

- The Mallard Bay Lift Station pumps into the force main used by the Central Lake Sammamish Lift Station.

The District monitors normal pump operations of lift stations that pump into common force mains for high head pressures or low flow rates. If either of these are noted this would trigger an investigation of each lift station and the common force main for operational issues.

Several lift stations discharge flows to downstream lift stations:

- Inglewood Lift Station receives flows from Camden Park, Good Samaritan, Beaver Dam and The Greens lift stations
- North Lake Sammamish Lift Station receives flows from Inglewood and the new Benham Ridge lift stations.
- Central Lake Sammamish Lift Station receives flow from the North Lake Sammamish Lift Station.
- Mallard Bay Lift Station receives flow from Alexander's Lift Station.
- Aldarra Lift Station receives flow from the Aldarra Club Lift Station.
- Trossachs Lift Station receives flow from the Aldarra Lift Station.

The smaller lift stations, such as Aldarra Club, The Greens and Alexander's lift stations do not have a significant impact on their downstream lift stations. Conversely, large lift stations, such as Inglewood and North Lake Sammamish lift stations significantly impact the downstream lift station operations. Lift station discharges are a slug type flow that can create the highest flow rates the downstream lift station will experience and cause the downstream lift station to operate as soon as the discharge arrives. If there are any operational issues at a downstream lift station, it may be necessary to temporarily slow the flows from the upstream lift station.

4.4 FUTURE KING COUNTY FACILITIES

According to the King County Conveyance System Improvement (CSI) Program, several proposed projects would directly affect District operations and should be considered in planning efforts. Three projects proposed according to the Task 260 South Sammamish Basin Task Summary include the Sammamish Plateau North Diversion, the Issaquah Storage project, and the Sammamish Plateau Storage project. These projects are discussed in the following sections.

4.4.1 NORTH DIVERSION PROJECT

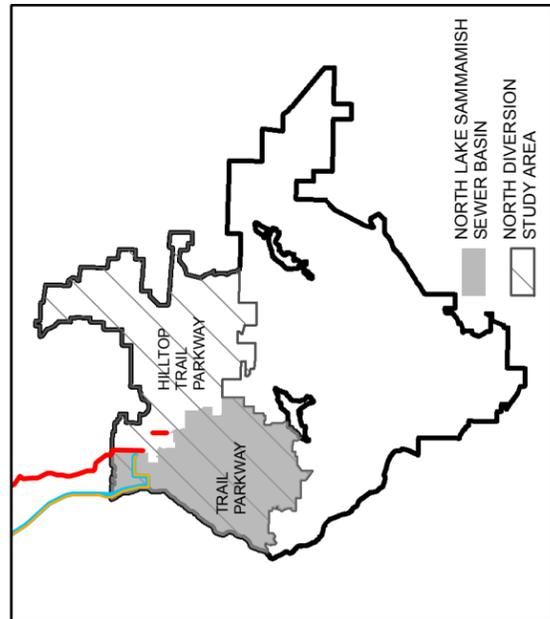
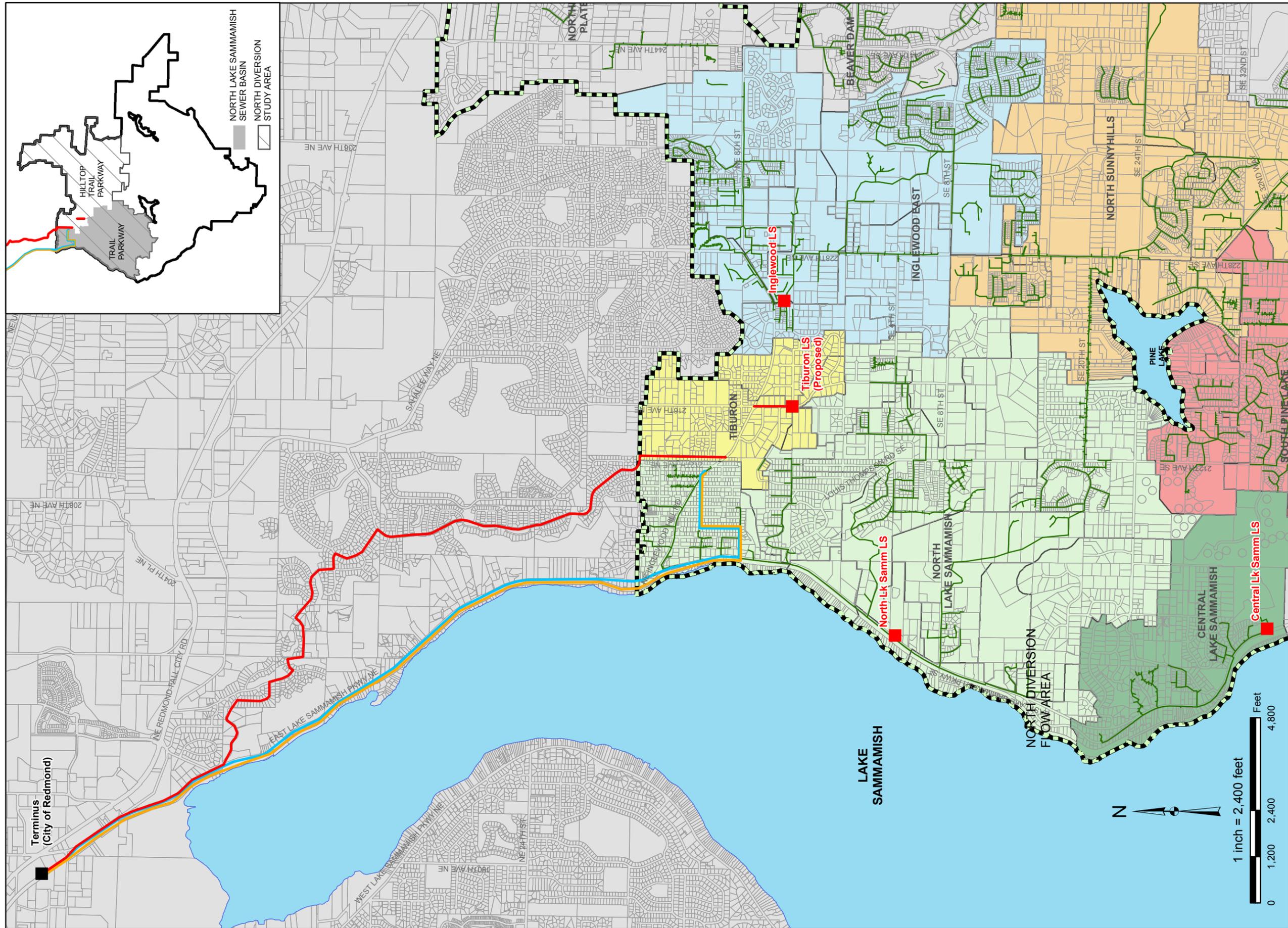
Based on prior KCDNR planning and in consultation with KCDNR, the District's 2003 Wastewater Comprehensive Plan (2003 Plan) recommended that wastewater flow from the District's northern sewer collection basins be redirected north to the KCDNR collection system. This is consistent with King County CSI Project planning in the 2007 CSI Program Update. The North Diversion project, as presently planned, would convey all flow from the District's Inglewood East, Tiburon, Northeast Plateau and Beaver Dam sewer basins north through a new pressure interceptor to the KCDNR collection system at the Northeast Lake Sammamish Interceptor in Redmond. Diverting the North Lake Sammamish Basin may be considered as well, and is reflected in the hydraulic model assumptions.

Diverting flow to the north would allow King County the flexibility of sending a portion of the District's wastewater to either the South Treatment Plant or the Brightwater Treatment Plant and it would reduce the impact to, and extend future upgrades of, downstream KCDNR facilities such as the Sunset and Heathfield pump stations.

There are three North Diversion alignment alternatives considered in this Plan: East Lake Sammamish Parkway (Parkway), Sammamish Trail (Trail), and Hill Top. The Sammamish Parkway and the Sammamish Trail Alignments convey the force main discharge of the Inglewood Lift Station north along the east side of Lake Sammamish to the terminus manhole of the existing KCDNR Northeast Lake Sammamish Interceptor. The Hill Top Alignment follows existing rights-of-way in a northwest direction up and over a portion of the Sammamish Plateau from the force main discharge of the Inglewood Lift Station at Inglewood Road and 212th Avenue NE to the same KCDNR terminus manhole. The three KCDNR North Diversion alignment alternatives; Parkway, Trail and Hilltop, are shown in plan view in Figure 4-1. Each alignment scenario includes improvements to the District's system in addition to a North Diversion alternative.

The preceding discussion assumes that the North Diversion will be constructed in the near future. However, if King County delays the North Diversion or decides not to construct it, the District must consider an alternative to accommodate anticipated growth. This alternative (Scenario 7 in future discussions and provided in Table 4-5) does not include a North Diversion pipeline.

In the 2003 Plan and King County's Conveyance System Improvement (CSI) Program, the North Diversion project only includes sanitary sewer flows from the Beaver Dam, Northeast Plateau, Inglewood East, and Tiburon sewer basins. According to growth projections and subsequent sewer flows provided in



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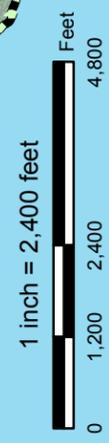
- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

- Hilltop
- Parkway
- Trail

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT



**SAMMAMISH PLATEAU
 WATER & SEWER DISTRICT**
 NORTH DIVERSION
 FIGURE 4-1

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Chapter 2 and Chapter 3 of this Plan, North Lake Sammamish sewer basin development is anticipated to increase by 500 percent. Resulting peak sanitary sewer flows, estimated at 2,400 gpm at build out, will exceed the capacity of the existing downstream facilities and would require significant upgrades. These upgrades would include the North Lake Sammamish Lift Station and force main, downstream gravity sewers, and the Central Lake Sammamish Lift Station. Due to the cost of these required future improvements, alternatives have also been considered where North Lake Sammamish Lift Station pumps north to the North Diversion for cost comparison purposes.

4.4.2 ALTERNATIVES ANALYSIS

The North Diversion route alternatives analysis is presented with two separate conditions:

- North Diversion does not include North Lake Sammamish Lift Station flows
- North Diversion does include North Lake Sammamish Lift Station flows.

The alternatives analysis also includes a “do nothing” analysis, where the North Diversion is not constructed, and District flows all continue to the south. This is known as Scenario 7 in the analysis.

This alternatives analysis is provided as a starting point for further consideration when the project is undertaken by King County Wastewater Treatment Division. The District and King County will coordinate further alternatives analysis and any subsequent construction to ensure that the facilities are designed and built using criteria and design standards that meet both District and King County needs.

4.4.2.1 Alternatives without North Lake Sammamish Basin

The following alternatives would convey flows from the District’s Inglewood East, Tiburon, Northeast Plateau and Beaver Dam sewer basins to King County’s North Diversion.

