

Using Hydraulic Modeling to Support Storage Evaluation and Operational Changes

Adib Altallal (City of Tukwila)

Aurelie Nabonnand & Natalie Reilly (Carollo Engineers)

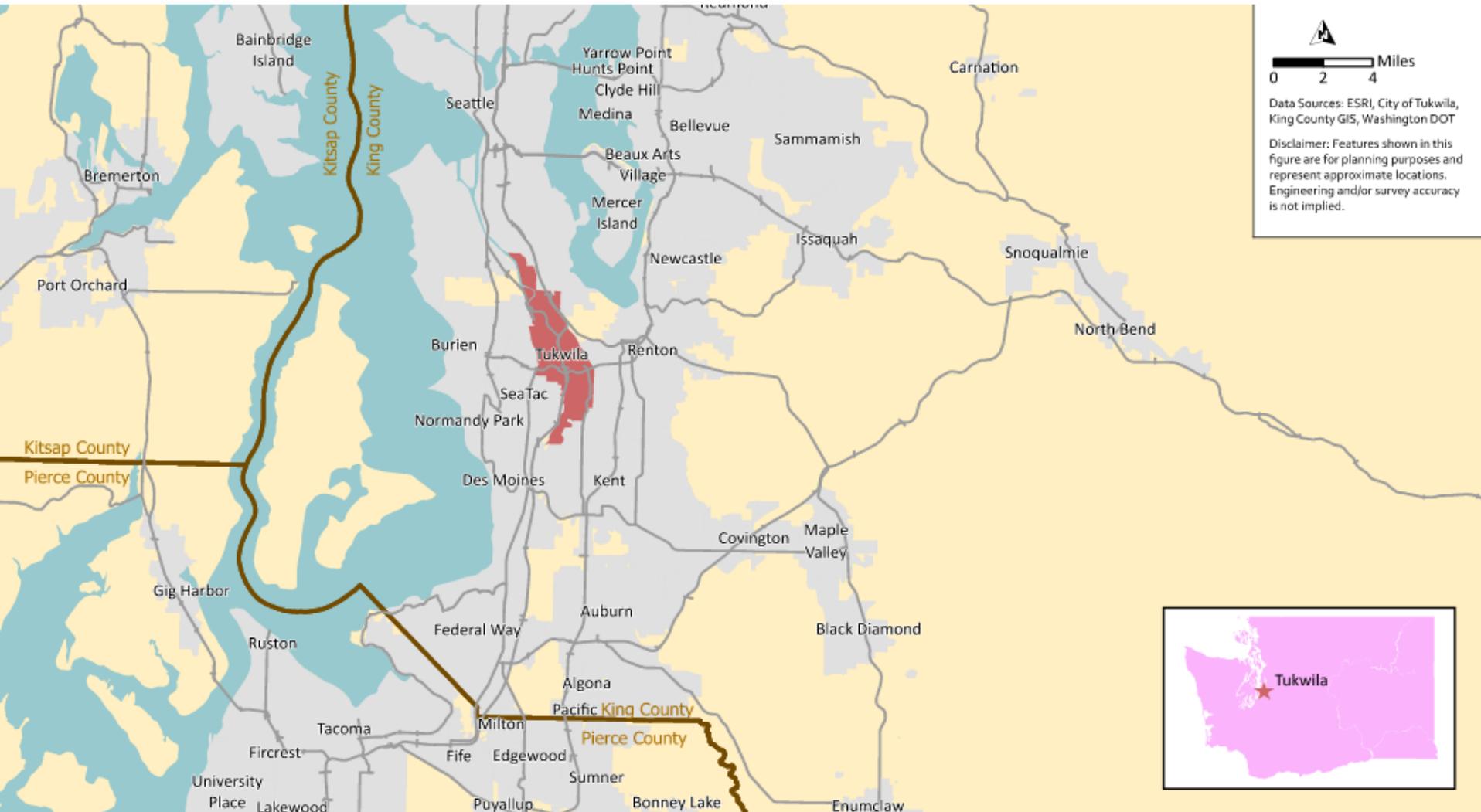


Today's Presentation

- Introduction
- Storage Analysis Overview
- New Storage Tank Siting
- Hydraulic Modeling Analysis
- Take Aways

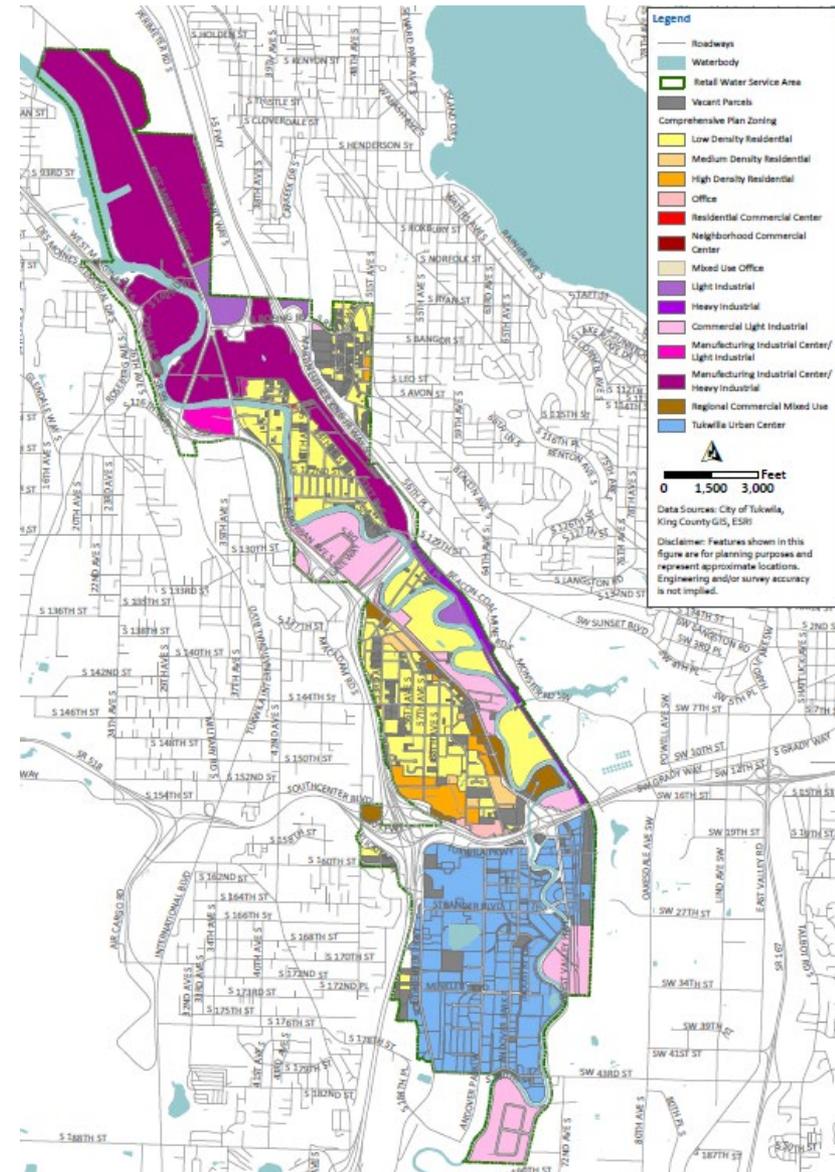
Introduction

Where is Tukwila?



