TECHNICAL MEMORANDUM

Date: June 19, 2025

To: Andrew Leach, City of Sumner

From: Kevin Cook, PE, Sudip Gautam, PhD, Kevin Garcia, PE; BHC Consultants, LLC

Subject: Urban Growth Area Rezone – Water and Sewer Utility Impacts Analysis

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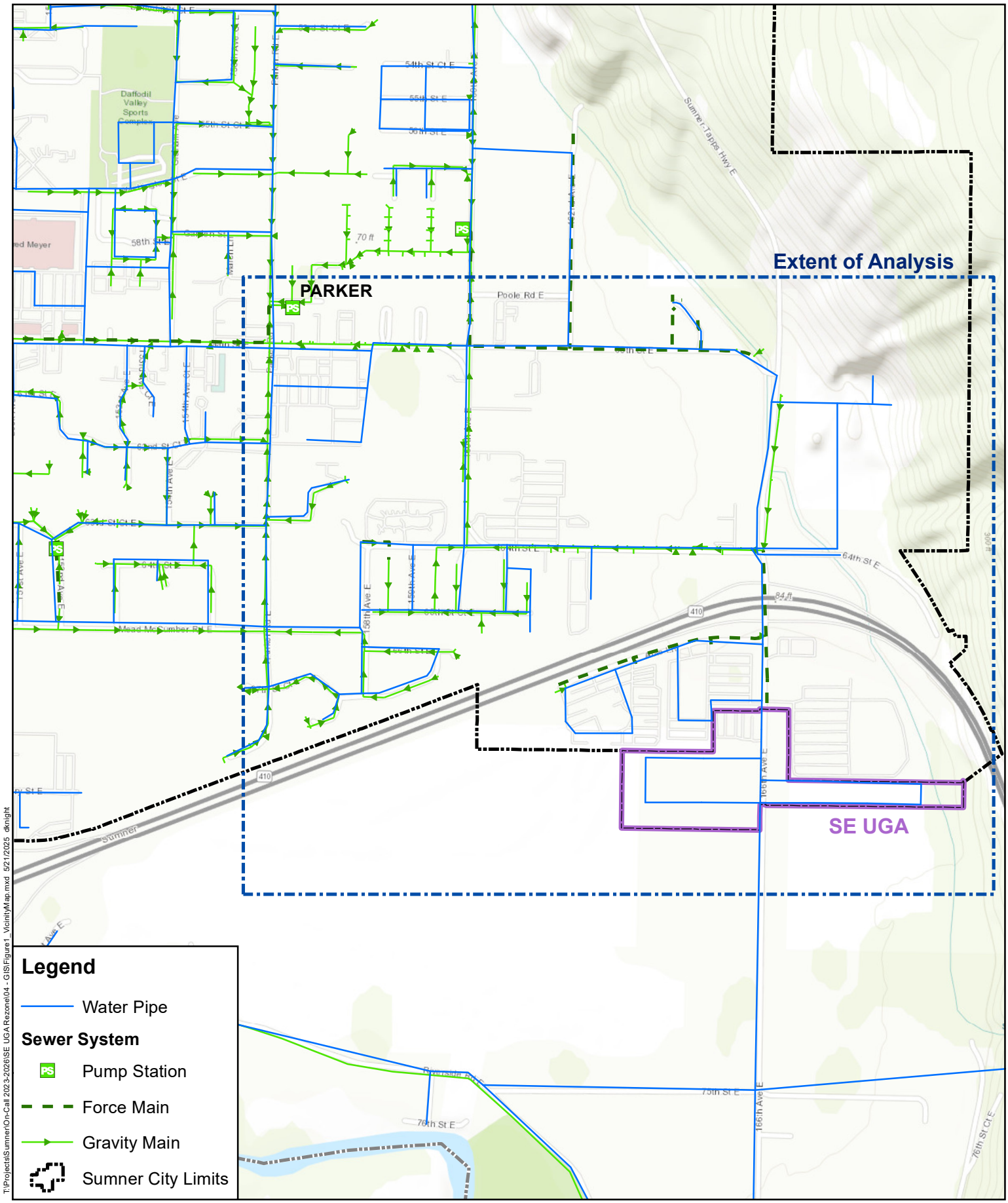
6/19/2025

Kevin Karl Cook, PE
BHC Consultants, LLC

1. Introduction

The City of Sumner (City) is evaluating potential impacts to its existing infrastructure associated with the proposed rezoning of the Southeast (SE) Urban Growth Area (UGA). The rezoning would modify existing single-family zoning to permit larger apartment buildings, resulting in higher residential densities.

