RECLAIMED WATER DISTRIBUTION SYSTEM ENGINEERING REPORT

Prepared for City of Snoqualmie

September 2023

SNQ 22-0187

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City of Snoqualmie
Reclaimed Water Distribution System
September 2023

Prepared by RH2 Engineering, Inc.

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Note: This Engineering Report was completed under the direct supervision of the following Licensed Professional Engineers registered in the State of Washington.

Sincerely,

RH2 ENGINEERING, INC.

Signed: 09/XX/2023

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Introduction

This Engineering Report (Report) evaluates alternatives for the City of Snoqualmie (City) to improve its reclaimed water distribution system to meet the requirements of the Washington State Department of Ecology's (Ecology) Reclaimed Water Rule and to comply with Permit Section R8.A.1 of the City's current Reclaimed Water Permit. This Report includes the reclaimed water system alternatives analysis and the preliminary design of the preferred alternative.

Background

The City owns and operates a potable water system, a sanitary sewer system, and a reclaimed water system. The reclaimed water supply and distribution system finished construction in 1999. The City's Water Reclamation Facility (WRF) supplies Class A reclaimed water to Eagle Lake, where it is stored as irrigation supply for City-supplied customers and the Snoqualmie Ridge Golf Course (Golf Course). City customers are supplied irrigation water from the City owned Irrigation Pump Station (IPS) located near Eagle Lake. The Golf Course irrigation system is owned and operated by the Golf Course and is separate from City operations. **Figure 1** shows the reclaimed water transmission main from the WRF to Eagle Lake, as well as the City's reclaimed water system irrigation areas.

In 2021, Ecology issued the City's updated National Pollutant Discharge Elimination System (Permit) Permit (No. WA0022403), which included additional requirements for the City's reclaimed water system. These updates are based on the recently modified Reclaimed Water Rule, Chapter 173-219 Washington Administrative Code (WAC), which includes requirements that did not exist at the time the reclaimed water system was constructed. Through the NPDES Permit, Ecology is requiring the City to modify the reclaimed water distribution system to "…not allow contamination of reclaimed water by lower quality water, such as urban stormwater runoff." The purpose of this Report is to analyze alternatives and propose reclaimed water system improvements to fulfill Permit Section R8.A.1 submittal requirements. The use of reclaimed water is necessary to help meet the growing need for clean water for beneficial use. It is RH2 Engineering, Inc., (RH2) and the City's understanding that the goal of the Reclaimed Water Rule and the Permit, as it pertains to the City's Class A reclaimed water irrigation system, is to prevent degradation of reclaimed water quality from other sources.

The existing City irrigation system is a non-expanding reclaimed water system. At this time, the City has no intention to increase the service area or number of customers that receive reclaimed water.

Historical Irrigation Usage

Currently, reclaimed water is produced at the WRF, sent to Eagle Lake via the Reclaimed Water Transmission Main, and then pumped from the IPS to the City's irrigation distribution system. The municipal side of the IPS has three pumps that supply a 10-inch pipeline that connects to

the City's irrigation distribution system. **Table 1** shows the existing pumps' capacity, total dynamic head, and horsepower.

