Appendix O

Master Sewer Report

TEHALEH DEVELOPMENT

Tehaleh E.B.P.C
Phase 2 Major Amendment

Pierce County, Washington

Master Sewer Plan

October 25, 2017

Owner: Newland Communities
Civil Engineer: MacKay Sposito

Master Sewer Plan

TEHALEH EMPLOYMENT BASED PLANNED COMMUNITY
PHASE II MAJOR AMENDMENT

Pierce County, WA

October 25, 2017

DRAFT

PREPARED FOR:
Newland Communities
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Project Number: 16076

Prepared by:
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Project Engineer's Certification:

"I hereby state that this Master Sewer Plan Report for Tehaleh Employment Based Plan Community has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Pierce County does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me."

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1.0 PROPOSED PROJECT DESCRIPTION

The purpose of this report is to amend the existing approved "Cascadia Master Sewer Plan" prepared by Hugh G. Goldsmith dated May 1997 and revised in November 1997 and January 1998. This report describes existing hydrologic conditions and constraints on the proposed development at the time of the 1998 Environmental Impact Statement (EIS). The report was prepared for the Cascadia Development Company as part of the Cascadia Development 1998 EIS. Since the 1998 EIS and the approval of this report, the Cascadia Development has been sold to Nash Cascadia Verde, LLC. and renamed Tehaleh. This report amends the information, description and computer modeling presented in the original drainage report to reflect the current proposed land use action for the 2017 Tehaleh Phase II Major Amendment as part of a Supplemental Environmental Impact Statement (SEIS).

The observations and conclusions provided herein are based on a review of resource data available through a variety of sources. This includes numerous field visits by MacKay Sposito, Inc. and other consultants as well as construction and historical information from previous report and construction documents for the site.

This report is not a design level sewer analysis, although proposed sanitary sewer flow calculations for full build-out have been completed to verify the proposed plan and assess potential impacts of development of the site. All proposed sanitary sewer infrastructure will follow the Pierce County Sanitary Sewer Extensions Checklist and construction documents will be reviewed and approved by Pierce County prior to construction

2.0 PROJECT LOCATION

The 4,756-acre Tehaleh Employment Based Planned Community development is located on a plateau northeast of the City of Orting and south of the City Bonney Lake in Pierce County, Washington (portions of Sections 8, 9, 16 through 23, 27 through 30 and 33, Township 19 North, Range 5 East, W.M.). Tehaleh is bounded to the south and west by the Carbon River, to the east by South Prairie Creek, and to the northwest by Canyonfalls Creek. A vicinity map showing the location of the site is included as Figure 1.

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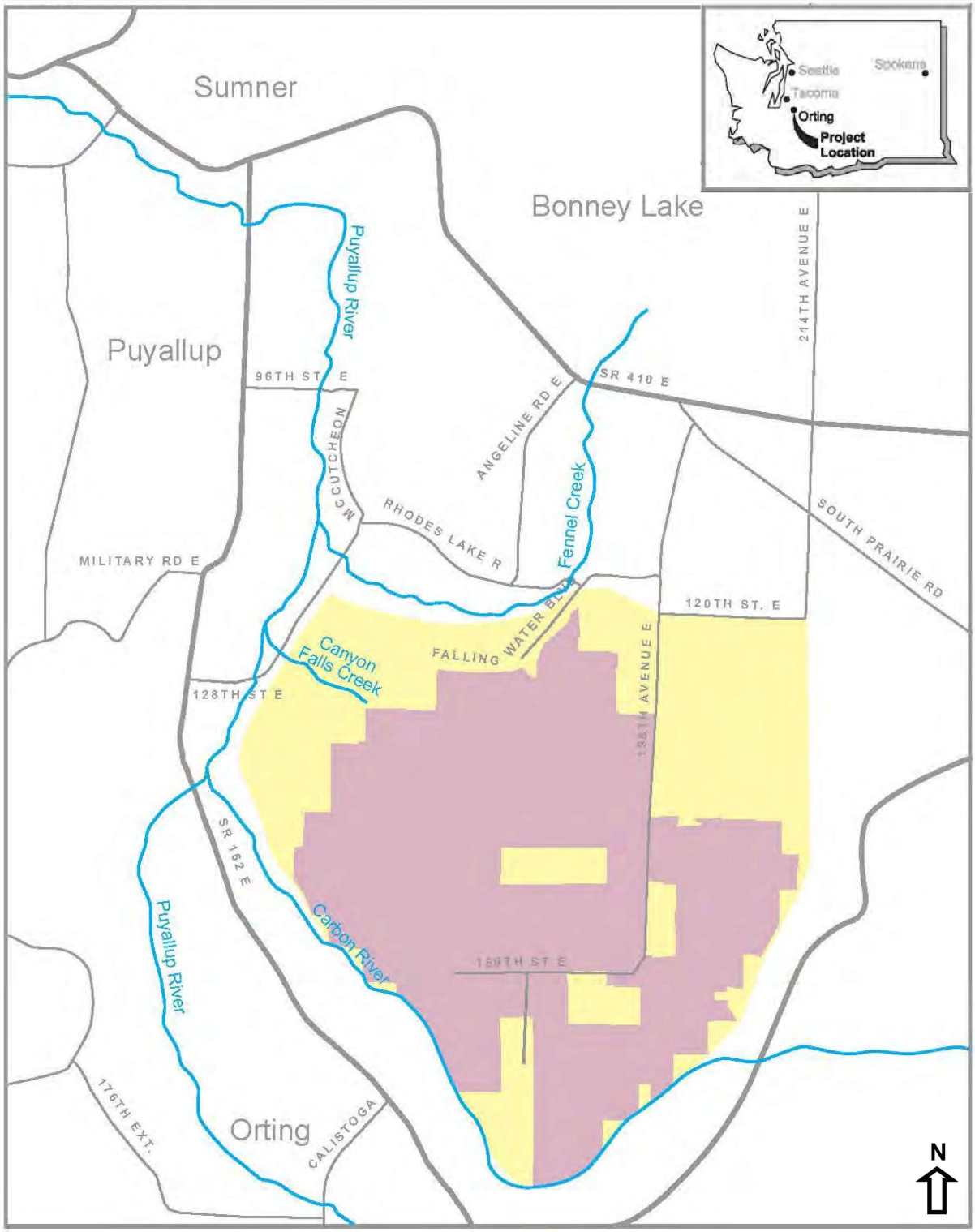
FILE: J:\CASCADIA\16076 - TEHALEH PHASE 2 EIS\CIVIL\EXHIBITS\FIGURE 1 - VICINITY MAP.DWG



Note: This figure is not to scale

MAP/IMAGE PROVIDED BY ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

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TEHALEH E.B.P.C.

FIGURE 1 - VICINITY MAP

PROJECT NO.:	16076
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DATE:	3/21/2016
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3.0 EXECUTIVE SUMMARY

The following report provides a preliminary analysis of the proposed Master Sewer Plan for Tehaleh. The analysis presents a description of the existing and proposed infrastructure requirements to meet estimated sewer demand. Estimated sewer demand is calculated from the proposed SEIS alternatives and their respective land uses. Five (5) SEIS alternatives are proposed (See Section 8.0 for detailed description of each Alternative. Four (4) alternatives propose 9,700 residential units or less and have similar ratios of commercial land use. Based on the distribution of land use and that the Applicant's Preferred Alternative does not have a Golf Course, the SEIS Applicant's Preferred Alternative was selected for analysis because its proposed land use layout would put the most significant impact on the existing and proposed sewer conveyance system. See sewer capacity calculations in Appendix A and Exhibit 1: Sanitary Sewer Master Plan in Appendix B.

The existing sanitary sewer system at Tehaleh was predominately constructed in 2007 and has continued from 2012 to current day. The infrastructure has been accepted by Pierce County Environmental Services and is in operation today. The sewer system flows to an existing Large On-site Septic System (LOSS) located in proposed parcels R2 and R3. The existing septic system and drainfield is Stage 1 of the ultimate Master Sewer Plan for the full build out of Tehaleh. The existing LOSS has a capacity of 100,000 gallons per day (gpd). Currently, the inflow to the LOSS is monitored and flow rates have remained under this requirement.

Monitoring of the LOSS has been conducted since the beginning of use. The continued monitoring program has been analyzed as developed parcels become occupied and started producing flows to determine a site-specific flow rate per RE (Residential Equivalent). The monitored flow rates have been consistent at approximately 140 gallons per day per RE.

The total estimated sewage flow for Tehaleh is approximately 3.05 MGD (average annual flow), 3.52 million gallons (maximum month flow) and 8.12 MGD (peak instantaneous wet weather flow). The total RE's in Tehaleh Preferred Alternative is approximately 14,000 with a contributing Infiltration and Inflow (I&I) from 2,979 acres. The flows from the Exception Parcels were included in the design of the proposed and existing infrastructure. All the Exception Parcels are analyzed assuming a maximum density of 4 dwelling units per acre (DU/ac) based on the parcels gross acreage. Latecomer's agreements will be applied to parcels tributary to proposed infrastructure within Tehaleh.

All sewer mains will be designed in accordance with Pierce County and Washington Department of Ecology Standards. In general, sewer mains will be located in public streets or trails wherever feasible. Rear yard sewer manholes will be used only where it is the only feasible alternative. Continuous access to all sewer manholes will be provided unless it is not feasible.

Pierce County Department of Public Works and Utilities will provide wastewater treatment and Sanitary Sewer Service for the entire Tehaleh EBPC in accordance with the following standards: Pierce County Unified Sewer Plan (approved 2012), the Development Agreement for the Cascadia Wastewater Treatment Plant at Tehaleh - 4/17/13 (the "Agreement"), Pierce County Title 13 (Sewer Code), the Cascadia Master Sewer Plan as amended (2013) and applicable Pierce County standards and specifications. All sewer facilities will be owned and operated by the Pierce County Department of Public Works and Utilities. Ultimately, wastewater treatment will be provided in an onsite permanent wastewater treatment plant (WWTP) located on Parcel 2C.3 in Tehaleh Phase II. The WWTP will be

constructed as part of Tehaleh Phase I and expanded in stage over time as needed to meet growth demands. Wastewater treatment will be provided in stages. Stage 1 is the large onsite septic system (LOSS), as previously discussed, with a maximum capacity of 100,000 gpd. Stage 1A is an Interim Waste Water Treatment Plant (IWWTP). The IWWTP will potentially use four MBR sliders each having a capacity of approximately 100,000 gpd, giving the IWWTP a maximum capacity of approximately 400,000 gpd. Stage 2 of wastewater management will include the permanent WWTP, which will serve the entire site at full build-out (9,700 residential units and 3.4 million square-feet of commercial uses (4,217 REs). The WWTP will also be built in phases to match the growth and needs of the development.

The phasing plan is based on sewage flows calculated using standard regionally accepted sewage loading rates. Discharge volumes and rates will continue to be monitored to verify design assumptions. The actual number of REs served by the sewage treatment facilities may vary depending on actual measured sewage flows and loading rates. The phasing plan is also the most cost effective method to serve the Tehaleh site, both from the perspective of the private and public sectors. Almost all facilities constructed to serve the site during the initial phases of development will be part of the overall final sewer system serving the entire site. The phasing plan avoids constructing major infrastructure years before it is needed. This type of cost effective and conservative approach is a key component of developing a successful master planned community.

4.0 AFFECTED ENVIRONMENT (EXISTING CONDITIONS)

4.1 ONSITE SOILS AND GEOLOGY

Onsite Soils and Geology were initially described in the *1998 Cascadia Master Sewer Plan prepared by Hugh G. Goldsmith &* Associates, Inc. final revision dated January 1998. For an updated technical report on the Onsite Soils and Geology see the "*Soils, Geology, Groundwater and Geologic Hazards Report for the Supplemental Draft Environmental Impact Statement" Earth and Groundwater for Tehaleh Phase II prepared by Associated Earth Sciences, Inc.* (AESI) *dated June 30, 2017* (AESI 2017 Report). The following is a summary of the information provided by AESI that is pertinent to onsite soils and geology of the site.

A Soils Map is provided in the AESI 2017 Report. Per AESI 2017 Report, site soils formed over relatively young glacial deposits on the upland or post-glacially deposited alluvial sediments in the valleys bordering and consist of Alderwood Series, Everett Series, Indianola Series, Kitsap Series, Xerochrepts, Dupont Muck, Semiahmoo Muck, and Assorted Alluvium Soils. For a detailed description of these soils series see the AESI 2017 Report.

The Everett and Indianola Series soils are considered extremely well-drained. Everett Series soil types were typically found across portions of the upper plateau and the terraces bordering the plateau. Indianola Series soils types were typically found on the southern portion of the site, and along the southern and eastern bank to Canyonfalls Creek valley. The Alderwood and Kitsap Series soils are considered moderately well-drained. The Alderwood series were typically found on portions of the upper plateau were they form on flat to steep slopes. The Kitsap Series soils were typically found along the western border of the site. These soil series are identified because they exhibit qualities, which are conducive to infiltration facilities. These types of soils will be referred to as "outwash" soils compared to less well-drained soils, referred to as "till" soils. The site is predominately "till" soils.

A key point from the AESI 2017 Report is that the Everett and Indianola soil series are identified as being considered adequate for a large community drainfield and a future rapid infiltration facility. AESI also conducted groundwater analysis of impacts from the projected volumes of water infiltration to the subsurface to the regional aquifer and the discharge into Canyonfalls Creek. Their report concludes that the soils have adequate capacity for the projected flows and volume from the treated effluent. AESI's report also analyzed these volumes as well as the added volume of water infiltrated from the proposed stormwater retention facilities within the same capture zone to compare with existing conditions groundwater flows.

4.2 GROUNDWATER

An detailed analysis of the Groundwater is provided in the "*Soils, Geology, Groundwater and Geologic Hazards Report for the Supplemental Draft Environmental Impact Statement" Earth and Groundwater for Tehaleh Phase II prepared by Associated Earth Sciences, Inc.* (AESI) *dated June 30, 2017* (AESI 2017 Report). The following is a summary of the information provided by AESI that is pertinent to groundwater of the site.

AESI identified four zones of groundwater flow; three of the zones are considered aquifers, while the other is considered an interflow zone, which is not an aquifer due to its seasonal occurrence. The three aquifers determined are a shallow Alluvial Aquifer that occurs within Holocene Carbon/Puyallup River valley sediments, a Plateau Aquifer formed primarily in Vashon advance outwash, pre-Vashon-age coarse-grained deposits and in upper portion of the Puyallup Formation, and a deeper upland aquifer in older predominately glacial deposits termed Orting Aquifer. See 2014 EIS Addendum and referenced reports for further details on the aquifers and interflow zones. These aquifers are partially recharged from the Tehaleh project area through infiltration of excess precipitation.

Previous reports and the June 30, 2017 report by AESI confirms that due to the unique hydrology of the Tehaleh site the vast majority of excess precipitation on the upland plateau is captured in the site system of closed depressions and is infiltrated into the groundwater. Per the AESI 2017 Report, Groundwater from the upland plateau flows west towards the Carbon/Puyallup River valley and northwest towards Canyonfalls Creek and Fennel Creek through a major aquifer system, referred to as the Plateau Aquifer. From groundwater analysis/models, slope stability analysis/models, field data, and field observations performed by AESI and described in detail in the AESI 2017 Report, most of the groundwater flowing in the Plateau Aquifer under the project area discharges to Canyonfalls Creek, which is the source of the spring and headwaters of Canyonfalls Creek. This occurs due to the large bluffs surrounding the plateau, and as the aquifer approaches the bluffs, some groundwater daylights onto the slope as springs and seeps. Areas where this occurs are described in more detail in the Master Drainage Report prepared by MacKay Sposito, Inc. dated June 10, 2016.