To support planning efforts, the City has requested BHC Consultants, LLC (BHC) conduct an engineering analysis assessing potential impacts on the City's sewer and water utility systems. BHC Consultants, LLC (BHC) previously developed hydraulic models for both systems as part of the City's 2018 General Sewer Plan and Water System Plan. These models, which have been subsequently updated for development-related assessments, will serve as the primary tools for evaluating infrastructure impacts resulting from the proposed UGA revisions. The analysis includes an evaluation of system performance under the projected conditions for the year 2038. Figure 1 shows the approximate location of UGA, extent of analyses, existing pipes, and network of modeled infrastructure for the analyses.



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Vicinity Map

Water and Sewer Utility Impacts Analysis
City of Sumner, Washington
May 2025

Figure 1

2. Background and Assumptions

The City's 2018 Sewer System Plan and Water System Plan Update documents serve as the basis for development demand and flow projections, utilizing derived per capita or per unit values established for different customer categories. Other system demand and flow projections for the 2038 planning horizon will remain consistent with those established during the development of the system plans.

In addition, the following assumptions are applied in this analysis:

- **Sewer System Infrastructure:** Since the proposed SE UGA lies outside of existing sewer service areas, no new sewer facilities were created in the model to introduce the projected flows. Instead, pipeline upgrades or other necessary improvements have been modeled as needed and impacts on previously identified improvements have been documented.
- **Sewer Capacity Analysis Limits:** The capacity analysis extends from the assumed connection point near 16th Avenue downstream to Pump Station 5 (PS-5).
- **Water System Infrastructure:** Preliminary water distribution pipelines have been created within the model to deliver projected demands to the area. Localized demands were conservatively added.
- **Supply and Storage Assumptions:** No additional source or storage adequacy evaluations were conducted. Tank levels and operational setpoints remain unchanged in the water model.
- **Design Criteria:** The design criteria established in the 2018 Sewer and Water System Plans were applied.

The 2038 scenarios from the Sewer Plan and the Water System Plan (WSP) were used in this analysis. The following sources were used to supplement the data and information used in the analyses:

- Hydraulic models of the sewer collection system from the Sewer Plan and the water distribution system from the WSP.
- Geographic Information System (GIS) data from the City.
- Drawings for the proposed site redevelopment (Attachment A).
- Density Estimate provided by the City.
- Correspondence with City.
- 2020 Pierce County Digital Terrain Model (DTM) data from the Washington State Department of Natural Resources.

3. Additional Flows from Rezoning

As a result of the rezoning of the SE UGA site, land use changes as outlined in Table 1 are expected. This results in additional water demand and sewer flows into the system. The City projects that the rezoning will result in the development of 315 residential units and the creation of 46 new jobs.

Table 1
UGA Rezoning

Current Zoning	Proposed Zone	Area (acres)
Interchange Commercial (IC)	Medium Density Residential (MDR)	4.1
Low Density Residential 2 (LDR-2)	Interchange Commercial (IC)	2.6
Low Density Residential 2 (LDR-2)	Medium Density Residential (MDR)	12.6

3.1 Sewer Flows

A comparison of sewer flows was conducted to calculate peak flow rates using assumptions from both the City's 2018 Sewer Plan and the Washington State Department of Ecology's (Ecology) Orange Book. This comparison was necessary because high-density localized areas, such as the proposed rezoned SE UGA, can exhibit higher peaking factors than those assumed for citywide planning analyses in the Sewer Plan.

The following components of sewer flow were estimated based on the proposed rezoning:

- Average Dry Weather Flow: Estimated at 57.2 gallons per minute (gpm).
    - Residential Flow: Estimated at 52.7 gpm, based on an average per-capita residential flow of 100 gallons per capita per day (gpcd) (per the Ecology Orange Book) and an average household size of 2.41 persons (based on City of Sumner data).
    - Commercial Flow: Estimated at 4.5 gpm, based on an average demand of 250 gallons per day (gpd) per 1,000 square feet of commercial space (from the Ecology Orange Book), and an average land use density of 0.1 acres per 1,000 square feet of commercial development.
- Peak Dry Weather Flow: Applying a peaking factor of 3.9 for residential land use, the peak dry weather flow is estimated at 210.1 gpm.
- Infiltration and Inflow (I/I): Based on an I/I rate of 641 gallons per acre per day from the 2018 Sewer Plan and a total area of 19.3 acres, additional I/I was calculated at approximately 8.6 gpm.