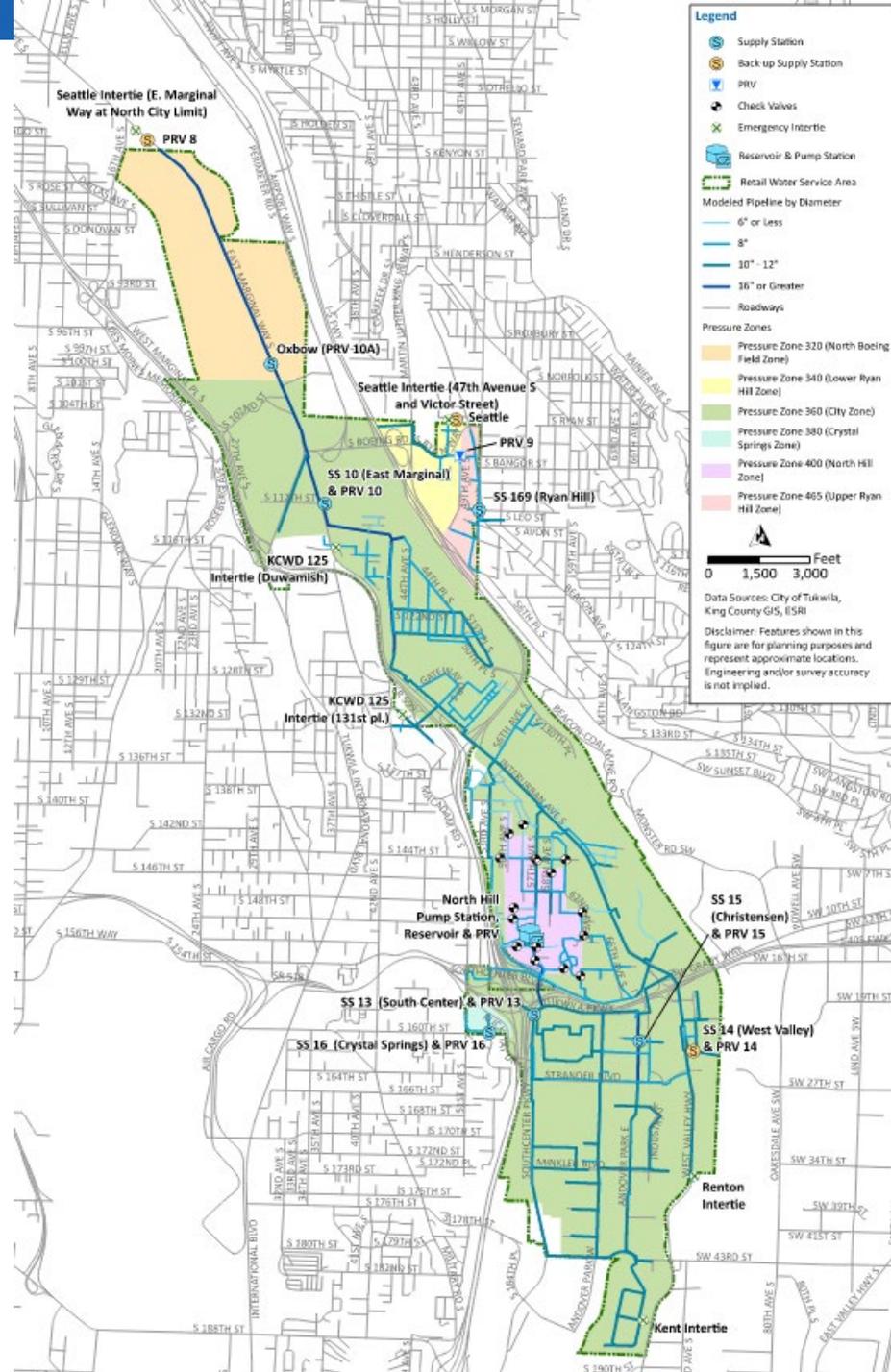
Who does Tukwila serve?

- 2,195 water accounts
- Average Day Demand= ~2 MGD
- Maximum Day Demand = ~3.2 MGD
- Large customers:
 - Shasta Beverage
 - Westfield Southcenter (two meters)
 - Boeing
 - Embassy Suites by Hilton

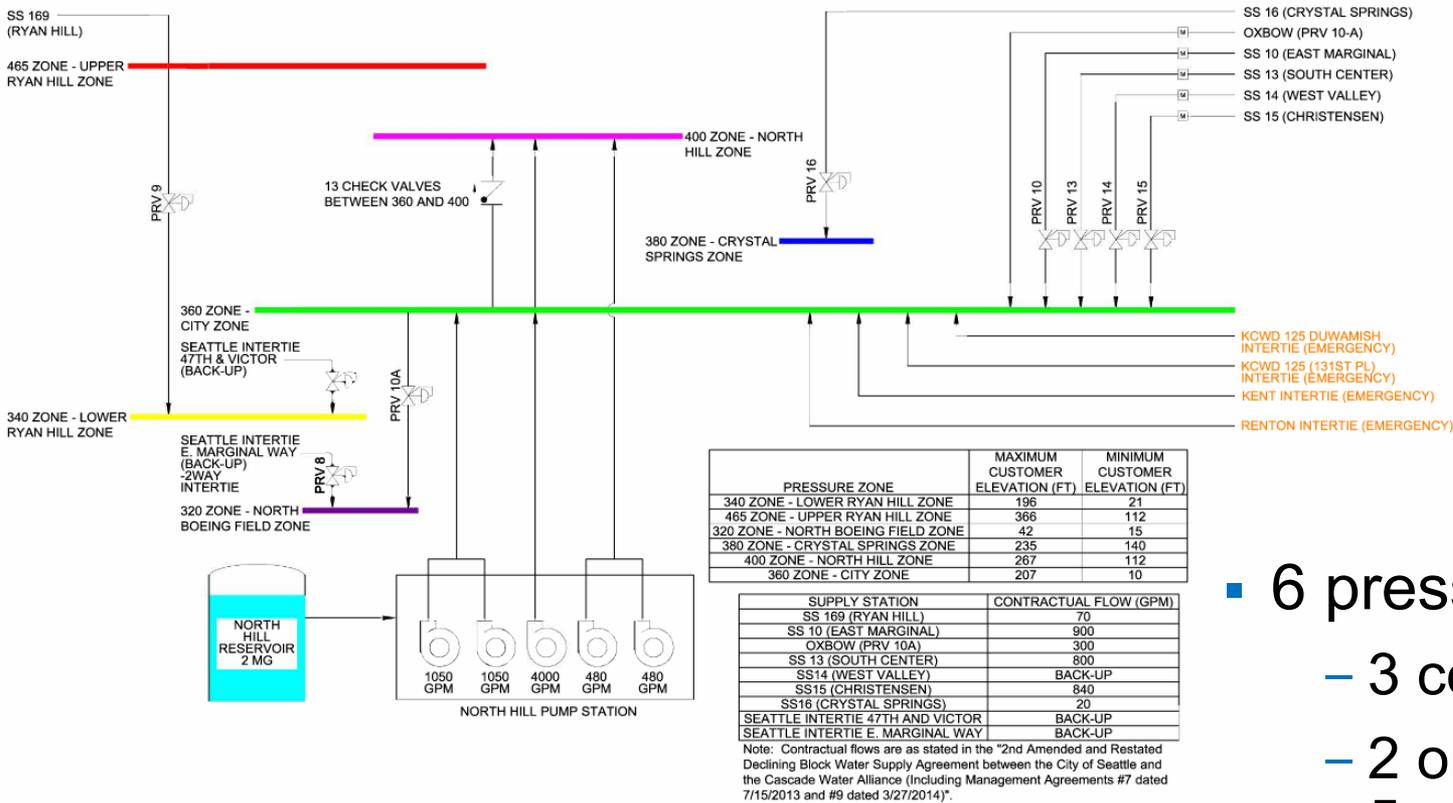


// Tukwila's Distribution System

- 7 supply stations and 5 emergency supply interties
- 44 miles of pipe
- One 2-MG storage reservoir



// Tukwila's Distribution System



- 6 pressure zones
 - 3 connected
 - 2 on east side of I-5 w/ no connection
 - 1 south of I-405 and west of I-5 w/ no connection