A smaller portion of the flows from the Plateau Aquifer also discharges to a series of springs located north of the project site and south of Fennel Creek. Some of this groundwater also remains in the subsurface and flows past Fennel Creek to the Carbon/Puyallup River valley within the permeable Fennel Creek Delta.

From AESI's analysis, the estimated groundwater capture zone of Canyonfalls Creek encompasses areas north and east of the Tehaleh project area. These springs and well locations are shown in Figure 4 of the AESI 2017 Report. The observations and analysis performed by AESI conclude that "*The primary*

implication is the understanding that both water quantity and water quality in the headwaters of Canyonfalls Creek can be strongly influenced by off-site land use activities." (AESI 2017 Report) Modeling of the existing and proposed groundwater systems and monitoring Canyonfalls Creek discharge for both quality and quantity will assist in determining and avoiding potential impacts from development.

4.3 EXISTING SEWER SYSTEM

The current sanitary sewer system of Tehaleh was predominately constructed in 2007 and has continued from 2012 to current day. This infrastructure has been accepted by Pierce County Environmental Services and is in operation today. Major components of the infrastructure include an existing large onsite septic system (LOSS) and community drain field, an interceptor sewer mainline ranging from 12" to 21" conveying sanitary sewer flows to the LOSS, and a sanitary sewer services and collection systems for the existing plats and plats under construction. Existing plats include Whitman, Winthrop, Liberty Ridge, Columbia Vista, Inspiration Ridge, and Trilogy East. Neighborhoods under construction include Pinnacle Ridge, Panorama Point, Berkeley Park, Cathedral Ridge and Trilogy West. The Visitor Center/the Post, the Elementary School and The Seven Summits Lodge also have sewer services in place.

The existing interceptor conveyance system was completed from the intersection of Cascadia Blvd E and 198th Ave E to the intersection of Cascadia Blvd E and Canyon View Blvd E in a 12-inch sewer line. The interceptor line continues north along Canyon View Blvd E to just north of the existing Liberty Ridge residential development in a 16-inch and then 18-inch sewer line. The interceptor continues west, north of Liberty Ridge and through proposed North Forest Park and between Inspiration Ridge and Berkeley Park residential developments in a 20-inch to 21-inch sewer line to the existing LOSS located in proposed parcels R2 and R3 (see Exhibit 1: Master Sewer Plan). The existing septic system and drainfield is stage 1 of the ultimate Master Sewer Plan for the full build out of Tehaleh. The existing LOSS has a capacity of 100,000 gallons per day (gpd). Currently the inflow to the LOSS is monitored and average flow rates have remained under this requirement.

4.4 TOTAL MAXIMUM DAILY LOAD LIMITS

Canyonfalls Creek will be the main receiving water body from the effluent of the Wastewater Treatment Plant (WWTP) being infiltrated into the sub-surface of the Tehaleh Plateau. As described in the groundwater section, above, the Canyonfalls Creek capture zone encompasses the majority of the Tehaleh area and discharges at Canyonfalls Creek via the regional aquifer. The Canyonfall Creek then discharges to the Puyallup River. Associated Earth Science Inc. (AESI) used computer-modeling tools to model the projected flows into the subsurface and the potential impacts on nitrogen loading and slope stability using MODFLOW, a detail description can be found in the AESI 2017 Report.

From their analysis and report, AESI first notes that the proposed WWTP treats effluent to a much higher degree then previous assumed in the 1998 EIS. Current nitrate concentration found from groundwater monitoring are also much lower than the 1988 EIS predicted would occur from the installation of the LOSS. AESI concludes that the SEIS Preferred Alternative will also cause least amount of nitrate contamination due to the absence of the golf course.

The proposed permanent WWTP will use the community drainfield and a future rapid infiltration facility to discharge treated effluent. Once a future rapid infiltration facility is completed, the existing drainfield will be decommissioned. Based on a WWTP designers report prepared by Kennedy/Jenks Consultants,

AESI analyzed multiple stages and concentration of effluent from the WWTP. To be conservative, no reduction in nitrate concentrations from additional denitrification processes occurring prior to discharge to Canyonfalls Creek was assumed in order to analyze the "worst-case" scenario.

From this analysis AESI concluded that "assuming the interim and permanent WWTP processes result in effluent having the nitrate concentrations approximately equal to the predicted effluent concentrations, and the LOSS and associated community drainfield cease being used in 2017 as planned, no significant adverse nitrate water quality impacts to receiving waters, including Canyonfalls creek, have been identified from wastewater effluent." (AESI 2017 Report).

There are two monitoring stations currently in use for Canyonfalls Creek. The first monitoring station is operated and maintained by AESI and the second is operated and maintained by Pierce County. These monitoring station will monitor the quality and quantity of flows from Canyonfall Creek. Water quality and flows will be monitored to ensure Canyonfalls Creeks stays within projected volume and quality predicted from modeling. If monitoring shows that volume or quality of water is beyond the predicted and safe levels, a secondary permanent WWTP effluent infiltration area has been determined. This secondary location will be located along the proposed new Rhodes Lake Road East within two recently purchased parcels by Nash Cascadia LLC parcel numbers 0519182005 and 051982025. Both of these parcels are not within the Canyonfalls Creek Capture Zone but within the Puyallup River Capture Zone.

5.0 MASTER SEWER PLAN

5.1 SEWAGE LOADING AND DESIGN CRITERIA

Sewer loading calculations have been performed for the proposed full build-out of Tehaleh. The calculations are based on design criteria consistent with Pierce County Public Works and Utilities' 2010 Unified Sewer Plan. Sewage flow rates are expressed in Residential Equivalents (RE's). An RE is the amount of sewage generated by a typical single family residential unit in a 24 hour time period.

The purpose of this report is to analyzes and identify any anticipated adverse impacts from the proposed sanitary sewer system within Tehaleh for the five alternatives presented as part of the Tehaleh Phase II Major Amendment Supplemental Environmental Impact Statement. The proposed Wastewater Treatment Plant (WWTP) was analyzed under a separate EIS "EIS Addendums for the Wastewater Treatment Plan (2014, 2015)". The five alternatives presented in this SEIS are briefly outlined below:

Alternatives	SEIS Applicant's Preferred Alt	SEIS Alt. 1	SEIS Alt. 2	SEIS Alt. 3	SEIS Alt. 4
Description	**Preferred Alternative**: No Golf Course or Hotel	Phase II Application Golf Course and Hotel	Current Approval: Golf Course and Hotel	Modified Current Approval with Golf Course	No Action Alternative: Golf Course and Hotel, no Phase II
Total Residential Units (REs)	9,700	9,700	6,437	9,700	2,586
Employment Center Areas (ac.)*	476	484	484	476	159

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*

As shown above, three of the five alternatives would have the same number of residential units (9,700 units). These alternatives have very similar land uses for commercial, public facilities, recreation and open space. Alternatives 2 and 4 have much lower residential unit counts. Alternative 2 has similar ratio of land uses for commercial, public facilities, recreation and open space as the Applicant's Preferred Alternative and Alternatives 1 and 3. All of the action alternatives will have similar plans for sanitary sewer infrastructure. Layouts are slightly different but major components of the infrastructure will remain in the proposed location. The biggest difference in infrastructure location will occur in Alternative 4, which will not include any infrastructure in Phase II but will have the same infrastructure as the remaining alternatives for Phase I.

In this Master Sewer Plan, the Applicant's Preferred Alternative was selected as the alternative to carry through the impact analysis as it would result in the most conservative hydraulic analysis and provide a master infrastructure plan that would accommodate all of the proposed action alternatives. See Appendix A and B for Hydraulic Calculations and Sanitary Sewer Master Plan, respectively.

5.2 FLOW ASSUMPTIONS

A summary of the estimated Tehaleh sewer flows based on the proposed Tehaleh Master Plan is presented in Appendix A for the Applicant's Preferred Alternative. For comparison, the original EIS proposed WWTP had a total estimated sewage flow of 2.35 MGD (average annual flow) for 10,686 RE's (see Appendix A, Table 5-1 of the original EIS). The total estimated sewage flow for Tehaleh is approximately 3.05 MGD (average annual flow), 3.52 million gallons (maximum month flow) and 8.12 MGD (peak instantaneous wet weather flow). The total RE's in the Applicant's Preferred Alternative is approximately 14,000 with a contributing Infiltration and Inflow (I&I) from 3,023 acres. SEIS Alternatives 1 and 3 will have almost identical "end of the line" numbers, whereas SEIS alternatives 2 and 4 would produce much lower flow rates due to their proposed residential and commercial uses. For comparison, for SEIS Alternative 2, the total estimated sewage flow would be approximately 2.34 MGD (average annual flow), 2.77 million gallons (maximum month flow) and 6.64 MGD (peak instantaneous wet weather flow). The Applicant's Preferred Alternative presents distribution of densities in Parcel O that puts the existing conveyance systems under the most conservative conditions and therefore will present the largest range of limitations/constraints for the proposed system.

Table 1: SEIS Alternatives Estimated Flows and Residential Equivalents

SEIS Alternatives	Applicant's Preferred Alt.	SEIS Alt. 1	SEIS Alt. 2	SEIS Alt. 3	SEIS Alt. 4
Residential RE's	9,700	9,700	6,437	9,700	2,586
Total RE's*	13,903	13,903	10,640	13,903	4,195
Average Daily Flow (MGD)**	3.05	3.05	2.34	3.05	0.92

*Total RE's assumes the same residential equivalents for employment and other land uses in SEIS Preferred Alternative and SEIS Alternative 1, 2 and 3. SEIS Alternative 4 Total RE's are based on Phase I area only.
**Average daily flow is based on 220 gpd per RE and does not include infiltration and inflow (I&I) or peaking factors.

SEIS Applicant's Preferred Alternative and Alternatives 1 and 3 all proposed 9,700 units and approximately the same Commercial/Employment uses. These alternatives would produce similar influent flow rates to the original EIS proposed WWTP. SEIS Alternatives 2 and 4 would produce much lower flow rates to the original EIS proposed WWTP due to the reduced residential unit count for SEIS Alternative 2, and no Phase II for SEIS Alternative 4. SEIS Applicant's Preferred Alternative was selected to as the best alternative to analyze because of the proposed land use and densities. SEIS Alternatives 1, 2 and 3 all propose a Golf Course in Parcel O. With the inclusion of a Golf Course, the projected densities within Parcel O will be less in SEIS Alternatives 1, 2, 3 and 4 than in SEIS Applicant's Preferred Alternative. SEIS Applicant's Preferred Alternative proposes no Golf Course and single-family residential uses in its place. Since the Parcel O proposed sewer system will be connected to an existing stub in Cascadia Blvd E, the SEIS Applicant's Preferred Alternative will produce the most significant impacts to the existing sewer system. Since SEIS Preferred Alternative shows no adverse impacts from proposed development, it is reasonable that a lower density area will cause an even less impact to the existing system.

The flows from the Exception Parcels were included in the design of the proposed and existing infrastructure. This includes the proposed Bonney Lake 26 plat, which is located at the north end of Exception Parcel #2 and has 163 lots proposed at this time. The remaining areas of the Exception Parcels were analyzed assuming a maximum density of 4 dwelling units per acre (DU/ac) based on the parcels gross acreage. Four (4) dwelling units per gross acre is approximately equivalent to 5 dwelling units per net acre. Moderate Density Single-Family (MSF) developments range from 4 to 6 DU/ac based on net acreage. Increasing assumed Exception parcel density to 6 DU per net acre would impact existing infrastructure, proposed infrastructure could accommodate increased densities to 6 DU/ac, this would include the southern portion of Exception Parcel # 2, and Exception Parcel # 4, if sewage is routed south to the Phase II SW interceptor. Latecomer's agreements will be applied to parcels tributary to proposed infrastructure within Tehaleh.

Estimated sewage flows for Tehaleh are reported as average daily flows (wet weather) and peak instantaneous flow. The average daily flow is used for determining the needed treatment plant capacity. The peak flow is used for determining the required system conveyance capacity.

Estimated sewage flows from Tehaleh are based on the Tehaleh Master Sewer Plan and residential equivalents from the Pierce County Unified Sewer Plan. Pierce County's Unified Sewer Plan follows a land use based flow projection methodology. This methodology is consistent with the Growth Management Act (GMA). The flow projections are based on land use maps and land use designations

from the 1996 Pierce County Comprehensive Plan and its revisions for unincorporated Pierce County. Tehaleh is located within unincorporated Pierce County and the final infrastructure and WWTP within Tehaleh will be operated and maintained by Pierce County. The standards presented in the Pierce County Unified Sewer Plan were used in estimating flow rates. These standards are presented below.

- Sanitary Sewer Conveyance and Treatment are based several measurement of sewage volumes, these include:
    - Average Dry Weather Flow (ADWF) is the base wastewater flow without groundwater or stormwater infiltration into sewer pipelines.
    - Maximum Month Flow (MMF) represents the sustained conditions under which sanitary wastewater flows are combined with wet season influences of groundwater infiltration and inflow (I&I). These flows are the measure of permitted capacity cited in the National Pollutant Discharge Elimination Section 2 December 2010 2-10 Pierce County Unified Sewer Plan Planning Criteria and Methods System (NPDES) permits for wastewater treatment plants issued since 1995. MMF does not apply to collection facilities.
    - Peak Wet Weather Flow represents an extreme condition under which wastewater flows are combined with storm influenced Infiltration and Inflow (I&I). Peak flows in the existing Pierce County collection system were used to estimate the appropriate size of force mains, interceptors and pump stations within the system. The peak wet weather flow is assumed to be 2.5 times MMF.
- Residential Equivalents (REs) are the basis for Flow rates, REs per Land Use are shown below.
    - Single Family Resident unit counts as 1 RE
    - Multi-Family Residential units counts as 0.83 RE
    - Commercial Area based on 1000 gallons per day per acre or 4.55 RE/ac.
    - Public Facilities range in use and to be conservative, they were modeled as commercial.
    - Schools are based on type (Elementary, Middle, High)
        - Elementary Schools assume 10 gpd per student at 600 students
        - Middle Schools assume 16 gpd per student at 1200 students
        - High Schools assume 16 gpd per student at 1800 students
        - All but one school have an unknown type, therefore for proposed school parcels without a known type, High School flows were assumed to allow for maximum flexibility.

- Flow Rates
    - Flow per RE is estimated at 220 gallons per day.
    - Infiltration and Inflow (I&I) is 1000 gallons per day per acre.
        - Infiltration and Inflow (I&I) Flow projections assume 600 gallons per acre per day for wet weather infiltration, which equates to maximum month flow conditions. An additional 400 gallons per acre per day were added for inflow, which occurs during peak wet weather flow conditions.
- Peaking Factors
    - Peaking Factors based on average dry weather flows. See Appendix A for Peaking Factor Graph.