These flow components were point-loaded into the hydraulic model as a combined peak wet weather flow. As a result, the total additional peak flow introduced to the sewer conveyance system due to the rezoning is estimated to be 218.7 gpm. The peak flow estimate incorporates conservative assumptions to account for potential variability in future development intensity and system response.

3.2 Water Demand

Average day, maximum day, and peak hour demands were estimated based on the planning projections provided by the City and the demand projections from the Water System Plan (WSP). Approximately 315 equivalent residential units (ERUs) were estimated for parcels with medium density residential zoning. The interchange commercial units were estimated to have 56 jobs or employees.

The following demands were estimated based on the proposed rezoning:

- Average Day Demand (ADD): 42 gpm (Approximately 41 gpm comes from the proposed residential units and 1 gpm from the interchange commercial units).
- Maximum Day Demand (MDD): 87 gpm, assuming an ADD-to-MDD peaking factor of 2.05 per Section 3.8.2 of the WSP.
- Peak Hour Demand (PHD): 141 gpm, assuming an MDD-to-PHD peaking factor of 1.624. This peaking factor was obtained by dividing the 2038 PHD by the 2038 MDD in Table 3-14 of the WSP.
- Fire Flow Demand: 1,500 gpm for two hours per Section 7.2 of the WSP. Both medium density residential and commercial areas were assumed to have a fire flow requirement of 1,500 gpm for two hours to be conservative.

4. Sanitary Sewer Collection System Analysis

The hydraulic model of the City's collection system developed as a part of the Sewer Plan was used to assess potential utility infrastructure impacts caused by the rezoning. The model run focused on the impacts in the vicinity of the development site, up to the connection point near 16th Avenue downstream to Parker Pumpstation (Figure 1).

The model scenarios were run, and the conveyance system deficiencies were identified based on further analysis of model results. To determine the location of capacity issues within the collection systems, the following guidelines were observed, which is consistent with the Sewer Plan:

- Gravity Pipe Segments: The flow depth is equal to or greater than the pipe diameter (d/D > 1).
- Force Main Segments: The flow velocity exceeds 8 feet per second (ft/s).
- Manholes: The manhole is flooding, leading to sewer overflow.
- Pump Stations: The rated capacity is exceeded.

Industry standard engineering judgment was used to review the simulated results such that the results provided a meaningful planning tool for the City and that deficiencies were being identified appropriately for the purposes of this analysis.

The Parker PS-5 is equipped with two submersible pumps, each rated at 1,330 gpm. The station's firm capacity is 1,330 gpm. Under the 2038 planning horizon scenario from the City's Sewer Plan hydraulic model, the existing peak flow into the Parker PS-5 is estimated at 424 gpm. With the addition of projected flows from the rezoned SE UGA, the modeled peak flow increases to 635 gpm. Based on the model results, this represents approximately 50% of the pump station's firm capacity, indicating that sufficient capacity remains available to accommodate the proposed rezoning and development.

Based on the analysis of model results, a capacity issue was identified in the 4 inch force main pipe along 166th Avenue East up to 64th Street East. This includes pipes with City GIS asset IDs of SML F9-24 and SML F9-25. The maximum flow velocity simulated in this force main pipe is 9.2 ft/s, which exceeds the velocity threshold of 8 ft/s.

Loading the additional sewer flows from the new development to the existing sewer manhole with City GIS asset ID Sewer Manhole (SMH) G9-1 will likely exceed the capacity of the 4 inch force main pipe along the 166th Avenue East. If the flow from the new development is to be connected into the existing manhole SMH G9-1 then the flow needs to be conveyed along the 166th Avenue East via a 6 inch force main pipe or an 8 inch main at a minimum slope of 0.4%, both of which represent pipe upsizing as a result of this new development.