4.4.2.1.1 Hill Top Alignment

The Hill Top Alignment would connect a new low pressure interceptor to the existing discharge of the Inglewood Lift Station force main at the intersection of NE Inglewood Road and 212th Avenue NE. The low pressure interceptor would be extended north along 212th Avenue NE, through the neighborhoods of

Inglewood Addition, Shannonwood, Sterlingwood, Timberline Highlands, and Hidden Ridge at High Point. This alignment is approximately 25,000 lineal feet and adds 220 feet of static lift at the Inglewood Lift Station. In addition, dynamic losses in the line would require a total dynamic head (TDH) of 350 feet (16-inch pipe) or 290 feet (18-inch pipe). The additional head will necessitate new 400-hp replacement pumps at the Inglewood Lift Station. For the purposes of this Plan, all hydraulic calculations are based on the Hazen-Williams friction headloss equation assuming a C-factor of 100 and design flow of 4.9 mgd (3,400 gpm). If the Hill Top Alignment is selected as the preferred alternative, pump selection and force main/low pressure interceptor sizing will be optimized to maximize system performance. A profile of the Hill Top Alignment is provided in Appendix I. Figure 4-2 presents the Hill Top Alignment without the inclusion of the North Lake Sammamish Basin.

Because this alignment has numerous grade changes, both up and down, an open-channel gravity line is not cost effective or practical, as it would require very deep cuts (over 30 feet) for extended distances. Consequently, the preliminary design used in this analysis has the extended force main transition to a low pressure interceptor at the high point of the system near 212th Avenue NE and NE 16th Street; this approach will necessitate the use of air- and vacuum-release valves at interim high points throughout the alignment.

Most of the Hill Top Alignment is located in existing developed residential areas. The road section along the route varies between a 24-foot-wide asphalt section to a 36-foot-wide asphalt section with sidewalks on both sides. For the purposes of this Plan, it is anticipated that the sewer force main/low pressure interceptor will be located within the asphalt road section. A detailed survey and design may present opportunities to relocate the assumed alignment into the unimproved edge of the right-of-way; however, these opportunities appear to be very limited at this time. Installation in the existing asphalt roadway will require an asphalt trench repair section, along with a half or a full width overlay. This determination is usually made during the submittal of the Right-of-Way Permit and discussions with the local permitting agency. For the purposes of this Plan it was assumed that an asphalt repair section along with a full width overlay section will be required. In addition, the proposed alignment will require that approximately 400 feet of line be installed on easements across existing residential lots. The cost estimate for the Hill Top Alignment assumes that this section of pipe will be installed using directional drilling technology.

The estimated project cost of this alignment is \$13,800,000 for a 16-inch main, including construction, design, permitting, and construction management. The Hill Top Alignment will also introduce a new, ongoing energy cost increase due

to the additional pumping head required at the Inglewood Lift Station. These costs have not been developed or included in this analysis, but should be considered when evaluating the preferred alternative.

4.4.2.1.2 Sammamish Parkway Alignment

The Sammamish Parkway Alignment is approximately 22,000 lineal feet in length. The 2003 Plan discussed the installation of a gravity sewer line ranging from 21 to 30 inches in diameter along this alignment. The alignment would continue from the existing discharge of the Inglewood Lift Station force main at the intersection of NE Inglewood Road and 212th Avenue NE, down NE Inglewood Road to East Lake Sammamish Parkway NE, then north along East Lake Sammamish Parkway NE to the KCDNR connection point. The 2003 Plan assumed that there was 25 feet of fall along the alignment from the intersection of NE Inglewood Road and East Lake Sammamish Parkway NE to the KCDNR connection point sufficient for the installation of an open channel gravity system. After further investigation for this Plan, it has been determined that the installation of a gravity system for the Sammamish Parkway Alignment is not cost effective or practical. The grade of the East Lake Sammamish Parkway NE has numerous changes in elevation, both up and down. Installation of an open channel gravity line will require deep excavations to maintain grade, with over 6,000 lineal feet of the alignment over 20-feet deep, and some areas over 35-feet deep. Consequently, a 16-inch low pressure interceptor has been selected for the purposes of analysis for this Plan. The low pressure interceptor will connect to the existing discharge of the Inglewood Lift Station force main at the high point at 212th Avenue NE/Inglewood Hill Road. The fall between this point and the terminus manhole of the existing KCDNR Northeast Lake Sammamish Interceptor will provide the static head necessary to convey the design flow of 4.9 mgd through the 16-inch low pressure interceptor. A profile of the Sammamish Parkway Alignment is provided in Appendix I. Figure 4-3 presents the Parkway Alignment without the inclusion of the North Lake Sammamish Basin.

The 16-inch low pressure interceptor will require air and vacuum release valves at high points with discharge to nearby or adjacent gravity sewers. This will require coordination with the local sewer purveyors, the Northeast Sammamish Water and Sewer District or the City of Redmond. It has been assumed that this alignment will also require a trench repair section along with a full width overlay wherever the low pressure interceptor is located in the existing pavement. It is also assumed that concrete road sections will need to be replaced in kind, which significantly impacts restoration costs for the project. These costs are included in the cost estimate for this alignment.

The estimated project cost of this alignment is \$15,370,000 for a 16-inch main, including construction, design, permitting, and construction management.

4.4.2.1.3 East Lake Sammamish Trail Alignment

The East Lake Sammamish Trail Alignment runs parallel to East Lake Sammamish Parkway NE and is approximately 22,000 lineal feet in length. King County Parks has jurisdiction of the trail and any work within the trail right-of-way will require an easement and Special Use permit or interlocal agreement. The alignment would continue from the existing discharge of the Inglewood Lift Station force main at the intersection of NE Inglewood Road and 212th Avenue NE, down NE Inglewood Road to East Lake Sammamish Parkway NE, then north along the trail to the KCDNR connection point. Figure 4-4 presents the Trail Alignment without the inclusion of the North Lake Sammamish Basin.

In contrast to East Lake Sammamish Parkway NE, the trail has a more consistent grade gradually increasing in elevation from the intersection of NE Inglewood Hill Road and East Lake Sammamish Parkway NE to the KCDNR connection point. An open channel gravity line along the north 10,000 lineal feet of this alignment will require cuts over 20-feet deep, with some sections over 30-feet deep. Potential impacts to adjacent properties and the technical challenges associated with working at these depths adjacent to Lake Sammamish prevent gravity line construction from being a cost effective or practical option. Consequently, for the purposes of this report, a 16-inch low pressure interceptor is the selected alternative for conveyance along the East Lake Sammamish Trail. A profile of the East Lake Sammamish Trail Alignment is provided in Appendix I.

The low pressure interceptor can be constructed with a cover of approximately 4 feet and can follow the grade of the existing trail as closely as is practical. Air and vacuum release valves will be required at high points with 2-inch vent lines to either nearby adjacent gravity sewers or to gravel drainage structures when adjacent sewers are not available. When installing vent lines to adjacent gravity sewers it will be necessary to coordinate with the local sewer purveyors, the Northeast Sammamish Water and Sewer District or the City of Redmond, and may require the acquisition of construction easements across private property to access nearby publicly owned sewers.

The trail alignment will require negotiations with the King County Parks Department. Issues to be determined will include access for maintenance, location of air and vacuum release valves, trail closure during construction, and trail restoration or improvements. The trail alignment offers an exceptional opportunity for a net benefit to both agencies as well as the public. Most of the

trail is not currently paved; however, it is in King County’s future plans to pave the trail. Consequently, an asphalt trail surface is included in the cost estimate for this alignment.

The estimated project cost of this alignment is \$10,400,000 for a 16-inch main, including construction, design, permitting, and construction management.

4.4.2.1.4 North Diversion Summary without North Lake Sammamish Basin

Table 4-2 summarizes the costs and the issues associated with each alternative alignment for the North Diversion. The costs shown in Table 4-2 are based on a 16-inch low pressure interceptor, and do not include the flows from the North Lake Sammamish Lift Station.

TABLE 4-2

North Diversion Alignment Alternatives Summary

Alignment	Construction	Interlocal Agreements, Permitting, and Easements	Environmental
Hill Top \$13,800,000⁽¹⁾	Pump and Electrical modifications at Inglewood Lift Station.	ROW permit and roadway restoration requirements. Shoreline Substantial Permit Agreements with local sewer purveyors for air and vacuum release valve discharge.	Additional energy usage due to additional pumping head.
Sammamish Parkway \$15,370,000⁽¹⁾	Traffic control impacts during construction. Thick concrete panels underlying the roadway. Crowded utility corridor.	ROW permit and roadway restoration requirements. Shoreline Substantial Permit Agreements with local sewer purveyors for air and vacuum release valve discharge.	Traffic impacts during construction and future maintenance.
Sammamish Trail \$10,400,000⁽¹⁾	Trail closure during construction. Repaving after 2014-2015 King County Paving Project	ROW permit and roadway restoration requirements. Shoreline Substantial Permit Permits or agreements with King County Parks. Possible easements over private property for air and vacuum release valve discharge.	Adjacent and nearby wetlands.

(1) Detailed cost estimates are provided in Appendix I.

4.4.2.2 Alternatives with North Lake Sammamish Basin

The following alternatives would convey flows from the District’s Inglewood East, Tiburon, Northeast Plateau, and Beaver Dam sewer basins, with the addition of the North Lake Sammamish sewer basin, to King County’s North Diversion.

North Lake Sammamish Lift Station currently pumps sanitary sewer flows from the Inglewood Lift Station and the North Lake Sammamish sewer basin to the south to the Central Lake Sammamish Lift Station. The alternatives described in this section would include adding the flows from the North Lake Sammamish sewer basin into the North Diversion. This would also involve reconfiguring the North Lake Sammamish Lift Station and force main to pump flows to the north instead of south as currently arranged. Also, North Lake Sammamish Lift Station would no longer be pumping flows from the Inglewood Lift Station. Instead only flows collected from the North Lake Sammamish sewer basin would be pumped at the North Lake Sammamish Lift Station, to the North Diversion, and would join with flows pumped from the Inglewood Lift Station and Tiburon sewer basin collection system.

4.4.2.2.1 Hill Top Alignment

The low pressure interceptor described in the Hill Top Alignment in Section 4.4.2.1.1 would need to be upsized from a 16-inch-diameter pipe to a 24-inch-diameter pipe to accommodate the additional flows from the North Lake Sammamish sewer basin.

The District would need to construct the Tiburon Lift Station, together with a 6,400 to 6,700-foot-long, 16-inch-diameter force main to connect the North Lake Sammamish Lift Station to the future Tiburon Lift Station. In addition, the District would need to upsize the pumps at the North Lake Sammamish, Inglewood, and future Tiburon Lift Stations to accommodate the buildout flows from the North Lake Sammamish sewer basin. Figure 4-5 presents the Hill Top Alignment with the inclusion of the North Lake Sammamish Basin.

The estimated project cost of this alignment is \$16,030,000, including construction, design, permitting, and construction management.