Pipe Size and Slope:

Pierce County sanitary sewer standards specify a minimum slope of 1% for 8-inch sewers unless calculations show a self-cleaning velocity of greater than 2 feet per second. Projected pipe sizes were based on slope, flow rates, capacity and velocity. The general criteria for determining minimum pipe slopes is based on topographic constraints, maintaining a minimum of 75% capacity full and a self-cleaning velocity of greater than 2 feet per second and less than 10 feet per second. The pipe size and minimum slope shown in Table 1, below, is the allowed minimum slopes from the current approved "Sanitary Sewer Master Plan for Cascadia E.B.P.C." approved on December 1, 2009.

Table 2: Pipe Slopes and Minimum Slopes

PIPE DIAMETER	MINIMUM SLOPE
24 – INCH	0.20%
21 - INCH	0.25%
18 – INCH	0.30%
15 – INCH	0.35%
12 – INCH	0.40%
10 – INCH	0.45%
8 - INCH	1.00%

Proposed Collection System:

All sewer mains will be designed in accordance with Pierce County and Washington Department of Ecology Standards. In general, sewer mains will be located in public streets or trails wherever feasible. Rear yard sewer manholes will be used only where it is the only feasible alternative. Continuous access to all sewer manholes will be provided unless it is not feasible. The usual sizes for normal sewer collection mains within the Tehaleh Employment Based Planned Community will be 8 inches in diameter. Private individual service lines to lots or buildings will be 6 inches in diameter. Major trunk and collector sewers will be sized as shown on the Master Sewer Plan. Detailed engineering designs will be provided for each individual development phase and will take into consideration hydraulic and

loading conditions for the development. Gravity sewer will be used wherever it is feasible to do so. Lift stations will be used when there is no feasible alternative.

5.3 PHASING OF PROPOSED WASTE WATER TREATMENT PLANT (WWTP)

The impacts of the proposed Wastewater Treatment Plant were assessed in a separate report for a separate EIS. Please see "EIS Addendums for the Wastewater Treatment Plan (2014, 2015)" and "Engineering Report for the WWTP" for a detail analysis of the impacts from the proposed WWTP.

Pierce County Department of Public Works and Utilities will provide wastewater treatment and Sanitary Sewer Service for the entire Tehaleh EBPC in accordance with the following standards: Pierce County Unified Sewer Plan (approved 2012), the Development Agreement for the Cascadia Wastewater Treatment Plant at Tehaleh - 4/17/13 (the "Agreement"), Pierce County Title 13 (Sewer Code), the Cascadia Master Sewer Plan as amended (2013) and applicable Pierce County standards and specifications. . All sewer facilities will be owned and operated by the Pierce County Department of Public Works and Utilities. Ultimately, wastewater treatment will be provided in an onsite permanent wastewater treatment plant (WWTP) located on Parcel 2C.3 in Tehaleh Phase II. The WWTP will be constructed as part of Tehaleh Phase I and expanded in stage over time as needed to meet growth demands as described below.

5.3.1 Community Large Onsite Septic System (LOSS)

Stage 1 of the Cascadia Wastewater Treatment Plant at Tehaleh is a Large Onsite Septic System (LOSS), which was constructed and accepted by Pierce County and placed in service in 2008. The LOSS consists of a septic tanks located on the east side planning parcel R3 and a large drainfield located within planning parcel R2. Stage 1 of the interim system is currently operational and provides service to the initial development in Tehaleh. It is authorized under WA State Waste Discharge Permit No. ST 6215. This facility has a permitted capacity of 0.1 MGD max month flow (approximately 602 RE's at current flow projections).

The existing Stage 1 LOSS consists of four 40,000 gallon in-line septic tanks (total volume of 160,000 gallons), and 8 - 20,000 gallon hydraulically interlinked pump chambers (acting as a single hydraulic unit - total volume of 160,000 gallons). The septic tanks are compartmentalized for solids separation, and contain screens to prevent solids carryover into the effluent pump chambers. Effluent flows from the septic tanks into the pump chamber system. Five pump system assemblies (each consisting of two alternating pumps) are housed in the pump chamber. These pump systems pump effluent to the various lobes of the LOSS.

In accordance with WA State Waste Discharge Permit No. ST 6215 and DOE criteria, the Stage 1A system shall be under design prior to the Stage 1 system reaching 80% of capacity (80,000 gal per day max month flow) and in place and operational prior to the Stage 1 system reaching 100% of capacity (100,000 gal per day max month flow). Flows into the system are monitored daily and the current average month flow into the Stage 1 system is 60,000 gal per day (60% of capacity).

The community drainfield will be used as the recipient of the treated effluent at this stage and for future stages until a rapid infiltration facility is constructed. The community drainfield was designed by D.R. Strong Consulting Engineers and permitted, inspected, and approved by Pierce County, the Washington State Department of Health and the Washington State Department of Ecology in 2008. The community

drainfield in this stage will be the main source of treatment for the wastewater. The drainfield, as a treatment facility, is approved by the Washington State Department of Ecology to treat 0.1 MGD and receive 0.5 MGD of treated effluent. The existing drainfield was analyzed by Terra Associates, Inc. (Memo Dated October 6, 2015, Terra Associates, Inc., provided in Appendix C) and found to have the hydraulic capacity flows up to 1.0 MGD.

5.3.2 Interim Wastewater Treatment Plant (IWWTP)

Stage 1A is an interim package MBR WWTP (IWWTP) located within planning parcel R2, and discharging to the existing Tehaleh drainfield located in planning parcel R2. It is authorized under WA State Waste Discharge Permit No. ST 6215 and agreements with Pierce County. This facility has a permitted capacity of up to 0.5 MGD max month flow (approximately 3,000 RE's at current flow projections) and it will be installed in modules as needed to provide treatment while the permanent WWTP is being constructed. Please see IWWTP Engineering Report (provided in Appendix D) for a detailed analysis of the IWWTP.

The first phase of the Stage 1A IWWTP will consist of a flow equalization basin and two leased MBR modules with a capacity of 100,000 gpd each. The Stage 1A IWWTP can reach a capacity of up to 500,000 gpd with the installation of a total of five modules (its maximum capacity by permit). Treated effluent from the IWWTP will be discharged into the existing LOSS pump chamber for distribution to the existing drainfield system. After the permanent Stage 2 WWTP is completed and operational the Stage 1A IWWTP modules will be decommissioned and removed from the site.

At the interim stage the community drainfield will no longer be used for sewage treatment. The sewage will be treated by the IWWTP package MBR systems prior to reaching the LOSS pump chamber. Therefore, the hydraulic loading on the drainfield can be increased to accept the effluent generated by the WWTP up to 1.0 MGD treated effluent per day. A rapid infiltration facility will be designed, approved and constructed prior to reaching this capacity.

5.3.3 Permanent Wastewater Treatment Plant (WWTP)

A permanent WWTP is planned to be constructed onsite within southeast corner of planning parcel 2C.3 (see Appendix B for Exhibit 1: Tehaleh Sanitary Sewer Master Plan). The WWTP will be built and expanded in phases to meet Tehaleh's projected sewer flows. The phasing of the WWTP is presented below.

Stage 2A will amend WA State Waste Discharge Permit No. ST 6215 to increase the permitted capacity of the Stage 2 WWTP to 1.0 MGD (approximately 5,000 RE's at current flow projections).

Stage 3 will add additional capacity (membranes and related equipment) and amend WA State Waste Discharge Permit No. ST 6215 to increase the capacity of the WWTP to 2.0 MGD (approximately 10,000 RE's at current flow projections).

Stage 4 will add additional capacity (membranes and related equipment) and amend WA State Waste Discharge Permit No. ST 6215 to increase the capacity of the WWTP to 3.0 MGD (approximately 14,000 RE's at current flow projections). If needed, the WWTP will add additional capacity as necessary to meet project growth needs. Please see "EIS Addendums for the Wastewater Treatment Plan (2014, 2015)"

and Engineering Report for the WWTP for a detailed analysis of the impacts from the proposed permanent WWTP.

Interim gravel mining is proposed within Phase II of the Tehaleh project site. Mining activities on proposed parcel 2C.2 and 2C.3 (previously named parcel KK) include the clearing and grading of approximately 130 acres to obtain suitable gravel material to meet the needs of future on- and offsite construction activities. The excavation for the mining will range from about 20 to 60 feet deep and 6 million cubic yards of material. The final excavation depths for the mining activities in the location of the proposed WWTP location will be closely coordinated so that final grades of the mining match the proposed graded required for the WWTP. Mining activities have been phased so that the WWTP location will be excavated prior to the beginning of the WWTP construction. Impacts from the proposed mining activities will include the clearing of forest and exposing soils to direct precipitation resulting in potential erosion and sediment problems.

Three locations will potentially receive effluent from the WWTP for infiltration into the groundwater system. The first location is the current drainfield located west of existing retention facility R4. This area is currently being used as a LOSS with a discharge permit of 0.5 million gallons per day (MGD) of grade "A" effluent. When the drainfield reaches capacity or when it is feasible to relocate the drainfield so the drainfield land can be developed, a rapid infiltration facility will be utilized on Parcel P3.1, located directly east from the retention facility R4. An alternative location for the rapid infiltration facility is located along the proposed new Rhodes Lake Road East within two recently purchased by Nash Cascadia, LLC parcel numbers 0519182005 and 051982025. These parcels are not within the Canyonfalls Creek Capture Zone but within the Puyallup River Capture Zone.

Preliminary analysis of the rapid infiltration facility has been completed for feasibility and general constructability. The most conservative size of the facility includes 24 60-inch perforated pipes in 100 LF segments. This was sized using the largest "max monthly flow" from the AESI 2017 Report, and a conservative infiltration rate of 30 in/hr. The size of this facility would not present any constructability issues on Parcel P3.1 due to the size and relative flatness of that parcel. However, if Parcel P3.1 was not the desired location for the facility, along Rhodes Lake Road E (as discussed above) would also be feasible. By using 100 LF segments, the rapid infiltration facility could be placed parallel to the east side of Rhodes Lake Road E and "step" down every 100 ft to better follow the grades of the road and maintain minimal cover over the pipes. To stay within the two parcels, the pipes would need to be configured 4 pipes deep into the eastern hillside. Additionally, if this location is selected, a force main pipe will need to be extended from the WWTP along Rhodes Lake Road E to that location.

The effluent from the proposed WWTP will also potentially be used for irrigation. The effluent will be routed to a reservoir where chlorine will be added to create reclaimed water. This reclaimed water will be used to irrigate landscaping along major arterials as well as local parks and landscaped tracks. See Tehaleh Master Drainage Report (dated June 2017) and AESI 2016 Report for more information on the effluent infiltration from the WWTP.

5.4 PROPOSED SEWER CONVEYANCE IMPROVEMENTS

The proposed Segment 5A and 5B are the next set of backbone infrastructure proposed on the site. Segment 5A and 5B will run from the existing terminus of the current 21" backbone infrastructure located just south of existing retention facility R4 (See Exhibit 1: Tehaleh Master Sewer Plan) This

Segment will continue the backbone infrastructure and run along Cascadia Blvd E to the intersection of Cascadia Blvd E and future Tehaleh Blvd E. This segment will continue north along Tehaleh Blvd E to the proposed access road of the permanent WWTP. The segment continues from this location to the headworks of the WWTP. Since Tehaleh Blvd E will be built concurrent to its adjacent parcels, the permanent WWTP will need to be in operation before Tehaleh Blvd E is scheduled to reach the proposed west access, therefore a 20-foot wide asphalt access road will need to be constructed from the end of existing Cascadia Blvd E to the WWTP. This access road will use the same grade as the proposed Tehaleh Blvd E and will be used for access to the WWTP and construction of the main sewer line (segment 5). The main sewer line proposed to run along Cascadia Blvd E will need to be constructed prior to 2018 and will also be completed before Cascadia Blvd E reaches as far west as the WWTP.

A separate interceptor sewer line will need to be constructed along the western border of the proposed development to provide service to the majority of Phase II. The line will begin at the very southern point of the proposed project area east of Exception Parcel # 4. This interceptor line is proposed to range from approximately 21 to 24 inches. This interceptor line will connect to Segment 5B, directly east from the proposed WWTP.

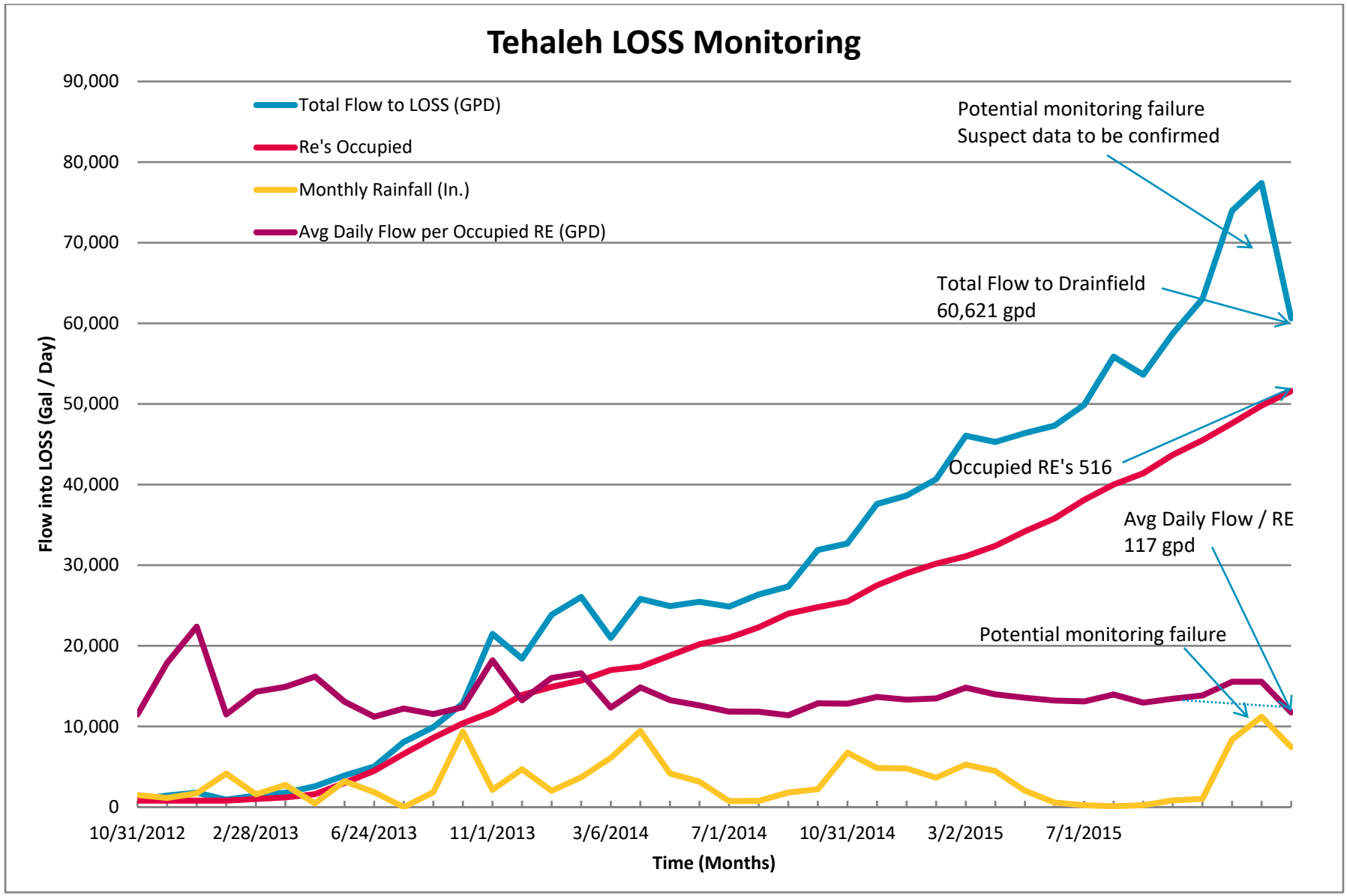
An additional interceptor line is also proposed on the east side of the project from the existing terminus of a 12" sewer line which runs through the existing Whitman plat to Parcel O and portions of Phase II. The proposed line will run from the terminus of the existing 12" line located at the southern end of Whitman to just east of Wetland 6. At this location the interceptor will split, one line will run south to proposed parcels located north of Exception Parcel # 3 and west of Exception Parcel # 2. The other line will run east to Parcel O, this portion of the interceptor will proposed to take approximately 12% of the Parcel O's gross area.

