Furthermore, the top inlet-bottom outlet piping orientation will also help improve water turnover within the reservoir, which should help provide consistent water quality within the distribution system. A Hydropillar reservoir would likely not exhibit this issue because of its small volume and very low dead storage volume.

Alternative 2 – New Reservoir Serves Adjacent High Zone and New Pump Station Serves New Brooklyn Zone

This alternative includes the creation of two new pressure zones: the New Brooklyn Zone and the Commodore Zone. The Commodore Zone would be served by a new reservoir and would have an HGL of 345 feet. The New Brooklyn Zone would be served by a new booster station connected to the existing High Zone along New Brooklyn Road and would have an HGL of 350 feet. Additional valves and fittings to isolate the newly created zones from the existing High Zone would also be required.

A proposed welded steel reservoir would be located at the existing Reservoir 1 site and design criteria for this new reservoir are summarized in Table 4.

TABLE 4

Alternative 2 – Proposed Welded Steel Reservoir 1 Preliminary Design Criteria

Parameter	Value
Type	Welded Steel
Location	Existing Reservoir 1 Site
Diameter (ft)	50
Maximum Water Height (ft)	90
Side Wall Height (ft)	97
Base Elevation (ft)	253
Overflow Elevation (ft)	345
Overflow Height (ft)	92
Operational Storage (gal) (1)	44,060
Equalizing Storage (gal) (2)	161,500
Fire Flow Storage (gal) (3)	337,800
Dead Storage (gal) (4)	778,400
Volume (gal)	1,351,200
Volume per Foot (gal/ft)	14,687
Inlet Type	Top; Fed from Reservoir 1 Booster Station
Outlet Type	Bottom; Connects to New Zone Distribution Piping

(1) Based on estimated volume of 100,000 gallons and gallons per foot.
(2) Based on the estimated required volume of 224,000 gallons for the Winslow Water System in 2035 in accordance with the 2017 Water System Plan. Includes an estimated existing volume of 66,000 gallons in Reservoir 2.
(3) Based on the volume between 306 feet (20 psi) and 329 feet (30 psi) elevation within the proposed reservoir.
(4) Total volume stored below elevation 306 feet (20 psi).

As with Alternative 1, a welded steel reservoir or a Hydropillar could be used to provide storage and pressure to the Commodore Zone. The design criteria for a Hydropillar in this alternative are identical to the tank proposed in Alternative 1. Design criteria for this tank are provided in Table 3.

Regardless of whether a welded steel tank or a Hydropillar tank is utilized, the fire flow volume included for the proposed reservoir includes only the fraction of total fire flow storage that is not provided by Reservoir 2. As such, Reservoirs 1 and 2 would need to be interconnected and equipped with specialized filling valves in order to provide the necessary system fire flow of 540,000 gallons to the High Zone. The proposed reservoir would provide adequate fire flow for the proposed service zone, which is 180,000 gallons (1,500 gpm for 120 minutes).

The High Zone would continue to be served by Reservoir 2 as well as the booster pumps at Fletcher Bay, Sands, and HOB. Additionally, Reservoir 2 would require selected seismic upgrades identified in Technical Memorandum 17614-4. The seismic recommendations listed in the memo included adding vertical ribs to address buckling failures, additional anchor bolts to address excessive bolt tension, and foundation modifications to address seismic overturning forces. The existing coating system is also in need of repair, but is suitable for at least 5 to 7 years and is not included with cost estimates provided in this analysis.

The Commodore Zone, located as shown on Figure 3 and sited around Commodore Lane directly west of the existing Reservoir 1, would be served directly through a connection to Reservoir 1 and would have an HGL of 345 feet. A dedicated outlet would connect with existing distribution system piping, and appropriate valves and appurtenances would be added to isolate this zone from the remaining High Zone.

The New Brooklyn Zone, located as shown on Figure 3 and sited along New Brooklyn Road near Mandus Olson Road, would be served by a dedicated booster station and would have an HGL of 350 feet. This booster station would be connected to the existing High Zone distribution system piping and would provide additional pressure for the service area. The booster station would consist of two operational pumps (one duty, one standby) and two fire flow pumps. Operational pumps would be sized to accommodate the peak hour flows for the service area and would be controlled by the downstream pressure. If the pressure drops below an operator-selectable set point, then the pumps would energize in order to provide additional pressure.

Reservoir 1 would be filled by a dedicated booster station that would move water from Reservoir 2 to Reservoir 1. The Reservoir 1 Booster Station will consist of three pumps (two duty/one standby). For the welded steel reservoir, the pumps would be housed in a CMU building located near Reservoir 2. The enclosure would include lighting, heating and ventilation, electrical service, alarms, access doors, and would be installed on a concrete slab. For the Hydropillar, the pumps would be housed within the tank support structure. The support structure has open space that would be heated and ventilated to provide freeze protection and suitable operation conditions. The operation of these pumps would be controlled by the level in Reservoir 1 – either by floats, an ultrasonic level sensor, or submersible pressure transmitter. An auxiliary diesel generator could also be provided if desired. The addition of this booster station will help improve water quality within both Reservoirs 1 and 2 by improving water turnover and mixing within both tanks.

The estimated construction cost for the proposed welded steel reservoir is $11,977,000 while the estimate for the proposed Hydropillar is $9,745,000. Each of these estimates

includes the items listed below. Complete budgetary cost estimates are provided in Exhibit B. These estimates assume that the existing well booster pumps will not need to be modified at this time.

- 1.35 MG Welded Steel Reservoir or 0.4 MG Hydropillar
- All Required Sitework and Appurtenances
- Connection to the Existing System
- 500 gpm Reservoir 1 Booster Station
- 500 gpm New Brooklyn Booster Station with 1,500 gpm Fire Flow Pumps
- Reservoir 2 Seismic Upgrades
- Additional Isolation Valves, Blowoff/Pressure Relief Assembly
- Pressure Monitoring Equipment
- Electrical, Telemetry, and Integration
- Contingency (30 percent)
- Washington State Sales Tax (9.0 percent)
- Design and Administration (25 percent)

Because the proposed welded steel reservoir contains a large volume of dead storage and serves only one small residential zone, it may be susceptible to low turnover and/or higher water age. A mechanical mixer may be effective in circulating the water and providing consistent water quality from the reservoir. Alternatively, the inlet piping could be fitted with a passive mixing manifold which would provide circulation of the reservoir contents when the Reservoir 1 Booster Station is in operation. Furthermore, the top inlet-bottom outlet piping orientation will also help improve water turnover within the reservoir, which should help provide consistent water quality within the distribution system. A Hydropillar reservoir would likely not exhibit this issue because of its small volume and very low dead storage volume.

Alternative 3 – New Reservoir Serves Expanded High Zone

This alternative would provide a new storage reservoir at the same location as Reservoir 1 and would raise the HGL of the existing High Zone including the Commodore neighborhood and the area off New Brooklyn Road. The improvements listed in this alternative are shown on Figure 4.

According to the City's draft Water System Plan, the existing reservoirs do not provide enough storage according to DOH design standards. The Manual provides equations to calculate the required volume of these storage components and any proposed reservoir should be able to provide the City with enough storage for at least a 20-year planning period. Using the formulas within the Manual and using a conservative peak hour demand projection of 3,290 gpm in 2035 from the Water System Plan, the City will

require approximately 224,000 gallons of equalizing storage in 2035. Additionally, 540,000 gallons of fire flow storage (3,000 gpm for 180 minutes) must be provided. Lastly, between 120,000 and 150,000 gallons of operational storage should be provided to minimize pump cycling and to promote good water turnover within the proposed Reservoir 1.

As discussed in Alternatives 1 and 2 above, both a welded steel reservoir and a Hydropillar tank are capable of providing the desired storage and pressure for the City's Winslow Water System.

Four potential reservoirs are identified in Table 5 that would meet the projected storage and pressure requirements for the City. Reservoir A is a welded steel reservoir and has a diameter only slightly larger than Reservoir 1. As such, this option would require minimal site modifications. Reservoir B is also a welded steel reservoir and has a diameter of 60 feet. Reservoir C is a welded steel reservoir with a diameter of 70 feet, which is the maximum diameter than can be constructed within the existing Reservoir 1 site and still maintain access around the circumference of the tank. Reservoir D is a Hydropillar and has a top diameter of approximately 61.5 feet.