Table 1

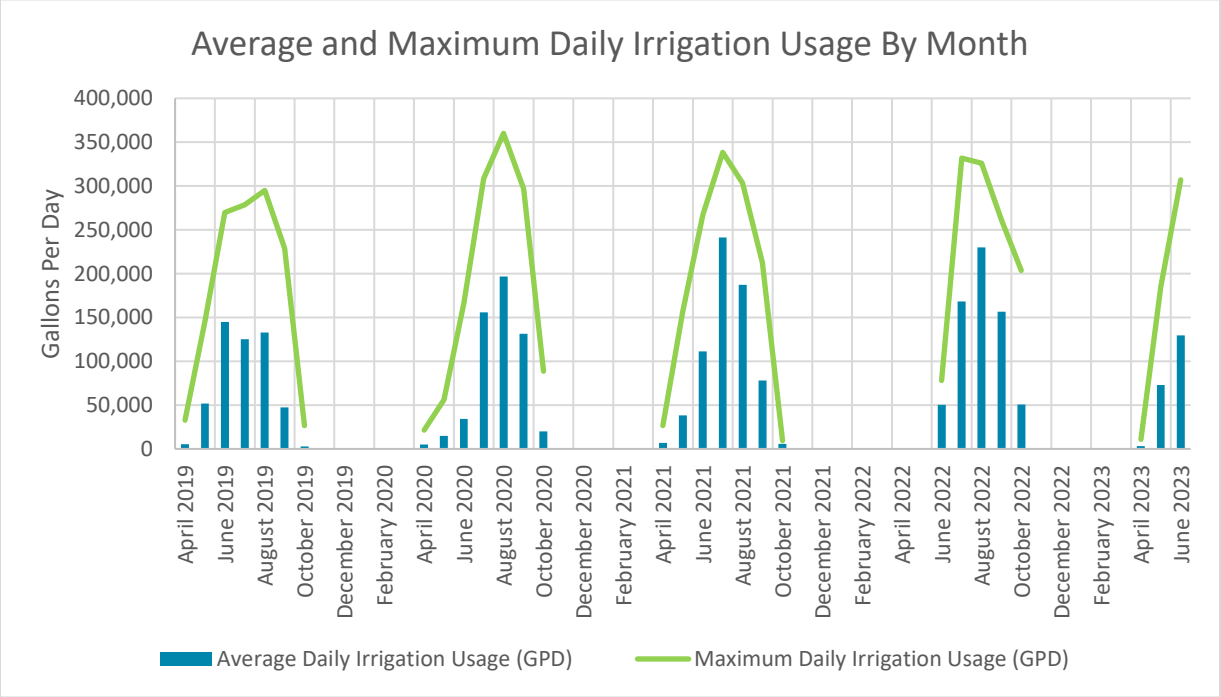
Existing Municipal Irrigation Pumps

Pump Quantity and Type	Pump Capacity (gpm)	Total Dynamic Head (ft)	Horsepower
(2) Vertical Turbine Pumps	500	400	75
(1) Jockey Pump	40	600	7.5

Historically, the City supplied Eagle Lake from two sources; Class A reclaimed water from the City's WRF, and water from the City's potable water system. In 2019, the City transitioned to using only reclaimed water for irrigation to help conserve potable water for beneficial use. **Figure 2** shows the average and maximum daily irrigation use for each month from April 2019 to June 2023 during irrigation season. During the 2019 through 2022 irrigation seasons, the average volume of irrigation water used for the City's irrigation system was 17.9 million gallons (MG) per year. This is not total reclaimed water supply to Eagle Lake or does it include supply to the Golf Course irrigation system.

Figure 2

Average and Maximum Daily Irrigation Usage per Month



The existing City irrigation system controller is a Rain Bird Maxicom Central Control System with meters to the various points of connection to bill customers. This Maxicom system controls irrigation of City areas overnight between the hours of 10 PM and 6 AM. **Table 2** summarizes the daily irrigation water demands.

Table 2

City Irrigation Demands Summary

Condition	Criteria	Gallons
Average Daily Demand	Average Day Production in July and August 2019-2022	180,000
Maximum Daily Demand	Maximum Day Production from 2019-2022	360,000
Maximum Daily Irrigation Pump Capacity	Eagle Lake Pump Station capacity with two 500 gallons per minute (gpm) pumps continuously running for 8 hours each night	480,000

The City contracts with Extended Range Forecasting Company, Inc., (ERF, aka Water Management Group, Inc.) to manage the irrigation system. The irrigation system piping varies throughout distribution, and there are multiple pressure regulating valves which reduce pressure to the zone of application. The jockey pump operates intermittently to maintain a pressure setpoint within the system, a minimum of 70 pounds per square inch (psi).