4.4.2.2.2 Sammamish Parkway Alignment

The low pressure interceptor described in the Sammamish Parkway Alignment in Section 4.4.2.1.2 would need to be upsized from a 16-inch-diameter pipe to a

24-inch-diameter pipe to accommodate the additional flows from the North Lake Sammamish sewer basin.

The District would need to construct a 6,400 to 6,700-foot-long, 16-inch-diameter force main to connect the North Lake Sammamish Lift Station to the North Diversion. In addition, the District would need to upsize the pumps at the North Lake Sammamish Lift Station to accommodate the buildout flows from the North Lake Sammamish sewer basin. Figure 4-6 presents the Sammamish Parkway Alignment with the inclusion of the North Lake Sammamish Basin.

The estimated project cost of this alignment is \$16,700,000, including construction, design, permitting, and construction management.

4.4.2.2.3 East Lake Sammamish Trail Alignment

The low pressure interceptor described in the East Lake Sammamish Trail Alignment in Section 4.4.2.1.3 would need to be upsized from a 16-inch-diameter pipe to a 24-inch-diameter pipe to accommodate the additional flows from the North Lake Sammamish sewer basin.

The District would need to construct a 6,400 to 6,700-foot-long, 16-inch-diameter force main to connect the North Lake Sammamish Lift Station to the North Diversion. In addition, the District would need to upsize the pumps at the North Lake Sammamish Lift Station to accommodate the buildout flows from the North Lake Sammamish sewer basin. Figure 4-7 presents the Sammamish Parkway Alignment with the inclusion of the North Lake Sammamish Basin.

The estimated project cost of this alignment is \$11,717,000, including construction, design, permitting, and construction management.

4.4.2.2.4 North Diversion Summary with North Lake Sammamish Basin

Table 4-3 summarizes the costs and the issues associated with each alternative alignment for the North Diversion with the addition of flows from the North Lake Sammamish sewer basin. The costs shown in Table 4-3 are based on a 24-inch low pressure interceptor, and include the flows from the North Lake Sammamish Lift Station.

TABLE 4-3

**North Diversion Alignment Alternatives
With North Lake Sammamish Sewer Basin Summary**

Alignment	Construction	Interlocal Agreements, Permitting, and Easements	Environmental
<p>Hill Top \$16,030,000⁽¹⁾</p>	<p>Upsize North Diversion from 16 inch to 24 inch</p> <p>Pump and Electrical modifications at Inglewood Lift Station and Tiburon Lift Station</p> <p>Force main from North Lake Sammamish Lift Station to North Diversion</p> <p>Upsize North Lake Sammamish Lift Station</p>	<p>ROW permit and roadway restoration requirements.</p> <p>Agreements with local sewer purveyors for air and vacuum release valve discharge.</p>	<p>Additional energy usage due to additional pumping head.</p>
<p>Sammamish Parkway \$16,700,000⁽¹⁾</p>	<p>Upsize North Diversion from 16 inch to 24 inch</p> <p>Traffic control impacts during construction.</p> <p>Thick concrete panels underlying the roadway.</p> <p>Crowded utility corridor.</p> <p>Force main from North Lake Sammamish Lift Station to North Diversion</p> <p>Upsize North Lake Sammamish Lift Station</p>	<p>ROW permit and roadway restoration requirements.</p> <p>Agreements with local sewer purveyors for air and vacuum release valve discharge.</p>	<p>Traffic impacts during construction and future maintenance.</p>

TABLE 4-3 - (continued)

**North Diversion Alignment Alternatives
With North Lake Sammamish Sewer Basin Summary**

Alignment	Construction	Interlocal Agreements, Permitting, and Easements	Environmental
Sammamish Trail \$11,717,000 ⁽¹⁾	Upsize North Diversion from 16-inch to 24-inch Trail closure during construction. Repaving after 2014-2015 King County Paving Project Force main from North Lake Sammamish Lift Station to North Diversion Upsize North Lake Sammamish Lift Station	Permits or agreements with King County Parks. Possible easements over private property for air and vacuum release valve discharge.	Adjacent and nearby wetlands.

(1) Detailed cost estimates are provided in Appendix I.

From Table 4-6, the cost to continue pumping flows from North Lake Sammamish Lift Station to Central Lake Sammamish Lift Station would be greater than to reverse the direction and pump flows from North Lake Sammamish Lift Station to the north and join with the North Diversion project. Although reversing the flows pumped from the North Lake Sammamish Lift Station would require installing a new force main from North Lake Sammamish Lift Station to the North Diversion connection point and would require upsizing the proposed 16-inch North Diversion force main to a 24-inch low pressure interceptor, the cost to upgrade the Central Lake Sammamish Lift Station and upstream gravity sewer pipes remains a greater cost. Therefore, for the purposes of this Plan, it will be assumed that the North Lake Sammamish Lift Station will be pumped north as part of the North Diversion project which now includes flows from the Beaver Dam, Northeast Plateau, Inglewood East, Tiburon, and North Lake Sammamish sewer basins.

Diverting flow from the North Lake Sammamish Lift Station to the North Diversion, if the Hill Top Alternative is the selected for the North Diversion requires a significant amount of horsepower, particularly static lift, in order to connect the force main with the proposed alignment. This amount of head is too high to overcome in a single pump, and would probably require an intermediate lift station. The Tiburon Lift Station could serve as this intermediate lift station. The Tiburon Lift Station, as currently planned, will pump to the gravity basin

served by the North Lake Sammamish Lift Station. If Tiburon Lift Station were designed for a higher capacity, and the proposed force main extended to the proposed connection with the Hill Top Alternative, it could serve as the intermediate lift station. Since the Tiburon Lift Station has not been constructed, this makes this alternative feasible, but more expensive than Parkway and Trail Alternatives, which would not require any changes to the proposed Tiburon Lift Station design.

4.4.2.3 Alternative without North Diversion (Scenario 7)

If the North Diversion is not constructed or is delayed beyond the time that the District's sewer system in the basins discussed above reaches capacity, the District must consider an alternative to accommodate anticipated growth. This alternative, referred to as Scenario 7, does not include a North Diversion pipeline. Instead it includes a "Southern Diversion" project to increase capacity of the system delivering flow to King County's system to the south. The Southern Diversion project includes the following, with a total estimated construction cost of \$9,737,000:

- Install approximately 6,300 LF of 21-inch gravity sewer upstream of the North Lake Sammamish Lift Station.
- Install approximately 6,500 LF of 16-inch force main to increase force main capacity for the North Lake Sammamish Lift Station to 5,200 gpm.
- Upgrade capacity of North Lake Sammamish Lift Station to 5,500 gpm.
- Upgrade the capacity of the Central Lake Sammamish Lift Station from 1,100 gpm to approximately 6,000 gpm.
- Replace 3,100 linear feet of existing 15-inch-diameter gravity main upstream of Central Lake Sammamish Lift Station with 18- and 24-inch-diameter mains.

Required downstream King County improvements resulting from increased flows to the existing "Southern Diversion", and the downstream King County transmission system are unknown, so their costs are not included in this analysis. However, it is presumed that since Inglewood Basin flows have been a part of the long-term King County North Diversion capital plan for over a decade, additional capital would need to be spent by King County at downstream facilities.

From Chapter 3, it has been determined that the capacity of the North Lake Sammamish Lift Station must be upgraded to accommodate the projected sanitary

sewer flows for buildout, even with the North Diversion in place. The average current reliable capacity at the North Lake Sammamish Lift Station (with the largest pump out of service) is approximately 880 gpm (with one pump) as determined by measured drawdown tests performed in August of 2012. The installation of a third pump in the existing empty pumping port in the lift station dry pit will allow the District to increase its reliable flow capacity to approximately 1,200 gpm (with two pumps running). Buildout flows from the North Lake Sammamish basin alone are estimated to be near 2,400 gpm; therefore, the North Lake Sammamish Lift Station must be upgraded regardless of whether flows are diverted to the North Diversion alternative or not. However, the North Lake Sammamish Lift Station will require a capacity of 5,500 gpm if the Inglewood Lift Station and Tiburon flows are included.

4.4.3 PROJECT TRIGGERS

Based on flow data developed as part of this Plan, the District has established daily and peaking flow design criteria for its RCEs, and established infiltration and inflow rates for each of sewer basins. This information can be used to develop prioritization and timing (“triggers”) for improvement projects. Table 4-4 provides a summary of the information used to develop triggers for capital projects such as lift station and force main upgrades and the construction of the North Diversion.

TABLE 4-4

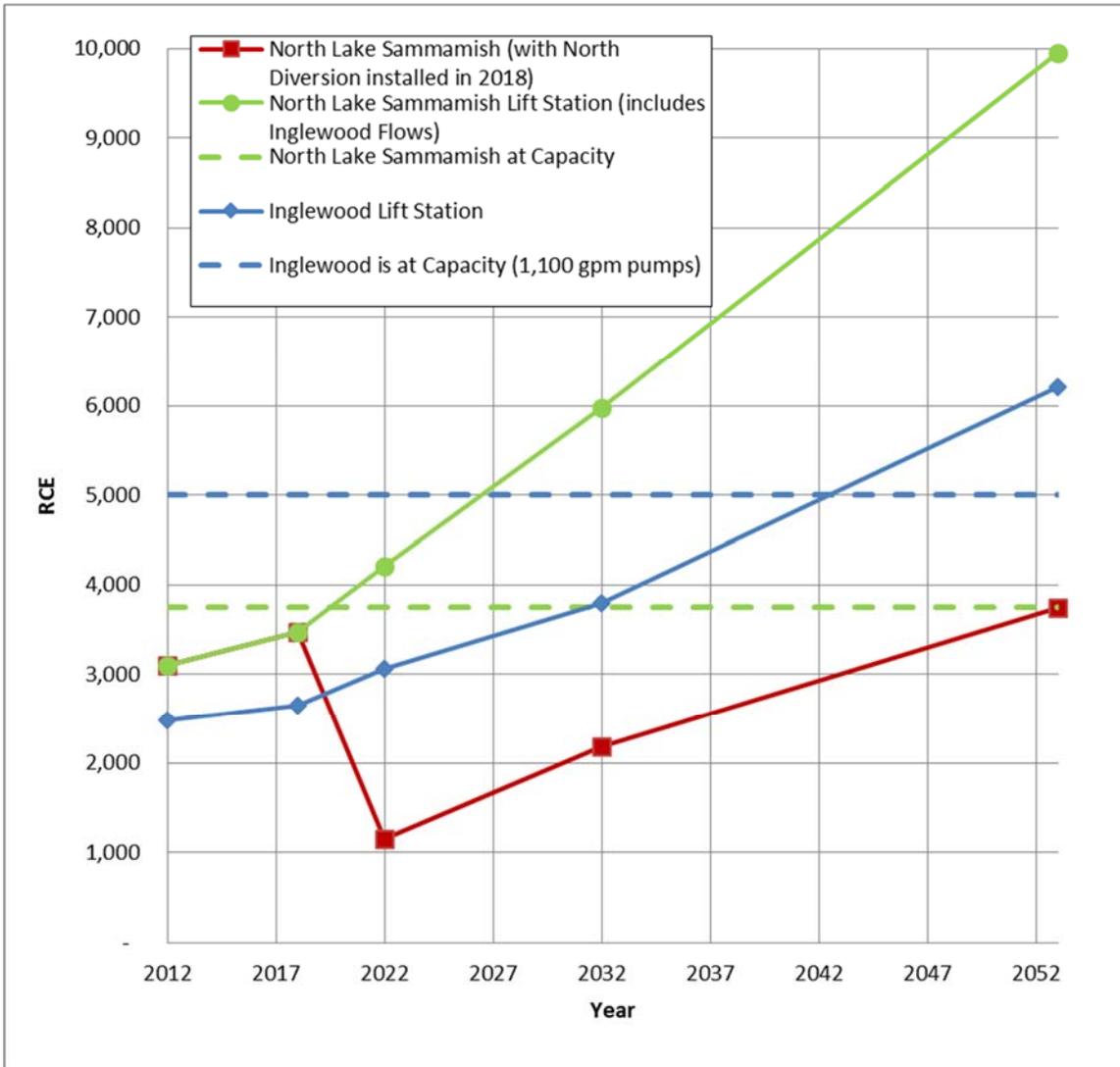
**Residential Customer Equivalent (RCE) Trigger Criteria for
North Lake Sammamish and Inglewood Basins**