Alternatively, the sewer flows from new development can be connected to the sewer system at the intersection of 166th Avenue East and 64th Street East (existing manhole SMH G8-2). These alternative approaches provide sufficient conveyance capacity to accommodate future flows under full buildout conditions.

5. Water Distribution System Impacts Analysis

The hydraulic model of the City's collection system developed as a part of the Water Plan was used to assess potential utility infrastructure impacts caused by the rezoning. Hydraulic model simulations were completed to evaluate the impacts of rezoning on the City's distribution system. The model was evaluated based on the performance and design criteria in Section 7.2 of the WSP:

- PHD Scenario: System pressures shall not be less than 30 pounds per square inch (psi) at all nodes.
- MDD + Fire Flow Scenario: System pressures shall not be less than 20 psi at all nodes.
- Pipe Velocity: Flow velocities in the distribution system shall not exceed 8 ft/s.

- Hydrant spacing: Commercial, industrial, and apartment use districts shall have a maximum fire hydrant spacing of 400 feet.

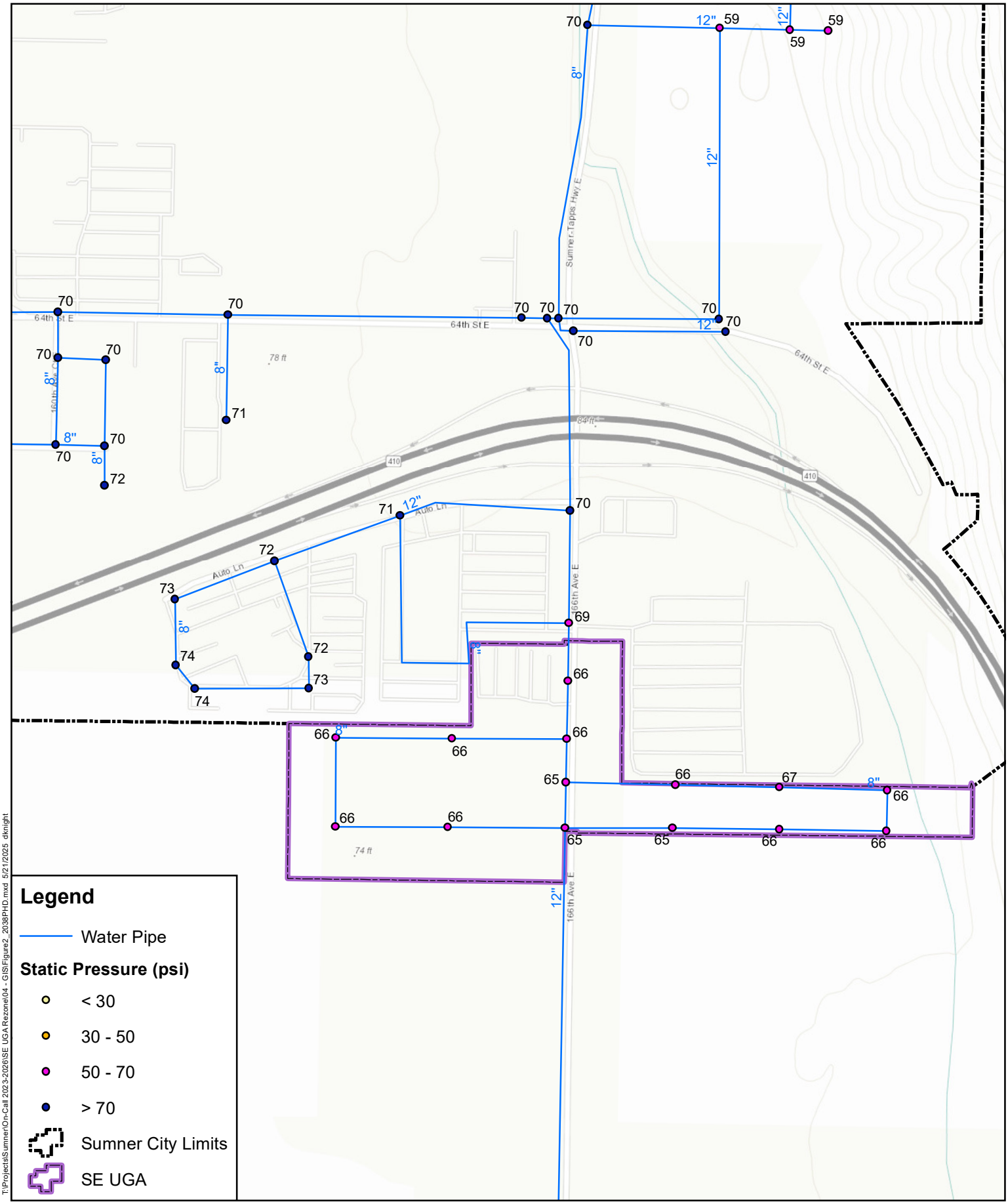
The following modifications and assumptions were applied to the hydraulic model:

1. 8-inch ductile iron (DI) pipe loops were input on the affected parcels and connected to the existing 12-inch alternating current (AC) main on 166th Avenue East. A Hazen-Williams coefficient of 140 was used for the proposed pipe.
2. Nodes were input to the model with a maximum distance of 400 feet between each node. Additional equivalent residential units and demands were proportionally allocated to each node.
3. Elevations of added nodes were extracted from the Washington State Department of Natural Resources' lidar data.
4. Peak hour demand and MDD + fire flow scenarios were run using steady state conditions, and as such, no demand pattern was applied.

No system deficiencies were simulated in the 2038 PHD scenario due to the SE UGA Rezone. Under 2038 PHD scenario, the added nodes have simulated pressures around 65 psi. The majority of the nodes in the system have pressures exceeding 30 psi. Figure 2 shows the static pressures in the SE UGA during PHD conditions. Nodes near Elhi Springs, the 2.0-million gallons (MG) South Tank, and the Viewpoint Booster Pump Station (BPS) have pressures between 12 to 25 psi. These nodes do not have service connections and therefore only require pressures greater than 5 psi per the latest edition of the Washington State Department of Health (DOH) Water System Design Manual.

No system deficiencies were simulated in the 2038 MDD + fire flow scenario due to the SE UGA Rezone. Under 2038 MDD + fire flow scenario, a 1,500-gpm fire flow, 2-hour duration fire flow requirement is available while maintaining a residual pressure of 20 psi and a velocity of 8 ft/s. Figure 3 shows the available hydrant flow in the SE UGA Area. The pipe east of 160th Avenue Court and south of 64th Street East has an 8-inch diameter pipe, limiting the available hydrant flow while maintaining a maximum pipe velocity of 8 ft/s. The 6-inch pipes near the 2.0-MG South tank and Viewpoint BPS were simulated to have a velocity of 8.8 ft/s. Per the latest edition of the DOH Water System Design manual, transmission mains and pump station piping may have velocities up to 10 ft/s.

The existing 12-inch AC main on 166th Avenue East has adequate hydraulic capacity to provide the peak hour demands and fire flow demands in the development. The City's GIS data indicates this water main was constructed in 1972 and has a history of leak in 2011. Replacement of the existing 12-inch AC main with DI is recommended for long-term reliability of the water main.