Alternatives Analysis

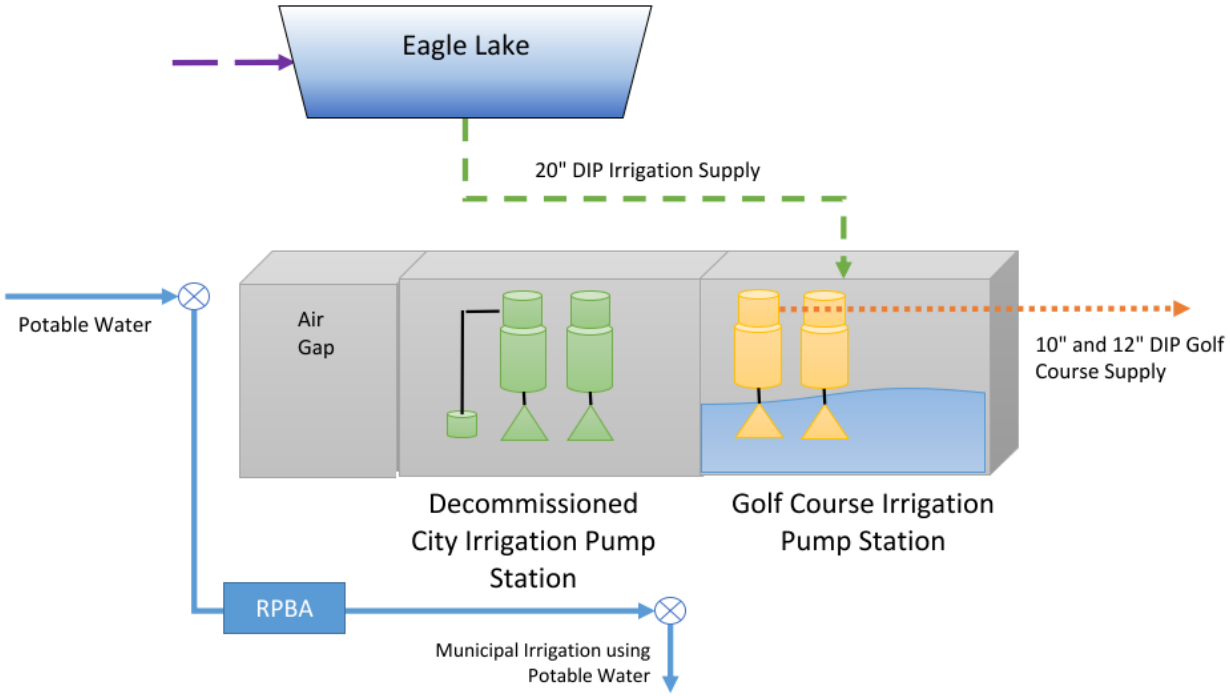
Ecology is requiring that the City's irrigation system be separated from Eagle Lake so that it does not pump water that is comingled with other potential water sources. In addition, the Reclaimed Water Rule requires that any Class A reclaimed water generator or distributor must maintain a free chlorine residual greater than 0.2 milligrams per liter (mg/L) or a total chlorine residual greater than 0.5 mg/L "…from the facility to the point of use to prevent biological growth, prevent deterioration of reclaimed water quality, and to protect public health." (WAC 173-219-370(1)). RH2 evaluated two distribution system improvement alternatives to comply with these regulations. Alternative 1 would transition the City's entire municipal irrigation supply downstream of the IPS to potable water, which inherently has a chlorine residual. Alternative 2 would construct a closed reservoir to store and separate reclaimed water generated by the WRF from the Golf Course's Eagle Lake. This alternative would either have a permanent chlorination system for disinfection or have appurtenances to implement emergency chlorination.

Alternative 1: Transition Irrigation Customers to Potable Supply

Alternative 1 would transition existing irrigation customers from reclaimed water to potable water. This can be accomplished by bypassing the IPS altogether and connecting the existing potable water supply directly to the 10-inch ductile iron pipe (DIP) municipal irrigation main. Piping associated with the municipal reclaimed IPS would be cut and capped. The existing 4-inch-diameter potable supply pipeline may need to be upsized to accommodate the new connection. A reduced pressure backflow assembly (RPBA) would be installed to prevent a cross connection to the domestic water system. The pipeline would be equipped with control valves

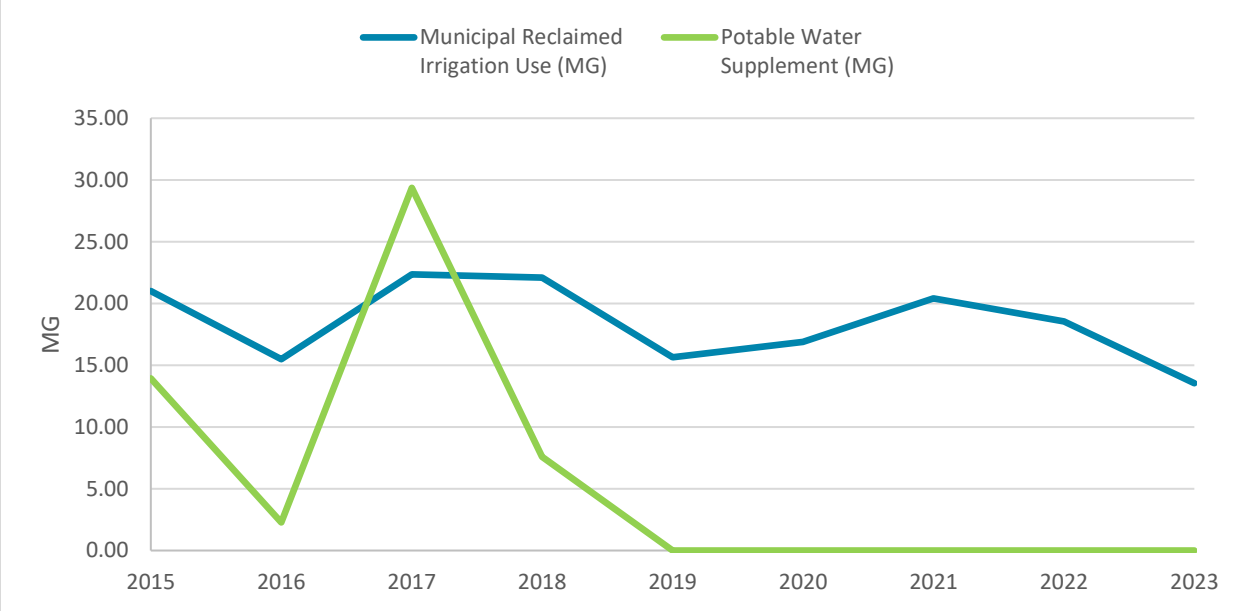
to regulate flow and a flow meter with a telemetry connection to allow the City to monitor water use. **Figure 3** shows a schematic of this alternative.