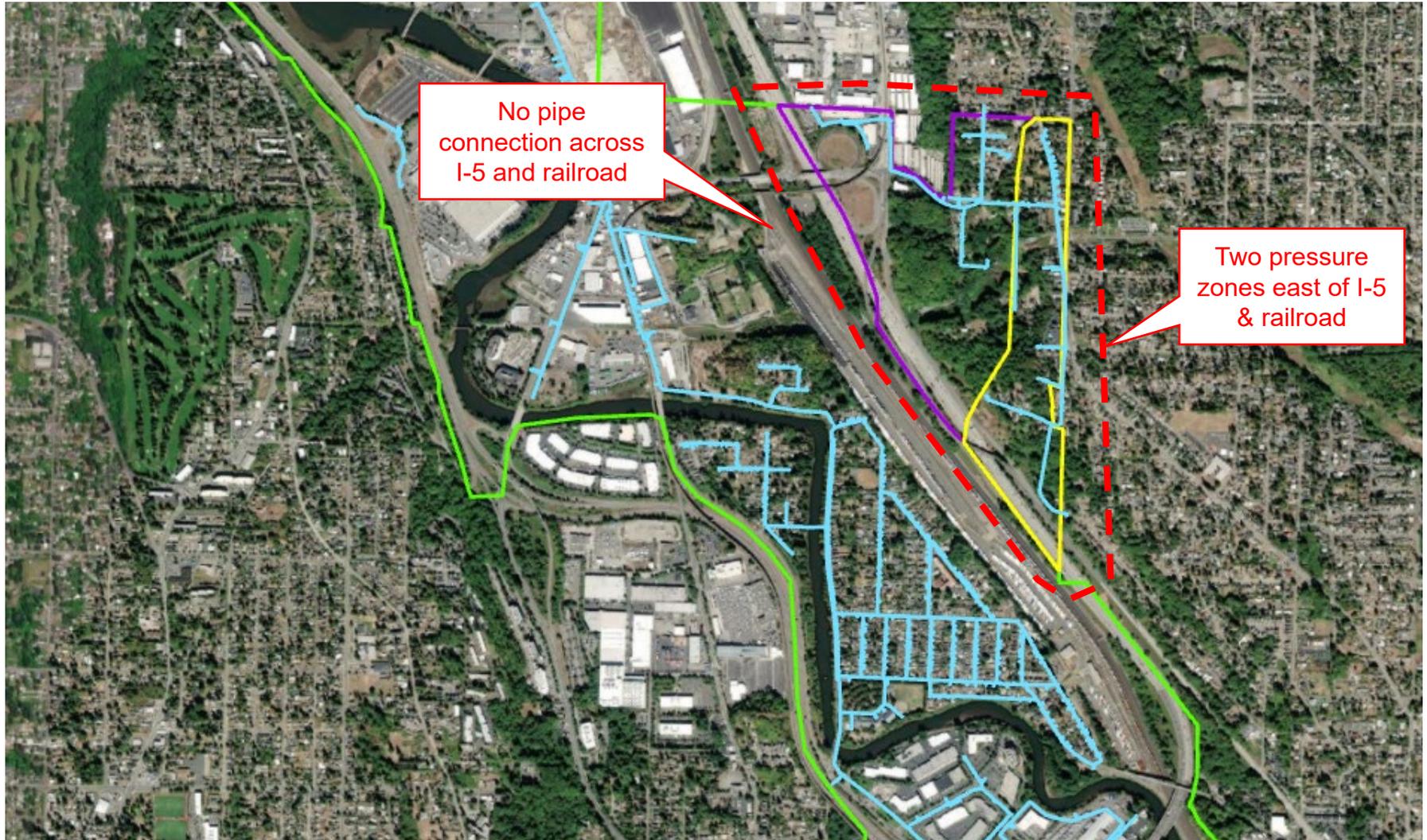
- Water supply: Cascade Water Alliance.
 - Cedar River and West Seattle Pipelines

Storage Analysis Overview

// Storage analysis was performed for the Water System Plan

- Follows DOH guidelines and requirements
- Storage deficiency is ~ 2.5 MG
- Strategies to acquire additional storage included:
 - Construct new storage tanks.
 - Collaborate with adjacent purveyors.
 - Move customers in isolated pressure zones to adjacent purveyors.

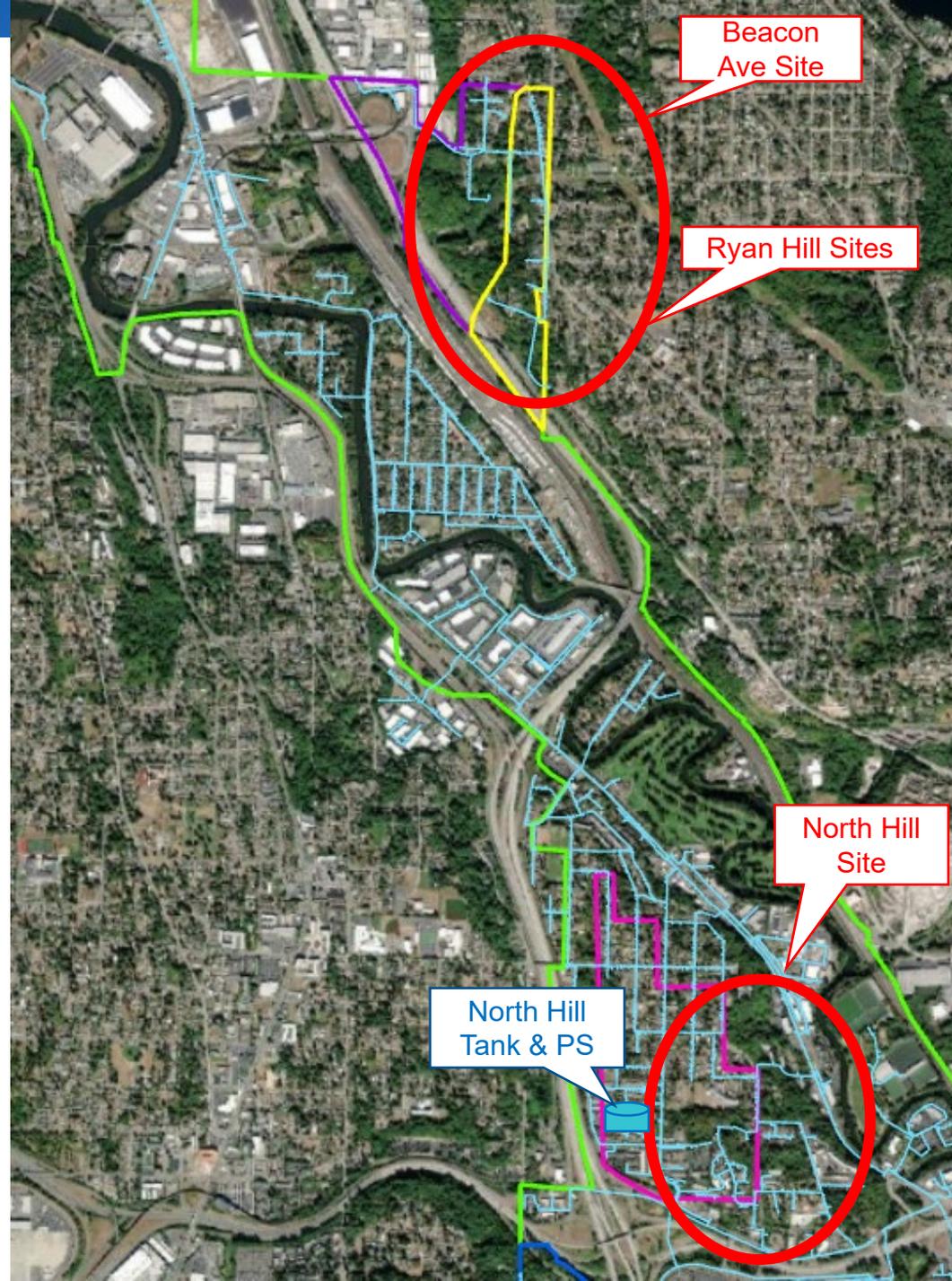
System Configuration makes it impossible to share storage



New Storage Tank Siting

Four locations for a future reservoir were evaluated

- Options 1A & 1B: North Hill Site
- Option 2: Beacon Ave Site
- Options 3 and 4: Ryan Hill Sites