Criteria	Value
North Lake Basin Existing RCE (Including Inglewood)	3,094 RCE
North Lake Sammamish Lift Station Capacity (Assuming two pumps running)	1,200 gpm
North Lake Sammamish Lift Station RCE Trigger	3,750 RCE
Inglewood Basin Existing RCE	2,480 RCE
Inglewood Lift Station Capacity (1,100 gpm pumps)	1,100 gpm
Inglewood Lift Station RCE Trigger (1,100 gpm pumps)	5,000 RCE
Inglewood Lift Station RCE Trigger (2,600 gpm pumps)	12,019 RCE

Figure 4-2 provides an illustration of the capacities and triggers of the Inglewood and North Lake Sammamish Lift Stations. To simplify the illustration, Figure 4-8 assumes the existing I/I rate for each basin (282 gpad for North Lake Sammamish,



and 217 gpad for Inglewood) and the flow rate per RCE remain constant. An increase in I/I rate would reduce the RCE trigger.

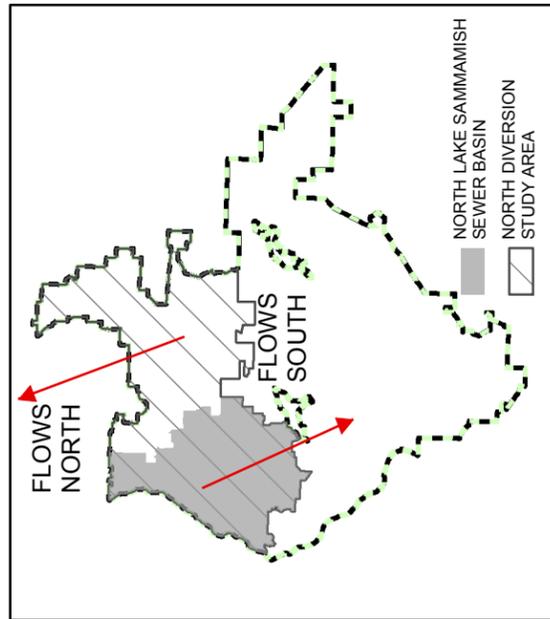
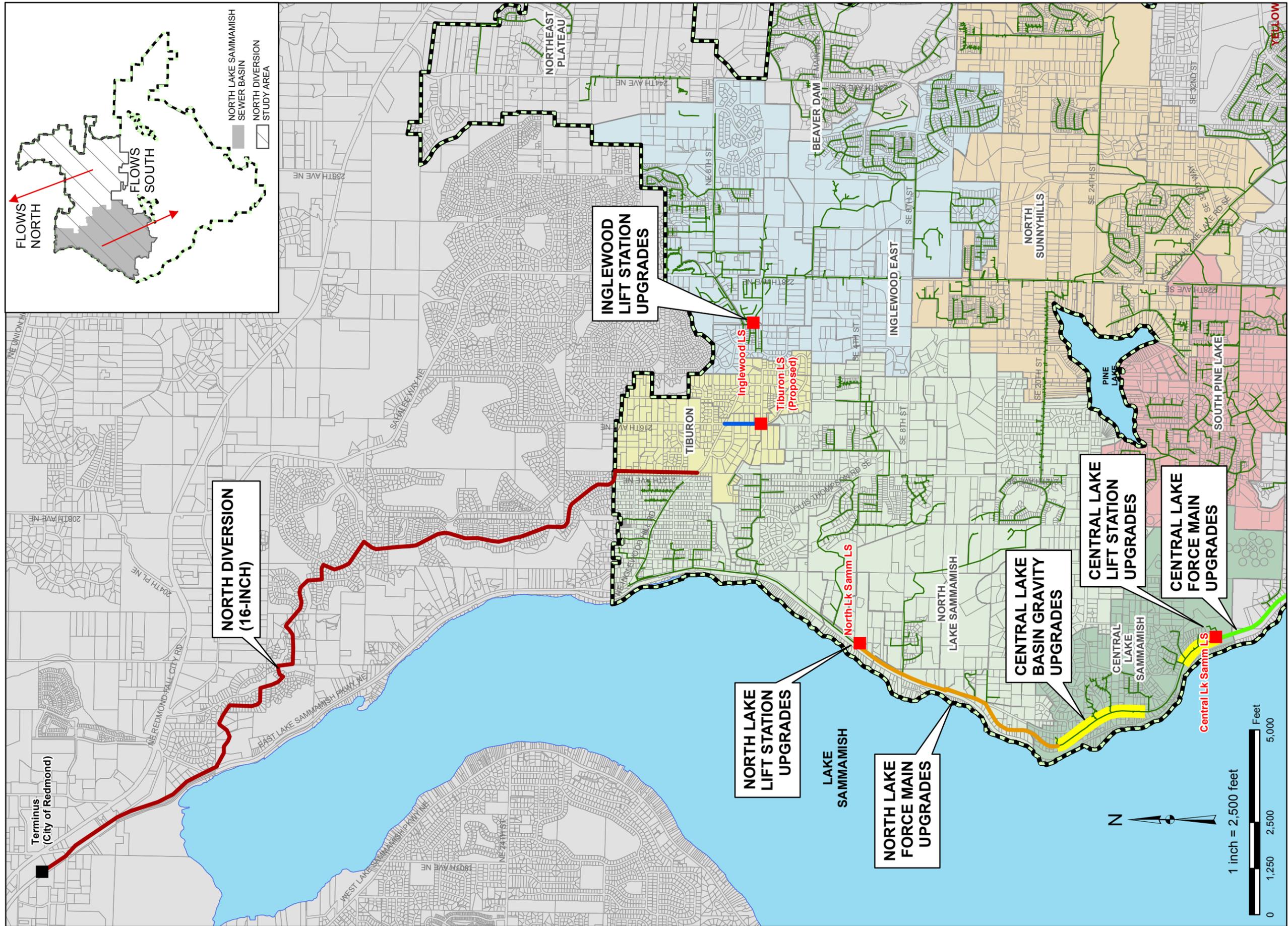


Note: Inglewood Lift Station 2,600 gpm pumps cannot be fully utilized until North Diversion is constructed.

FIGURE 4-2

Inglewood and North Lake Sammamish Lift Station RCE Capacity and Triggers⁽¹⁾

Based on the existing pumping capacity a of 1,200 gpm and assuming a constant I/I rate and capacity per RCE, the existing North Lake Sammamish Lift Station has a trigger of 3,750 RCE before capacity upgrades will be required. If the Inglewood Lift Station continues to flow to the North Lake Sammamish Lift Station, the North



LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

Force Mains:

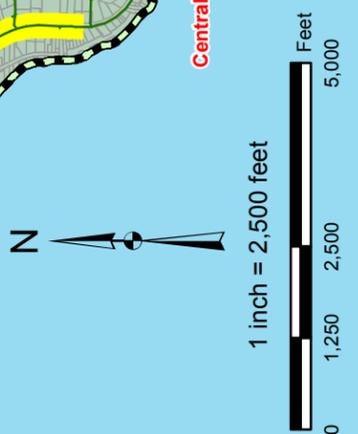
- Central Lake L.S. Force main
- North Diversion
- North Lake L.S. Force main
- Tiburon L.S. Force main