Figure 3
Alternative 1 Schematic



The City's Water Use Efficiency (WUE) Program, in accordance with the WUE Rule in the Municipal Water Supply – Efficiency Requirements Act, is helping to curtail excess potable water demands. Prior to 2019, potable water was used occasionally to supplement reclaimed water for irrigation. Since 2019, the City has not supplemented reclaimed water demands with potable water. **Figure 4** shows the historical annual municipal reclaimed water irrigation usage and potable water supplement. Converting municipal customers' irrigation supply from reclaimed water to potable water will result in higher potable water usage for irrigation. This will result in higher potable water usage for irrigation and may result in greater burden to water supply which has not been accounted for in water system planning.

Figure 4
Municipal Reclaimed Irrigation Use and Potable Water Supplement



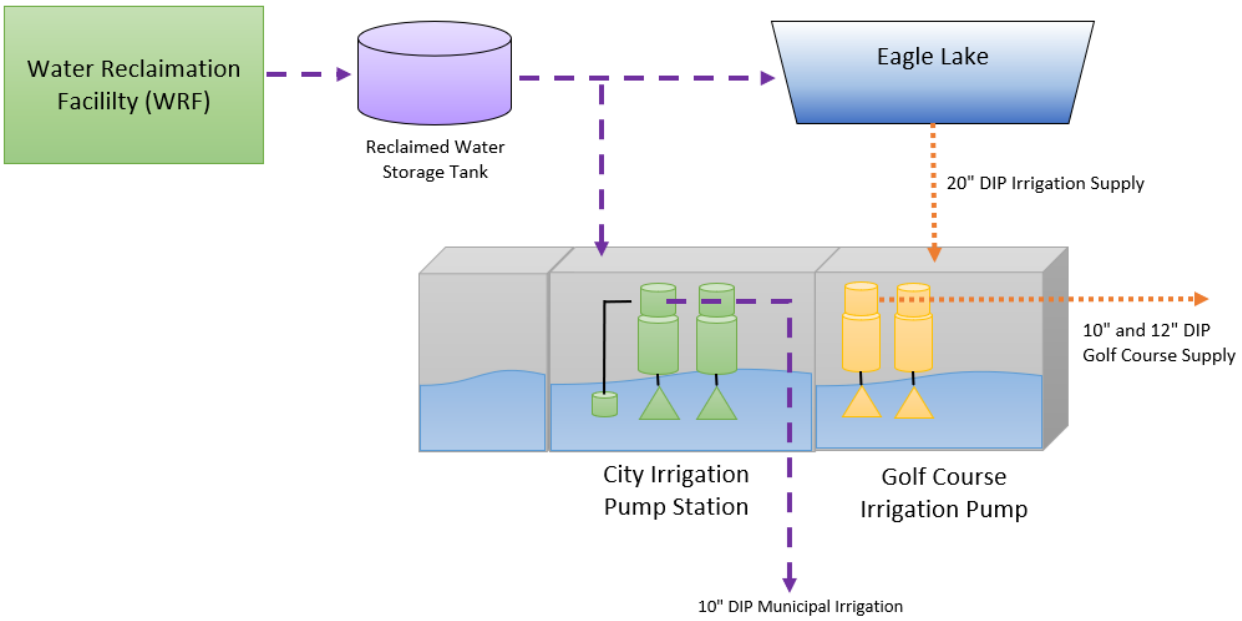
Converting the City's irrigation supply to potable water also will cause an increase in prices for City customers currently billed for reclaimed water. Per City Ordinance 1187, the rate for retail customers of the municipal irrigation system for reclaimed water is a flat rate (based on the percent of total zones a customer owns) plus a volumetric rate of $3.21 per 100 cubic feet (ccf) in 2023. The commercial water/potable irrigation rate is a flat rate (based on the size of the customer's water meter) plus a volumetric rate of $4.09/ccf in 2023 (assuming the usage falls within 300 to 801 ccf). Therefore, transitioning customers from reclaimed water to potable water would result in a cost increase of $0.88/ccf in 2023.