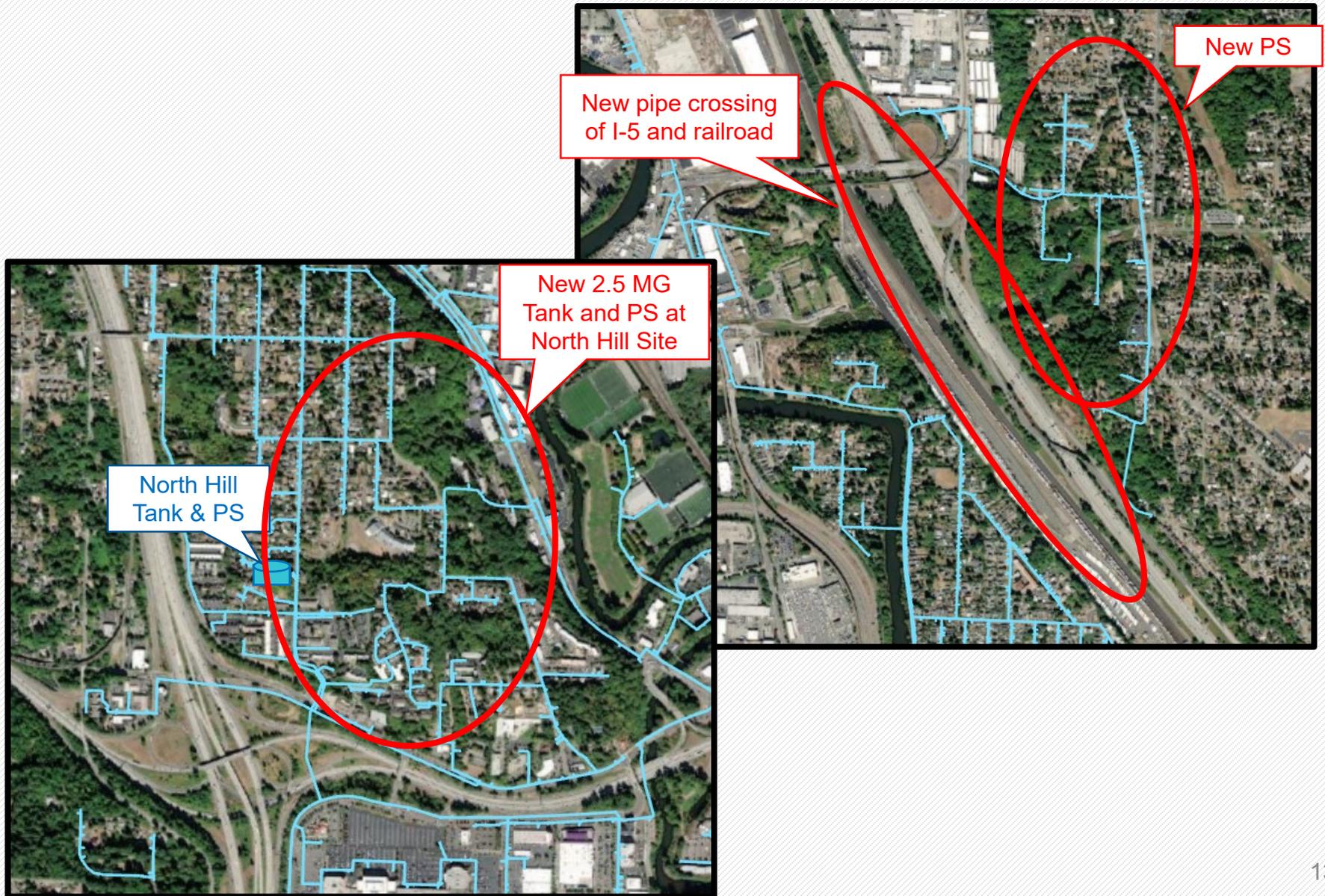
Beacon Ave Site

Ryan Hill Sites

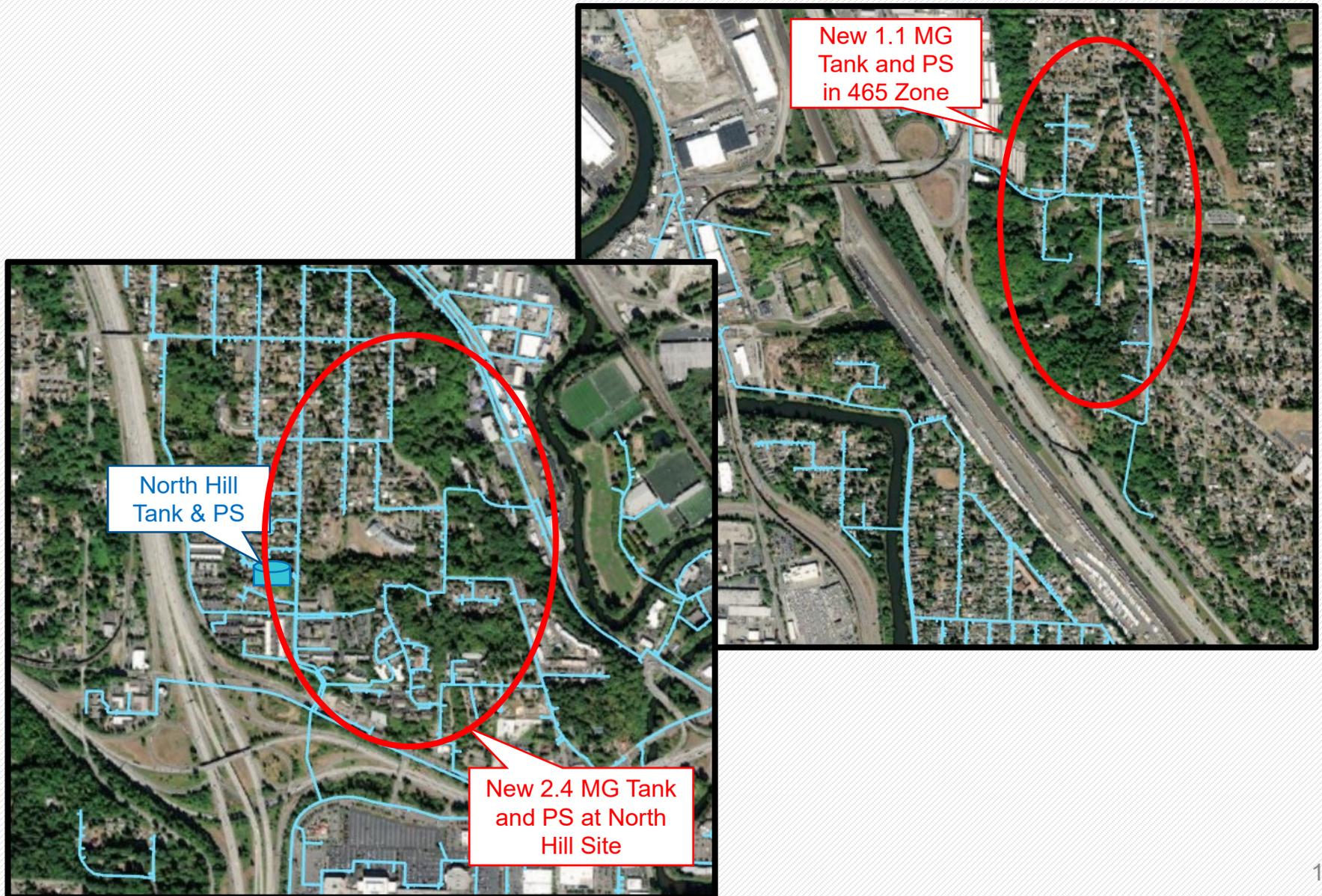
North Hill Site

North Hill Tank & PS

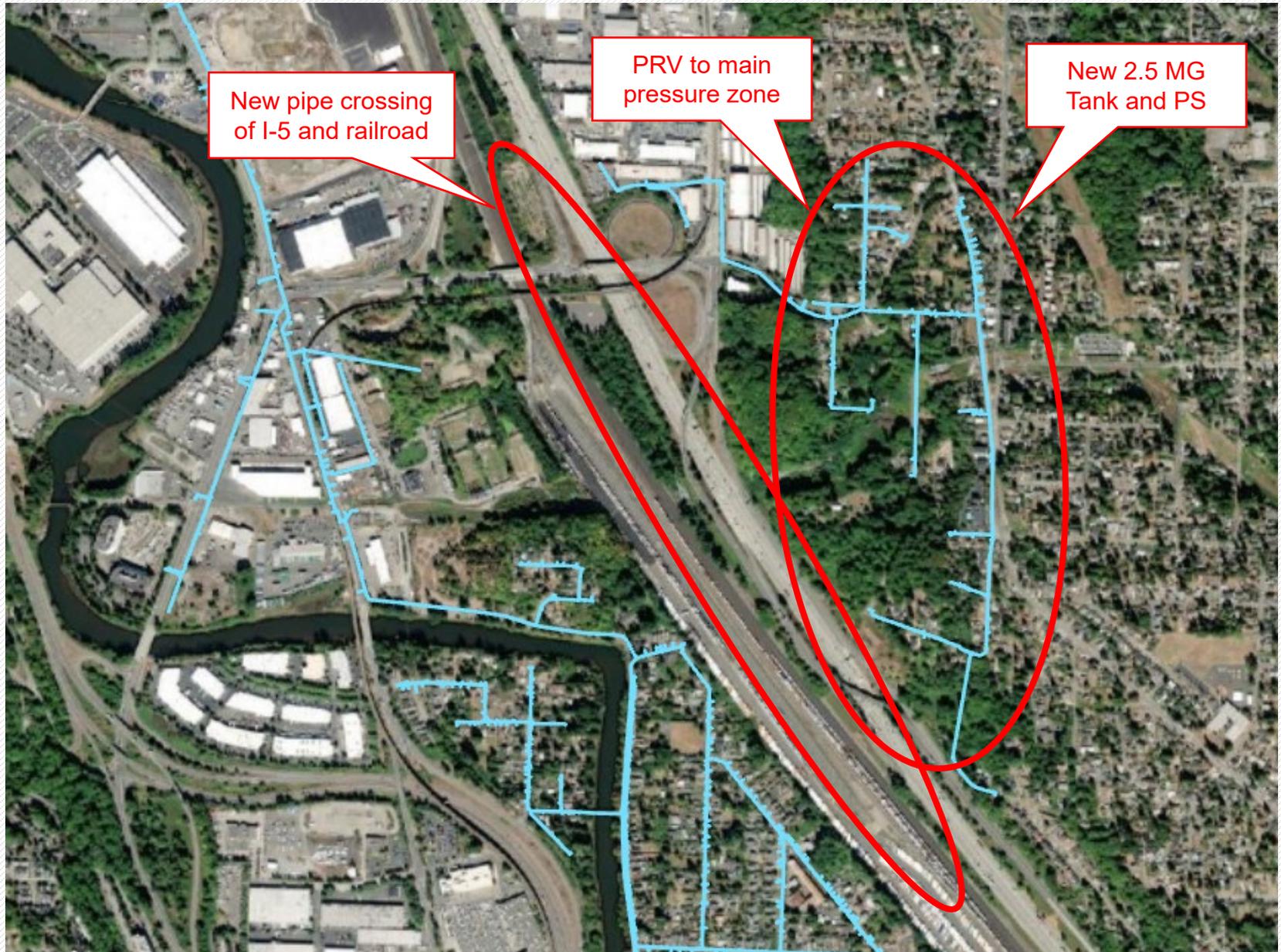
Option 1A: North Hill Site w/ BPS to East I-5 Zone