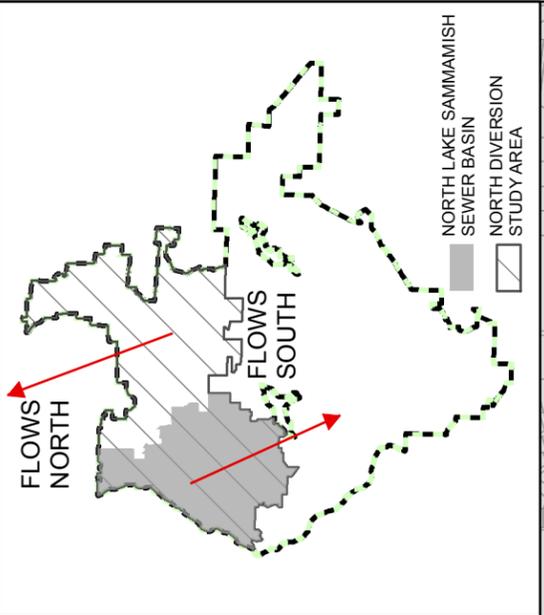
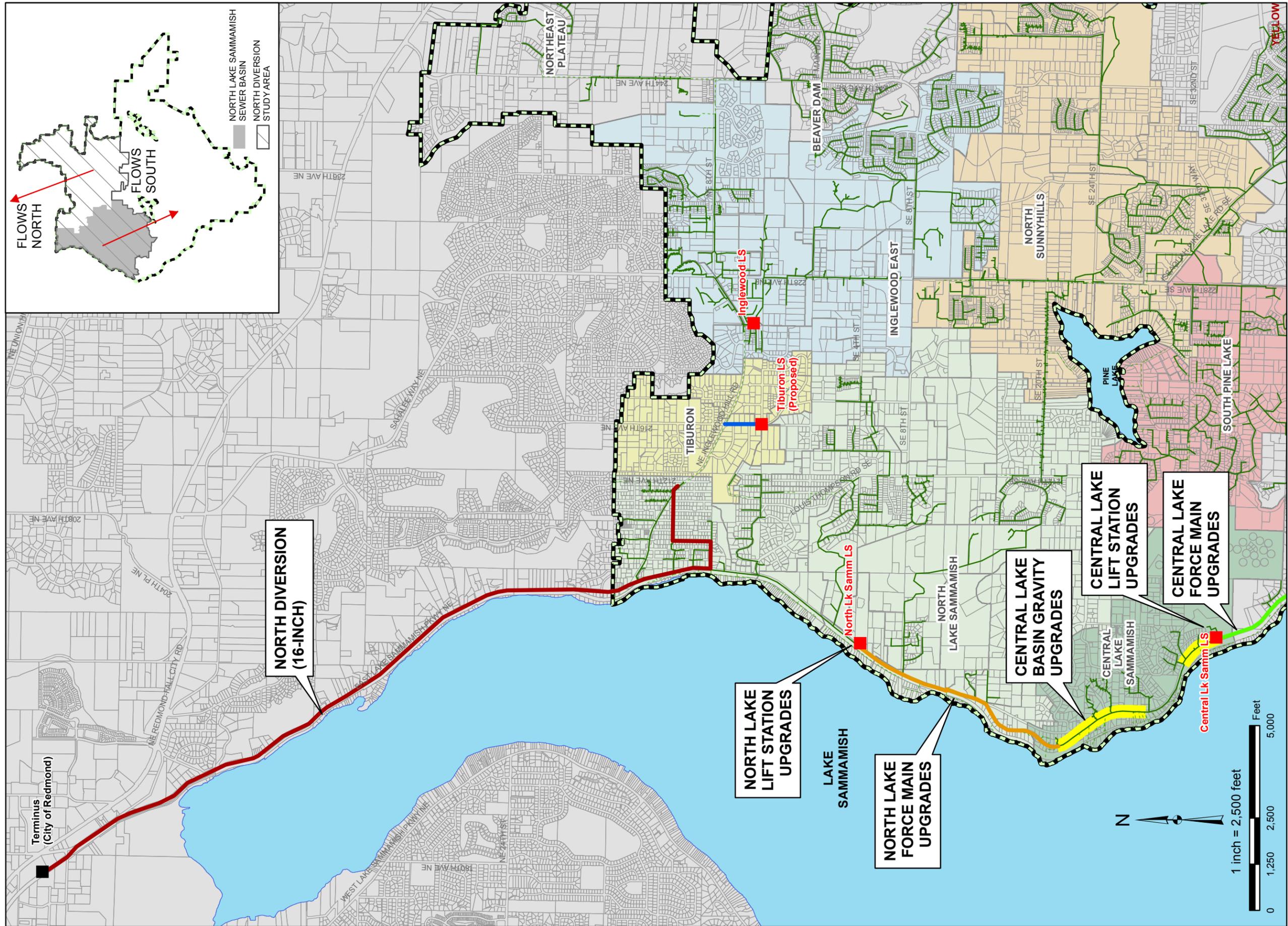
Gravity Upgrades:

- Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT

SAMMAMISH PLATEAU
WATER & SEWER DISTRICT
NORTH DIVERSION
HILL TOP ALIGNMENT
SCENARIO NO. 1
FIGURE 4-3





LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

Force Mains:

- Central Lake L.S. Force main
- North Diversion
- North Lake L.S. Force main
- Tiburon L.S. Force main

Gravity Upgrades:

- Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT

**NORTH DIVERSION
(16-INCH)**

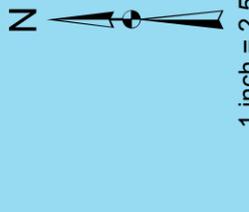
**NORTH LAKE
LIFT STATION
UPGRADES**

**NORTH LAKE
FORCE MAIN
UPGRADES**

**CENTRAL LAKE
BASIN GRAVITY
UPGRADES**

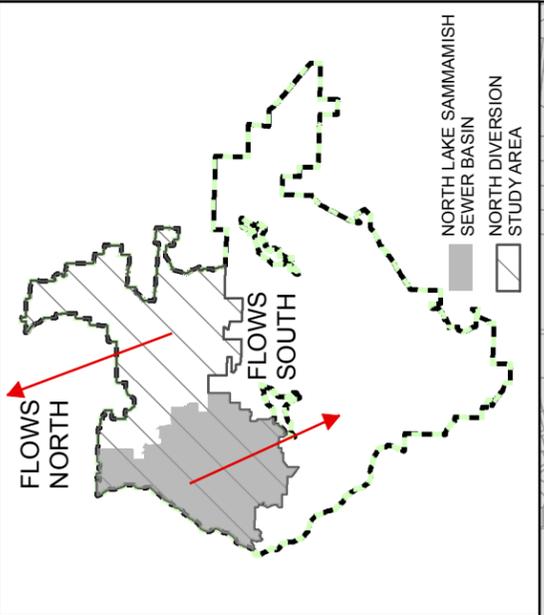
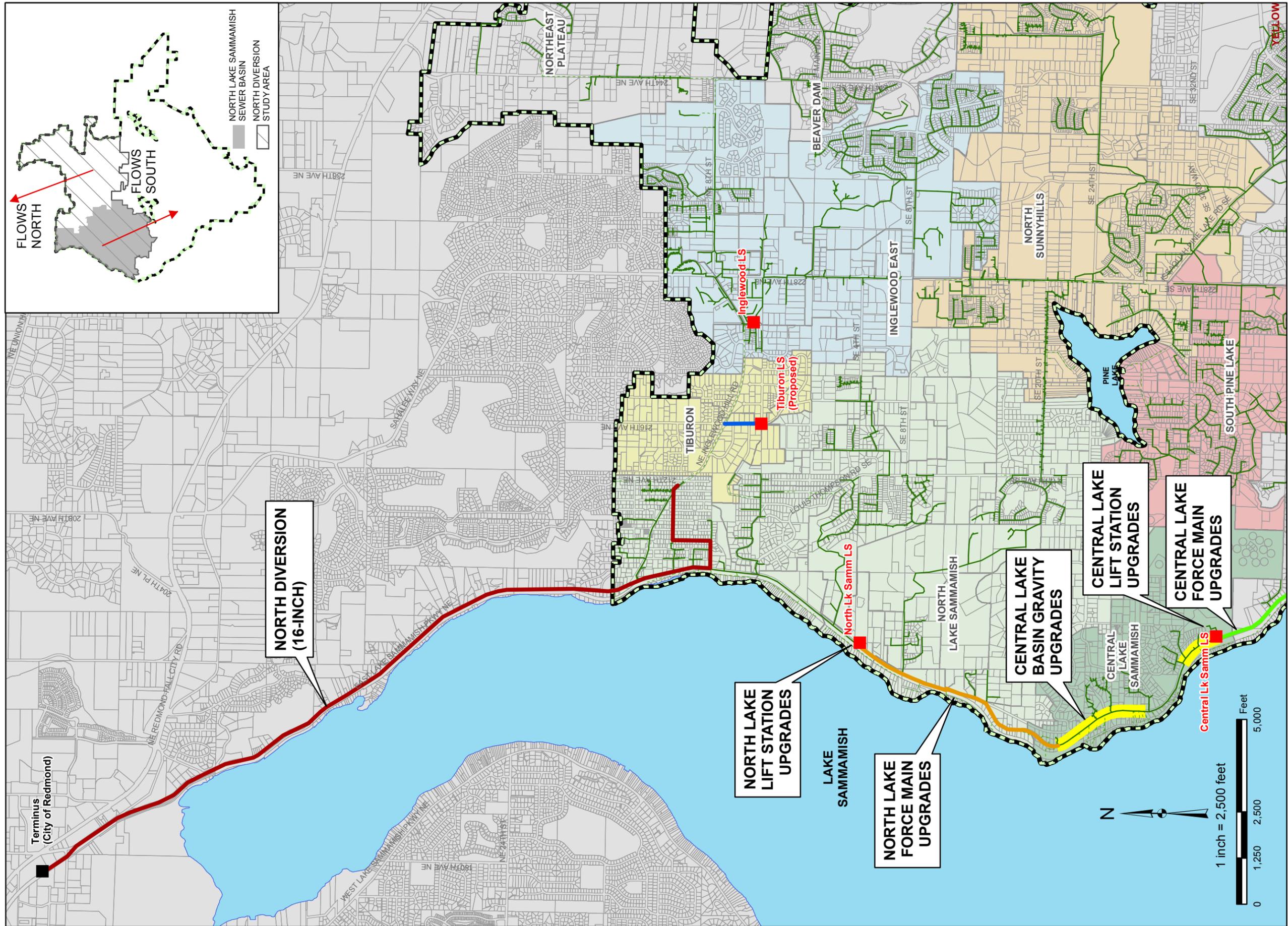
**CENTRAL LAKE
LIFT STATION
UPGRADES**

**CENTRAL LAKE
FORCE MAIN
UPGRADES**



SAMMAMISH PLATEAU
WATER & SEWER DISTRICT
NORTH DIVERSION
PARKWAY ALIGNMENT
SCENARIO NO. 2
FIGURE 4-4

Gray & Osborne, Inc.
CONSULTING ENGINEERS



LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

Force Mains:

- Central Lake L.S. Force main
- North Diversion
- North Lake L.S. Force main
- Tiburon L.S. Force main