The Water System Plan (WSP) details future water rights and source capacity limitations. Table 6-3 of the WSP shows that instantaneous water rights would be deficient by 2040 even factoring Water Use Efficiency (WUE). Table 7-2 of the WSP shows that projected water source capacity would be deficient by 2030. Due to the City's population growth, limited water rights, and customer cost impacts, potable water is not a viable long-term solution for the City to comply with the Reclaimed Water Rule.

Alternative 2: Separation of City Reclaimed Water Irrigation System

Alternative 2 consists of constructing a new reclaimed water reservoir. Reclaimed water produced at the WRF would be stored in the reservoir and then connected to the irrigation distribution system at the IPS, thereby completely separating Eagle Lake from the municipal irrigation system. This alternative would provide the City with complete control of the reclaimed water quantity and quality as it leaves the WRF. Eagle Lake would continue to be supplied with reclaimed water for use by the Golf Course. **Figure 5** shows a schematic of this alternative.

Figure 5
Alternative 2 Schematic



Alternative 2A: Reclaimed Water Reservoir with Chlorination

To maintain a chlorine residual per WAC 173-219-370, a chlorination system would inject sodium hypochlorite into the City's irrigation pump station discharge as the water is pumped to the municipal irrigation distribution system. The disinfection infrastructure would include a bulk sodium hypochlorite chemical storage and feed system, chlorine residual analyzers in the irrigation distribution system at key locations (to ensure a residual greater than 0.2 mg/L free chlorine or greater than 0.5 mg/L total chlorine), and electrical and control improvements.

The disadvantages of chlorinating reclaimed water not only include the additional capital and operational costs for the chemical feed system, but also the challenges and labor required to maintain a chlorine residual in this type of distribution system. As shown in **Figure 1**, unlike a potable water distribution system that typically loops fresh water throughout a system, the reclaimed water distribution system consists of a 10-inch-diameter transmission main to Eagle Lake and a branching network of irrigation lines from the pump station. This results in many dead-end, small diameter pipelines, each with their own extended water age issues. It would be challenging to monitor the various extents of the irrigation zones for chlorine residual. It would be even more challenging to consistently maintain a healthy chlorine residual in an intermittent system that only operates overnight and is dormant for most of the day. A fully looped irrigation system would require a complete rebuild of this distribution system.

Alternative 2B: Reclaimed Water Reservoir without Chlorination

WAC 173-219-370 allows for the distribution chlorine residual requirement to be waived or modified if the reclaimed water generator can demonstrate a benefit from reducing or eliminating the chlorine residual. The City previously requested a distribution chlorine residual waiver in a December 2015 Engineering Report under the condition that the chlorination disinfection system be maintained to either mitigate biological growth within the irrigation distribution system or provide disinfection in the event the ultraviolet (UV) disinfection system

cannot meet reclaimed water standards. In 2019, the City received formal approval from Ecology and the Washington State Department of Health (DOH) to waive the distribution chlorine residual requirement for the UV application. The City is requesting that Ecology and DOH continue to waive the distribution chlorine residual requirement for the proposed application of completely separating Eagle Lake from the municipal irrigation system by constructing a reclaimed water reservoir. The many benefits of not chlorinating the City's reclaimed water include the issues referenced previously. City operations staff would not need to operate and maintain the chlorine storage and feed equipment or monitor chlorine residual throughout the various dead-end irrigation zones overnight during the hours of irrigation.

One of the strongest reasons to not chlorinate is that the City has been operating this irrigation system for more than two decades without any recorded violations or public health concerns regarding the use of reclaimed irrigation water. The City has complete control of the irrigation system, there are no unauthorized users of the reclaimed water system, and the late-night hours of operation limit human exposure to the Class A reclaimed water. Augmenting this water with a chlorine residual would require extensive additional maintenance for City staff with minimal health benefit.