Option 1B: North Hill Site w/ Separate East I-5 Zone Tank

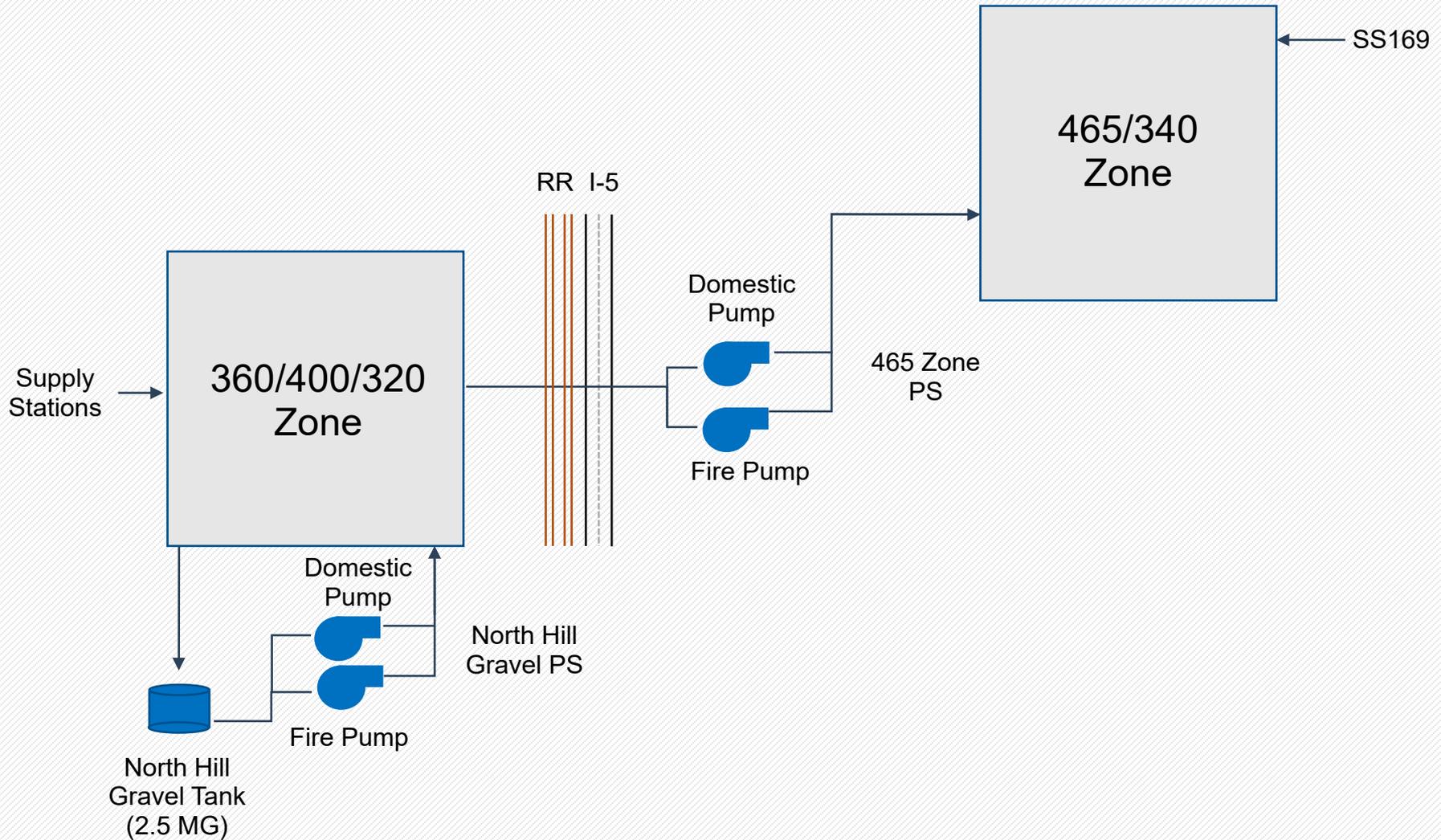


Options 2/3/4: Beacon Ave & Ryan Hill Sites

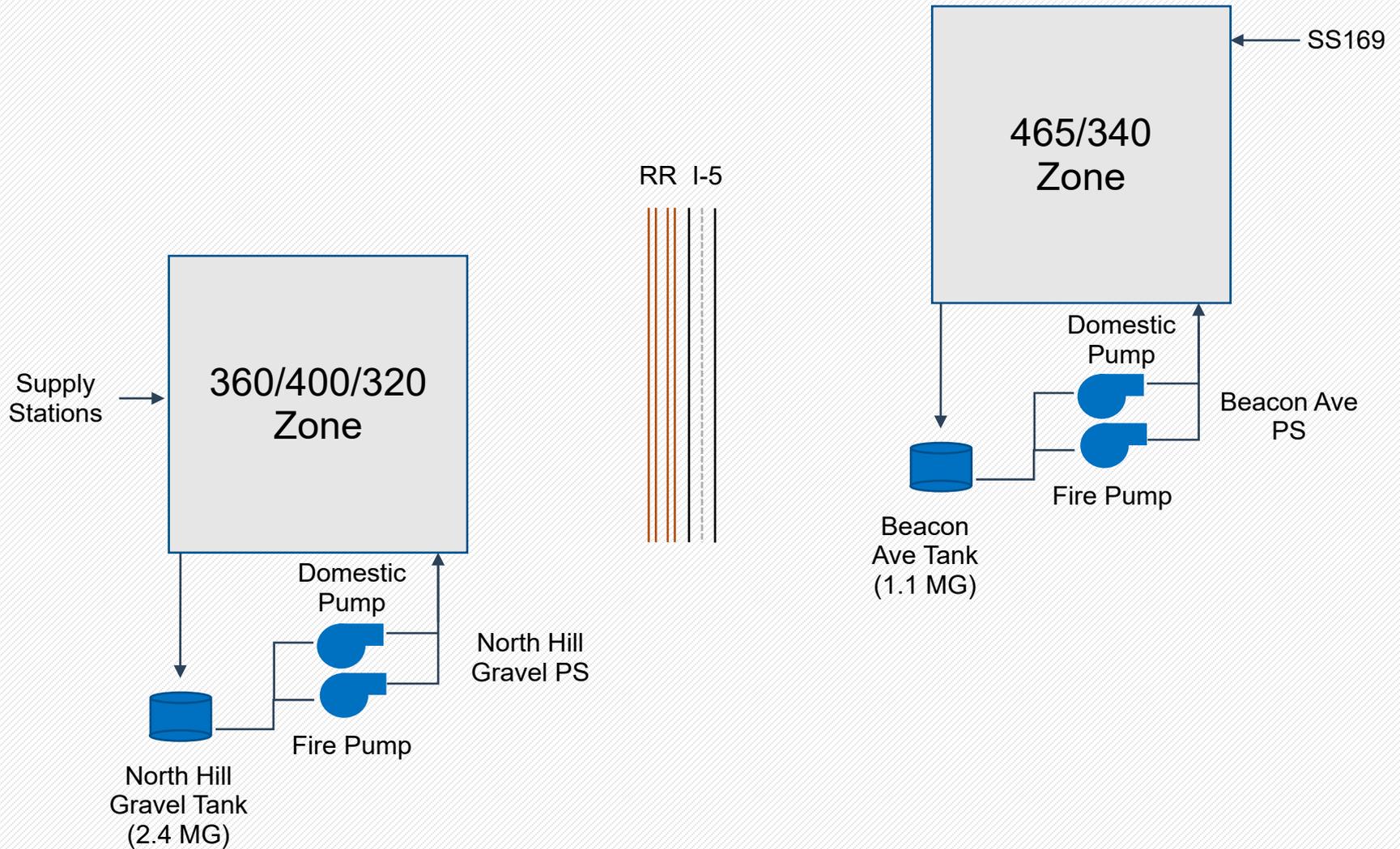


Hydraulic Modeling Analysis

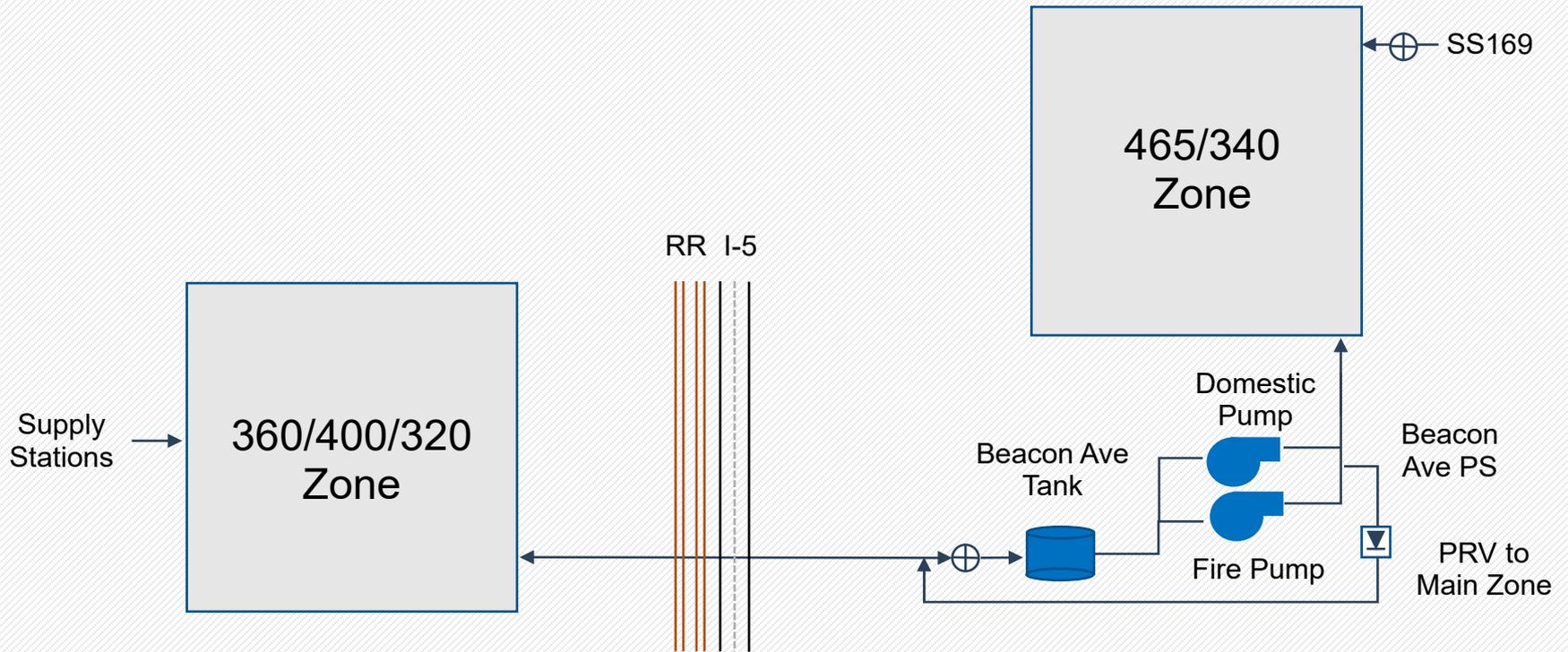
Option 1A: North Hill Site w/ BPS to East I-5 Zone Hydraulic Schematic