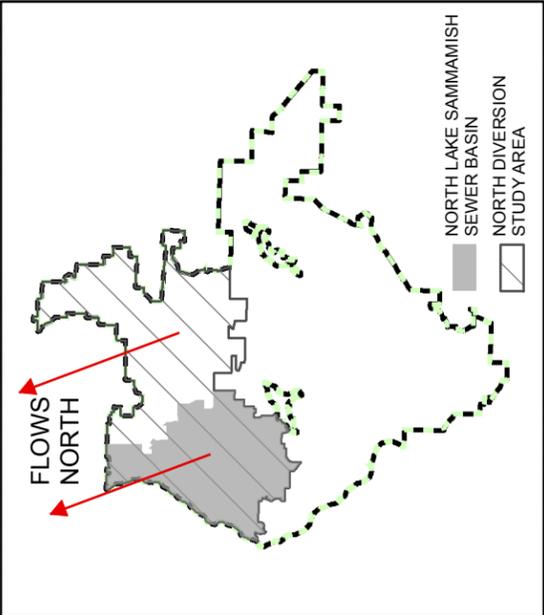
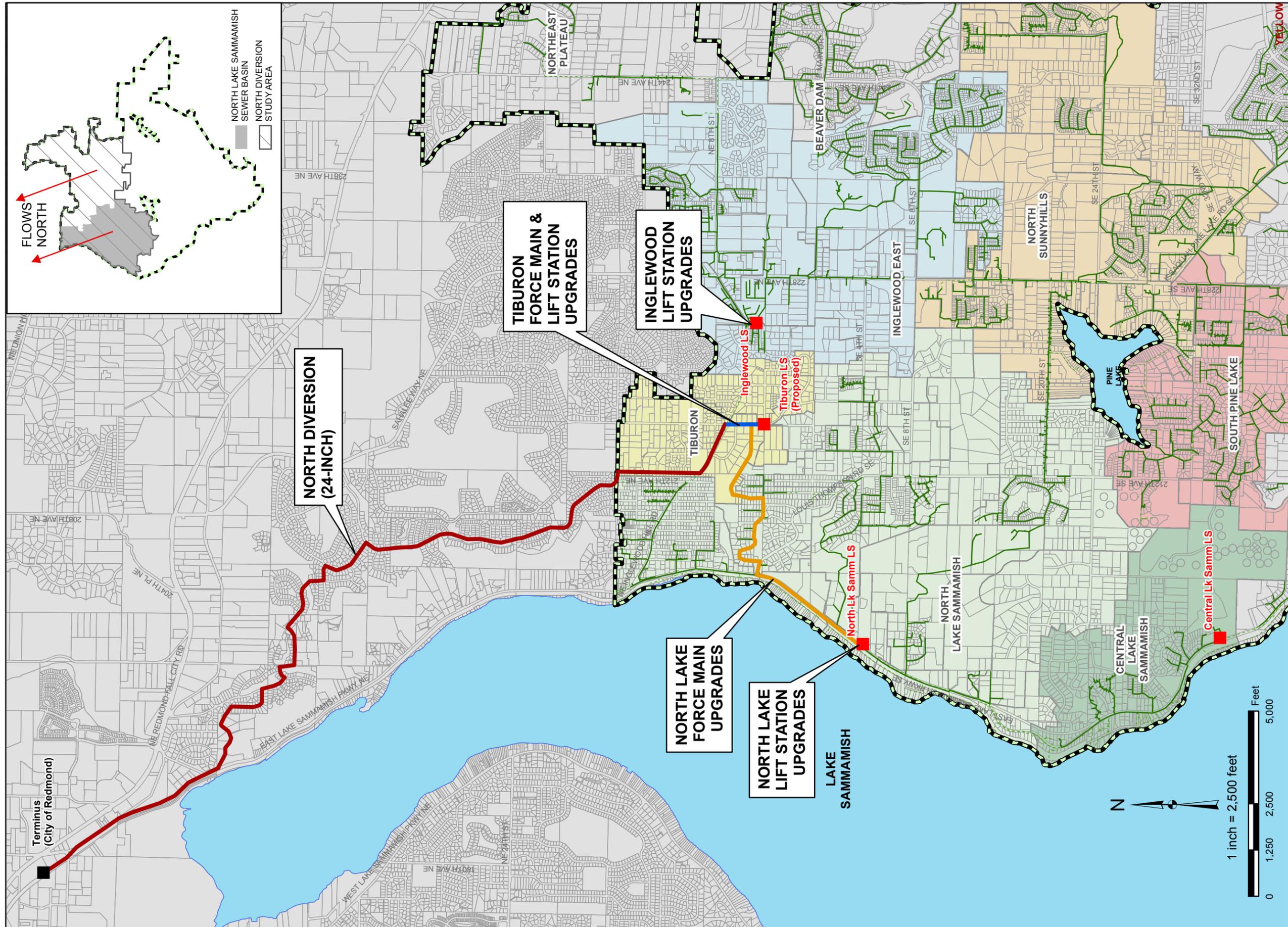
Gravity Upgrades:

- Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT

SAMMAMISH PLATEAU
WATER & SEWER DISTRICT
NORTH DIVERSION
TRAIL ALIGNMENT
SCENARIO NO. 3
FIGURE 4-5

Gray & Osborne, Inc.
CONSULTING ENGINEERS



LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- WATER

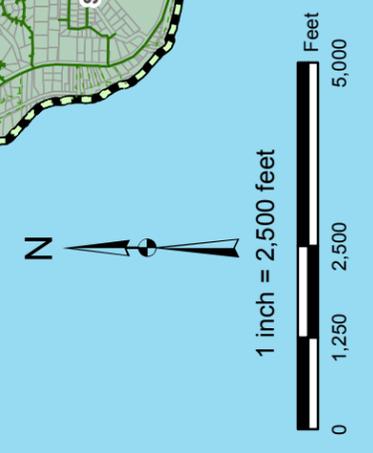
SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

Force Mains & Gravity Upgrades:

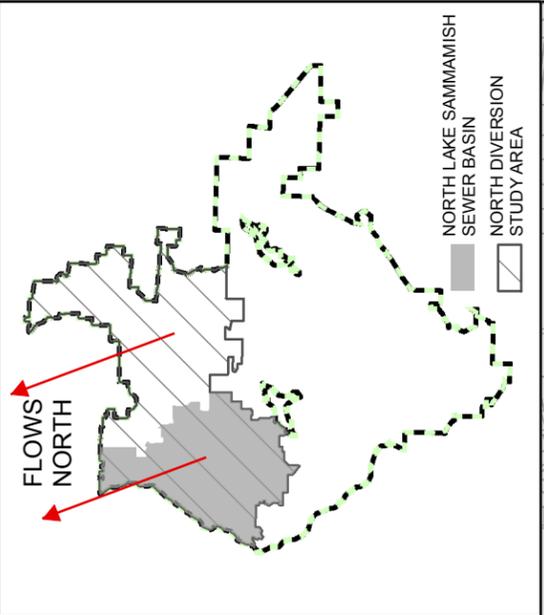
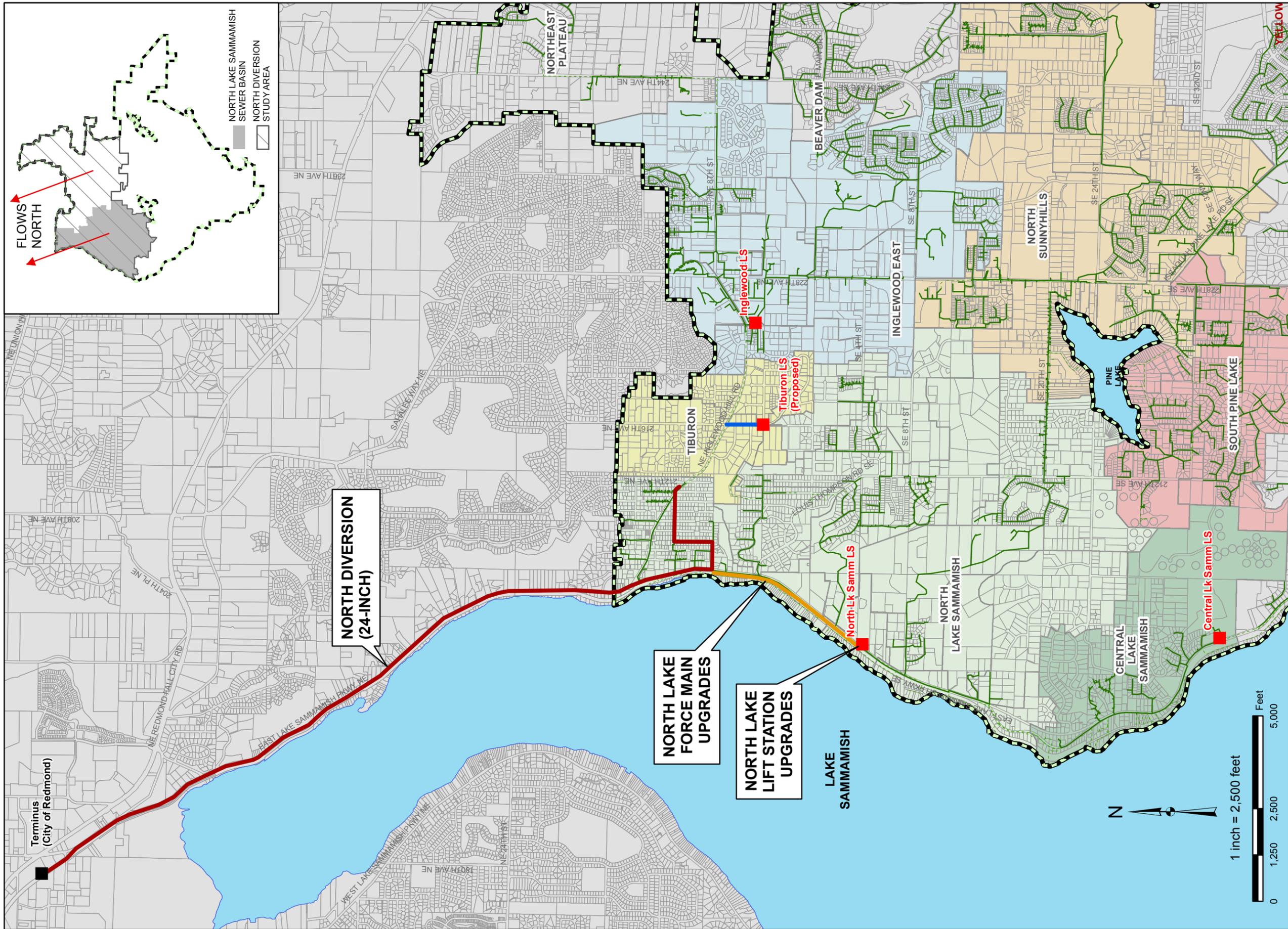
- Central Lake L.S. Force main
- North Diversion
- North Lake L.S. Force main
- Tiburon L.S. Force main
- Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT



SAMMAMISH PLATEAU
WATER & SEWER DISTRICT
NORTH DIVERSION
HILL TOP ALIGNMENT
SCENARIO NO. 4
FIGURE 4-6

Gray & Osborne, Inc.
CONSULTING ENGINEERS



LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- ▭ DISTRICT FUTURE SEWER SERVICE BOUNDARY
- ☁ WATER

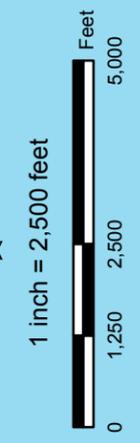
SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

--- Central Lake L.S. Force main
 --- North Diversion
 --- North Lake L.S. Force main
 --- Tiburon L.S. Force main