TABLE 5

Proposed Reservoir Preliminary Design Criteria

Parameter	Reservoir A	Reservoir B	Reservoir C	Reservoir D
Type	Welded Steel	Welded Steel	Welded Steel	Elevated, Hydropillar
Location	Existing Reservoir 1 Site	Existing Reservoir 1 Site	Existing Reservoir 1 Site	Existing Reservoir 1 Site
Diameter (ft)	50	60	70	61.5 (top); 40 (support cylinder)
Maximum Water Height (ft)	115.5	96.5	89.5	96
Side Wall Height (ft)	122.5	103.5	96	45
Base Elevation (ft)	253	253	253	253
Overflow Elevation (ft)	370.5	351.5	344.5	355
Overflow Height (ft)	117.5	98.5	91.5	102
Operational Storage (gal) (1)	154,210	158,620	158,320	160,000
Equalizing Storage (gal) (2)	227,650	232,640	230,290	260,000
Fire Flow Storage (gal) (3)	543,440	549,870	662,080	570,000
Dead Storage (gal) (4)	778,410	1,120,910	1,525,680	10,000 (1)
Volume (gal)	1,721,780	2,077,210	2,497,250	1,000,000
Volume per Foot (gal/ft) (5)	14,687	21,149	28,786	22,222 (5)
Inlet Type	Common Inlet/Outlet with Passive Mixing Manifold	Common Inlet/Outlet with Passive Mixing Manifold	Common Inlet/Outlet with Passive Mixing Manifold	Common Inlet/Outlet with Passive Mixing Manifold
Additional High Zone Pressure (psi)	11	4	2	4

(1) Based on estimated volume of 150,000 gallons.
(2) Based on the estimated required volume of 224,000 gallons for the Winslow Water System in 2035 in accordance with the 2017 Water System Plan.
(3) Based on the volume between 306 feet (20 psi) and 329 feet (30 psi) elevation within the proposed reservoir.
(4) Total volume stored below elevation 306 feet (20 psi).
(5) Estimate based on best available information.

Because all four proposed reservoirs are taller than the existing Reservoir 1 and would be connected to the existing High Zone, all locations within the current High Zone will be subject to higher system pressures if either of these reservoirs is constructed. The estimated increase in pressure to the High Zone depends on the final reservoir height listed in Table 5. In general, the smaller the tank diameter, the higher the tank must be to provide the required projected storage volume. However, as the tank height increases, so too does the pressure in the existing High Zone. While some additional pressure may be acceptable, too much pressure will likely require that additional pressure reducing valves be installed, either at individual services or in portions of the distribution system. DOH recommends water service pressures not exceed 100 psi and a system pressure analysis would be required once the desired reservoir is selected to determine the number and location of additional pressure reducing valves that may be required. For the purposes of this analysis, it is assumed that two additional pressure reducing valve (PRV) stations will be required to address areas susceptible to pressures greater than 100 psi. This equipment is installed within buried vaults within the City right-of-way and includes specialized valves that reduce the pressure of water for all downstream connections. In general, services that will be susceptible to these higher pressures will be located in the northeast regions of the Winslow Water System at elevations less than approximately 115 feet.

Reservoirs A, B, and C also contain large dead storage volumes. As mentioned previously, large volumes of dead storage can negatively impact turnover and water quality within a reservoir and subsequently, a distribution system, and as such should be avoided where possible. If a welded steel reservoir is utilized, a mechanical or passive mixing system may help improve water quality within the reservoir.

A new taller reservoir may also have an impact on the existing well booster pumps. If a new taller reservoir is constructed, the static head on the existing booster pumps will increase, which would decrease the flow from these pumps to the new reservoir. Table 6 summarizes the existing head and flow from the existing booster pumps and estimates the impact to projected flows. It should be noted that this exercise was based on available information provided by the City and should be verified using additional analysis before proceeding further with design.

TABLE 6

Existing Booster Pump Flow Analysis Summary

Location	Current Water Height (ft)	Current Design Head (ft)	Current Flow (gpm) (1)	Proposed Water Height (ft)	Estimated Flow (gpm) (2)	Flow Reduction (gpm)
Reservoir A – Welded Steel (50 ft)						
Fletcher Bay	79.5	265	586	115.5	405	181
HOB 1	79.5	380	600	115.5	420	180
HOB 2	79.5	375	300	115.5	150	150
Sands 1	79.5	307	616	115.5	280	336
Sands 2	79.5	307	670	115.5	280	390
Total Estimated Reduction in Flow (gpm) (3)						**1,237**
Reservoir C – Welded Steel (70 ft)						
Fletcher Bay	79.5	265	586	89.5	520	66
HOB 1	79.5	380	600	89.5	500	100
HOB 2	79.5	375	300	89.5	175	125
Sands 1	79.5	307	616	89.5	380	236
Sands 2	79.5	307	670	89.5	380	290
Total Estimated Reduction in Flow (gpm) (3)						**817**
Reservoir D – Hydropillar						
Fletcher Bay	79.5	265	586	96	505	81
HOB 1	79.5	380	600	96	550	50
HOB 2	79.5	375	300	96	230	70
Sands 1	79.5	307	616	96	420	196
Sands 2	79.5	307	670	96	420	250
Total Estimated Reduction in Flow (gpm) (3)						**647**

(1) Flow and head data were collected from the proposed Water System Plan. It should be noted that some flow and head measurements significantly exceeded the pump curves provided for this analysis.
(2) Values listed are based on actual pump curves and not on 2014 test data.
(3) Total reduction in flow includes flow differentials for Fletcher Bay, HOB 1, and Sands 2 pumps.

Table 6 suggests that a shorter, wider tank will have less impact on the overall flow from each well to the proposed reservoir. It is important to note that the total estimated reduction in flow is for all pumps combined. Typically, all pumps are not operating simultaneously, and so the actual reduction in flow seen at the proposed reservoir would be less than the total volume listed. This decrease in flow could also be mitigated by

filling Reservoir 1 directly from Reservoir 2; however, this arrangement would require additional actuated valves, piping, fittings, and telemetry.

Lastly, the analysis above and cost estimates provided below assume that the Winslow Water System would be served solely by the new Reservoir 1. Reservoir 2, which also exhibited seismic deficiencies and coating fatigue described in Technical Memorandum 17614-4 could be removed from service. The City may elect to demolish the existing reservoir, decommission the reservoir but leave it empty in the event that Reservoir 1 must be taken out of service for cleaning/maintenance, or may continue to operate the reservoir to provide additional system capacity and fire flow. If Reservoir 2 is demolished, it reduces the level of redundancy available to the City, and accommodations should be made for when Reservoir 1 must be taken offline or drained for recoating. During this period, which can often last between 3 and 9 months, the existing well booster pumps must be able to provide enough flow and pressure to the distribution system during both peak/maximum demands as well as during fire flow situations. If Reservoir 2 remains in service, the inlet/outlet piping should be outfitted with an altitude valve so that it does not overflow from the resulting higher HGL in Reservoir 1. Furthermore, the turnover within Reservoir 2 may decrease due to the higher HGL of Reservoir 1. As such, a small booster station, mechanical mixer, or chlorine booster system may be warranted in order to provide consistent water quality from Reservoir 2 to the distribution system.

The estimated construction cost for a 70-foot-diameter welded steel reservoir (Reservoir C) is $11,261,000 while the estimate for the proposed Hydropillar (Reservoir D) is $10,238,000. Each of these estimates includes the items listed below. Complete budgetary cost estimates are provided in Exhibit B. These estimates assume that the existing booster pumps have capacity to provide water to the proposed reservoir.

- A 2.5 MG (70-foot-diameter) Welded Steel Reservoir or 1.0 MG Hydropillar
- All Required Sitework and Appurtenances
- Two Pressure Reducing Valve Stations
- Connection to the Existing System
- Small Booster Pump System for Reservoir 2 Turnover
- Reservoir 2 Seismic Upgrades
- Additional Isolation Valves, Blowoff/Pressure Relief Assembly
- Pressure Monitoring Equipment
- Electrical, Telemetry, and Integration
- Contingency (30 percent)

- Washington State Sales Tax (9.0 percent)
- Design and Administration (25 percent)

SUMMARY AND ANALYSIS

Table 7 below summarizes each of the various alternatives for both welded steel and Hydropillar reservoirs. Table 8 then highlights some of the primary advantages and disadvantages for each alternative.