Option 1B: North Hill Site w/ Separate East I-5 Zone Tank Hydraulic Schematic

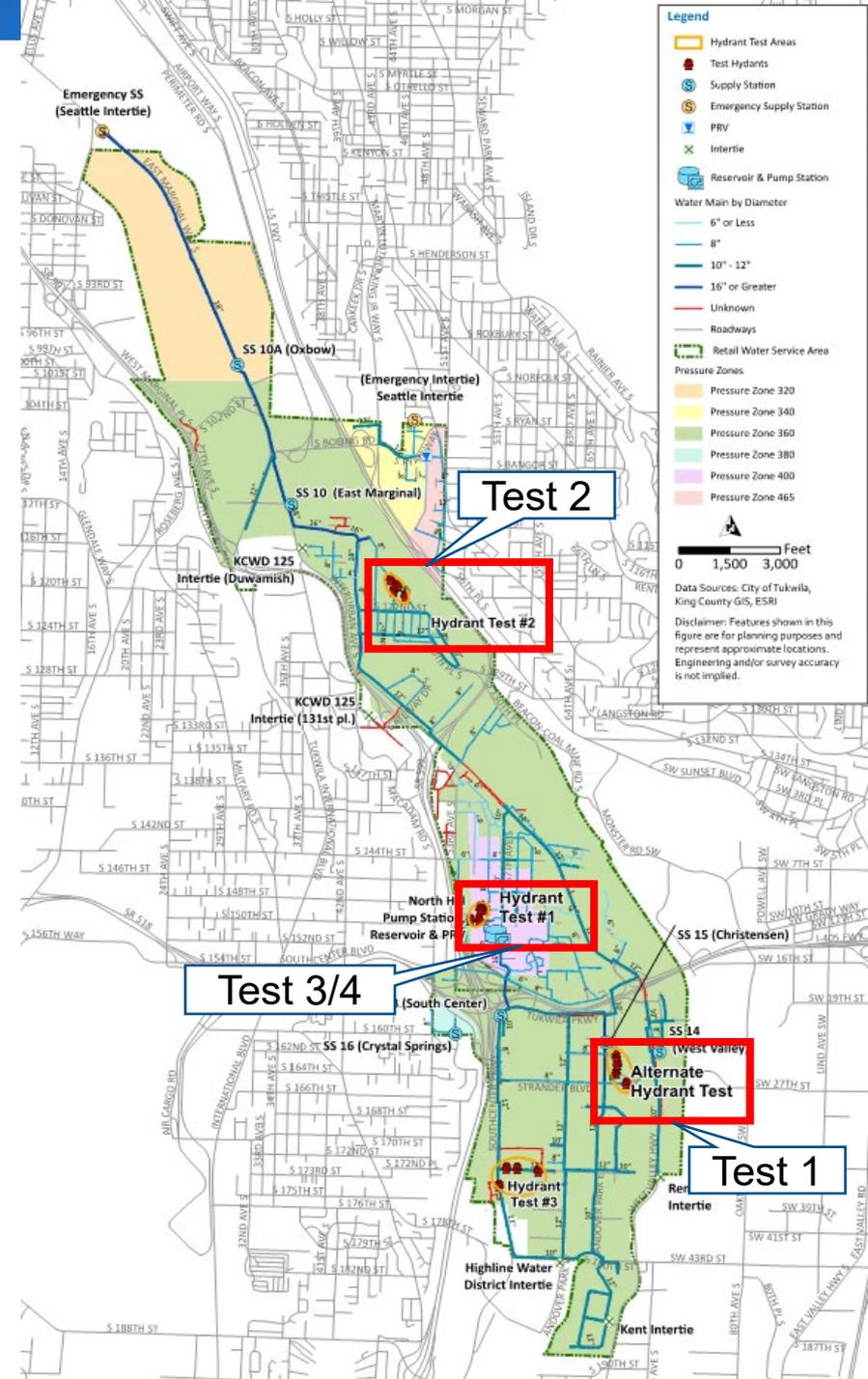


Options 2/3/4 Hydraulic Schematic



City's hydraulic model was updated and calibrated

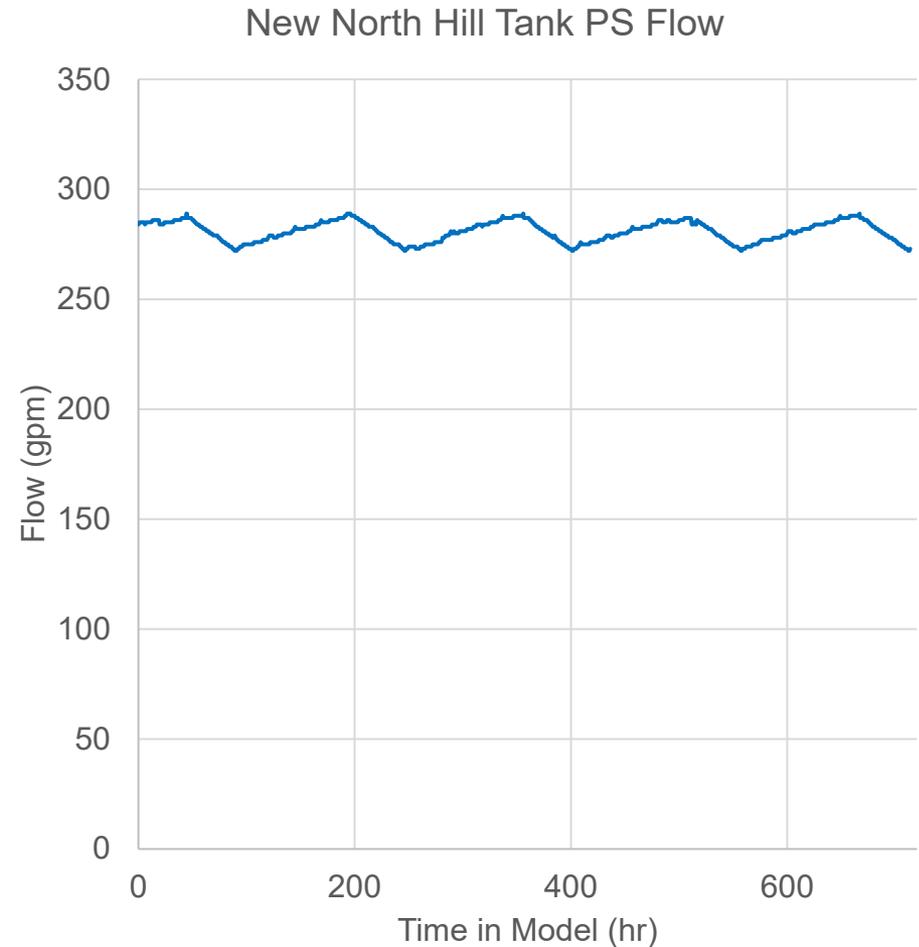
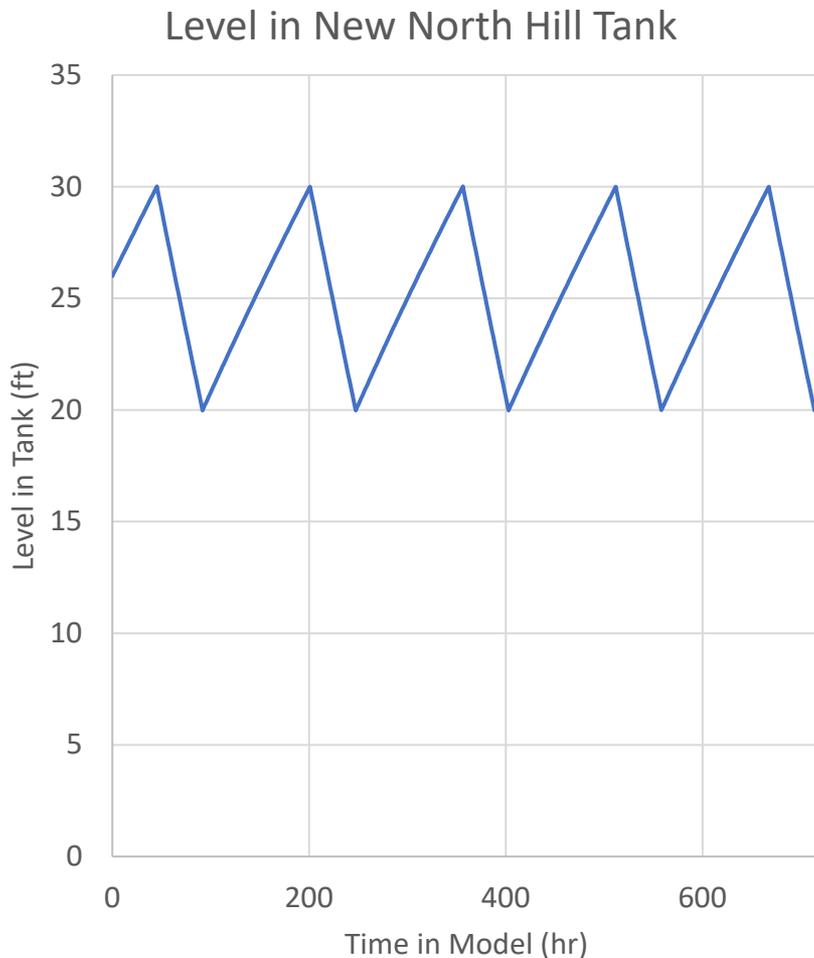
- Hydraulic model in WaterCAD software.
- Updated physical system to show existing system.