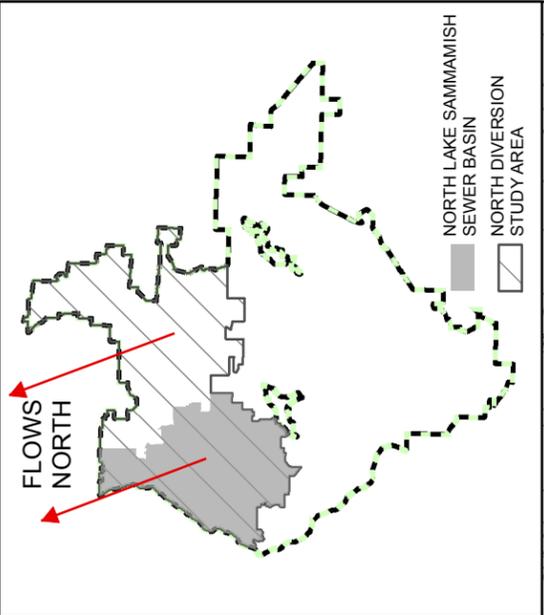
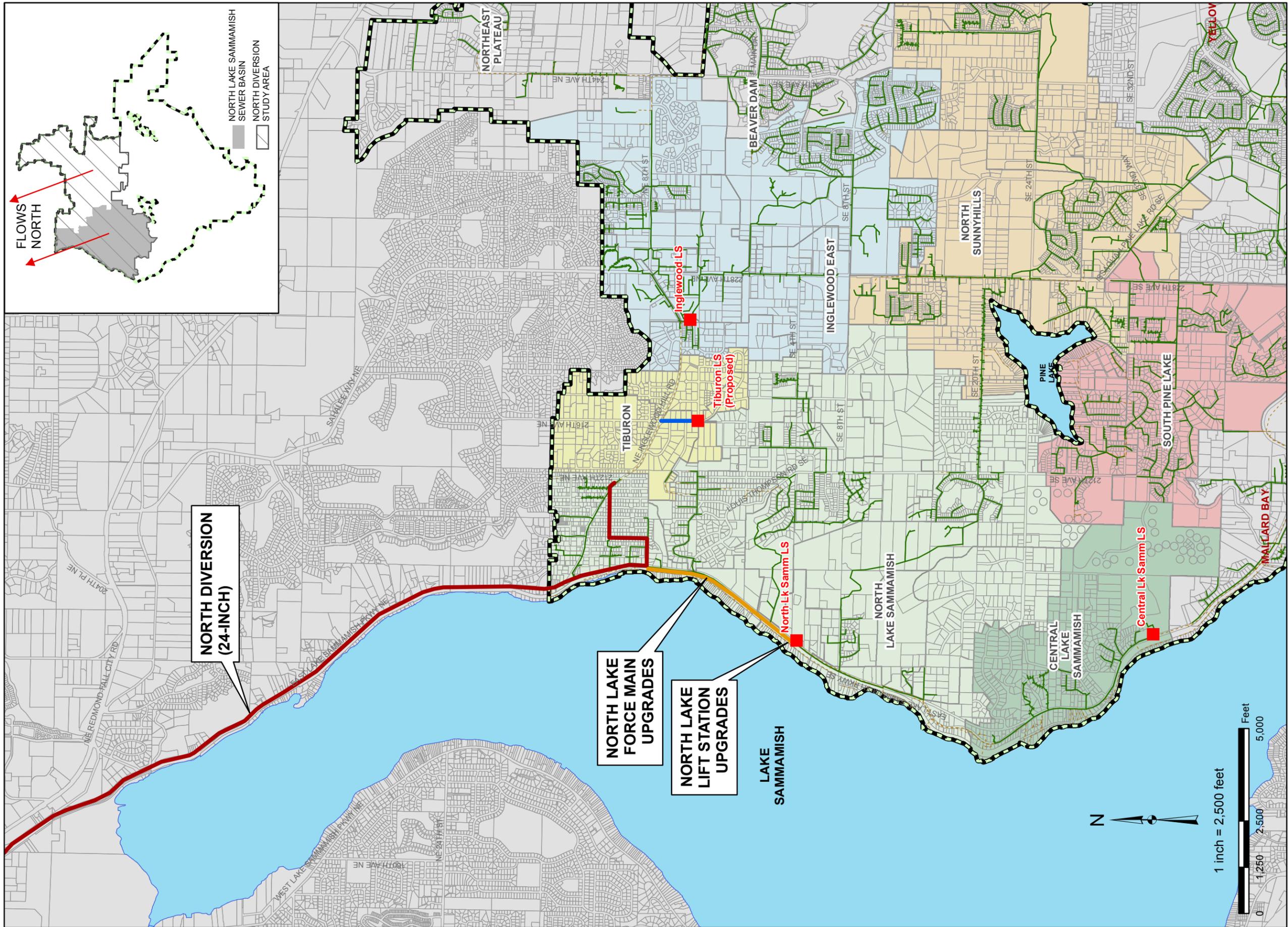
◆ Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT



SAMMAMISH PLATEAU
 WATER & SEWER DISTRICT
 NORTH DIVERSION
 PARKWAY ALIGNMENT
 SCENARIO NO. 5
 FIGURE 4-7

Gray & Osborne, Inc.
 CONSULTING ENGINEERS



LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- ☁ WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon

--- Central Lake L.S. Force main
 --- North Diversion
 --- North Lake L.S. Force main
 --- Tiburon L.S. Force main

◆ Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT

1 inch = 2,500 feet

0 1,250 2,500 5,000 Feet

N

SAMMAMISH PLATEAU
WATER & SEWER DISTRICT
NORTH DIVERSION
TRAIL ALIGNMENT
SCENARIO NO. 6
FIGURE 4-8

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Lake Sammamish Lift Station will exceed its capacity in approximately 2019. However, if the North Diversion is in service prior to 2019, and the Inglewood Lift Station flows are diverted away from the North Lake Sammamish Lift Station collection system, then the North Lake Sammamish Lift Station will not need capacity related improvements until build out if I/I rates are maintained at the current level.

4.4.4 SUMMARY OF ALTERNATIVES

Table 4-5 shows the alignment and flow direction of the seven North Diversion alternatives. Table 4-6 provides a summary of the various alternatives discussed in the Chapter. Figures illustrating Scenarios 1 through 7 and the improvements required for each scenario are provided in Figures 4-3 through 4-9.

TABLE 4-5

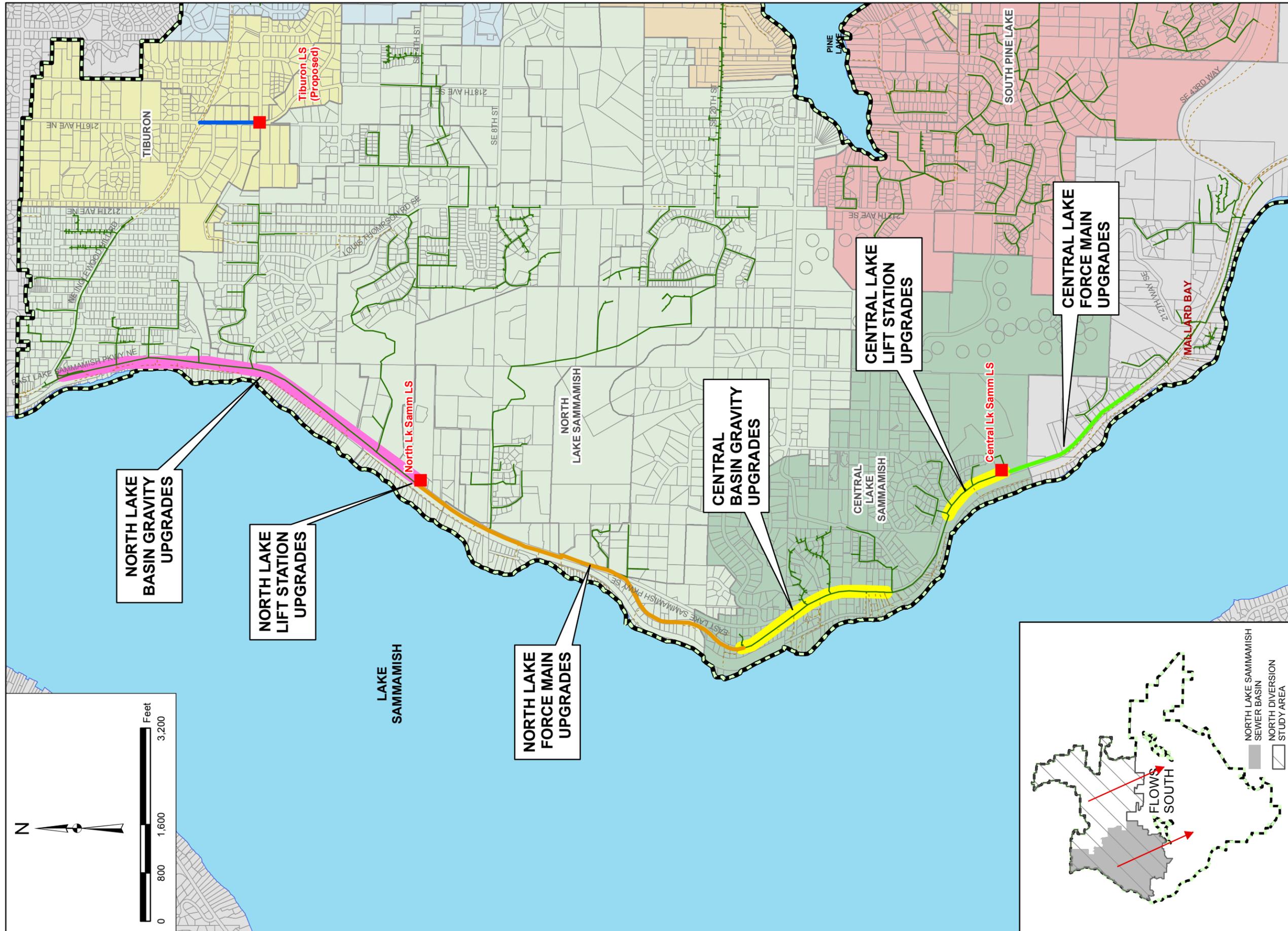
North Diversion Alternatives Description

Scenario No.	Alignment Description	North Lake Sammamish Basin Conveyance Direction	Figure No.
1	North Diversion Hill Top	South	4-3
2	North Diversion Parkway	South	4-4
3	North Diversion Trail	South	4-5
4	North Diversion Hill Top	North	4-6
5	North Diversion Parkway	North	4-7
6	North Diversion Trail	North	4-8
7	No North Diversion, South Diversion instead	South Including Inglewood Flows	4-9

TABLE 4-6

Alternative Analysis Summary

Scenario No.	1	2	3	4	5	6	7
	Not Including North Lake Sammamish Basin			Includes North Lake Sammamish Basin			All South ⁽²⁾
North Diversion							
North Diversion Route	Hill Top	Parkway	Trail	Hill Top	Parkway	Trail	South
North Diversion Diameter (inch)	16	16	16	24	24	24	24
North Diversion Length (feet)	25,000	22,000	22,000	25,000	22,000	22,000	10,000
North Diversion Cost	\$13,788,000	\$15,369,900	\$10,394,000	\$16,026,000	\$16,693,300	\$11,717,000	\$unknown
North Lake Sammamish Lift Station and Force Main							
North Lake Pumping Direction	South	South	South	North	North	North	South
North Lake LS Force Main Length (LF)	6,500	6,500	6,500	11,400	6,700	6,700	6,500
North Lake LS Force Main Diameter (inch)	16	16	16	16	16	16	16
North Lake LS Force Main Cost	\$2,906,000	\$2,906,000	\$2,906,000	\$4,376,000	\$3,677,000	\$3,677,000	\$2,906,000
North Lake LS Pumping TDH (feet)	66	66	66	319	55	55	66
North Lake LS Pumping required HP	60	60	60	200	50	50	60
North Lake LS Cost	\$500,000	\$500,000	\$500,000	\$1,000,000	\$500,000	\$500,000	\$500,000
North Lake Sammamish LS and Force Main	\$3,409,000	\$3,409,000	\$3,409,000	\$5,376,000	\$4,177,000	\$4,177,000	\$3,409,000
North Lake Gravity Improvements 21-inch	N/A	N/A	N/A	N/A	N/A	N/A	\$2,270,000
Central Lake Sammamish Lift Station and Basin							
Central Lake Sammamish Lift Station and Force Main Upgrade Cost	\$1,239,000	\$1,239,000	\$1,239,000	\$-	\$-	\$-	\$1,239,000
Central Lake Gravity Improvements	\$2,933,000	\$2,933,000	\$2,933,000	\$-	\$-	\$-	\$2,933,000
Central LS and Gravity Costs	\$4,172,000	\$4,172,000	\$4,172,000	\$-	\$-	\$-	\$4,172,000
Inglewood Lift Station							
Inglewood Pump Capacity Upgrade - 400-hp pumps @ 280 ft TDH	\$750,000	N/A	N/A	\$750,000	N/A	N/A	N/A