Seven potential sewer lift stations are proposed within the Tehaleh site. Five of these lift stations are proposed; two of the lift stations are proposed as alternatives to gravity mains if gravity sewer becomes infeasible. The first lift station is proposed on the far east side of Parcel O and will be accompanied by a force main from this lift station to the existing interceptor line stubbed at the intersection of Cascadia Blvd E and 198th Ave E. The second lift station is located in the far north end of the project site on the upper bluffs near the proposed 2A parcels. This lift station will be accompanied by a force main from the lift station to the existing sewer interceptor running north of Liberty Ridge. The third lift station is proposed to be located north of the Canyonfalls Creek Valley. This lift station will be accompanied by a force main from the lift station to a proposed plat level interceptor in the northwest corner of proposed Parcel Q1. The fourth lift station is proposed to be located on the far western side of the project area near the 2D parcels. This lift station will be accompanied by a force main from the lift station to the proposed interceptor running along the west border of the project. The fifth lift station is location outside of the Tehaleh project boundary and within Exception Parcel #2. This lift station is an alternative to using a gravity route, if the alternative lift station is used, a force main from the lift station north to the existing interceptor line in Phase I or south to a proposed interceptor in Phase II. The sixth lift station is located at the very southern point of the proposed development. This lift station is proposed as a preferred alternative to acquiring an easement through Exception Parcel # 4. In this preferred alternative, a force main will run from the lift station north around Exception Parcel # 4. The seventh lift station is proposed on the northwest corner of the project site, northwest of the proposed WWTP. This lift station will have a force main running south then east to the proposed interceptor running along the west border of the project.

5.5 PROJECTED FLOWS PER CURRENT MONITORING

Monitoring of the LOSS has been conducted from the very beginning of use. The continued monitoring program has been analyzed as developed parcels become occupied and started producing flows to determine a site specific flow rate per RE. The monitored flow rates have been consistent at approximately 140 gallons per day per RE. This consistent flow rate per RE has been established during the wet and dry seasons. See below for a graph of the flow to the LOSS in gallons per day versus time in months. The graph also includes rainfall in inches, occupied RE's, and calculated average daily flow per RE.

Using the conservative flow rate of 150 gpd/RE and the REs determined in the hydraulic calculations of approximately 14,000 (actual 13,903) at full build-out, a projected effluent flow rate can be calculated to be approximately 2.1 MGD.


Tehaleh LOSS Monitoring
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Flow into LOSS (Gal / Day)
Total Flow to LOSS (GPD)
Re's Occupied
Monthly Rainfall (In.)
Avg Daily Flow per Occupied RE (GPD)
Potential monitoring failure
Suspect data to be confirmed
Total Flow to Drainfield
60,621 gpd
Occupied RE's 516
Avg Daily Flow / RE
117 gpd
Potential monitoring failure
10/31/2012
2/28/2013
6/24/2013
11/1/2013
3/6/2014
7/1/2014
10/31/2014
3/2/2015
7/1/2015
Time (Months)

DRAFT

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5.6 IRRIGATION

The effluent from the proposed full build-out of Tehaleh site will be used as irrigation throughout the site. Irrigation master plans are ongoing and a formal study will be conducted to determine the volume and reservoirs needed to supply irrigation to the Tehaleh site. See the Master Water Plan report prepared by MacKay Sposito, Inc. dated June 15, 2016 for more details on proposed irrigation demand and projected supply of reclaimed water.

From the AESI 2017 report, the proposed used of reclaimed water created from the WWTP effluent will reduce estimated nitrate concentration to the regional aquifer and therefore to associated discharge locations. See AESI 2017 Report for more details on nitrate concentration and potential impact.

5.7 SUMMARY AND CONCULSION

The proposed Tehaleh Sewer Master Plan will provide sanitary sewer conveyance through plat level collection, and collector trunk lines to a phased onsite treatment system. The treatment system will be developed in three major stages: a large onsite septic system (LOSS) and drainfield, an onsite interim wastewater treatment plant (IWWTP), and finally an onsite permanent wastewater treatment plant (WWTP). The WWTP plant has been designed by a Kennedy/Jenks Consultants for an average dry weather flow of more than the projected 3.05 million gallons per day (MGD) and the conveyance system was designed per Pierce County standards to the capacity for the projected peak instantaneous wet weather flow of 8.12 MGD. The proposed WWTP capacity has increased from the original EIS proposed WWTP to accommodate the flows from the additional 3,263 REs per the Applicant's Preferred Alternative.

The effluent from the WWTP will be considered class "A" effluent and will be infiltrated onsite. A proposed rapid infiltration facility will be constructed to infiltrate approximately 2.1 MGD. The effluent infiltration will also be phased. During the initial LOSS stage, effluent will be treated by the existing drainfield with a maximum capacity of approximately 0.5 MGD (the LOSS stage will be at capacity at 0.1 MGD). The next stage consists of an IWWTP, which will release treated class "A" effluent to the drainfield, the drainfield has a capacity of 1.0 MGD for treated effluent (the IWWTP has a capacity of 0.5 MGD). The final major stage will consist of the WWTP, which will release treated class "A" effluent to the drainfield until the effluent begins to approach 1.0 MGD, at this point effluent will be conveyed to a Rapid Infiltration Facility proposed to be located in Parcel P3.1 and will have capacity to infiltrate approximately 2.1 MGD. From an analysis of water quantity and quality based on the infiltrated effluent at full build-out and infiltrate stormwater from regional retention facilities, no adverse impacts shall occur to the quantity or quality of receiving water bodies.

The proposed conveyance system and treatment systems will be design and constructed per Pierce County Standards and will comply with Washington State Department of Ecology (DOE) and Washington State Department of Health (DOH). The phasing plan is based on sewage flows calculated using standard regionally accepted sewage loading rates. Discharge volumes and rates will continue to be monitored to verify design assumptions. The actual number of REs served by the sewage treatment facilities may vary depending on actual measured sewage flows and loading rates. The phasing plan is also the most cost effective method to serve the Tehaleh site, both from the perspective of the private and public sectors. Almost all facilities constructed to serve the site during the initial phases of development will be part of the overall final sewer system serving the entire site. The phasing plan avoids constructing major

infrastructure years before it is needed. This type of cost effective and conservative approach is a key component of developing a successful master planned community.

6.0 GOVERNMENTAL APPROVALS

Below is a list of governmental approvals that will be required for implementation of the Master Sanitary Sewer Plan. It is intended to provide a list of major approvals and milestone that will be required. Changes to this list of approvals may occur based on final determination by Pierce County.

Pierce County

Approval of WWTP report, plans and specifications
Approval of WWTP Effluent for Reclaimed Water
Approval of Rapid Infiltration Facility
Approval of all Sewer Line Extension Plans

7.0 ENVIRONMENTAL IMPACTS & MITIGATION MEASURES (PROPOSED ACTION)

7.1.1 Collection Sewer Mains

There will be a minor short term construction related impact to the surface runoff water quality during installation of the sewer mains onsite. These impacts will be mitigated by implementation of Stormwater Pollution Prevent Plans (SWPPP), which are required for all clearing and grading activities. SWPPP will implement erosion and sediment control using best management practices.

7.1.2 Community Drainfield

The community drainfield is in place and no reported adverse impacts have been presented since it became active. Continued monitoring is checked monthly and no unanticipated impacts have occurred. The community drainfield is only tributary to the Canyonfall Creek. Canyonfalls Creek has been monitored through the lifespan of the project and no adverse impacts or changes in flow rate or pollutants have been identified during the operational life of the community drainfield.

At full build-out of Tehaleh the potential impacts from the Sanitary Sewer Master Plan are infiltration to groundwater, nitrogen loading in Canyonfalls Creek and slope stability. These potential impacts would be caused by the volume and rate of water infiltrated into the subsurface from the WWTP effluent and the proposed stormwater retention facilities within the same capture zone. AESI has performed groundwater computer modeling to determine the impact from the projected flows and the nitrogen content that would reach Canyonfalls Creek. From their analysis, the subsurface soils have capacity for the projected flows from both the WWTP effluent and stormwater retention facilities. Additionally, no slope stability problems were identified from the projected rates and volumes of water infiltrated, and the projected nitrogen content at the discharge from the regional aquifer to Canyonfalls Creek will cause no anticipated impacts.

7.1.3 Onsite WWTP

The onsite WWTP impacts have been addressed in the separate EIS Addendums. Please see "EIS Addendums for the Wastewater Treatment Plan (2014, 2015)" for a detail analysis of the impacts from the proposed permanent WWTP.

1. Average irrigation demands for the landscaping and the potential Phase I golf course shall ultimately be met through the reuse of Class "A" treated effluent from the sewer service provider's waste water treatment plant when feasible, or via alternate sources, such as groundwater, if so approved

2. A phased program for providing sewer service to the EBPC shall be implemented to target infrastructure needs to actual development phasing. All sewer facilities would be designed and constructed to applicable local and state standards.

3. The applicant shall participate on a fair-share basis in all costs associated with the construction of off-site sewer collection and treatment facilities needed to serve Tehaleh.

4. The applicant shall provide certificates of water and sewer availability as part of each preliminary plat application.

5. Emergency Vehicle Access shall be provided for all residential or commercial structures in accordance with PCC 17C.60.150 and shall be reviewed upon application for building permit.

Additional Required/Proposed Mitigation Measures

The Development Agreement would be updated to include the proposed Master Sewer Plan.

Significant Unavoidable Adverse Impacts

With implementation of the Current Conditions of Approval and the additional mitigation measure identified above, no significant unavoidable adverse utilities impacts are anticipated.

8.0 DEVELOPMENT ALTERNATIVES

As shown below, three of the five alternatives propose the same maximum residential units of 9,700 units. These alternatives have very similar land uses for commercial, public facilities, recreation and open space. Alternatives 2 and 4 have a much lower residential unit count and with similar ratio of land uses for commercial, public facilities, recreation and open space as alternatives 1, 2, and 3. Additionally, all proposed alternatives will have similar plans for sewer infrastructure. The biggest difference in infrastructure location will occur in alternative 4, which will not include any infrastructure proposed in Phase II but will have the same infrastructure proposed in the remaining alternatives for Phase I.

Applicant's Preferred Alternative *– No Golf Course or Hotel - 9,700 dwelling units*

The Preferred Alternative proposes to modify the Current Approval to allow project-level development in Phase II and more residential development on the entire site (up to 9,700 dwelling units). The site would be developed as an EBPC PUD with the same general types of land uses as the

Current Approval; however, the areas and in some cases locations of the various uses would differ. The percentage of unrestricted single-family/two-family housing would increase and the percentage of Age Qualified housing would decrease at similar modest rates over that approved in the Phase I Major Amendment. The percentage of multifamily housing is proposed to develop at a rate similar to that approved in the Phase I Major Amendment.No golf course and associated uses are proposed. The EBPC would include:

- *Employment Center Areas – 476 acres* (10 percent of the site, including no golf course, hotel or conference center; 1 existing school and additional school sites; and up to 3.4 million sq. ft. of employment-related building space);*
- *Residential Areas – 2,024 acres (43 percent of the site, including 9,700 units – 6,397 detached units, 1,101 attached multifamily units and 2,202 Age Qualified units);*
- *Public Facility Areas – 398 acres (8 percent of the site); and*
- *Open Space/Parks/Critical Areas – 1,855 acres (39 percent of the site).*

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*

***SEIS Alternative 1** – Golf Course and Hotel - 9,700 dwelling units*

Alternative 1 is the 2014 Phase II Major Amendment Application and proposes to modify the Current Approval to allow project-level development in Phase II and more residential development on the overall site (up to 9,700 dwelling units). The site would be developed as an EBPC PUD with the same general types of land uses as the Current Approval; however, the areas and in some cases locations of the various uses would differ. A golf resort with hotel is proposed. The EBPC would include:

- *Employment Center Areas –484 acres* (10 percent of the site, including 16 acres of golf uses** and up to 3.5 million sq. ft. of employment-related uses);*
- *Residential Areas – 1,865 acres (39 percent of the site, including 9,700 units – 7,514 detached units, 1,486 attached multifamily units and 700 designated Age Qualified units);*
- *Public Facility Areas – 367 acres (10 percent of the site, including 1 existing school and additional school sites); and*
- *Open Space/Parks/Critical Areas –2,040 acres (43 percent of the site, including 219 acres in a golf course***).*

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*

***As under the Current Approval, golf uses (e.g., hotel, conference center and golf academy) would be included as employment area.*

****As in the 1998 EIS, the golf course would be included as open space area.*

***SEIS Alternative 2** – Golf Course and Hotel - 6,437 dwelling units*

Under Alternative 2, the site would be developed as an EBPC PUD conceptually consistent with the 1998 EIS and PUD approval. The general types and layout of land uses would be the same as the Preferred Alternative, except that fewer dwelling units would be included (up to 6,437 dwelling units). A golf resort with hotel is proposed. (This alternative does not meet the Applicant's objectives for the project because the magnitude of the infrastructure costs would not be offset by the revenue from building fewer housing units.) The EBPC would include:

- *Employment Center Areas –484 acres* (10 percent of the site, including 16 acres of golf uses** and up to 3.9 million sq. ft. of employment-related building space);*
- *Residential Areas – 1,865 acres (39 percent of the site, 6,437 units – 4,980 detached units, 757 attached multifamily units and 700 designated Age Qualified units);*
- *Public Facility Areas – 367 acres (10 percent of the sites, including 1 existing school and additional school sites); and*
- *Open Space/Parks/Critical Areas –2,040 acres (43 percent of the site, including 219 acres in a golf course***).*

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*

***As under the Current Approval, golf uses (e.g., hotel, conference center and golf academy) would be included as employment area.*

****As in the 1998 EIS, the golf course would be included as open space area.*

***SEIS Alternative 3** – Golf Course - 9,700 dwelling units*

Alternative 3 proposes to modify the Current Approval to allow project-level development in Phase II and more residential development on the overall site (up to 9,700 dwelling units). The site would be developed as an EBPC PUD with the same general types of land uses as the Current Approval; however, the areas and in some cases locations of the various uses would differ. The percentage of Age Qualified housing would decrease at similar modest rates over that approved in the Phase 1 Major Amendment, and the percentage of multifamily housing is proposed to develop at a rate similar to approved in the Phase I Major Amendment. These changes are intended to reduce impacts on the environment, particularly on traffic. A golf course is proposed, but in a different configuration than under the Current Approval. No hotel, resort of conference center would be included. The EBPC would include:

- *Employment Center Areas – 476 acres* (10 percent of the site, including no golf uses, 1 existing school and additional school sites and up to 3.3 million sq. ft. of employment-related building space);*
- *Residential Areas – 1,912 acres (40 percent of the site, including 9,700 units – 6,333 detached units, 1,148 attached multifamily units and 2,219 designated Age Qualified units);*
- *Public Facility Areas – 400 acres (8 percent of the site); and*
- *Open Space/Parks/Critical Areas – 1,968 acres, (41 percent of the site, including 155 acres in a golf course**).*

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*

***As in the 1998 EIS, the golf course would be included as open space area.*

***SEIS Alternative 4** – Phase I Build-out/No Phase II Development - 2,586 dwelling units (No Action Alternative)*

Under Alternative 4, the No Action Alternative, Phase I would continue to build out as approved through the 2014 Phase I Major Amendment (including up to 2,586 dwelling units). A golf resort with hotel is proposed in Phase I. Phase II would remain largely undeveloped at this time except for infrastructure needed to serve Phase I and resources uses in Phase II. However, it is likely that development would occur in the future, in accordance with the site's EBPC zoning. Site development would include:

- *Employment Center Areas –159 acres* (3 percent of the site, including 16 acres of golf uses** and up to 1.0 million sq. ft. of employment-related building space);*
- *Residential Areas – 821 acres (17 percent of the site, including 2,586 units – 1,600 detached units, 286 attached multifamily units and 700 designated Age Qualified units);*
- *Public Facility Areas – 127 acres (3 percent of the site, including 1 existing school and an additional school site(s)); and*
- *Open Space/Parks/Critical Areas –3,648 acres (77 percent of the site, including 219 acres in a golf course***).*

**Assumes 100% of the school acreage counts toward employment center area, consistent with the Phase II proposal and as allowed by the current Tehaleh zoning (Exhibit I to the 2015 Development Agreement).*
***As under the Current Approval, golf uses (e.g., hotel, conference center and golf academy) would be included as employment uses.*
****As in the 1998 EIS, the golf course would be included as open space area.*

Under all of the SEIS Alternatives, resource uses (e.g., gravel mining, timber harvesting and topsoil production) would be included as allowed uses in the EBPC. Material harvested, mined or manufactured onsite may be produced commercially for profit and used for residential and employment development onsite or may be transported offsite.