- City performed hydrant tests used for model calibration.



// Hydraulic model was used to evaluate potential storage locations

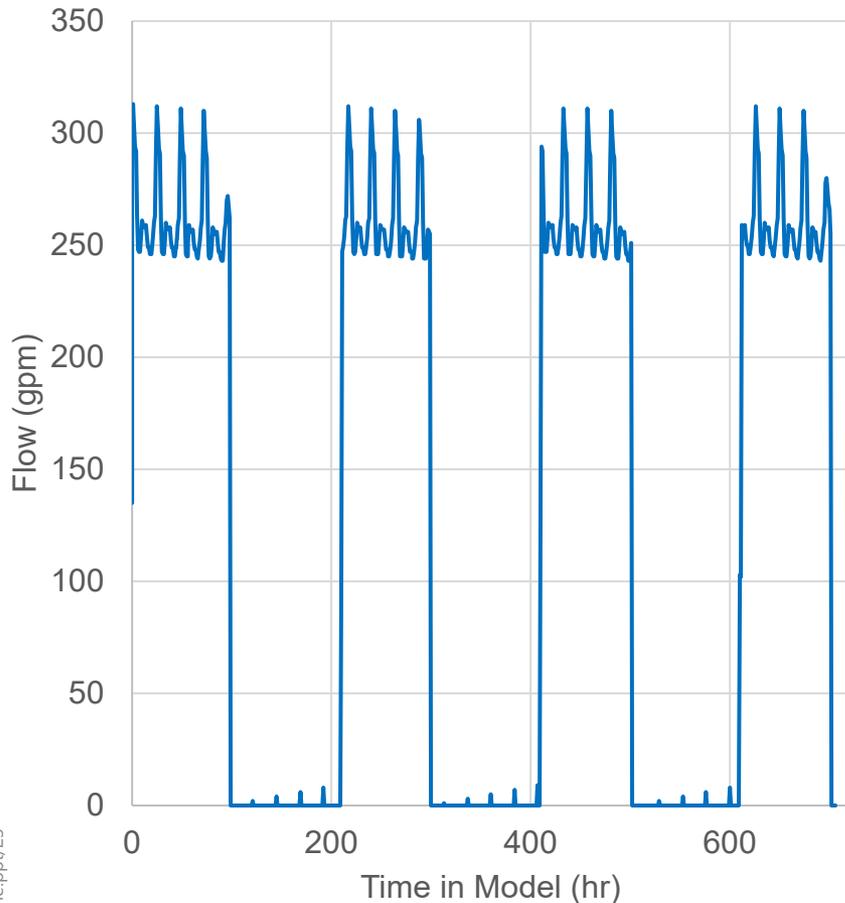
- Modeled scenarios to review:
 - Tank turnover and ability to fill.
 - Pump station flows.
 - Flows from supply stations compared to contractual flows.
 - Minimum and maximum system pressures.
 - Residual pressures during fire flow events.