TABLE 7

Alternative Cost Comparison Summary

Alternative	Description	Cost
1A	Welded Steel Reservoir (50 ft diam.)	$15,204,000
1B	0.4 MG Hydropillar	$12,879,000
2A	Welded Steel Reservoir (50 ft diam.)	$11,977,000
2B	0.4 MG Hydropillar	$9,745,000
3A	Welded Steel Reservoir (70 ft diam.)	$11,261,000
3B	1.0 MG Hydropillar	$10,238,000

TABLE 8

Alternative Comparison Summary

Alternative	Advantages	Disadvantages
1 – Reservoir with Transmission Main	• Address pressure and water quality issues	• High capital cost • Disruption during construction • Reservoir 2 must remain in service
2 – Reservoir with Booster Station	• Address pressure and water quality issues • Slightly smaller reservoir required • No transmission main required	• Higher maintenance • Higher O&M cost • Reservoir 2 must remain in service • Requires right-of-way or property acquisition
3 – Reservoir with Elevated High Zone HGL	• Address pressure, storage, and water quality issues • Reservoir 2 could be removed from service • No transmission main or system booster pumps required	• Potential impacts to High Zone • Potential impacts to booster pumps

To determine which alternative the City may wish to pursue, a decision matrix is a useful tool that will weigh the City's critical factors and rank each alternative according to these factors. The decision matrix shown in Table 9 below ranks each alternative according to the following factors:

- Capital Cost
- Operational Cost
- Constructability
- Addresses System Pressure
- Addresses System Storage
- Addresses Water Quality
- Complexity
- Environmental Impact

A score between 1 and 10 was given to each alternative for each factor, then the sum of all scores for all factors was tallied. For all factors, a higher score indicates it more successfully addresses the City's goals for each factor. A score of 10 was assigned to the

alternative the best suited a specific critical factor, and scoring for the remaining alternatives was made relative to the highest scoring alternative.

TABLE 9

Alternative Analysis Decision Matrix

Alternative	Capital Cost	Operational Cost	Constructability	Addresses System Pressure	Addresses System Storage	Addresses Water Quality	Complexity	Environmental Impact	Total
1A – Welded Steel Reservoir w/Transmission Main	4	8	6	10	7	8	8	6	**57**
1B – Hydropillar with Transmission Main	6	8	8	10	7	9	7	6	**61**
2A – Welded Steel Reservoir with Booster Station	8	6	8	10	7	8	6	8	**61**
2B – Hydropillar with Booster Station	10	6	8	10	7	10	5	8	**64**
3A – Welded Steel Res. w/Elev. High Zone HGL	8	10	10	9	10	7	10	10	**74**
3B – Hydropillar with Elevated High Zone HGL	9	10	10	8	10	9	9	10	**75**

The results from Table 9 suggest that a new reservoir that raises the HGL of the existing High Zone will most effectively accomplish the City's service goals regarding pressure, storage, and water quality.

RECOMMENDATIONS

Based on the design criteria and decision matrix shown above, we recommend that the City pursue the design of a single new reservoir to replace the existing Reservoir 1 as included with Alternative 3 and raise the HGL of the High Zone. The new reservoir should be sized to address the City's projected storage deficiencies for the year 2035 according to the design criteria listed in Table 10.

TABLE 10

Proposed Reservoir 1 Design Criteria

Parameter	Value
Type	Elevated, Hydropillar
Location	Existing Reservoir 1 Site
Diameter (ft)	61.5 (top); 40 (support cylinder)
Maximum Water Height (ft)	96
Side Wall Height (ft)	45
Base Elevation (ft)	253
Overflow Elevation (ft)	355
Overflow Height (ft)	102
Operational Storage (gal)	160,000
Equalizing Storage (gal)	260,000
Fire Flow Storage (gal)	570,000
Dead Storage (gal)	<10,000
Volume (gal)	1,000,000
Volume per Foot (gal/ft)	22,222
Inlet Type	Passive with Mixing Manifold
Additional High Zone Pressure (psi)	4

The reservoir could be constructed at the location of the existing Reservoir 1, or could be located on other City-owned property.

A new reservoir would address pressure issues by raising the HGL of the existing High Zone as well as areas previously identified as susceptible to low system pressure; would address storage deficiencies by increasing the size to accommodate operational, equalization, and fire flow storage per DOH requirements; would address current Reservoir 1 seismic and coating deficiencies by constructing a new reservoir designed to meet current seismic building codes; and would address water quality issues by including a passive mixing manifold on the inlet piping.

To further address water quality issues, if the City intends to keep Reservoir 2 in service, we recommend that the City modify the reservoir to improve mixing and water quality and prevent overflow. This could be through installation of a mechanical mixer or a passive mixing system on the inlet piping. A chlorine booster station may also be required in order to combat high water age, chlorine demand, and to ensure sufficient chlorine residual within Reservoir 2 and the distribution system. Reservoir 2 may also require a small booster pump station in order to provide enough turnover within the tank and reduce water age.

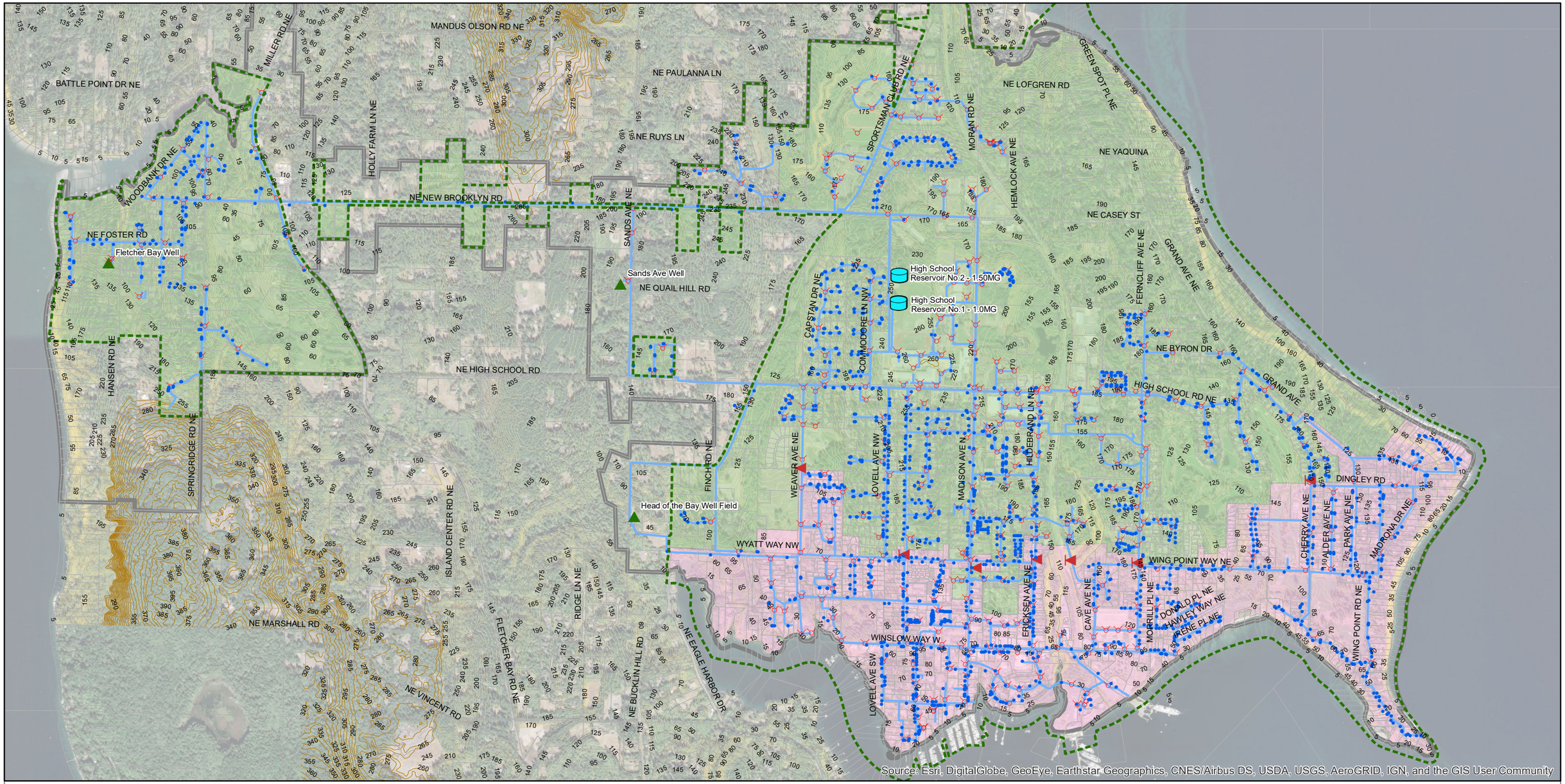
Because the new HGL of the recommended elevated storage tank is only moderately higher than the top of the existing operating storage, it is not anticipated that any modifications will be required to the individual well booster pumps. The reduction in flow for the well booster pumps is not anticipated to negatively affect system performance to the distribution system, and will only slightly reduce the potential flow to the proposed reservoir.