Appendix A

SEWER SYSTEM SIZING AND HYDRAULIC CALCULATIONS

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Below is a table showing the Proposed Parcels and Corresponding Area, Phase, Land Use, Density, RE's, and designated Sanitary Sewer Manhole (SSMH), which correspond to Exhibit 1: Tehaleh Master Sewer Plan and the Hydraulic Calculations, see Appendix B.

SANITARY SEWER BASIN TABLE						
BASIN	**AREA (AC.)**	**PHASE**	**LAND USE**	**DENSITY (DU/AC)**	**RE'S**	**FLOW TO SSMH**
D	25.0	1	RESIDENTIAL-SF	5.0	125	P-114
E1 (Edmunds Park)	11.3	1	RESIDENTIAL-SF	5.6	63	P-115
E2 (Edmunds Park)	10.2	1	RESIDENTIAL-SF	4.5	46	P-115
F1 (Edmunds Park)	24.3	1	RESIDENTIAL-SF	5.6	136	P-115
G (Berkeley Park)	22.9	1	RESIDENTIAL-SF	5.3	122	14424
H1(Inspiration Ridge)	37.7	1	RESIDENTIAL-SF	5.0	188	15980/15992
H2 (Inspiration Ridge)	21.7	1	RESIDENTIAL-SF	4.4	96	15980/15992
I1(Pyramid Ridge)	12.6	1	RESIDENTIAL-SF	0.9	11	14875
I2 (Cathedral Ridge)	14.6	1	RESIDENTIAL-SF	4.4	64	15986
I3 (Cathedral Ridge)	15.6	1	RESIDENTIAL-SF	2.2	35	15983
J (Pinnacle Ridge)	32.9	1	RESIDENTIAL-SF	3.6	120	14803
K1 (Columbia Vista)	17.8	1	RESIDENTIAL-SF	4.8	85	14780
K2 (Columbia Vista)	25.3	1	RESIDENTIAL-SF	4.5	114	14787/14798
L (Liberty Ridge)	24.7	1	RESIDENTIAL-SF	4.8	119	14432/14878
L1 (Winthrop)	12.9	1	RESIDENTIAL-SF	4.7	61	14441/14445
M1 (Whitman)	23.0	1	RESIDENTIAL-SF	5.3	121	14839/14835
Trilogy Clubhouse	5.3	1	PUBLIC FACILITY	1.7	9	15932
M2 (Trilogy)	13.4	1	RESIDENTIAL-SF	4.5	60	15933
M3 (Trilogy)	17.6	1	RESIDENTIAL-SF	4.9	86	15961/15944
M4 (Trilogy)	21.0	1	RESIDENTIAL-SF	4.4	92	15936
M5 (Trilogy West)	26.8	1	RESIDENTIAL-SF	3.8	103	15962
N (Panorama Point)	15.9	1	RESIDENTIAL-SF	2.7	43	14459
Observation Ridge (O2.1-3)	39.7	1	RESIDENTIAL-SF	4.5	177	P-110
O3	29.3	1	RESIDENTIAL-SF	5.0	147	P-006
O4	45.3	1	RESIDENTIAL-SF	5.0	228	P-007
O5	50.5	1	RESIDENTIAL-SF	5.0	250	P-010
O6	17.7	1	RESIDENTIAL-SF	5.0	88	P-004
O7	19.1	1	RESIDENTIAL-SF	5.0	95	P-003
O8	12.6	1	RESIDENTIAL-SF	5.0	63	P-009
O9	33.3	1	RESIDENTIAL-SF	5.0	165	P-011
O10	24.8	1	RESIDENTIAL-SF	2.0	50	P-008
O11	18.0	1	RESIDENTIAL-SF	1.0	18	P-002
O12	41.5	1	RESIDENTIAL-SF	1.0	42	P-003
O13	8.3	1	RESIDENTIAL-SF	5.1	42	P-005
SC.1	15.5	1	SCHOOL		87	P-226
NC.5	2.0	1	COMMERCIAL-NC		9	P-004
P1B	7.5	1	RESIDENTIAL-MF	20.1	150	16704
P1A (SCHOOL)	14.1	1	SCHOOL		131	16706
P2.1 (Berkeley Park)	11.8	1	RESIDENTIAL-SF	4.9	58	14420

P2.2 (Berkeley Park)	15.4	1	RESIDENTIAL-SF	5.3	82	14420
P3.2 (Berkeley Park)	5.8	1	RESIDENTIAL-SF	3.6	21	14422
P3.1 (WWTP UIC)	6.0	1	PUBLIC FACILITY		27	
Q1	15.4	1	RESIDENTIAL-SF	5.0	77	P-121
Q2	13.3	1	RESIDENTIAL-SF	5.0	66	P-122
R1A	15.1	1	RESIDENTIAL-SF	5.0	75	P-120
R1B	10.0	1	RESIDENTIAL-MF	24.3	243	P-120
R2 (Drain Field)	22.5	1	PUBLIC FACILITY/ SCHOOL		131	P-124
R3 (Drain Field)	13.4	1	PUBLIC FACILITY/ COMMERCIAL		61	P-118
T1 (Trilogy West)	15.6	1	RESIDENTIAL-SF	3.4	53	P-116
T2 (Trilogy West)	39.0	1	RESIDENTIAL-SF	4.0	155	16427
U1	20.3	1	RESIDENTIAL-SF	5.0	101	P-117
U2 (Trilogy West)	9.5	1	RESIDENTIAL-SF	4.4	42	P-116
U2 (Undeveloped)	4.3	1	RESIDENTIAL-SF	5.1	22	P-117
V1	35.0	1	COMMERCIAL-BP		159	P-206
V2	58.2	1	COMMERCIAL-BP		265	P-208
DEES	14.1	1	SCHOOL		27	14448
FIRE STATION[7 & 8]	3.3	1	PUBLIC FACILITY		15	15962
Post	1.4	1	COMMERCIAL-CC		3	14451
NC.2	3.2	1	COMMERCIAL-NC		43	14451
NC.1	4.1	1	COMMERCIAL-NC		83	14451
O1 Comercial	4.4	1	COMMERCIAL-CC		20	P-109
RV Site	8.1	1	COMMERCIAL-CC		37	P-108
EXCEPTION #1 (WEST)	40.3	1	RESIDENTIAL-SF	4	161	P-112
EXCEPTION #1 (EAST)	80.7	1	RESIDENTIAL-SF	4	323	P-111
EXCEPTION #2	48.7	1	RESIDENTIAL-SF	4.0	194	
BL 26 PLAT	32.6	1	RESIDENTIAL-SF	5.0	163	P-108A
OPEN SPACE #1	15.2	1	OPEN SPACE (I&I only)			P-101
OPEN SPACE #2	27.2	1	OPEN SPACE (I&I only)			14429
OPEN SPACE #3	33.3	1	OPEN SPACE (I&I only)			14413
2A.1	27.4	2	RESIDENTIAL-SF	5.0	138	P-114
2A.2	10.1	2	RESIDENTIAL-SF	5.0	50	P-114
2A.3	11.9	2	RESIDENTIAL-SF	5.0	59	P-114
2A.4	13.6	2	RESIDENTIAL-SF	5.0	68	P-114
2B.1	42.4	2	COMMERCIAL-BP		193	P-123
2B.2	75.6	2	COMMERCIAL-BP		344	P-123
2C.1	9.5	2	COMMERCIAL-BP		43	P-204
2C.2	74.4	2	COMMERCIAL-BP		338	P-203
2C.3	50.8	2	COMMERCIAL-BP		231	P-203
2D.1	32.6	2	RESIDENTIAL-SF	1.0	33	P-207
2D.2	10.2	2	RESIDENTIAL-SF	1.0	10	P-207
2D.4	38.1	2	RESIDENTIAL-SF	1.0	38	P-207
2D.5	33.7	2	RESIDENTIAL-SF	3.0	100	P-207
2D.6	24.7	2	RESIDENTIAL-SF	5.0	124	P-209
2D.8	15.9	2	RESIDENTIAL-SF	5.0	80	P-211

2D.9	28.9	2	RESIDENTIAL-SF	5.0	145	P-213
2D.10	18.8	2	RESIDENTIAL-SF	1.0	19	P-207
2E.1	14.2	2	RESIDENTIAL-SF	5.0	71	P-215
2E.2	15.1	2	RESIDENTIAL-SF	5.0	75	P-216
2E.3	12.8	2	RESIDENTIAL-SF	5.0	64	P-217
2E.4	29.4	2	RESIDENTIAL-SF	8.0	235	P-217
2E.6	20.9	2	RESIDENTIAL-SF	8.0	167	P-218
2E.7	13.2	2	RESIDENTIAL-SF	5.0	66	P-105
2E.8	14.8	2	RESIDENTIAL-SF	5.0	74	9-104
2E.9	10.4	2	RESIDENTIAL-SF	5.0	52	P-103
2E.10	17	2	RESIDENTIAL-SF	5.0	85	P-104
2F.1	19.9	2	RESIDENTIAL-MF	12.0	239	P-215
2F.2	32	2	RESIDENTIAL-MF	18.0	576	P-214
2F.3	53.3	2	RESIDENTIAL-SF	5.0	267	P-220
2F.4	21.4	2	RESIDENTIAL-SF	5.0	108	P-221
2F.5	47.7	2	RESIDENTIAL-SF	6.0	285	P-227
2F.6	14.6	2	RESIDENTIAL-SF	5.0	73	P-227
2F.8	8.1	2	RESIDENTIAL-SF	5.1	41	9-105
2F.9	13.9	2	RESIDENTIAL-SF	5.0	70	P-106
2F.10	14.3	2	RESIDENTIAL-SF	5.0	72	P-106
2G.1	20.3	2	RESIDENTIAL-SF	5.0	102	P-107
2G.2	43	2	RESIDENTIAL-SF	6.5	280	P-229
2G.3	14.9	2	RESIDENTIAL-SF	5.0	75	P-107
2G.4	7.9	2	RESIDENTIAL-SF	6.5	51	P-234
2G.5	37.4	2	RESIDENTIAL-SF	6.5	243	P-233
2H.1	29.9	2	RESIDENTIAL-SF	3.0	89	P-224
2H.2	30.1	2	RESIDENTIAL-SF	3.0	89	P-223
2H.3	23.2	2	RESIDENTIAL-SF	3.0	70	P-222
2H.4	12.6	2	RESIDENTIAL-SF	1.0	13	P-230
2H.5	42.7	2	RESIDENTIAL-SF	3.0	128	P-230
2H.6	40.2	2	RESIDENTIAL-SF	6.5	260	P-228
2H.7	27.4	2	RESIDENTIAL-SF	3.0	82	P-223
2H.8	40.8	2	RESIDENTIAL-SF	3.0	124	P-231
2H.10	46	2	RESIDENTIAL-SF	3.0	136	P-232
2K.1	24.4	2	RESIDENTIAL-SF	3.0	74	P-207
NC.3	2.0	2	COMMERCIAL-NC		9	P-210
NC.4	12.5	2	COMMERCIAL-NC		57	P-214
SC.2	25.0	2	SCHOOL		131	P-219
SC.3	14	2	SCHOOL		131	P-211
EXCEPTION #3 (NW)	45.8	2	RESIDENTIAL-SF	4.0	183	P-105
EXCEPTION #3 (SE)	73.1	2	RESIDENTIAL-SF	4.0	293	P-228
EXCEPTION #4	79.1	2	RESIDENTIAL-SF	4.0	316	P-222
Total Acreage	3,023			Total REs	13,917	

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The table below is the Hydraulic Calculations for the Full-Build out of the Tehaleh Master Sewer Plan. The Calculations