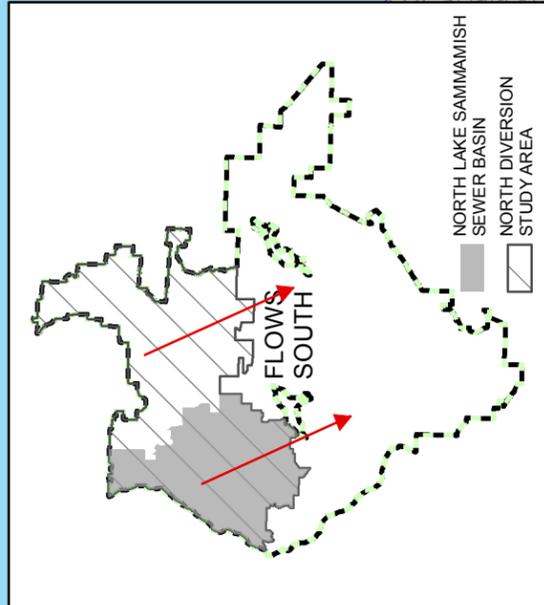
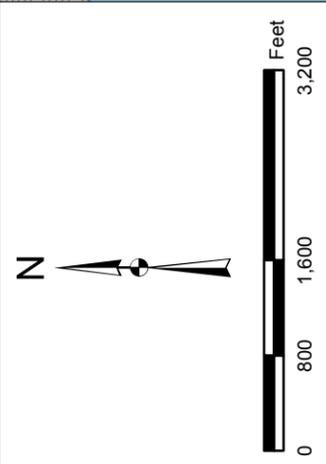
LEGEND:

- LIFT STATIONS
- FORCEMAINS & TIGHTLINES
- SEWER GRAVITY LINES
- DISTRICT FUTURE SEWER SERVICE BOUNDARY
- ~ WATER

SEWER BASINS:

- Central Lake Sammamish
- Inglewood East
- North Lake Sammamish
- North Sunnyhills
- South Pine Lake
- Tiburon
- Central Lake L.S. Force main
- North Diversion
- North Lake L.S. Force main
- Tiburon L.S. Force main
- Gravity Upgrades
- North Lake Gravity Upgrades

SOURCE: KING COUNTY AND SAMMAMISH PLATEAU WATER & SEWER DISTRICT



**SAMMAMISH PLATEAU
 WATER & SEWER DISTRICT
 NORTH DIVERSION
 INTERIM
 SCENARIO NO. 7
 FIGURE 4-9**


Gray & Osborne, Inc.
 CONSULTING ENGINEERS

TABLE 4-6 - (continued)

Alternative Analysis Summary

Scenario No.	1	2	3	4	5	6	7
	Not Including North Lake Sammamish Basin			Includes North Lake Sammamish Basin			All South ⁽²⁾
Tiburon Sewer Basin							
Tiburon LS Force Main Diameter (inch)	N/A	N/A	N/A	16	N/A	N/A	N/A
Tiburon Force Main Cost	N/A	N/A	N/A	\$350,000	N/A	N/A	N/A
Tiburon LS Pumping TDH (feet)	N/A	N/A	N/A	252	N/A	N/A	N/A
Tiburon LS Pumping required HP	N/A	N/A	N/A	250	N/A	N/A	N/A
Tiburon LS Cost	N/A	N/A	N/A	\$400,000	N/A	N/A	N/A
Tiburon LS and Force Main Costs	\$ -	\$-	\$-	\$750,000	\$-	\$-	\$-
Scenario Comparison							
TOTAL SCENARIO COST	\$22,116,000	\$22,947,900	\$17,972,000	\$22,902,000	\$20,870,300	\$15,894,000	\$9,737,000
TOTAL KCDNR COST ⁽¹⁾	\$13,788,000	\$15,369,900	\$10,394,000	\$16,026,000	\$16,693,300	\$11,717,000	\$unknown
TOTAL DISTRICT COST	\$8,328,000	\$7,578,000	\$7,578,000	\$6,876,000	\$4,177,000	\$4,177,000	\$9,737,000 + KCDNR

- (1) KCDNR Cost is funded from Rate and Capacity Charges based on District sewer customer counts.
- (2) King County capacity improvements required to accept the flows identified in Scenario 7 are unknown, and thus have an unidentified cost at this time. For this reason, no King County costs are identified for Scenario 7.

The costs shown for the Tiburon Lift Station are the cost differential of being constructed as a Regional Lift Station, rather than its planned construction as a Neighborhood Lift Station.

From Table 4-6, the following conclusions were drawn:

- From an over-all capital cost perspective, the Trail Alternative, with the North Lake Sammamish Lift Station pumping to the North Diversion is the most cost effective.
- The Trail alignment is the least expensive for King County, with the additional costs for adding the North Lake Basin flows requiring a pipe upsizing.
- Including flows from the North Lake Sammamish Lift Station pumping to the Trail alignment also requires the least amount of cost for other District facilities.
- Regardless of North Diversion route selected, District capital costs should be less expensive if the North Lake Sammamish Lift Station pumps to the North Diversion than if it pumps to the Central Lake Sammamish Lift Station as it currently pumps.
- Due to the significant horsepower and long term power costs, pumping the North Lake Sammamish Lift Station to the Hilltop Alternative requires favorable results from a life-cycle analysis before being considered a viable option.
- The North Lake Sammamish Lift Station, as noted by the RCE Triggers, is at, or near, the current the capacity of lift station. Modeled existing flows result in a peak instantaneous flow of 1,252 gpm, which is higher than the 1,200 gpm capacity of the station. This is consistent with historical reports provided by District staff regarding concerns with pumping capacities at North Lake and Central Lake Sammamish Lift Stations.
- The Inglewood Lift Station, as noted by the RCE Triggers, is not able to utilize its full capacity due to downstream collection system limitations. Modeled existing flows result in a peak instantaneous flow of 1,440 gpm, which is higher than the 1,135 gpm capacity of the station's lower capacity pumps. The station's wet well storage is

presently allowing the District to equalize peak flows and prevent triggering the higher capacity pumps. The higher capacity pumps will overwhelm the downstream system in the North Lake Sammamish Lift Station, and so it is critical that the North Diversion be online before this event occurs.

- Construction of the North Diversion eliminates the District’s capacity issues for several years. If Inglewood Lift Station is diverted to the North Diversion, the District has sufficient capacity in the North Lake Sammamish Lift Station and the Central Lake Sammamish Lift Station to continue pumping south, without improvements, for several years. This will give the District sufficient time to plan, finance, and construct force main and lift station improvements at the North Lake Sammamish Lift Station.

Based on these conclusions, the following is recommended:

1. The North Diversion needs to be an extremely high priority project with the District and King County. Construction of this project is the critical path for service in the Inglewood, North Lake, and Central Lake basins, including the City of Sammamish’s Town Center. The North Diversion satisfies King County’s commitment to meet the District’s sewerage needs.
2. Install a third pump in the North Lake Sammamish Lift Station and the Central Lake Sammamish Lift Station. This pump should be identical to the two existing pumps in each of these stations. While this third pump will not likely upgrade the capacity of these stations, it will greatly improve the reliability of these stations in the event that a pump is out of service.
3. Include projects required for pumping North Lake Sammamish Lift Station to the North Diversion in the District’s capital improvement program (CIP) in the Wastewater Comprehensive Plan. The District should place these projects in the 10-year CIP.

4.4.5 ISSAQUAH STORAGE PROJECT

The Issaquah Storage project was included in the recommended conveyance projects in the 2007 CSI Program Update. The project includes the installation of a 3.2 million gallon underground storage facility designed to attenuate peak wastewater flows generated from the Issaquah Highlands area. King County is expecting considerable growth in this area between the current year and buildout

(estimated to be 2050) and is concerned that the existing infrastructure and downstream facilities do not have sufficient capacity to accommodate the projected flows.

In an effort to reduce the impacts due to current peak flows and interim year growth and subsequent domestic wastewater flow projections, King County has evaluated and proposed installing two 144-inch- (12-foot-) diameter storage pipes in parallel that would extend approximately 1,900 linear feet along the existing alignment within NW Sammamish Road just west of the Lake Sammamish Park entrance and downstream of the location where Sammamish Plateau Water and Sewer District and City of Issaquah sanitary sewer collection systems join together. The storage facilities are not considered to be long-term solutions to remedy the expected the future growth for total buildout in the surrounding areas. Rather, they would be installed to attenuate peak flows that would otherwise exceed capacity of downstream facilities such as the Eastgate Trunk main and the Sunset and Heathfield sewer pump stations and force mains. These storage tanks, working together with the Sammamish Plateau North Diversion and the Sammamish Plateau Storage projects (discussed below) could potentially eliminate increasing the capacity of the Eastgate Trunk main and reduce the capacity required and limit the upgrades needed at the Sunset and Heathfield sewer pump stations and force mains for the future.

4.4.6 SAMMAMISH PLATEAU STORAGE PROJECT

The Sammamish Plateau Storage project was also included in the recommended conveyance projects in the 2007 CSI Program Update. The project includes a 3.3 million gallon underground storage facility tunneled into a hillside near the intersection of East Lake Sammamish Parkway SE and SE 43rd Way in the City of Issaquah, just downstream of the Sammamish Plateau Water and Sewer District Control Structure. Paired with the Issaquah Storage project and the Sammamish Plateau North Diversion, the proposed in-line storage facility would accommodate anticipated growth in the Sammamish Plateau region.

The Sammamish Plateau Storage project, in tandem with the Issaquah Storage project, would eliminate the need to install parallel transmission mains for both the Issaquah Interceptor and potentially the Eastgate Trunk main, and it would also limit the upgrades needed at the Sunset and Heathfield sewer pump stations and force mains for the future. Lastly, it would also reduce peak flows to downstream facilities that would otherwise exceed their current capacities.