Lastly, a more formal system pressure analysis should be completed in order to determine the number of additional pressure reducing stations that may be necessary as a result of elevating the HGL for the existing High Zone.

A complete budgetary construction cost estimate for this alternative is provided in Exhibit B.

EXHIBIT A

FIGURES



LEGEND

- WATER SERVICE AREA
- PARCELS
- HIGH PRESSURE ZONE
- LOW PRESSURE ZONE
- PIPES
- 5FT CONTOUR
- ELEVATION >= 265FT
- RESERVOIR
- WATER METER
- WATER HYDRANT
- WELL
- PRV
- WINSLOW RWSA

N

0 750 1,500 3,000 Feet

CITY OF BAINBRIDGE ISLAND
WATER SYSTEM IMPROVEMENTS PLAN

2017 WATER SYSTEM IMPROVEMENTS ANALYSIS
FIGURE 1
EXISTING WATER SYSTEM FACILITIES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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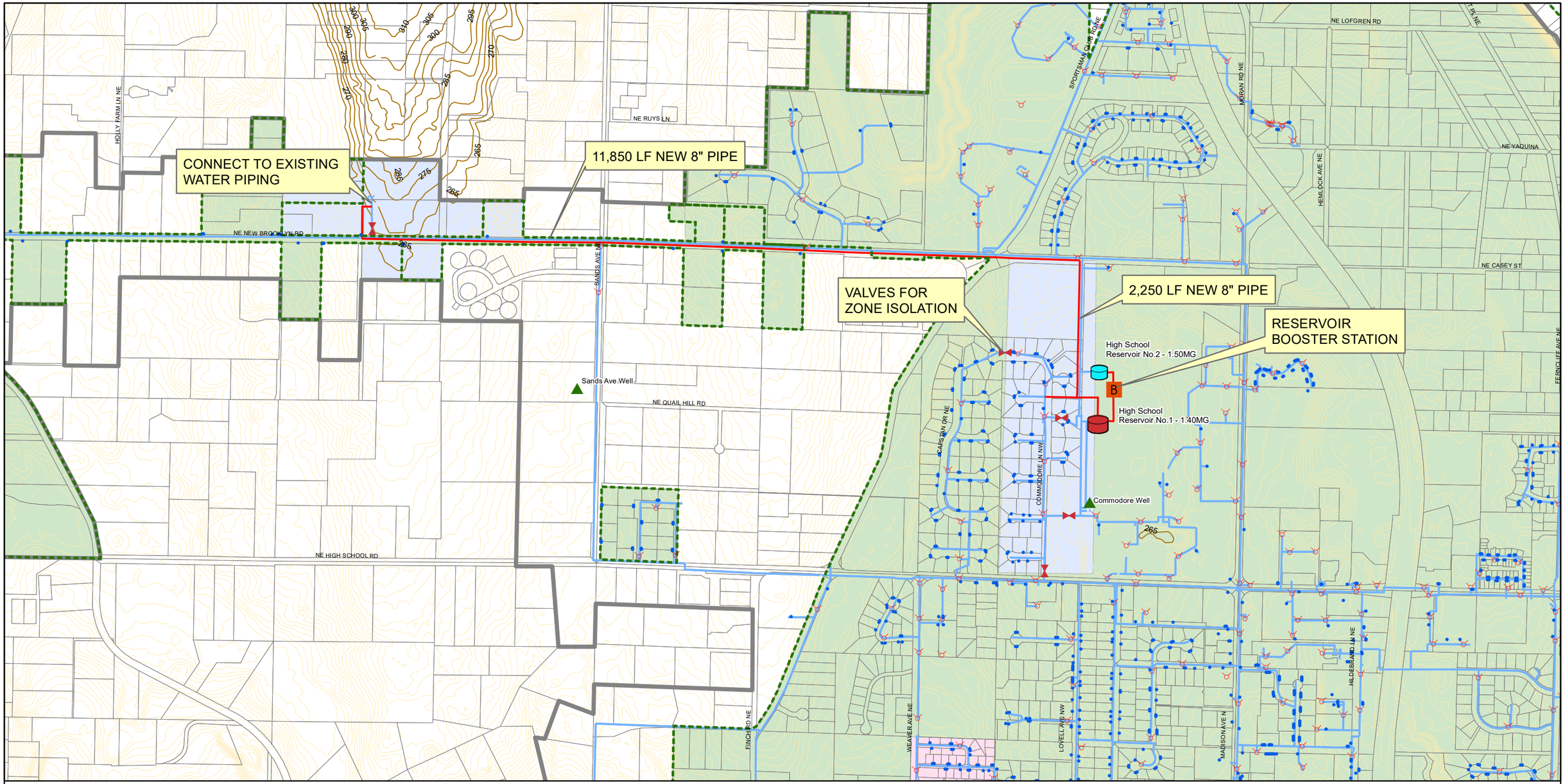

LEGEND

- WATER SERVICE AREA
- PARCELS
- HIGH PRESSURE ZONE
- LOW PRESSURE ZONE
- PROPOSED 347 ZONE
- PROPOSED IMPROVEMENTS
- PIPES
- 5FT CONTOUR
- ELEVATION >= 265FT
- RESERVOIR
- WATER METER
- WATER HYDRANT
- WELL
- PRV
- BOOSTER STATION
- ISOLATION VALVE
- WINSLOW RWSA
- PROPOSED RESERVOIR

N

0 400 800 1,600 Feet

CITY OF BAINBRIDGE ISLAND
WATER SYSTEMS IMPROVEMENT PLAN

2017 WATER SYSTEM IMPROVEMENTS ANALYSIS
FIGURE 2
REVISED ALTERNATIVE 1

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CONSULTING ENGINEERS

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NEW BROOKLYN BOOSTER STATION

RESERVOIR BOOSTER STATION

High School Reservoir No.2 - 1.50MG

New High School Reservoir No.1 - 1.35MG

Sands Ave Well

Commodore Well

NE PAULANNA LN

NE RUYS LN

NE NEW BROOKLYN RD

NE QUAIL HILL RD

NE HIGH SCHOOL RD

NE LOFGREN RD

HOLLY FARM LN NE

SANDS AVE NE

SPORTSMAN CLUB ROAD NE

MORAN RD NE

HEMLOCK AVE NE

CARSTON DR NE

COMMODORE LN NW

FINCH RD NE

WEANER AVE NE

LOWELL AVE NW

MADISON AVE N

HILDEBRAND LN NE

LEGEND

- WATER SERVICE AREA
- PARCELS
- HIGH PRESSURE ZONE
- LOW PRESSURE ZONE
- PROPOSED 347 ZONE
- PROPOSED IMPROVEMENTS
- PIPES
- 5FT CONTOUR
- ELEVATION >= 265FT
- RESERVOIR
- WATER METER
- WATER HYDRANT
- WELL
- PRV
- BOOSTER STATION
- ISOLATION VALVE
- WINSLOW RWSA
- PROPOSED RESERVOIR