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
O4	P-007	P-006	45.3	228	228	638	638	220	50,160	50,160	45	45,260	0.050	5.29	0.48	0.31	8	1.10%	0.013	1.27	37.8%
O3	P-006	P-005	29.3	147	375	412	1,050	220	32,340	82,500	75	74,560	0.083	4.49	0.69	0.44	8	1.10%	0.013	1.27	54.1%
O13	P-005	P-004	8.3	42	417	118	1,168	220	9,240	91,740	83	82,860	0.092	4.36	0.75	0.48	8	1.10%	0.013	1.27	58.8%
O6 + NC.5	P-004	P-003	19.7	97	514	272	1,439	220	21,340	113,080	103	102,560	0.113	4.15	0.88	0.57	8	1.10%	0.013	1.27	69.6%
O7 + O12	P-003	P-002	60.6	137	651	384	1,823	220	30,140	143,220	163	163,160	0.143	3.90	1.12	0.72	10	0.50%	0.013	1.55	71.9%
O11	P-002	P-001	18.0	18	669	50	1,873	220	3,960	147,180	181	181,160	0.147	3.87	1.16	0.75	10	0.55%	0.013	1.63	71.3%
O9	P-011	*P-010*	33.3	165	165	462	462	220	36,300	36,300	33	33,300	0.036	5.85	0.38	0.25	8	1.10%	0.013	1.27	29.9%
O5	P-010	*P-009*	50.5	250	415	700	1,162	220	55,000	91,300	84	83,760	0.091	4.36	0.75	0.48	8	1.10%	0.013	1.27	58.7%
O8	P-009	*P-008*	12.6	63	478	176	1,338	220	13,860	105,160	96	96,360	0.105	4.21	0.83	0.54	8	1.10%	0.013	1.27	65.6%
O10	P-008	*P-001*	24.8	50	528	140	1,478	220	11,000	116,160	121	121,160	0.116	4.12	0.93	0.60	10	0.40%	0.013	1.39	66.8%
Lift Station # 1	P-001	*14463*			1,197		3,352			263,340	302	302,320	0.263	3.41	1.86	1.20	12	*0.66%*	0.013	2.90	64.0%
	14463	*14462*			1,197		3,352			263,340	302	302,320	0.263	3.41	1.86	1.20	**12**	***0.66%***	0.013	2.90	***64.0%***
	14462	*14461*			1,197		3,352			263,340	302	302,320	0.263	3.41	1.86	1.20	**12**	***0.94%***	0.013	3.46	***53.6%***
	14461	*14460*			1,197		3,352			263,340	302	302,320	0.263	3.41	1.86	1.20	**12**	***0.74%***	0.013	3.07	***60.4%***
	14460	*14459*			1,197		3,352			263,340	302	302,320	0.263	3.41	1.86	1.20	**12**	***4.38%***	0.013	7.48	***24.8%***
J (Pinnacle Ridge)	*14803*	*14802*	32.9	120	120	336	336	220	26,400	26,400	33	32,900	0.026	6.00	0.30	0.19	**8**	***1.05%***	0.013	1.24	***23.8%***
	14802	*14801*			120		336			26,400	33	32,900	0.026	6.00	0.30	0.19	**8**	***1.07%***	0.013	1.25	***23.6%***
	14801	*14800*			120		336			26,400	33	32,900	0.026	6.00	0.30	0.19	**8**	***0.99%***	0.013	1.21	***24.6%***
	14800	*14799*			120		336			26,400	33	32,900	0.026	6.00	0.30	0.19	**8**	***1.13%***	0.013	1.29	***23.0%***
	14799	*14798*			120		336			26,400	33	32,900	0.026	6.00	0.30	0.19	**8**	***1.08%***	0.013	1.26	***23.5%***
K2 (Columbia Vista - 94E)	*14798*	*14797*	20.8	94	214	263	599	220	20,680	47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***1.07%***	0.013	1.25	***38.1%***
	14797	*14795*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***1.03%***	0.013	1.23	***38.8%***
	14795	*14794*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***1.00%***	0.013	1.21	***39.4%***
	14794	*14793*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***0.98%***	0.013	1.20	***39.8%***
	14793	*14792*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***1.12%***	0.013	1.28	***37.3%***
	14792	*14791*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***1.01%***	0.013	1.22	***39.2%***
	14791	*14780*			214		599			47,080	54	53,700	0.047	5.42	0.48	0.31	**8**	***0.95%***	0.013	1.18	***40.4%***
K2 (Columbia Vista - 20W)	*14787*	*14786*	4.5	20	20	56	56	220	4,400	4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***0.96%***	0.013	1.19	***4.0%***
	14786	*14785*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***0.94%***	0.013	1.17	***4.1%***
	14785	*14784*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***1.02%***	0.013	1.22	***3.9%***
	14784	*14783*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***1.12%***	0.013	1.28	***3.7%***
	14783	*14782*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***2.13%***	0.013	1.77	***2.7%***
	14782	*14781*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***4.99%***	0.013	2.71	***1.8%***
	14781	*14780*			20		56			4,400	5	4,500	0.004	6.00	0.05	0.03	**8**	***20.22%***	0.013	5.45	***0.9%***
K1 (Columbia Vista)	*14780*	*14779*	17.8	85	319	238	893	220	18,700	70,180	76	76,000	0.070	4.75	0.63	0.41	**8**	***1.08%***	0.013	1.26	***50.3%***
	14779	*14778*			319		893			70,180	76	76,000	0.070	4.75	0.63	0.41	**8**	***5.03%***	0.013	2.72	***23.3%***
	14778	*14459*			319		893			70,180	76	76,000	0.070	4.75	0.63	0.41	**8**	***13.70%***	0.013	4.48	***14.1%***
N (Panorama Point)	*14459*	*14458*	15.9	43	1,559	120	4,365	220	9,460	342,980	394	394,220	0.343	3.24	2.33	1.50	**12**	***0.97%***	0.013	3.52	***66.1%***
	14458	*14457*			1,559		4,365			342,980	394	394,220	0.343	3.24	2.33	1.50	**12**	***5.80%***	0.013	8.60	***27.0%***

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
	14457	*14456*			1,559		4,365			342,980	394	394,220	0.343	3.24	2.33	1.50	12	***8.03%***	0.013	10.12	***23.0%***
	14456	*14455*			1,559		4,365			342,980	394	394,220	0.343	3.24	2.33	1.50	12	***6.45%***	0.013	9.07	***25.6%***
	14455	*14453*			1,559		4,365			342,980	394	394,220	0.343	3.24	2.33	1.50	12	***5.37%***	0.013	8.28	***28.1%***
	14453	*14452*			1,559		4,365			342,980	394	394,220	0.343	3.24	2.33	1.50	12	***7.88%***	0.013	10.03	***23.2%***
O2.1-3 (Observation Ridge)	P-110	P-109	39.7	177	177	496	496	220	38,940	38,940	40	39,700	0.039	5.74	0.41	0.26	8	0.40%	0.013	0.77	53.2%
O1 (Commercial)	P-109	P-108	4.4	20	197	56	552	220	4,400	43,340	44	44,080	0.043	5.57	0.44	0.29	8	0.40%	0.013	0.77	57.6%
RV Site	P-108	P-108A	8.1	37	234	104	655	220	8,140	51,480	52	52,150	0.051	5.24	0.50	0.32	8	0.40%	0.013	0.77	65.0%
BL - 26	P-108A	P-101	32.6	163	397	456	1,112	220	35,860	87,340	85	84,770	0.087	4.42	0.73	0.47	8	0.70%	0.013	1.01	71.8%
2G.1 + 2G.3	P-107	P-106	35.2	177	177	496	496	220	38,940	38,940	35	35,200	0.039	5.74	0.40	0.26	8	0.40%	0.013	0.77	52.3%
2F.9 + 2F.10	P-106	P-104	28.2	142	319	398	893	220	31,240	70,180	63	63,400	0.070	4.75	0.61	0.40	8	0.55%	0.013	0.90	68.3%
2E.7 + 2F.8 + Exception # 3 NW	P-105	P-104	67.1	290	290	812	812	220	63,800	63,800	67	67,116	0.064	4.91	0.59	0.38	8	0.45%	0.013	0.81	72.3%
2E.8 + 2E.10	P-104	P-103	31.8	159.0	768	445	2,150	220	34,980	168,960	162	162,316	0.169	3.74	1.23	0.79	10	0.60%	0.013	1.70	72.2%
2E.9	P-103	P-102	10.4	52	820	146	2,296	220	11,440	180,400	173	172,726	0.180	3.68	1.29	0.84	10	0.65%	0.013	1.77	73.1%
Exception Parcel 2 Alt	P-102	P-101			820		2,296	220	0	180,400	173	172,726	0.180	3.68	1.29	0.84	10	0.65%	0.013	1.77	73.1%
OPEN SPACE 1	P-101	*14856*	15.2		1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	0.40%	0.013	2.26	81.0%
	14856	*14855*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.39%***	0.013	2.23	***82.0%***
	14855	*14854*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.40%***	0.013	2.26	***81.0%***
	14854	*14853*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.36%***	0.013	2.14	***85.3%***
	14853	*14852*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.42%***	0.013	2.32	***79.0%***
	14852	*14851*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.37%***	0.013	2.17	***84.2%***
	14851	*14850*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.38%***	0.013	2.20	***83.1%***
	14850	*14849*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.40%***	0.013	2.26	***81.0%***
	14849	*14848*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.38%***	0.013	2.20	***83.1%***
	14848	*14847*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.38%***	0.013	2.20	***83.1%***
	14847	*14846*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.47%***	0.013	2.45	***74.7%***
	14846	*14845*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.42%***	0.013	2.32	***79.0%***
	14845	*14844*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***0.42%***	0.013	2.32	***79.0%***
	14844	*14843*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***1.11%***	0.013	3.76	***48.6%***
	14843	*14842*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***2.46%***	0.013	5.60	***32.6%***
	14842	*14841*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***2.54%***	0.013	5.69	***32.1%***
	14841	*14835*			1,217		3,408			267,740	273	272,696	0.268	3.40	1.83	1.18	12	***2.58%***	0.013	5.74	***31.9%***
Exception 1 (West)	P-112	*15962*	40.3	161	161	451	451	220	35,420	35,420	40	40,300	0.035	5.89	0.39	0.25	8	0.32%	0.013	0.69	**56.2%**
M5 (Trilogy West Ph. 1 & 2) + Fire Station	*15962*	*15961*	30.1	118	279	330	781	220	25,960	61,380	70	70,400	0.061	4.97	0.58	0.38	8	***0.55%***	0.013	0.90	**64.6%**
M3 (Trilogy East Ph. 3 - 4S)	*15961*	*15960*	1	4	283	11	792	220	880	62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.64%***	0.013	0.97	**60.5%**
	15960	*15959*			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.66%***	0.013	0.98	**59.6%**
	15959	*15958*			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.65%***	0.013	0.98	**60.1%**
	15958	*15957*			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.58%***	0.013	0.92	**63.6%**
	15957	*15956*			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.56%***	0.013	0.91	**64.7%**
	15956	*15955*			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	***0.42%***	0.013	0.79	**74.7%**

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
	15955	15954			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	0.59%	0.013	0.93	63.0%
	15954	15944			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	0.57%	0.013	0.91	64.1%
	15945	15944			283		792			62,260	71	71,400	0.062	4.94	0.59	0.38	8	6.51%	0.013	3.09	19.0%
M3 (Trilogy East Ph. 2 - 82S)	15944	15943	16.6	82	365	230	1,022	220	18,040	80,300	88	88,000	0.080	4.52	0.70	0.45	10	0.64%	0.013	1.76	39.7%
	15943	15942			365		1,022			80,300	88	88,000	0.080	4.52	0.70	0.45	10	0.51%	0.013	1.57	44.4%
	15942	15938			365		1,022			80,300	88	88,000	0.080	4.52	0.70	0.45	10	0.43%	0.013	1.44	48.4%
	15938	15936			365		1,022			80,300	88	88,000	0.080	4.52	0.70	0.45	10	0.44%	0.013	1.46	47.8%
M4 (Trilogy East Ph. 1 & 2)	15936	15935	21	92	457	258	1,280	220	20,240	100,540	109	109,000	0.101	4.25	0.83	0.54	10	0.49%	0.013	1.54	53.9%
	15935	15934			457		1,280			100,540	109	109,000	0.101	4.25	0.83	0.54	10	0.52%	0.013	1.58	52.3%
	15934	15932			457		1,280			100,540	109	109,000	0.101	4.25	0.83	0.54	10	0.46%	0.013	1.49	55.6%
Exception 1 (East)	P-111	16214	80.7	323	323	904	904	220	71,060	71,060	81	80,700	0.071	4.73	0.64	0.42	8	0.60%	0.013	0.94	68.7%
	16214	16213			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.50%	0.013	1.55	41.5%
	16213	16212			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.51%	0.013	1.57	41.1%
	16212	16204			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.51%	0.013	1.57	41.1%
	16204	16203			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.52%	0.013	1.58	40.7%
	16203	16202			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.52%	0.013	1.58	40.7%
	16202	16201			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.50%	0.013	1.55	41.5%
	16201	15933			323		904			71,060	81	80,700	0.071	4.73	0.64	0.42	10	0.50%	0.013	1.55	41.5%
M2 (Trilogy East Ph. 4 & 5)	15933	15932	13.4	60	383	168	1,072	220	13,200	84,260	94	94,100	0.084	4.46	0.73	0.47	10	0.26%	0.013	1.12	64.9%
Trilogy Clubhouse	15932	14840	5.3	9	849	25.2	2,377	220	1980	186,780	208	208,400	0.187	3.65	1.38	0.89	12	1.06%	0.013	3.68	37.5%
	14840	14839			849		2,377			186,780	208	208,400	0.187	3.65	1.38	0.89	12	1.06%	0.013	3.68	37.5%
M1 (Whitman-38S)	14839	14838	6.5	38	887	106.4	2,484	220	8360	195,140	215	214,900	0.195	3.62	1.43	0.92	12	0.74%	0.013	3.07	46.4%
	14838	14837			887		2,484			195,140	215	214,900	0.195	3.62	1.43	0.92	12	0.91%	0.013	3.41	41.8%
	14837	14836			887		2,484			195,140	215	214,900	0.195	3.62	1.43	0.92	12	0.73%	0.013	3.05	46.7%
	14836	14835			887		2,484			195,140	215	214,900	0.195	3.62	1.43	0.92	12	1.20%	0.013	3.91	36.4%
M (Whitman-83N)	14835	14834	16.5	83	2,187	232	6,124	220	18,260	481,140	504	504,096	0.481	3.05	3.05	1.97	16	0.64%	0.013	6.15	49.6%
	14834	14454			2,187		6,124			481,140	504	504,096	0.481	3.05	3.05	1.97	16	0.49%	0.013	5.39	56.7%
	14454	14452			2,187		6,124			481,140	504	504,096	0.481	3.05	3.05	1.97	16	0.65%	0.013	6.20	49.2%
	14452	14451			3,746		10,489			824,120	898	898,316	0.824	2.78	4.93	3.19	16	0.53%	0.013	5.60	88.1%
Post + NC.1 + NC.2	14451	14450	8.7	129	3,875	361.2	10,850	220	28,380	852,500	907	907,016	0.853	2.76	5.05	3.26	16	0.52%	0.013	5.55	91.0%
	14450	14449			3,875		10,850			852,500	907	907,016	0.853	2.76	5.05	3.26	16	0.52%	0.013	5.55	91.0%
	14449	14448			3,875		10,850			852,500	907	907,016	0.853	2.76	5.05	3.26	16	0.55%	0.013	5.71	88.5%
DEES	14448	14447	14.1	27	3,902	76	10,926	220	5,940	858,440	921	921,116	0.858	2.76	5.09	3.29	16	0.54%	0.013	5.65	90.1%
	14447	14446			3,902		10,926			858,440	921	921,116	0.858	2.76	5.09	3.29	16	0.54%	0.013	5.65	90.1%
	14446	14445			3,902		10,926			858,440	921	921,116	0.858	2.76	5.09	3.29	16	0.53%	0.013	5.60	90.9%
L1 (Winthrop - 23S)	14445	14444	4.8	23	3,925	64	10,990	220	5,060	863,500	926	925,916	0.864	2.76	5.12	3.31	16	0.54%	0.013	5.65	90.5%
	14444	14443			3,925		10,990			863,500	926	925,916	0.864	2.76	5.12	3.31	18	0.41%	0.013	6.74	75.9%
L (Liberty Ridge - 20S)	14878	14877	4.2	20	20	56	56	220	4,400	4,400	4	4,200	0.004	6.00	0.05	0.03	8	3.25%	0.013	2.18	2.2%
	14877	14876			20		56			4,400	4	4,200	0.004	6.00	0.05	0.03	8	3.09%	0.013	2.13	2.2%
	14876	14875			20		56			4,400	4	4,200	0.004	6.00	0.05	0.03	8	3.35%	0.013	2.22	2.1%