To provide disinfection flexibility, the City can keep the WRF reclaimed water pump discharge chemical injection point available if sodium hypochlorite is ever needed to sanitize the irrigation distribution system in an emergency. The City previously chlorinated Class A reclaimed water before the UV light disinfection system was implemented at the WRF.

Recommendation

Separating the City's reclaimed water allotment from Eagle Lake by installing a new closed water reservoir is the best solution to meet the updated Permit requirements. This will allow the City to have full control of the quality of reclaimed water generated by the WRF. Maintenance of a chlorine residual to comply with WAC 176-219-370 may require rebuilding the City's entire irrigation distribution system, as well as extensive operator labor to maintain and operate a chlorine storage and injection system and monitor chlorine residuals in dead-end zones overnight. The non-looped irrigation distribution system may not feasibly sustain a chlorine residual due to extensive water quality issues within dead-end pipes. The effort required for maintaining this residual has minimal benefit since the City has had no reported public health issues with humans interacting with this reclaimed irrigation water since 1999 when construction was completed. It would be challenging to estimate the costs of chlorinating reclaimed water while upgrading the reclaimed water distribution system to ensure a persistent chlorine residual. The City is formally requesting Ecology waive the requirement of maintaining a chlorine residual as outlined in WAC 173-219-370, since separation through a proposed reclaimed water reservoir will meet the intent of the NPDES Permit.

Reclaimed Water Reservoir Preliminary Design

Reservoir Sizing

The reservoir will be sized to provide at least enough storage to meet the maximum day demand of the existing system over the 8 hour irrigation period. The irrigation period is from 10 PM to 6 AM and most reclaimed water is produced during the day. **Table 3** shows the basis of design for the reservoir's volume.

Table 3

Reclaimed Water Reservoir Volume Basis of Design

Condition	Criteria	Design Usage (gal)
Average Daily Demand	Average Day Demand (During Peak Irrigation Season)	180,000
Minimum Storage Volume	1.5 x Average Day Demand (per Reclaimed Water Facilities Manual)	270,000
Maximum Daily Storage Volume	Maximum Production from 2019-2022	360,000
Conservative Maximum Daily Storage Volume	Maximum Production with a 10% Safety Factor	400,000
Maximum IPS Pumping Condition	Eagle Lake Pump Station capacity with two 500 gpm pumps continuously running for 8 hours each night	480,000

The proposed reservoir should be sized to store approximately 400,000 gallons to provide some conservatism for the maximum daily volume. The exact size will be determined in a future phase of this project.

Reservoir Location

The proposed reclaimed water reservoir will be constructed along the reclaimed water transmission main that currently runs from the WRF to Eagle Lake. Reclaimed water will flow from the reservoir to the IPS and bypass Eagle Lake. A new control structure and clearwell also will need to be installed at the IPS. **Figure 6** provides six possible sites for the proposed reservoir. Sites 1 and 2 are preferable as they are out of the neighborhood's public view; however, they are both within Bonneville Power Administration's (BPA) easement and would require additional coordination and permitting prior to construction. If the BPA permitting timeline would prevent the tank from being constructed and operational by June 30, 2026, then Site 3 or 4 should be selected. Site 3 is within view of the Golf Course and many homeowners; therefore, it would require additional coordination with these stakeholders. Site 4 is at the WRF. This site would simplify operations and maintenance; however, due to hydraulic constraints, a reservoir at the WRF would have to be very shallow and would be significantly more expensive than the other sites. Site 5 would require constructing an additional clarifier at the WRF and utilizing it as a reclaimed water reservoir until City growth requires it to function as a clarifier to increase WRF treatment capacity. This option was eliminated as it is significantly more expensive than sites 1-3 and once a third clarifier is needed at the WRF, another reclaimed water reservoir also would be necessary. Site 6 is next to the IPS. This site was

eliminated due to the large number of existing utilities in the area. **Planning-Level Capital Costs** for all six sites are presented later in this Report.

Reservoir Access

The site will be developed to allow for large vehicles to drive to the infrastructure for any future work. The reservoir will be buried or partially buried depending on the selected location. There will be a single roof access hatch that will be a minimum of 30 inches in diameter for interior access and transport of any maintenance equipment inside the reservoir. The interior access ladder will be stainless steel and equipped with a safety climb system. The reservoir will be designed to prevent any stormwater intrusion to maintain the water quality of the reclaimed water.