N

0 400 800 1,600 Feet

CITY OF BAINBRIDGE ISLAND
WATER SYSTEMS IMPROVEMENT PLAN

2017 WATER SYSTEM IMPROVEMENTS ANALYSIS
FIGURE 3
REVISED ALTERNATIVE 2

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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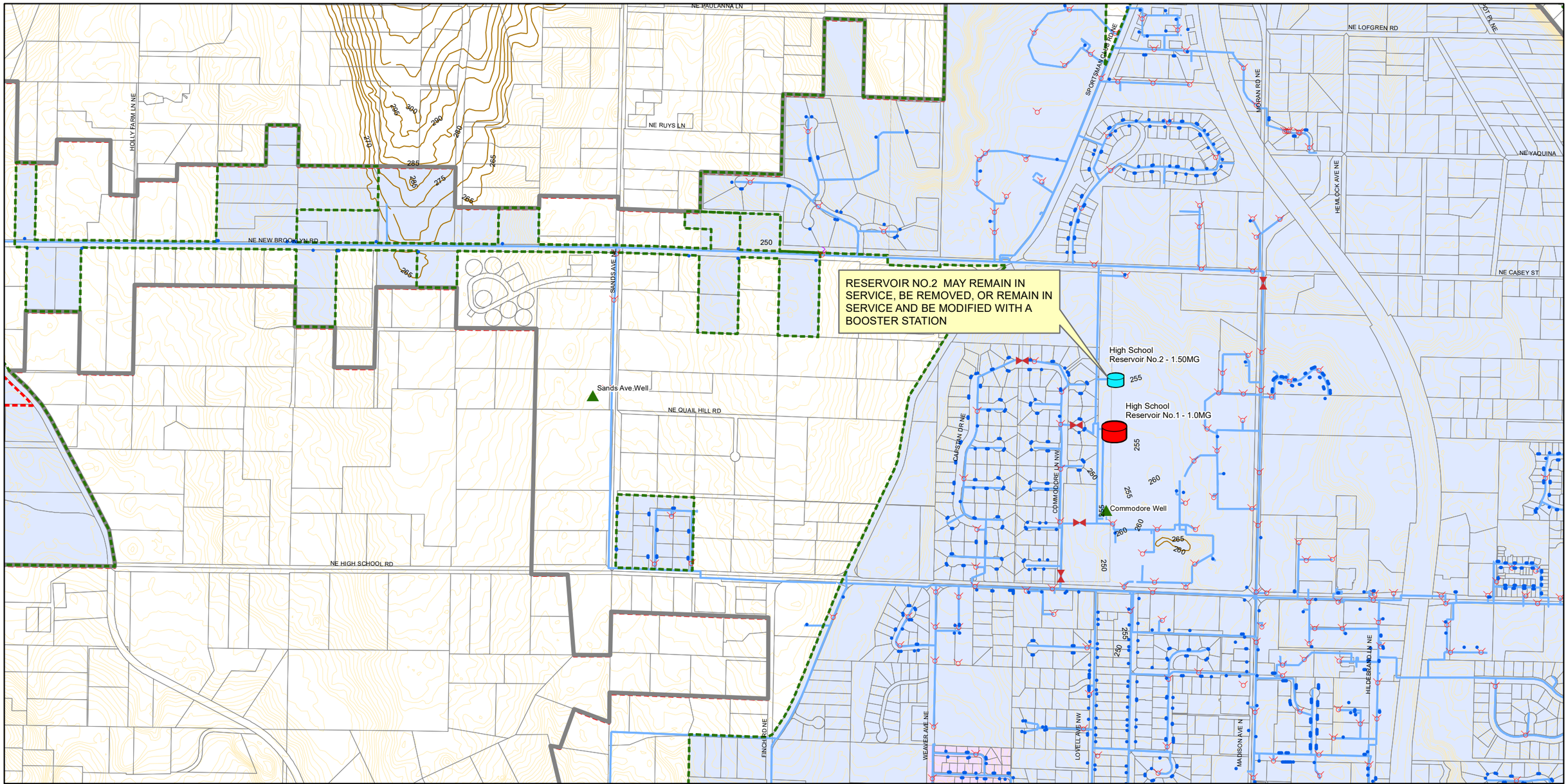

LEGEND

- WATER SERVICE AREA
- PARCELS
- LOW PRESSURE ZONE
- NEW HIGH PRESSURE ZONE
- PIPES
- 5FT CONTOUR
- ELEVATION >= 265FT
- RESERVOIR
- WATER METER
- WATER HYDRANT
- WELL
- PRV
- ISOLATION VALVE
- WINSLOW RWSA
- PROPOSED RESERVOIR

N

0 400 800 1,600 Feet

CITY OF BAINBRIDGE ISLAND
WATER SYSTEMS IMPROVEMENT PLAN

2017 WATER SYSTEM IMPROVEMENTS ANALYSIS
FIGURE 4
REVISED ALTERNATIVE 3

Gray & Osborne, Inc.
CONSULTING ENGINEERS

L:\Bainbridge Island\17614 2017 Water System Improvements\GIS\MXDs\Project MXDs\REVISEDALT3.mxd

EXHIBIT B

BUDGETARY COST ESTIMATES

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 1A: Service to New Zone w/Transmission Main (Welded Steel Tank)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization / Demobilization	1	LS	$ 408,750	$ 408,750
2	Sitework / Site Restoration	1	LS	$ 300,000	$ 300,000
3	Reservoir Booster Station	1	LS	$ 375,000	$ 375,000
4	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
5	8-inch DI Transmission Main	14,000	LF	$ 150	$ 2,100,000
6	Connection to Existing System	2	EA	$ 10,000	$ 20,000
7	Piping, Valves, and Appurtenances	1	LS	$ 200,000	$ 200,000
8	Electrical (including generator)	1	LS	$ 400,000	$ 400,000
9	Programming & Integration	1	LS	$ 30,000	$ 30,000
10	1.40MG Welded Steel Reservoir	1	LS	$ 3,750,000	$ 3,750,000
				Subtotal	**$ 8,583,750**
				Contingency (30%)	$ 2,575,100
				Subtotal	**$ 11,158,850**
				Washington State Sales Tax (9.0%)	$ 1,004,300
				Subtotal	**$ 12,163,150**
				Design and Project Administration (25.0%)	$ 3,040,800
				TOTAL CONSTRUCTION COST	**$ 15,204,000**

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 1B: Service to New Zone w/Transmission Main (Hydropillar)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization / Demobilization	1	LS	$ 346,250	$ 346,250
2	Sitework / Site Restoration	1	LS	$ 300,000	$ 300,000
3	Reservoir Booster Station	1	LS	$ 375,000	$ 375,000
4	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
5	8-inch DI Transmission Main	14,000	LF	$ 150	$ 2,100,000
6	Connection to Existing System	2	EA	$ 10,000	$ 20,000
7	Piping, Valves, and Appurtenances	1	LS	$ 200,000	$ 200,000
8	Electrical (including generator)	1	LS	$ 400,000	$ 400,000
9	Programming & Integration	1	LS	$ 30,000	$ 30,000
10	0.40MG Hydropillar	1	LS	$ 2,500,000	$ 2,500,000
				Subtotal	**$ 7,271,250**
				Contingency (30%)	$ 2,181,400
				Subtotal	**$ 9,452,650**
				Washington State Sales Tax (9.0%)	$ 850,700
				Subtotal	**$ 10,303,350**
				Design and Project Administration (25.0%)	$ 2,575,800
				TOTAL CONSTRUCTION COST	**$ 12,879,000**

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 2A: Service for New Zone w/Satellite Booster Station (Welded Steel Tank)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization and Demobilization	1	LS	$ 322,000	$ 322,000
2	Sitework / Site Restoration	1	LS	$ 200,000	$ 200,000
3	Reservoir Booster Station	1	LS	$ 350,000	$ 350,000
4	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
5	New Brooklyn Booster Station	1	LS	$ 375,000	$ 375,000
6	Connection to Existing System	2	EA	$ 10,000	$ 20,000
7	Piping, Valves, and Appurtenances	1	LS	$ 150,000	$ 150,000
8	Electrical	1	LS	$ 600,000	$ 600,000
9	Programming and Integration	1	LS	$ 45,000	$ 45,000
10	1.35MG Welded Steel Reservoir	1	LS	$ 3,700,000	$ 3,700,000
				Subtotal	**$ 6,762,000**
				Contingency (30%)	$ 2,028,600
				Subtotal	**$ 8,790,600**
				Washington State Sales Tax (9.0%)	$ 791,200
				Subtotal	**$ 9,581,800**
				Design and Project Administration (25.0%)	$ 2,395,500
				TOTAL CONSTRUCTION COST	**$ 11,977,000**