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
I1 (Pyramid Ridge)	*14875*	*14874*	12.6	11	31	31	87	220	2,420	6,820	17	16,800	0.007	6.00	0.09	0.06	8	3.26%	0.013	2.19	4.1%
	14874	*14873*			31		87			6,820	17	16,800	0.007	6.00	0.09	0.06	8	3.20%	0.013	2.17	4.1%
	14873	*14443*			31		87			6,820	17	16,800	0.007	6.00	0.09	0.06	8	2.47%	0.013	1.90	4.7%
	14443	*14442*			3,956		11,077			870,320	943	942,716	0.870	2.75	5.17	3.34	18	0.96%	0.013	10.32	50.1%
	14442	*14441*			3,956		11,077			870,320	943	942,716	0.870	2.75	5.17	3.34	18	0.96%	0.013	10.32	50.1%
L1 (Winthrop - 38N)	*14441*	*14440*	8.1	38	3,994	106	11,183	220	8,360	878,680	951	950,816	0.879	2.75	5.21	3.37	20	0.24%	0.013	6.83	76.2%
	14440	*14439*			3,994		11,183			878,680	951	950,816	0.879	2.75	5.21	3.37	20	0.25%	0.013	6.97	74.7%
	14439	*14438*			3,994		11,183			878,680	951	950,816	0.879	2.75	5.21	3.37	20	0.23%	0.013	6.69	77.9%
F1-E1-E2 (Edmunds Park)	P-115	P-114	45.8	245	245	686	686	220	53,900	53,900	46	45,800	0.054	5.16	0.50	0.32	8	1.10%	0.013	1.27	39.5%
D	P-114	P-113	25.0	125	370	350	1,036	220	27,500	81,400	71	70,800	0.081	4.50	0.68	0.44	8	1.10%	0.013	1.27	53.2%
2A.1 + 2A.2 + 2A.3 + 2A.4 *(Lift Station 2)*	P-113	*14438*	63.0	315	685	882	1,918	220	69,300	150,700	134	133,800	0.151	3.85	1.10	0.71	10	0.45%	0.013	1.47	74.9%
	14438	*14437*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.23%	0.013	6.69	88.9%
	14437	*14436*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.23%	0.013	6.69	88.9%
	14436	*14435*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.23%	0.013	6.69	88.9%
	14435	*14434*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.23%	0.013	6.69	88.9%
	14434	*14433*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.26%	0.013	7.11	83.6%
	14433	*14432*			4,679		13,101			1,029,380	1,085	1,084,616	1.029	2.68	5.95	3.84	20	0.25%	0.013	6.97	85.3%
L (Liberty Ridge - 99N)	*14432*	*14431*	20.5	99	4,778	277	13,378	220	21,780	1,051,160	1,105	1,105,116	1.051	2.67	6.06	3.92	20	0.24%	0.013	6.83	88.7%
FULLEST PIPE (ORIGINAL CALCS=88.5%)	*14431*	*14430*			4,778		13,378			1,051,160	1,105	1,105,116	1.051	2.67	6.06	3.92	20	0.23%	0.013	6.69	90.6%
	14430	*14429*			4,778		13,378			1,051,160	1,105	1,105,116	1.051	2.67	6.06	3.92	20	0.26%	0.013	7.11	85.2%
OPEN SPACE 2	*14429*	*14428*	27.2		4,778		13,378			1,051,160	1,132	1,132,316	1.051	2.67	6.10	3.94	20	0.24%	0.013	6.83	89.3%
	14428	*14427*			4,778		13,378			1,051,160	1,132	1,132,316	1.051	2.67	6.10	3.94	21	0.23%	0.013	7.62	80.1%
	14427	*14426*			4,778		13,378			1,051,160	1,132	1,132,316	1.051	2.67	6.10	3.94	21	0.24%	0.013	7.78	78.4%
H1-H2 (Inspiration Ridge - 84S)	*15992*	*15991*	17.5	84	84	235	235	220	18,480	18,480	18	17,500	0.018	6.00	0.20	0.13	8	3.05%	0.013	2.12	9.4%
	15991	*15990*			84		235			18,480	18	17,500	0.018	6.00	0.20	0.13	8	7.49%	0.013	3.32	6.0%
	15990	*15989*			84		235			18,480	18	17,500	0.018	6.00	0.20	0.13	8	1.00%	0.013	1.21	16.4%
	15989	*15988*			84		235			18,480	18	17,500	0.018	6.00	0.20	0.13	8	9.70%	0.013	3.77	5.3%
	15988	*15987*			84		235			18,480	18	17,500	0.018	6.00	0.20	0.13	8	1.00%	0.013	1.21	16.4%
	15987	*15986*			84		235			18,480	18	17,500	0.018	6.00	0.20	0.13	8	1.06%	0.013	1.25	15.9%
I2 (Cathedral Ridge)	*15986*	*15985*	14.6	64	148	179	414	220	14,080	32,560	32	32,100	0.033	6.00	0.35	0.23	8	1.00%	0.013	1.21	29.0%
	15985	*15984*			148		414			32,560	32	32,100	0.033	6.00	0.35	0.23	8	4.00%	0.013	2.42	14.5%
	15984	*15983*			148		414			32,560	32	32,100	0.033	6.00	0.35	0.23	8	3.51%	0.013	2.27	15.5%
I3 (Cathedral Ridge)	*15983*	*15982*	15.6	35	183	98	512	220	7,700	40,260	48	47,700	0.040	5.69	0.43	0.28	8	1.69%	0.013	1.58	27.2%
	15982	*15980*			183		512			40,260	48	47,700	0.040	5.69	0.43	0.28	8	1.51%	0.013	1.49	28.8%
H1-H2 (Inspiration Ridge - 200N)	*15980*	*15979*	41.9	200	383	560	1,072	220	44,000	84,260	90	89,600	0.084	4.46	0.72	0.47	8	4.06%	0.013	2.44	29.5%
	15979	*14464*			383		1,072			84,260	90	89,600	0.084	4.46	0.72	0.47	8	9.78%	0.013	3.79	19.0%
	14464	*14426*			383		1,072			84,260	90	89,600	0.084	4.46	0.72	0.47	8	1.28%	0.013	1.37	52.5%

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
	14426	*14425*			5,161		14,451			1,135,420	1,222	1,221,916	1.135	2.65	6.54	4.23	***21***	***0.23%***	0.013	7.62	***85.8%***
	14425	*14424*			5,161		14,451			1,135,420	1,222	1,221,916	1.135	2.65	6.54	4.23	***21***	***0.23%***	0.013	7.62	***85.8%***
G (Berkeley Park - 25E)	*14424*	*14423*	17.8	35	5,196	98	14,549	220	7,700	1,143,120	1,240	1,239,716	1.143	2.64	6.59	4.26	***21***	***0.29%***	0.013	8.56	***77.1%***
	14423	*14422*			5,196		14,549			1,143,120	1,240	1,239,716	1.143	2.64	6.59	4.26	***21***	***0.28%***	0.013	8.41	***78.4%***
P3.2 (Berkeley Park) +P3.1	*14422*	*14421*	11.8	48	5,244	134	14,683	220	10,560	1,153,680	1,252	1,251,516	1.154	2.64	6.65	4.30	***21***	***0.28%***	0.013	8.41	***79.1%***
	14421	*14420*			5,244		14,683			1,153,680	1,252	1,251,516	1.154	2.64	6.65	4.30	***21***	***0.30%***	0.013	8.70	***76.4%***
G-P2.1-P2.2 (Berkeley Park - G-87W)	*14420*	*14419*	32.3	227	5,471	636	15,319	220	49,940	1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.28%***	0.013	8.41	***81.8%***
	14419	*14418*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.28%***	0.013	8.41	***81.8%***
	14418	*14417*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.30%***	0.013	8.70	***79.0%***
	14417	*14416*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.29%***	0.013	8.56	***80.3%***
	14416	*14415*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.28%***	0.013	8.41	***81.8%***
	14415	*14414*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.28%***	0.013	8.41	***81.8%***
	14414	*14413*			5,471		15,319			1,203,620	1,284	1,283,816	1.204	2.62	6.87	4.44	***21***	***0.29%***	0.013	8.56	***80.3%***
OPEN SPACE 3	*14413*	*15126*	33.3		5,471		15,319			1,203,620	1,317	1,317,116	1.204	2.62	6.93	4.48	***21***	***0.31%***	0.013	8.85	***78.3%***
	15216	16429			5,471		15,319			1,203,620	1,317	1,317,116	1.204	2.62	6.93	4.48	***21***	***0.29%***	0.013	8.56	***81.0%***
	16429	16428			5,471		15,319			1,203,620	1,317	1,317,116	1.204	2.62	6.93	4.48	***21***	***0.40%***	0.013	10.05	68.9%
	16428	16425			5,471		15,319			1,203,620	1,317	1,317,116	1.204	2.62	6.93	4.48	***21***	***0.35%***	0.013	9.40	73.7%
T2 (Trilogy West)	16427	16426	39.0	155	155	434	434	220	34,100	34,100	39	39,000	0.034	5.95	0.37	0.24	8	0.40%	0.013	0.77	48.8%
	16426	16425			155		434			34,100	39	39,000	0.034	5.95	0.37	0.24	8	0.40%	0.013	0.77	48.8%
T1+U2 (Trilogy West)	P-116	16425	25.1	95	95	266	266	220	20,900	20,900	25	25,090	0.021	6.00	0.23	0.15	8	0.40%	0.013	0.77	30.4%
	16425	16424			5,721.00		16,019			1,258,620	1,381	1,381,206	1.259	2.61	7.21	4.66	***21***	***0.35%***	0.013	9.40	76.8%
	16424	16423			5,721		16,019			1,258,620	1,381	1,381,206	1.259	2.61	7.21	4.66	***21***	***0.35%***	0.013	9.40	76.8%
	16423	16422			5,721		16,019			1,258,620	1,381	1,381,206	1.259	2.61	7.21	4.66	***21***	***0.41%***	0.013	10.17	70.9%
P1A	16706	16705	14.1	131	131	367	367	220	28,820	28,820	14	14,140	0.029	6.00	0.29	0.19	8	0.40%	0.013	0.77	37.8%
	16705	16704			131		367			28,820	14	14,140	0.029	6.00	0.29	0.19	8	0.40%	0.013	0.77	37.8%
P1B	16704	16422	7.5	150	281	420	787	220	33,000	61,820	22	21,620	0.062	4.95	0.51	0.33	8	0.40%	0.013	0.77	66.2%
	16422	16421			6,002		16,806			1,320,440	1,403	1,402,826	1.320	2.59	7.46	4.82	***21***	***0.51%***	0.013	11.35	65.8%
	16421	16456			6,002		16,806			1,320,440	1,403	1,402,826	1.320	2.59	7.46	4.82	***21***	***4.43%***	0.013	33.44	22.3%
	16456	16455			6,002		16,806			1,320,440	1,403	1,402,826	1.320	2.59	7.46	4.82	***21***	***1.16%***	0.013	17.11	43.6%
U1 + U2 (Undeveloped)	P-117	16455	24.6	123	123	344	344	220	27,060	27,060	25	24,600	0.027	6.00	0.29	0.19	8	0.40%	0.013	0.77	37.7%
	16455	16454			6,125		17,150			1,347,500	1,427	1,427,426	1.348	2.58	7.59	4.91	***21***	***3.73%***	0.013	30.68	24.7%
	16454	16453			6,125		17,150			1,347,500	1,427	1,427,426	1.348	2.58	7.59	4.91	***21***	***6.71%***	0.013	41.15	18.5%
R3	P-118	16453	13.4	61	61	171	171	220	13,420	13,420	13	13,400	0.013	6.00	0.15	0.09	8	0.40%	0.013	0.77	19.0%
	16453	16452			6,186		17,321			1,360,920	1,441	1,440,826	1.361	2.58	7.66	4.95	***21***	***7.54%***	0.013	43.63	17.6%
2B.1 + 2B.2 *(Lift Station # 3)*	P-123	P-122	118.0	537	537	1,504	1,504	220	118,140	118,140	118	118,000	0.118	4.10	0.93	0.60	8	1.10%	0.013	1.27	73.4%
Q2	P-122	P-121	13.3	66	603	185	1,688	220	14,520	132,660	131	131,300	0.133	3.99	1.02	0.66	10	0.40%	0.013	1.39	73.5%
Q1	P-121	P-120	15.4	77	680	216	1,904	220	16,940	149,600	147	146,700	0.150	3.85	1.12	0.72	10	0.50%	0.013	1.55	72.0%
R1.A + R1.B	P-120	P-119	25.1	318	998	890	2,794	220	69,960	219,560	172	171,800	0.220	3.54	1.47	0.95	10	0.80%	0.013	1.96	74.8%