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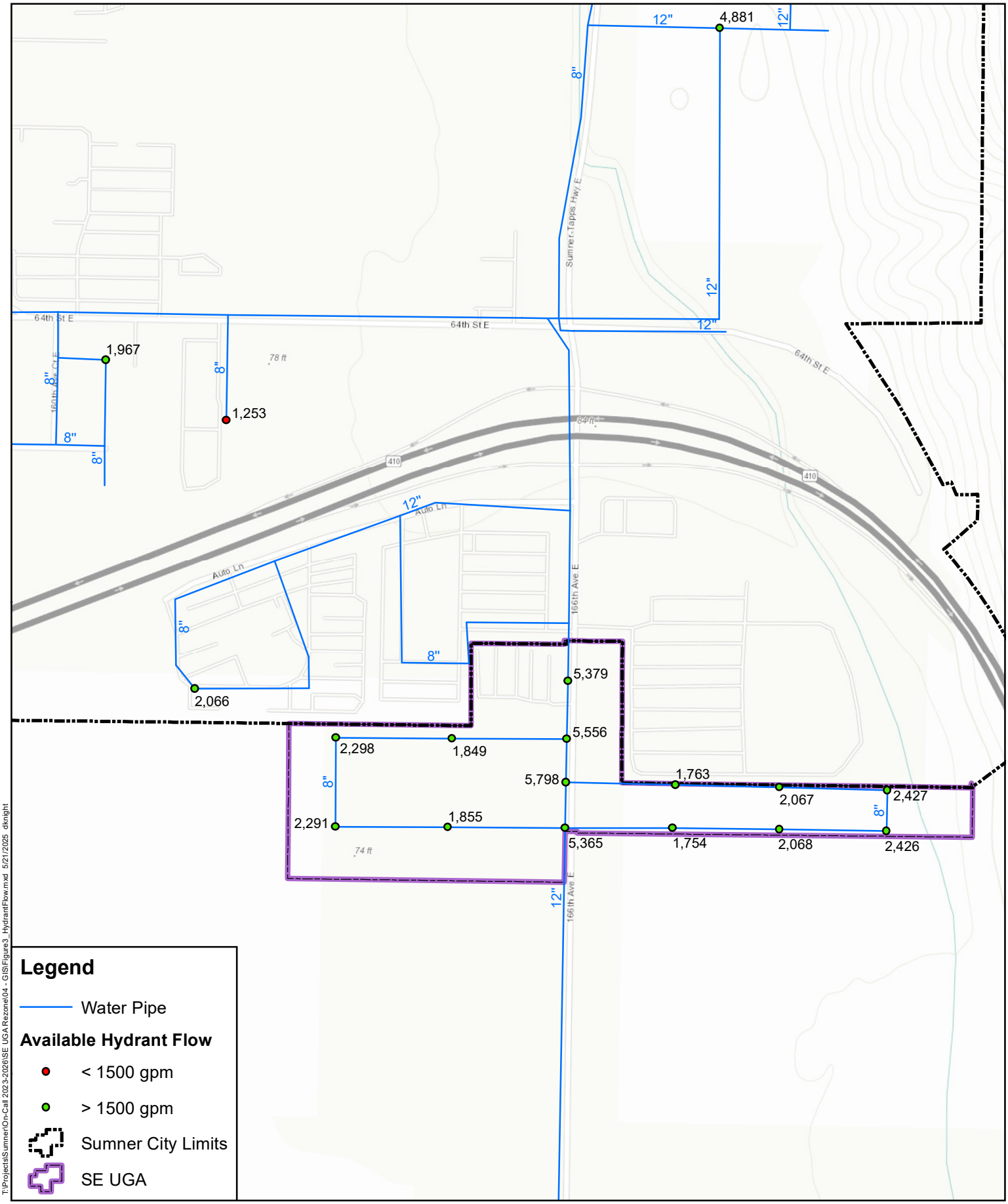
2038 PHD Analysis
Water and Sewer Utility Impacts Analysis
City of Sumner, Washington
May 2025

Figure **2**



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2038 Available Hydrant Flow

Water and Sewer Utility Impacts Analysis
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Figure **3**

6. Limitations and Uncertainty

The hydraulic models of the City's sanitary sewer and water systems that were previously developed as a part of the Sewer and Water Plans were used to evaluate the utility impacts in this study, and thus all the previous assumptions and limitations also apply to this analysis. Additional limitations of this analysis include the following:

- Previous development assumptions regarding land usage may be different based on actual developments that have occurred.
- Infiltration and inflow (I/I) characteristics are subject to change and dependent on numerous factors that impact peak flow including but not limited to precipitation characteristics, pipe condition, operations and maintenance.
- Accuracy of City's GIS data was not performed as part of this analysis.

7. Conclusion

The hydraulic analysis of the sewer system indicates that the proposed rezoning of the SE UGA can be accommodated by the existing sanitary sewer collection system and water distribution system with minimal improvements.