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 2B: Service for New Zone w/Satellite Booster Station (Hydropillar)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization and Demobilization	1	LS	$ 262,000	$ 262,000
2	Sitework / Site Restoration	1	LS	$ 200,000	$ 200,000
3	Reservoir Booster Station	1	LS	$ 350,000	$ 350,000
4	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
5	New Brooklyn Booster Station	1	LS	$ 375,000	$ 375,000
6	Connection to Existing System	2	EA	$ 10,000	$ 20,000
7	Piping, Valves, and Appurtenances	1	LS	$ 150,000	$ 150,000
8	Electrical	1	LS	$ 600,000	$ 600,000
9	Programming and Integration	1	LS	$ 45,000	$ 45,000
10	0.40MG Hydropillar	1	LS	$ 2,500,000	$ 2,500,000
				Subtotal	**$ 5,502,000**
				Contingency (30%)	$ 1,650,600
				Subtotal	**$ 7,152,600**
				Washington State Sales Tax (9.0%)	$ 643,700
				Subtotal	**$ 7,796,300**
				Design and Project Administration (25.0%)	$ 1,949,100
				TOTAL CONSTRUCTION COST	**$ 9,745,000**

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 3A: Raise HGL of Existing High Zone (Welded Steel Tank)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization and Demobilization	1	LS	$ 302,750	$ 302,750
2	Sitework / Site Restoration	1	LS	$ 250,000	$ 250,000
3	Pressure Reducing Valve Station	2	EA	$ 60,000	$ 120,000
4	Reservoir 2 Booster Station	1	LS	$ 300,000	$ 300,000
5	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
6	Piping, Valves, and Appurtenances	1	LS	$ 300,000	$ 300,000
7	Electrical (including generators)	1	LS	$ 200,000	$ 200,000
8	Programming and Integration	1	LS	$ 35,000	$ 35,000
9	2.50MG Welded Steel Reservoir	1	LS	$ 3,850,000	$ 3,850,000

Subtotal	**$ 6,357,750**
Contingency (30%)	$ 1,907,300
Subtotal	**$ 8,265,050**
Washington State Sales Tax (9.0%)	$ 743,900
Subtotal	**$ 9,008,950**
Design and Project Administration (25.0%)	$ 2,252,200
TOTAL CONSTRUCTION COST	**$ 11,261,000**

CITY OF BAINBRIDGE ISLAND

2017 WATER SYSTEM IMPROVEMENT PROJECT
PRELIMINARY PROJECT COST ESTIMATE

Alternative 3B: Raise HGL of Existing High Zone (Hydropillar)
March 13, 2019
G&O# 17614.00

NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization and Demobilization	1	LS	$ 275,250	$ 275,250
2	Sitework / Site Restoration	1	LS	$ 250,000	$ 250,000
3	Pressure Reducing Valve Station	2	EA	$ 60,000	$ 120,000
4	Reservoir 2 Booster Station	1	LS	$ 300,000	$ 300,000
5	Reservoir 2 Seismic Upgrades	1	LS	$ 1,000,000	$ 1,000,000
6	Piping, Valves, and Appurtenances	1	LS	$ 300,000	$ 300,000
7	Electrical (including generators)	1	LS	$ 200,000	$ 200,000
8	Programming and Integration	1	LS	$ 35,000	$ 35,000
9	1.0MG Hydropillar	1	LS	$ 3,300,000	$ 3,300,000

Subtotal	**$ 5,780,250**
Contingency (30%)	$ 1,734,100
Subtotal	**$ 7,514,350**
Washington State Sales Tax (9.0%)	$ 676,300
Subtotal	**$ 8,190,650**
Design and Project Administration (25.0%)	$ 2,047,700
TOTAL CONSTRUCTION COST	**$ 10,238,000**

EXHIBIT "A"

SCOPE OF WORK

CITY OF BAINBRIDGE ISLAND
RESERVOIR 1 IMPROVEMENTS PREDESIGN REPORT

BACKGROUND

The City of Bainbridge Island owns, operates, and maintains a public water system on Bainbridge Island in King County, Washington. The system includes approximately 11 groundwater sources, two storage reservoirs, and approximately 251,000 linear feet of pipe, all of which serve approximately 2,500 residential and commercial service connections and a population of approximately 7,200 people.

In 2017, the City of Bainbridge Island contracted with Gray & Osborne to complete the 2017 Water System Improvements Project, which served to analyze and assess specific existing facilities and to design improvements to these facilities based on the recommendations identified during the system analysis. Specifically, this project included assessing the seismic resiliency, exterior and interior coating, and water quality for the two High School Reservoirs; assessment and design of water treatment improvements at the Head of the Bay (HOB) and Sands Wellfields; design of a standby generator at the HOB wellfield; and analysis and design of improvements to address regions susceptible to low water pressure within the existing High Zone.

To date for this project, eight technical memoranda have been finalized that discuss the analysis completed for the project components listed above. One of these technical memoranda, Technical Memorandum 17614-4, found that the existing High School Reservoir 1 is seismically deficient and the exterior coating system is at or very near the end of its service life. Technical Memoranda 17614-5 and 17614-8 investigated the existing distribution system and where it is susceptible to low service pressure due to the elevation of the existing service connections. Several alternatives were presented that would address both susceptibility to low service pressure, improve water quality within the Reservoirs as well as the distribution system, and address the deficiencies noted for Reservoir 1.

Rather than seismically retrofit and recoat Reservoir 1, the City has elected to replace Reservoir 1 with a new water storage basin. Furthermore, in order to reduce the volume of dead storage within the Reservoir, which will positively affect overall water quality within the reservoir and distribution system, the City has elected to install an elevated storage tank, or Hydropillar®.

The scope or work below highlights the work that will be provided to complete the Predesign report required for construction of a new reservoir. Design, bid assistance, and

construction management services for the new Reservoir will be provided under a separate contract, or an amendment to this contract.

SCOPE OF WORK

Gray & Osborne will perform the following tasks.

Task 1 – Project Management

Provide overall project management and oversight of the project work by the Project Manager and senior staff members. Work will include the following:

- Procure sufficient staff resources to dedicate to the project.
- Manage and control project budget and schedule.
- Manage and provide monthly invoices.

Deliverables

- Monthly invoices

Task 2 –Reservoir 1 Predesign Report

Services shall include the preparation of a predesign report for submission to the Washington State Department of Health (DOH). The report will meet the requirements listed in WAC 246-290-110. The report will include a summary of the reservoir design criteria, impacts to surrounding areas, summary of control and operational parameters, discussion of the impacts to overall water quality, preliminary drawings/figures, and other critical information as required in WAC 246-290-110.

The predesign report will also include a discussion of the proposed modifications to the existing reservoir levels in order to create the new, higher, hydraulic zone; an evaluation of current and proposed reservoir storage volumes for 2020 as well as the 30-year planning period; an identification of potential pressure reducing valve (PRV) locations; a discussion of impacts to the overall water system operation; and the potential impact to existing well flows.

Services will also include up to two site visits for documentation of existing facilities and additional water quality and/or pump testing analysis.

Services will also include a field survey of the existing Reservoir 1 parcel. This parcel is the proposed location for the new Reservoir 1, and completion of the survey will assist G&O with the preparation of preliminary site plans for submission with the Predesign Report.

Assumptions

- City will return comments on Draft Predesign Report within 3 weeks of receipt.
- City personnel, facilities, and equipment will be made available during site visits and pump testing.
- The City's most recent Water System Planning document will be used for population and demand projections.
- Previously completed geotechnical analysis is sufficient and no additional geotechnical testing or analysis is required at this stage.
- Up to two days of field survey will be provided.
- Existing Geotechnical Investigation Report (January 4, 2018, PanGEO, Inc.) is sufficient to complete a predesign report. Additional geotechnical work is outside the scope defined herein.