Reservoir Mechanical

A control structure or mechanical piping system will be designed in a future phase of this project to split reclaimed water flows to the reservoir and to Eagle Lake. Due to the volume differences between the reservoir and Eagle Lake, the intent of the control structure would be to prioritize filling the reservoir first. The reservoir inlet pipe will be ductile iron outside of the reservoir, stainless steel under and through the reservoir foundation, and coated steel within the reservoir. The inlet pipe sizing and location will be determined during future phases of the project.

The separate outlet pipe also will be coated steel pipe inside the reservoir, stainless steel piping through the reservoir, and ductile iron piping outside the reservoir. There also will be new ductile iron piping from the reservoir outlet to the City's municipal irrigation pump station clearwell. The outlet pipe sizing will be determined during future phases of the project.

The reservoir control structure would direct any reservoir overflow water to Eagle Lake. This will be designed during future phases of the project. Reservoir drainage will also be determined during the design phase of the project and will account for the partially buried or completely buried structure, likely through piping or an accessory structure.

All pipes entering or leaving the reservoir will have expansion joints to allow for differential settling without putting strain on the pipes.

The reservoir will have one roof vent to move air during normal operation and provide vacuum protection for a major drawdown event. The vent system will be confirmed during the design phase of the project.

Reservoir Electrical, Telemetry, and Lighting

The reservoir instrumentation will communicate with the City's Supervisory Control and Data Acquisition (SCADA) system through fiber optic lines. The location of the existing wiring that can be extended to the site will be evaluated during future phases of the project.

The SCADA system at the reservoir site will monitor reservoir levels, notify staff of access hatch intrusion, and notify the City if there is an overflow event. Updates to the telemetry system at

the IPS will allow City operators to monitor and control water levels in Eagle Lake and the bypass control structure.

The reservoir will have site lighting to help facilitate City staff to access the reservoir anytime throughout the day. Additional security measures will be determined during future phases of the project.

Operations and Maintenance Considerations

City WRF staff would operate and maintain the proposed reservoir and control structure, but the required labor is expected to be minimal due to the passive nature of these distribution system improvements.

If irrigation water is required in early spring before the WRF starts producing Class A reclaimed water regularly, then the irrigation system should be configured to be supplemented with potable water through an air gap or an approved backflow prevention device for potable cross-connection control.

The City can plan on shock chlorinating the transmission main, reservoir, and pipeline routinely as a maintenance procedure to ensure sanitary conditions at the start of each irrigation season. The emergency chlorination injection point can be activated for this activity. At the end of each irrigation season, the irrigation distribution system can be flushed and drained as much as possible.

Once construction of the reclaimed water reservoir is complete, the City will update its *Reclaimed Water Operations and Maintenance Manual* per the NPDES Permit requirements. This will include shock chlorination and flushing protocols for the reclaimed water distribution system, updates to the sign maintenance program, and cross-connection control maintenance activities, such as proper backflow prevention assembly testing protocols.

Planning-Level Capital Costs

This section summarizes the capital costs of the reclaimed water storage tank alternatives presented in **Figure 6**. **Table 4** presents an opinion of probable construction and overall project costs for a proposed reservoir on Sites 1 through 3, as these three sites have similar capital costs related to being undeveloped with minimal existing infrastructure and utilities. **Table 5** presents an opinion of probable cost for Site 4, which is significantly higher than Sites 1, 2, and 3 due to the shallow and wide geometry of the proposed tank to make the WRF location feasible. **Table 6** presents an opinion of probable cost for Site 5, which constructs a new clarifier to function as a reclaimed water reservoir. **Table 7** presents an opinion of probable cost for Site 6, which locates the proposed reservoir directly adjacent to the IPS. Costs and contingencies will be further refined during future phases of the project.

Table 4

Engineer's Opinion of Probable Capital Cost for Sites 1 through 3 (Greenfield Sites)

Item	Unit	Total Cost
Mobilization, Demobilization, Site Prep, and Cleanup (10%)	LS	$265,000
Site Work	LS	$275,000
Structural	LS	$2,239,000
Utility	LS	$100,000
Electrical, Telemetry, and Automatic Control	LS	$100,000
Construction Cost Subtotal		**$2,979,000**
Construction Contingency (30%)		$894,000
Sales Tax (8.9%)		$265,200
Total Estimated Construction Cost		**$4,139,000**
Engineering Design, Survey, Geotechnical, Permitting, Bid-Phase Services, Construction-Phase Services		$1,449,000
City Project Administration		$621,000
Total Project Cost		**$6,300,000**

Table 5

Engineer's Opinion of Probable Capital Cost for Site 4 (at WRF)