// Identified PS flows to provide adequate tank turnover and fire flow replenishment

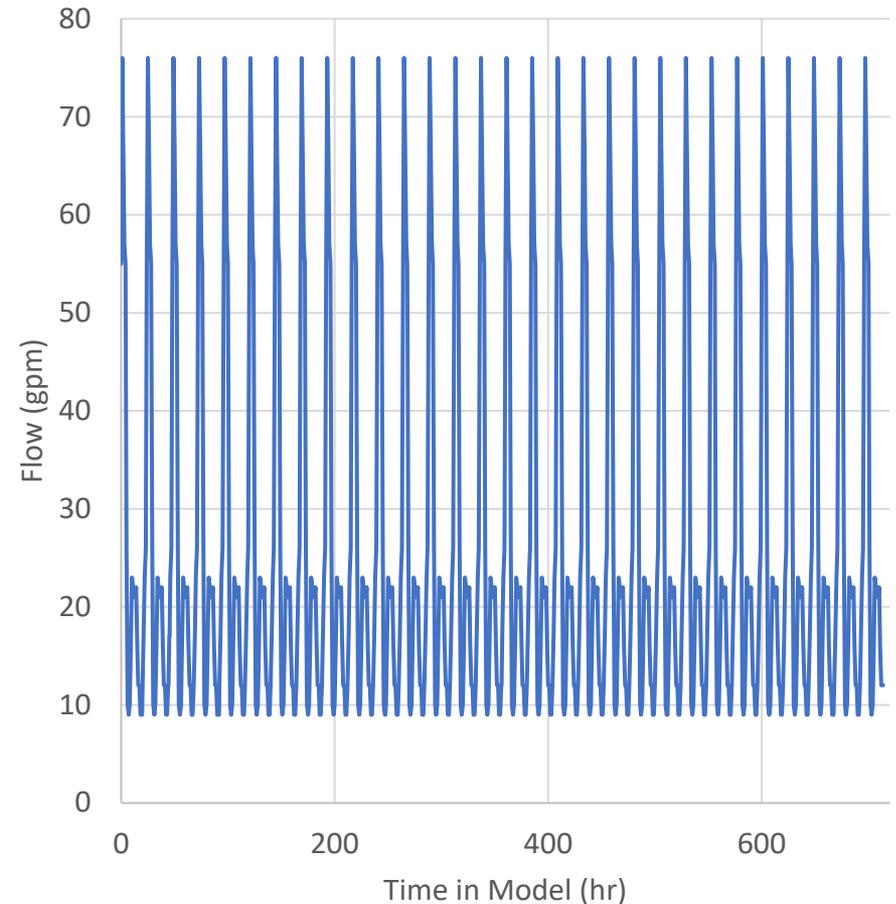


// Compared flows from supply stations to contractual flows

Flow from SS 169

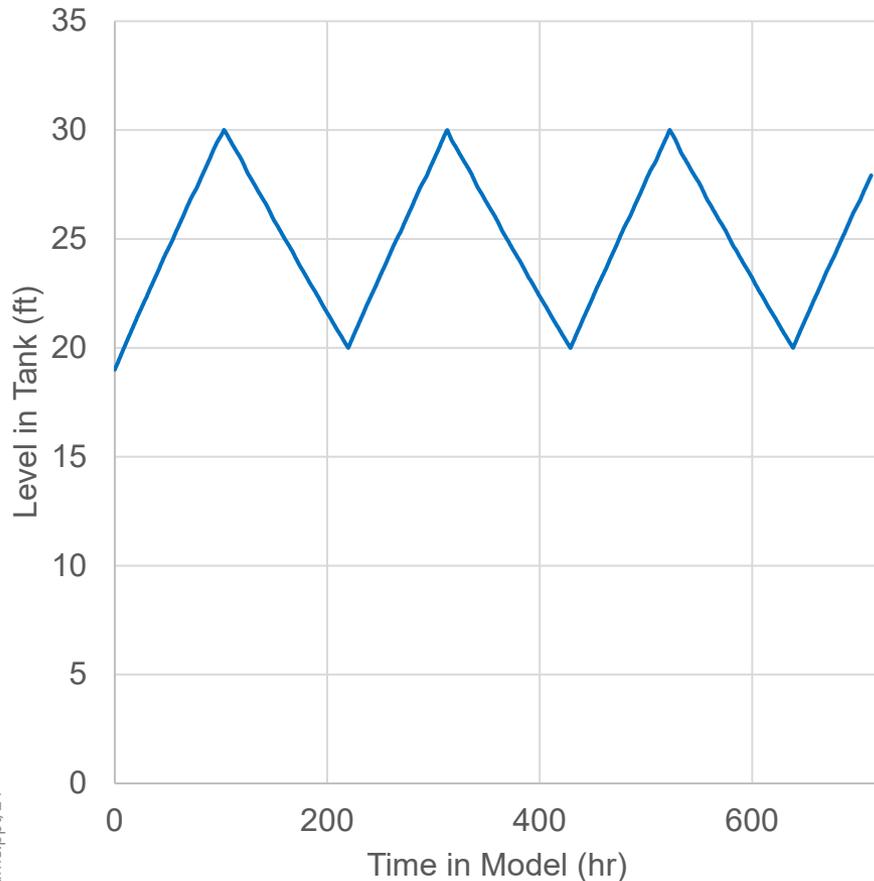


Flow from SS 169

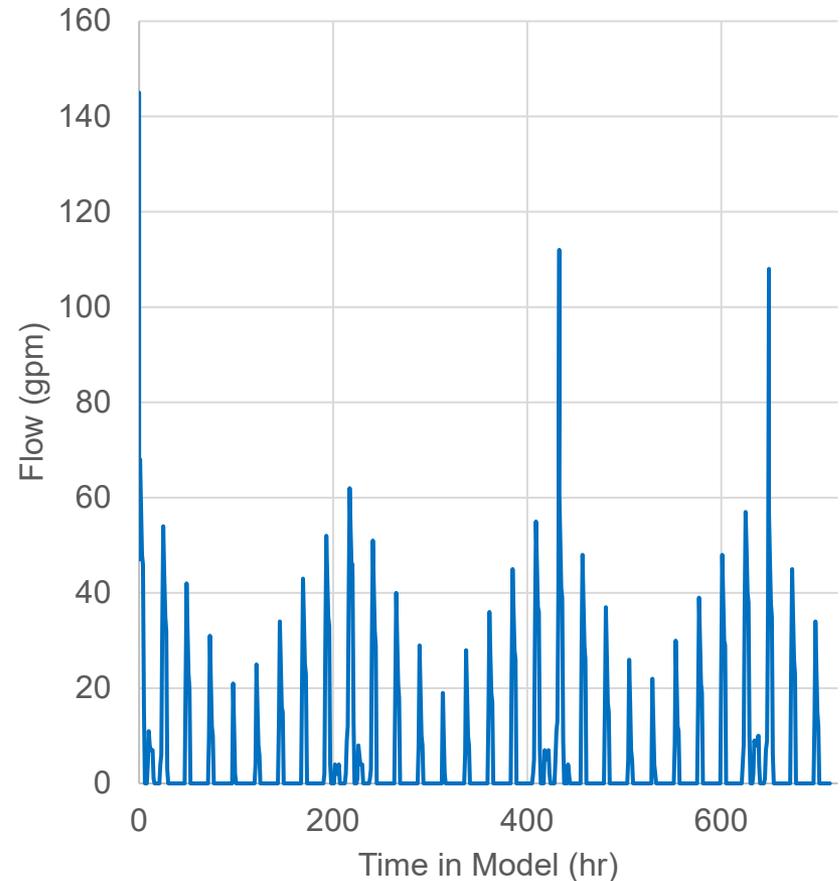


// Determined gravity flow to fill tank and supplemental flows from supply station

Level in Beacon Ave Tank



Flow from SS 169



// Modeling results considered during alternatives analysis for storage site

Evaluation Criteria	Alternative 1A	Alternative 1B	Alternative 2	Alternatives 3/4
Initial Capital Cost				
Annual O&M Costs				
Water Age Issues				
Fire Flow Availability				
Maximize Gravity Storage				
Construction Complexity				
System Resiliency				

Notes:

 Good
  Fair
  Poor

// Take Aways

- Hydraulic model used to confirm infrastructure size and operations → more than “just” a paper exercise
- Parameters such as tank cycling, turnover, pressures and impact to existing infrastructure were evaluated
- Provides the City with a jump start on this project and detailed data to make an informed decision

Questions?