Deliverables

- Draft Predesign report
- Final Predesign report

Task 3 – Quality Assurance/Quality Control

Objective: Oversee one, in-house, quality assurance/quality control (QA/QC) meeting at G&O's office during the course of the project. The meetings will include senior project staff and selected design team members.

1. One QA/QC meeting will take place prior to the submission of the Draft Predesign Report to the City.

2. Ensure incorporation of relevant recommendations and suggestions into the final Predesign Report resulting from QA/QC reviews.

3. Meet with City staff and discuss the progress of the report, topics covered, and answer questions regarding the systems/equipment proposed for installation.

Assumptions

- Project manager and project engineer will attend up to three meetings with City staff.

Deliverables

- QA/QC notes (upon request).

BUDGET

Based on the Scope of Work described above. the fee for design and construction administration services is $55,100, as shown on next page.

EXHIBIT A

ENGINEERING SERVICES
SCOPE AND ESTIMATED COST

CITY OF BAINBRIDGE ISLAND - RESERVOIR 1 IMPROVEMENTS PREDESIGN REPORT

Tasks	Principal Hours	Project Manager Hours	Project Engineer Hours	Structural Engineer Hours	Electrical Engineer Hours	AutoCAD Technician Hours	PLS Hours	Field Survey (2 person) Hours
Task 1 - Project Management								
Project Management	4	16	8					
Task 2 - Reservoir 1 Predesign Report								
Site Visits and Analysis		20	20					
Predesign Report	8	24	112	20	20	64	8	16
Task 3 - Quality Assurance/Quality Control								
Quality Assurance/Quality Control	4	8	8	4	4			
Review Meeting with City Staff		8	8					
Hour Estimate:	16	76	156	24	24	64	8	16
Fully Burdened Billing Rate Range:*	$135 to $200	$119 to $200	$119 to $148	$110 to $167	$120 to $190	$50 to $132	$118 to $148	$170 to $222
Estimated Fully Burdened Billing Rate:*	$170	$160	$135	$155	$155	$105	$140	$200
Fully Burdened Labor Cost:	$2,720	$12,160	$21,060	$3,720	$3,720	$6,720	$1,120	$3,200

Total Fully Burdened Labor Cost:	$	54,420
Direct Non-Salary Cost:		
Mileage & Expenses (Mileage @ current IRS rate)	$	180
Equipment	$	500
TOTAL ESTIMATED COST:	**$**	**55,100**

* Actual labor cost will be based on each employee's actual rate. Estimated rates are for determining total estimated cost only. Fully burdened billing rates include direct salary cost, overhead, and profit.

City of Bainbridge Island
Total CIP (2019 - 2024)
2019-2020 Adopted Budget

	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
in (1000s)									
Transportation Projects	3,880	216	820	25	300	550	500	-	6,291
Transportation Grants	2,671	-	703	-	-	-	-	-	3,374
Non Motorized Projects	2,860	25	292	860	2,550	-	500	-	7,087
Non Motorized Grants	2,042	23	202	210	1,900	-	-	-	4,377
Fleet and Equipment	-	1,127	832	627	380	1,006	759	-	4,731
General Gov't Funded	-	*706*	*688*	*567*	*341*	*384*	*602*	-	3,288
Utility Funded	-	*421*	*144*	*60*	*39*	*622*	*157*	-	1,443
Facility Projects	3,310	17,192	76	-	-	-	-	-	20,578
Facility Grants	-	-	-	-	-	-	-	-	-
Water Projects	725	1,400	750	75	2,600	790	1,930	-	8,270
Water Grants	-	-	-	-	-	-	-	-	-
Sewer Projects	1,250	1,040	170	3,120	600	750	1,400	-	8,330
Sewer Grants	-	-	-	-	-	-	-	-	-
SSWM Projects	260	900	760	450	600	650	-	-	3,620
SSWM Grants	-	-	-	-	*450*	-	-	-	*450*
Utility Funding	2,235	3,761	1,824	3,705	3,389	2,812	3,487	-	21,213
General Govt Funding	5,337	18,117	971	1,242	1,291	934	1,602	-	29,494
Total Project Cost Less Grants	7,572	21,878	2,795	4,947	4,680	3,746	5,089	-	50,707
Grant Totals	4,713	23	905	210	2,350	-	-	-	8,201
TOTAL PROJECT COST	12,285	21,900	3,700	5,157	7,030	3,746	5,089	-	58,907

Amounts in thousands

City of Bainbridge Island
Transportation CIP (2019- 2024)
2019-2020 Adopted Budget

Project / Location	Grant Eligible	Grant Awarded	Grant Funds	General Comp	Strts Component	Wtr Component	Swr Component	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
TRANSPORTATION PROJECTS - 6-YEAR CIP																	
Wyatt Way Reconstruction Phase 1	X	X	2,516		Y	Y			3,700	-	-	-	-	-	-	-	3,700
Madison - Lovell																	
Sportsman Club/New Brooklyn	X	X	858		Y				180	216	820	-	-	-	-	-	1,216
Intersection Imprv.																	
Country Club Rd Reconstruction & Drainage Improvements			-		Y				-	-	-	25	250	-	-	-	275
Past Toe Jam to Seawall																	
Manitou Beach Road Stabilization (Phase 1)			-		Y				-	-	-	-	50	500	-	-	550
Murden Cove to Falk																	
Manitou Beach Road Stabilization (Phase 2)			-		Y				-	-	-	-	-	50	500	-	550
Falk to Skiff																	
City Funding									1,209	216	117	25	300	550	500	-	2,917
Grant Totals									2,671	-	703	-	-	-	-	-	3,374
TOTALS									3,880	216	820	25	300	550	500	-	6,291

Amounts in thousands

City of Bainbridge Island
Non-Motorized Transportation CIP (2019- 2024)
2019-2020 Adopted Budget

Project	Grant Eligible	Grant Awarded	Grant Funds	General Comp	Strts Comp	Wtr Comp	Swr Comp	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
NON-MOTORIZED PROJECTS - 6-YEAR CIP																	
SR305/Olympic Drive Non Motorized	X	X	2,042		Y	Y			2,813	-	-	-	-	-	-	-	2,813
Harbor Dr. to Winslow Way																	
High School Road Safety Improvements	X	X	225						-	25	202	-	-	-	-	-	227
SR305 to Grow																	
Madison Avenue Sidewalk Improvements	X	X	1,410		Y				-	-	-	260	1,750	-	-	-	2,010
Wyatt to High School																	
C40 - Bucklin Ph 2	X		-		Y				47	-	-	600	-	-	-	-	647
Blakely - Fletcher Bay																	
C40 - Eagle Harbor - Phase 1	X		-		Y			Y	-	-	90	-	-	-	500	-	590
Wyatt - Past Bucklin																	
C40 - Eagle Harbor - Phase 2	X		700						-	-	-	-	800	-	-	-	800
Past Bucklin to Eagle																	
City Project Funding									818	3	90	650	650	-	500	-	2,711
Grant Totals									2,042	23	202	210	1,900	-	-	-	4,377
TOTALS									2,860	25	292	860	2,550	-	500	-	7,087

OTHER NON-MOTORIZED PROJECTS		
Manitou Beach Rd Impr.	Manitou Beach Rd	TBD
Crosswalk to STO	Crossing SR305 at Vineyard Lane	TBD
Sidewalk Extension	Pt. White Dr. Schel Chelb Park to Lynwood. Ctr	TBD
Intersection Impr.	SR305 at High School Rd	TBD
Miller Road Impr.	Crosswalk and other safety improvements	TBD