Item	Unit	Total Cost
Mobilization, Demobilization, Site Prep, and Cleanup (10%)	LS	$323,000
Site Work	LS	$300,000
Structural	LS	$2,688,000
Utility	LS	$90,000
Electrical, Telemetry, and Automatic Control	LS	$150,000
Construction Cost Subtotal		**$3,551,000**
Construction Contingency (30%)		$1,066,000
Sales Tax (8.9%)		$316,000
Total Estimated Construction Cost		**$4,933,000**
Engineering Design, Survey, Geotechnical, Permitting, Bid-Phase Services, Construction-Phase Services		$1,727,000
City Project Administration		$740,000
Total Project Cost		**$7,400,000**

Table 6

Engineer's Opinion of Probable Capital Cost for Site 5 (WRF Clarifier)

Item	Unit	Total Cost
Mobilization, Demobilization, Site Prep, and Cleanup (10%)	LS	$302,000
Site Work	LS	$450,000
Structural	LS	$1,715,000
Utility	LS	$450,000
Electrical, Telemetry, and Automatic Control	LS	$400,000
Construction Cost Subtotal		**$3,317,000**
Construction Contingency (30%)		$996,000
Sales Tax (8.9%)		$296,000
Total Estimated Construction Cost		**$4,610,000**
Engineering Design, Survey, Geotechnical, Permitting, Bid-Phase Services, Construction-Phase Services		$1,614,000
City Project Administration		$692,000
Total Project Cost		**$7,000,000**

Table 7

Engineer's Opinion of Probable Capital Cost for Site 6 (at IPS)

Item	Unit	Total Cost
Mobilization, Demobilization, Site Prep, and Cleanup (10%)	LS	$316,000
Site Work	LS	$400,000
Structural	LS	$1,910,000
Utility	LS	$750,000
Electrical, Telemetry, and Automatic Control	LS	$100,000
Construction Cost Subtotal		**$3,476,000**
Construction Contingency (30%)		$1,041,000
Sales Tax (8.9%)		$309,000
Total Estimated Construction Cost		**$4,826,000**
Engineering Design, Survey, Geotechnical, Permitting, Bid-Phase Services, Construction-Phase Services		$1,687,000
City Project Administration		$723,000
Total Project Cost		**$7,300,000**

Sites 1, 2, and 3 are the lowest cost options for the proposed reclaimed water reservoir and are to be further explored during future phases of this project. Locating the reservoir at the WRF (Site 4) was eliminated since it is more expensive and would reduce the amount of expandable area at the WRF. While developing a third WRF clarifier (Site 5) would be more expensive than Sites 1 through 3, it has the benefit of being converted into a future clarifier when needed.

However, this option postpones a true reclaimed water storage solution for the future and has been eliminated. Building the reservoir directly at the IPS (Site 6) would require a massive reconstruction of below-grade utilities; this option has been eliminated due to the additional cost and unknown risks.

Conclusions and Next Steps

The recommended alternative to comply with the Reclaimed Water Rule is for the City to store reclaimed water in a proposed reservoir, separating this supply. The proposed reservoir should be located in an open area near the Golf Course away from existing infrastructure and utilities (proposed Sites 1, 2, and 3). The irrigation system is a non-expanding system with no proposed new reclaimed water users in the near future. The existing infrastructure was operated and maintained for more than two decades with no public health concerns since the City irrigates overnight to minimize human exposure. Implementing a chlorination system to provide a chlorine residual would incur extensive costs and labor for minimal benefit.

The predesign and site selection will be finalized in 2023. A preliminary environmental review and planning-level State Environmental Policy Act (SEPA) Checklist will be prepared in 2023 and will be amended to a project-level SEPA in a future phase of this project after site selection. Design of the recommended improvements is anticipated to begin in 2024, with the goal to have construction complete by June 30, 2026, to comply with the milestones listed on the Permit. The preliminary design-level cost estimate for this project is between $6,000,000 to $7,000,000, depending on the selected tank location.

Figures

FIGURE 1: EXISTING RECLAIMED WATER SYSTEM MAP

RECLAIMED WATER DISTRIBUTION SYSTEM ENGINEERING REPORT

RH2

CITY OF SNOQUALMIE

SCALE: 1" = 800'

0" 1/2" 1"

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 6/28/2023

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FIGURE 6: POTENTIAL RESERVOIR LOCATIONS

RECLAIMED WATER DISTRIBUTION SYSTEM ENGINEERING REPORT

RH2

CITY OF SNOQUALMIE

SCALE: NTS

0" 1/2" 1"

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

PLOT DATE: 9/11/2023

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