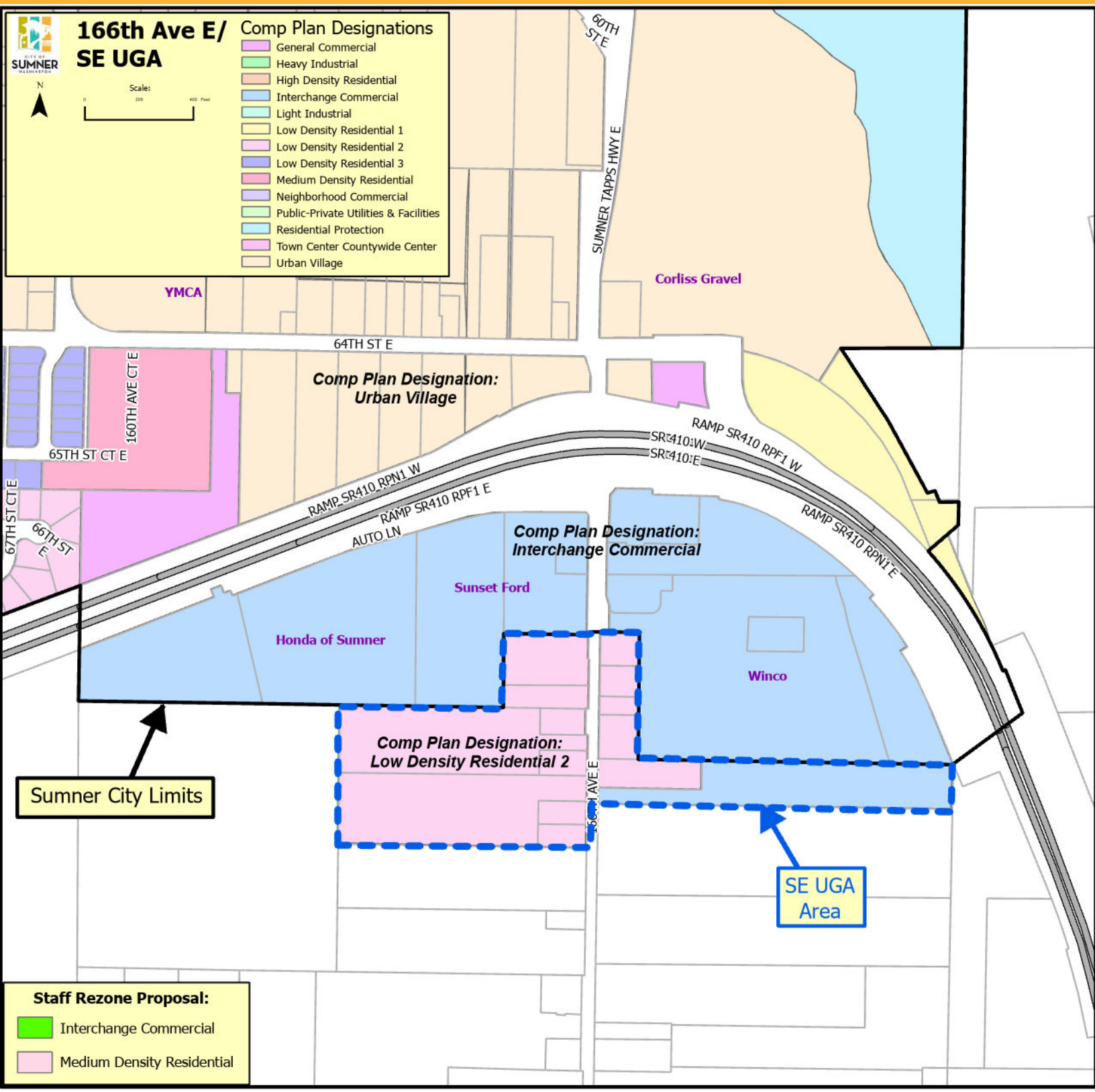
The Parker PS-5 is projected to operate at approximately 50% of its firm capacity under 2038 full buildout conditions, confirming sufficient downstream pumping capacity. One localized deficiency was identified in a force main segment along the 166th Avenue East, where peak flow velocity exceeds recommended limits. This deficiency can be removed either by increasing capacity or loading the sewer flows at area with available pipe capacity (at the intersection of 166th Avenue East and 64th Street East), ensuring a reliable long-term performance. No additional downstream capacity constraints were identified as a result of this improvement. Overall, the sewer system has adequate capacity to support the proposed development, contingent on the recommended force main upgrade.

State-required minimum pressures are available in the SE UGA under peak hour demand scenarios and MDD + fire flow scenarios. Pipe velocities are generally less than 8 ft/s. Replacement of the existing 12-inch AC main on 166th Avenue East with 12-inch DI main is recommended for long-term reliability of the main.

ATTACHMENT A

Sumner SE UGA Rezone Information

SE UGA Existing Comprehensive Plan Designations



SE UGA Proposed Comprehensive Plan Amendment
City Alternative for MA-02