Amounts in thousands

CITY OF BAINBRIDGE ISLAND
FLEET AND EQUIPMENT CIP (2019 - 2024)
2019-2020 ADOPTED BUDGET

Project	Grant Eligible	Grant Awarded	General Comp	Strts Component	Wtr Component	Swr Component	SSWM Comp	2019	2020	2021	2022	2023	2024	**Total**
FLEET & EQUIPMENT - 6-YEAR CIP (1000s)														
Police Vehicles (5)			1,473					330	208	219	230	237	249	1,473
Broom Sweeper				96				96	-	-	-	-	-	96
Chipper				95				95	-	-	-	-	-	95
Van					49	12		61	-	-	-	-	-	61
PUP Trailer				13			13	26	-	-	-	-	-	26
Dump Truck Cab/Chassis				138			138	276	-	-	-	-	-	276
Light Duty Pick Up			11	11	11	11	11	55	-	-	-	-	-	55
SUV			12		23		23	58	-	-	-	-	-	58
Slope Mower and Trailer							60	60	-	-	-	-	-	60
Video Inspection Camera						35	35	70	-	-	-	-	-	70
Heavy Duty Pickup			19	76				-	95	-	-	-	-	95
Van					14	56		-	70	-	-	-	-	70
Medium Duty Pickup Truck					59	15		-	74	-	-	-	-	74
Light Duty Pick Up			60					-	60	-	-	-	-	60
Manlift				325				-	325	-	-	-	-	325
Track Excavator				160				-	-	160	-	-	-	160
Medium Duty Pickup				66				-	-	66	-	-	-	66
Medium Duty Pickup			20	20	20	20	20	-	-	100	-	-	-	100
Police Motorcycle			41					-	-	41	-	-	-	41
Police Motorcycle			41					-	-	41	-	-	-	41
Light Duty Pickup			13	13	13	13	13	-	-	-	65	-	-	65
Light Duty Pickup			65					-	-	-	65	-	-	65
Police Boat Trailer			20					-	-	-	20	-	-	20
Vactor Truck						231	231	-	-	-	-	462	-	462
Heavy Duty Pickup					59		59	-	-	-	-	118	-	118
Heavy Duty Pickup			24	95				-	-	-	-	119	-	119
Light Duty Pickup			14	14	14	14	14	-	-	-	-	70	-	70
Light Duty Pickup			14	14	14	14	14	-	-	-	-	-	70	70
Light Duty Pickup			70					-	-	-	-	-	70	70
Van						92	23	-	-	-	-	-	115	115
Police Boat			95					-	-	-	-	-	95	95
Loader				160				-	-	-	-	-	160	160
TOTALS								1,127	832	627	380	1,006	759	4,731

Amounts in thousands

CITY OF BAINBRIDGE ISLAND
FACILITIES CIP (2019 - 2024)
2019-2020 ADOPTED BUDGET

Project	Grant Eligible	Grant Awarded	Grant Funds	General Comp	Strts Component	Wtr Component	Swr Component	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
FACILITIES PROJECTS - 6-YEAR CIP																	
City Dock			-	Y					-	30	-	-	-	-	-	-	30
Waterfront Park																	
Police and Municipal Court Building			-	Y					3,100	16,900	-	-	-	-	-	-	20,000
Police Station/Court																	-
AM Radio			-	Y					100	50	-	-	-	-	-	-	150
EOC																	
Underground Power			-	Y					-	-	76	-	-	-	-	-	76
Waterfront Park																	
Fueling System				Y					90	-	-	-	-	-	-	-	90
Public Works Facility																	
Open Water Marina Additional Buoys				Y					20	147	-	-	-	-	-	-	167
Marina																	
Farmers Market Cover				Y					-	65	-	-	-	-	-	-	65
Farmers Market																	
City Total									3,310	17,192	76	-	-	-	-	-	20,578
Grant Totals									-	-	-	-	-	-	-	-	-
TOTALS									3,310	17,192	76	-	-	-	-	-	20,578

Amounts in thousands

City of Bainbridge Island
Water CIP (2019 - 2024)
2019-2020 Adopted Budget

Project	Location	Grant Eligible	General Comp	Strts Comp	Wtr Comp	Swr Comp	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
WATER PROJECTS - 6-YEAR CIP (1000s)																
SR 305 Olympic Drive Non-Motorized Improvements	Olympic Drive			Y	Y			175	-	-	-	-	-	-	-	175
Rockaway Intertie	Rockaway				Y			250	-	-	-	-	-	-	-	250
Wyatt Way Reconstruction	Wyatt Way				Y			150	-	-	-	-	-	-	-	150
High Zone Improvements	High School/New Brooklyn				Y			150	-	750	-	-	-	-	-	900
SCADA Upgrades	Various				Y			-	150	-	-	-	-	-	-	150
Chlorine Generator Upgrades	Various				Y			-	250	-	-	-	-	-	-	250
New Storage Tank	New Brooklyn				Y			-	1,000	-	-	2,250	-	-	-	3,250
Fire Flow Improvements	Winslow				Y			-	-	-	75	350	-	-	-	425
Well Development/Rehab	Pritchard Park				Y			-	-	-	-	-	200	-	-	200
Pipeline Improvements	Shephard Way				Y			-	-	-	-	-	50	300	-	350
Emergency Generator	Head of the Bay				Y			-	-	-	-	-	40	130	-	170
Water Treatment Improvements	Head of the Bay				Y			-	-	-	-	-	500	1,500	-	2,000
City Project Funding								725	1,400	750	75	2,600	790	1,930	-	8,270
Grant Totals								-	-	-	-	-	-	-	-	-
TOTALS								725	1,400	750	75	2,600	790	1,930	-	8,270

Amounts in thousands

City of Bainbridge Island
Sewer CIP (2019 - 2024)
2019-2020 Adopted Budget

Project	Location and/or Phase	Grant Eligible	Grant Awarded	Grant Funds	General Comp	Strts Component	Wtr Component	Swr Component	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
SEWER PROJECTS - 6-YEAR CIP (1000s)																		
Pump Station/Force Main Upgrade	NTW/New Brooklyn/ Madison			-				Y		700	-	-	-	-	-	-	-	700
Rehabilitate Pump Station (Old Treatment Plant)	Old Treatment Plant			-				Y		550	-	-	-	-	-	-	-	550
Rehabilitate Pumps	Sunday Cove			-				Y		-	150	-	-	-	-	-	-	150
Lift Station SCADA Upgrades	Various			-				Y		-	140	70	70	-	-	-	-	280
Pump Station & Force Main	Wood Ave			-				Y		-	750	-	2,500	-	-	-	-	3,250
Rehabilitate Pump Station (Wing Point)	Wing Point			-				Y		-	-	100	450	-	-	-	-	550
Rehabilitate Pump Station (Island Terrace)	Island Terrace			-				Y		-	-	-	100	400	-	-	-	500
Install Gravity Sewers	Sunday Cove			-				Y		-	-	-	-	200	450	-	-	650
Rehabilitate Pump Station (Lower Lovell)	Lower Lovell			-				Y		-	-	-	-	-	100	500	-	600
Extend WWTP Outfall	Wing Point			-						-	-	-	-	-	200	900	-	1,100
City Total										1,250	1,040	170	3,120	600	750	1,400	-	8,330
Grant Total										-	-	-	-	-	-	-	-	-
TOTALS										1,250	1,040	170	3,120	600	750	1,400	-	8,330

Amounts in thousands

City of Bainbridge Island
Stormwater CIP (2019 - 2024)
2019-2020 Adopted Budget

Project	Grant Eligible	Grant Awarded	Grant Funds	General Comp	Strts Component	Wtr Component	Swr Component	SSWM Comp	Prior Years	2019	2020	2021	2022	2023	2024	2025 - 2038	**Total**
STORMWATER PROJECTS - 6-YEAR CIP (1000s)																	
Eagle Hrbr. Dr. @ McDonald Creek Culvert			-					Y	200	900	-	-	-	-	-	-	1,100
Yeomalt Area Drainage Improvements			-					Y	60	-	510	-	-	-	-	-	570
Wing Point Culvert			-					Y	-	-	150	-	-	-	-	-	150
Blakely Ave. Drainage Improvements			-					Y	-	-	-	450	-	-	-	-	450
Springbrook Creek Restoration and Culvert Replacement	x		450					Y	-	-	-	-	600	-	-	-	600
Blakely Falls Creek Culvert (Halls Hill)			-					Y	-	-	-	-	-	150	-	-	150
C40 Eagle Harbor Phase 1			-	Y				Y	-	-	100	-	-	500	-	-	600
City Funding									260	900	760	450	150	650	-	-	3,170
Grant Totals									-	-	-	-	450	-	-	-	450
TOTALS									260	900	760	450	600	650	-	-	3,620

Amounts in thousands