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
R2	P-124	P-119	22.5	131	131	367	367	220	28,820	28,820	23	22,500	0.029	6.00	0.30	0.20	8	0.40%	0.013	0.77	39.5%
	P-119	16452			1,129		3,161			248,380	194	194,300	0.248	3.45	1.63	1.05	10	1.00%	0.013	2.20	74.1%
	16452	16451			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	4.33%	0.013	47.20	18.6%
	16451	16450			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	2.71%	0.013	37.34	23.6%
	16450	16449			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	2.77%	0.013	37.75	23.3%
	16449	16448			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	2.68%	0.013	37.13	23.7%
	16448	16447			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	0.94%	0.013	21.99	40.0%
	16447	16446			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	5.49%	0.013	53.15	16.6%
	16446	16445			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	0.50%	0.013	16.04	54.9%
End Seg 5	16445	P-201			7,315		20,482			1,609,300	1,635	1,635,126	1.609	2.52	8.80	5.69	24	0.50%	0.013	16.04	54.9%
Exception 2	P-235	P-334	48.7	194	194	543	543	220	42,680	42,680	49	48,680	0.043	5.59	0.44	0.29	8	0.55%	0.013	0.90	49.5%
2G.4	P-234	P-233	7.9	51	245	143	686	220	11,220	53,900	57	56,580	0.054	5.16	0.52	0.33	10	0.40%	0.013	1.39	37.3%
2G.5	P-233	P-232	37.4	243	488	680	1,366	220	53,460	107,360	94	93,980	0.107	4.19	0.84	0.54	12	0.40%	0.013	2.26	37.2%
2H.10	P-232	P-231	46.0	136	624	381	1,747	220	29,920	137,280	140	139,980	0.137	3.95	1.06	0.68	12	0.40%	0.013	2.26	46.7%
2H.8	P-231	P-230	40.8	124	748	347	2,094	220	27,280	164,560	181	180,780	0.165	3.76	1.24	0.80	15	0.35%	0.013	3.83	32.3%
2H.4 + 2H.5	P-230	P-222	55.3	141	889	395	2,489	220	31,020	195,580	236	236,080	0.196	3.62	1.46	0.94	15	0.35%	0.013	3.83	38.1%
2G.2 + Except 2 ALT	P-229	P-228	43.0	280	280	784	784	220	61,600	61,600	43	43,000	0.062	4.96	0.54	0.35	8	1.10%	0.013	1.27	42.4%
2H.6 + Exception 3 SE	P-228	P-225	113.3	553	833	1,548	2,332	220	121,660	183,260	156	156,325	0.183	3.67	1.28	0.83	10	0.75%	0.013	1.90	67.4%
2F.5 + 2F.6	P-227	P-226	62.3	358.0	358	1,002	1,002	220	78,760	78,760	62	62,348	0.079	4.55	0.65	0.42	8	0.55%	0.013	0.90	72.4%
SC.1	P-226	P-225	15.5	87.0	445	244	1,246	220	19,140	97,900	78	77,878	0.098	4.28	0.77	0.50	8	0.75%	0.013	1.05	73.2%
	P-225	P-224			1,278		3,578			281,160	234	234,204	0.281	3.36	1.82	1.18	12	0.50%	0.013	2.53	72.1%
2H.1	P-224	P-223	29.9	89	1,367	249	3,828	220	19,580	300,740	264	264,104	0.301	3.30	1.94	1.26	12	0.60%	0.013	2.77	70.2%
2H.2 + 2H.7	P-223	P-222	57.5	171	1,538	479	4,306	220	37,620	338,360	322	321,604	0.338	3.24	2.20	1.42	18	0.30%	0.013	5.77	38.1%
2H.3 + Exception 4 *(Lift Station 6)*	P-222	P-221	102.3	386	2,813		6,796			533,940	660	659,984	0.534	3.00	3.50	2.26	21	0.25%	0.013	7.94	44.0%
2F.4	P-221	P-220	21.4	108	2,921	302	7,098	220	23,760	557,700	681	681,384	0.558	2.98	3.62	2.34	21	0.25%	0.013	7.94	45.6%
2F.3	P-220	P-217	53.3	267	3,188	748	7,846	220	58,740	616,440	735	734,684	0.616	2.93	3.93	2.54	21	0.25%	0.013	7.94	49.4%
SC.2	P-219	P-218	25.0	131	131	367	367	220	28,820	28,820	25	25,000	0.029	6.00	0.31	0.20	8	0.40%	0.013	0.77	40.0%
2E.6	P-218	P-217	20.9	167	298	468	834	220	36,740	65,560	46	45,900	0.066	4.86	0.56	0.36	8	0.40%	0.013	0.77	73.6%
2E.3 + 2E.4	P-217	P-216	42.2	299	597	837	1,672	220	65,780	131,340	88	88,100	0.131	4.00	0.95	0.61	10	0.40%	0.013	1.39	68.3%
2E.2	P-216	P-215	15.1	75	672	210	1,882	220	16,500	147,840	103	103,200	0.148	3.87	1.04	0.67	10	0.45%	0.013	1.47	70.9%
2E.1 + 2F.1	P-215	P-213	34.1	310	982	868	2,750	220	68,200	216,040	137	137,300	0.216	3.55	1.40	0.90	10	0.80%	0.013	1.96	71.2%
NC.4 + 2F.2	P-214	P-213	44.5	633	633	1,772	1,772	220	139,260	139,260	45	44,500	0.139	3.94	0.92	0.59	8	1.10%	0.013	1.27	72.2%
2D.9	P-213	P-212	28.9	145	1,760	406	4,928	220	31,900	387,200	211	210,700	0.387	3.17	2.22	1.44	12	0.70%	0.013	2.99	74.4%
	P-212	P-211			4,948		12,774			1,003,640	945	945,384	1.004	2.69	5.64	3.64	24	0.20%	0.013	10.14	55.6%
2D.8 + SC.3	P-211	P-210	29.9	211	5,159	591	13,364	220	46,420	1,050,060	975	975,284	1.050	2.67	5.85	3.78	24	0.20%	0.013	10.14	57.7%
NC.3	P-210	P-209	2.0	9	5,168	25	13,390	220	1,980	1,052,040	977	977,284	1.052	2.67	5.86	3.79	24	0.20%	0.013	10.14	57.8%
2D.6	P-209	P-208	24.7	124	5,292	347	13,737	220	27,280	1,079,320	1,002	1,001,984	1.079	2.66	6.00	3.88	24	0.20%	0.013	10.14	59.1%
V2	P-208	P-206	58.2	265	5,557	742	14,479	220	58,300	1,137,620	1,060	1,060,184	1.138	2.65	6.30	4.07	24	0.20%	0.013	10.14	62.1%

TRIBUTARY AREA	MANHOLE FROM	MANHOLE TO	DRAINAGE AREA (acres)	RE	CUMM. RE	POPULATION EQUIV.	CUMM. POPULATION EQUIV.	UNIT FLOW RATE (gpd/RE)	AVERAGE FLOW (gpd)	CUMM. FLOW (gpd)	CUMM. AREA (acres)	CUMM. I & I (gpd/ac)	CUMM. FLOW (MGD)	PEAKING FACTOR	PEAK FLOW (cfs)	PEAK FLOW (MGD)	PIPE SIZE (in)	MIN. SLOPE (%)	Manning's n	Q_{FULL} (cfs)	PERCENT CAPACITY (%)
2D.1 + 2D.2 + 2D.4 +2D.5 + 2D.10 + 2K.1 *(Lift Station 4)*	P-207	P-206	157.8	274	274	767	274	220	60,280	60,280	158	157,800	0.060	4.99	0.71	0.46	8	0.65%	0.013	0.98	72.7%
V1	P-206	P-205	35.0	159	5,990	445	15,198	220	34,980	1,232,880	1,253	1,252,984	1.233	2.62	6.93	4.48	24	0.20%	0.013	10.14	68.3%
	P-205	P-202			5,990		15,198			1,232,880	1,253	1,252,984	1.233	2.62	6.93	4.48	24	0.20%	0.013	10.14	68.3%
2C.1	P-204	P-203	9.5	43	43	120	120	220	9,460	9,460	10	9,500	0.009	6.00	0.10	0.07	8	0.40%	0.013	0.77	13.4%
2C.2 + 2C.3 *(Lift Station 7)*	P-203	P-202	125.2	569	612	1,593	1,714	220	125,180	134,640	135	134,700	0.135	3.97	1.04	0.67	10	0.40%	0.013	1.39	74.6%
	P-202	P-201			6,602		16,912			1,367,520	1,388	1,387,684	1.368	2.58	7.60	4.91	24	0.21%	0.013	10.39	73.1%
HEADWORKS	P-201	WWTP			13,917		37,394			2,976,820	3,023	3,022,809	2.977	2.30	15.28	9.88	24	0.81%	0.013	20.41	74.9%

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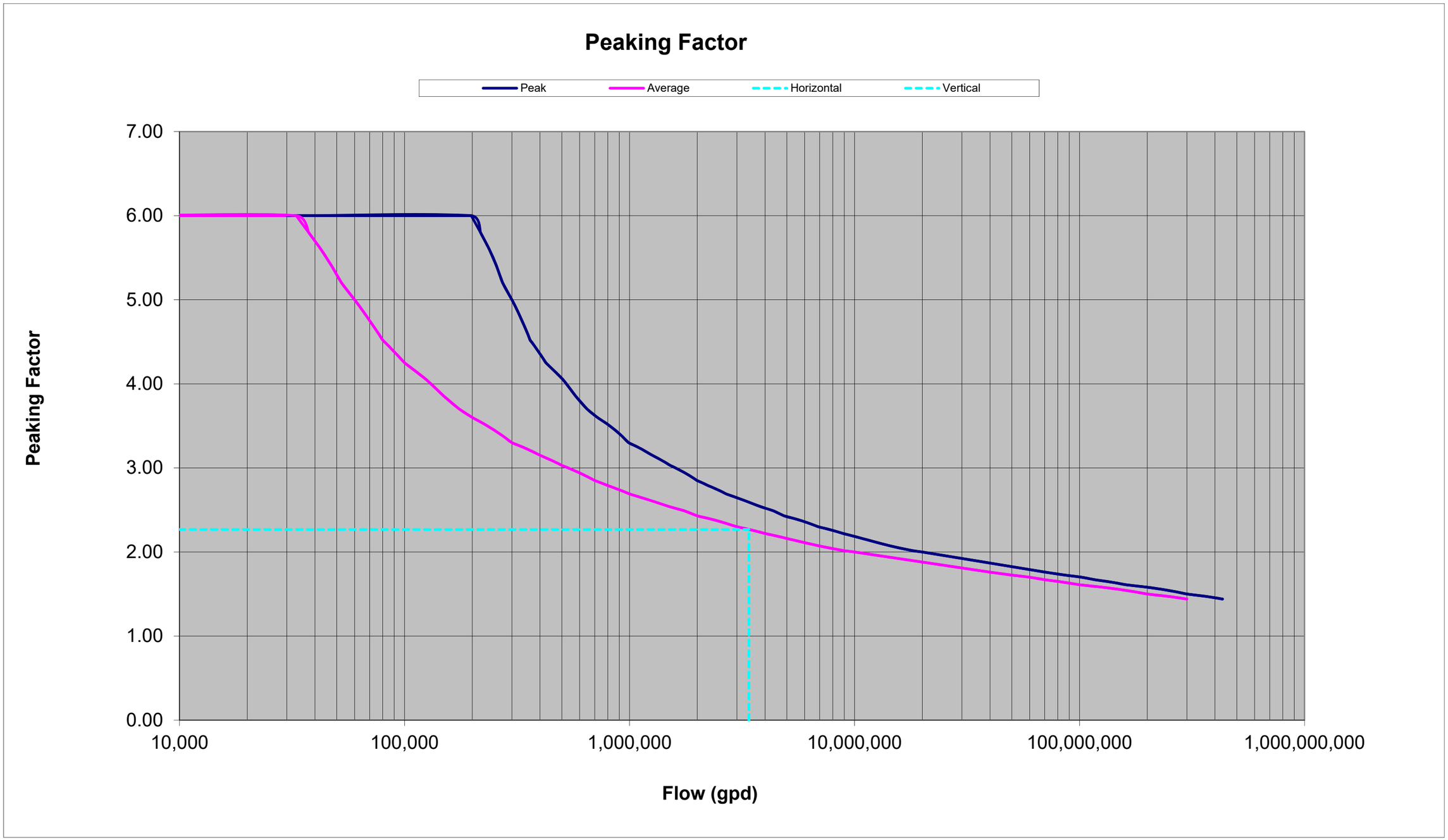
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Peaking Factor
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Flow (gpd)

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Appendix B

PROPOSED SANITARY SEWER MASTER PLAN

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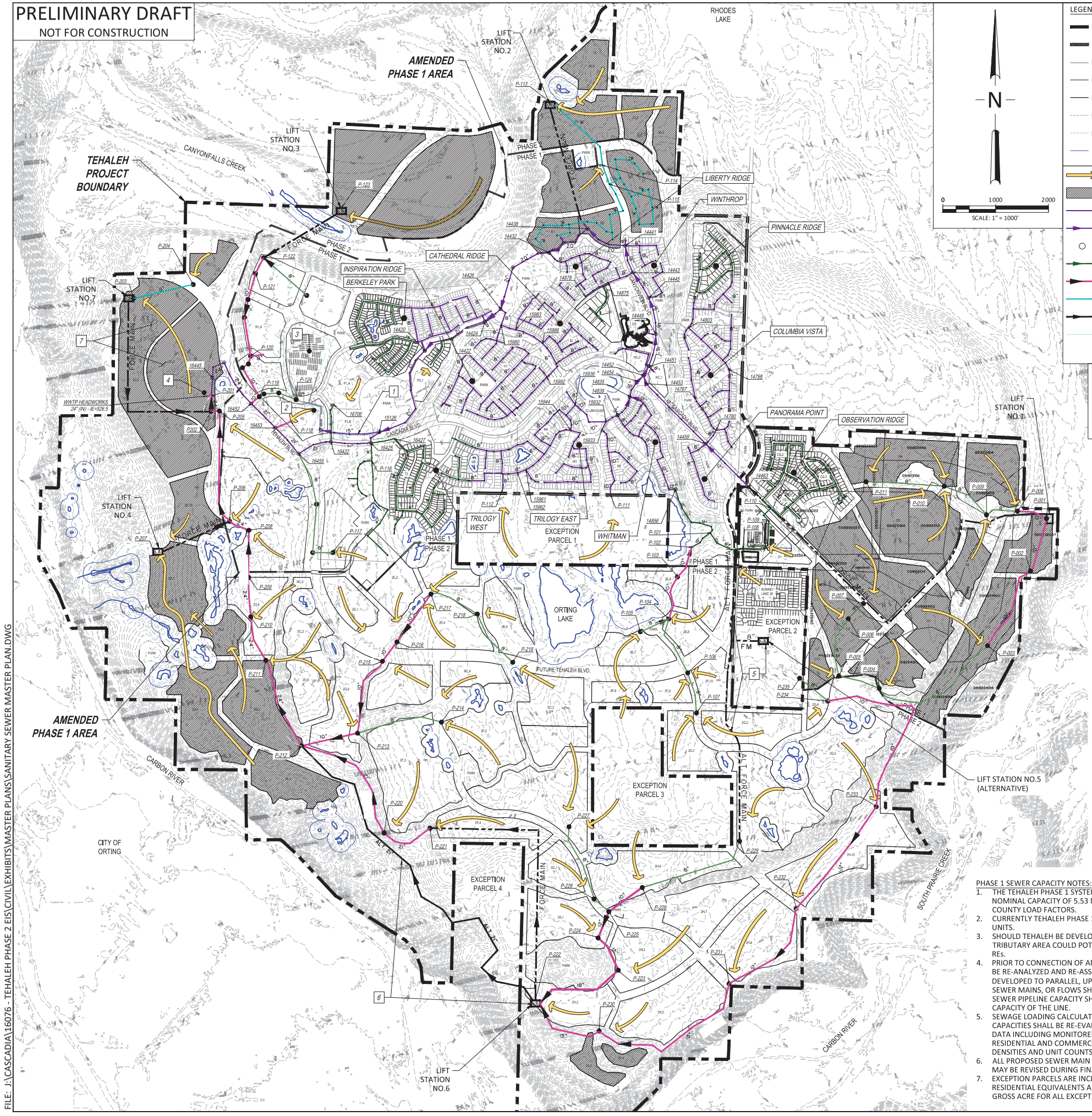
PRELIMINARY DRAFT
NOT FOR CONSTRUCTION



LEGEND

- TEHALEH PROJECT BOUNDARY
- TEHALEH PHASE LINE
- EXISTING PLAT LAYOUT
- PROPOSED PLAT LAYOUT
- PROPOSED PARCELS
- FUTURE PLAT LAYOUT
- EXISTING CONTOURS (LIDAR)
- WETLAND AREA & BUFFER
- PROPOSED SEWER FLOW ARROWS
- AREA NOT SERVED BY GRAVITY SEWER
- EXISTING SANITARY SEWER
- EXISTING SANITARY SEWER TRUNK LINES
- SANITARY SEWER MANHOLE
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY SEWER TRUNK LINE
- FUTURE SANITARY SEWER
- PROPOSED FORCE MAIN LINE
- EXISTING SANITARY SEWER FACILITIES
- PROPOSED PARCEL SEWER DELINEATION

PIPER SIZES & MINIMUM SLOPES

24 - INCH	0.20%
21 - INCH	0.25%
18 - INCH	0.30%
15 - INCH	0.35%
12 - INCH	0.40%
10 - INCH	0.45%
8 - INCH	1.00%

KEY INDEX:

1. STAGE 1 L.O.S.S. 15" SEWER MAIN (SEGMENT 3A)
2. STAGE 1 L.O.S.S. SEPTIC TANKS AND PROPOSED STAGE 1A INTERIM WASTEWATER TREATMENT PLANT (IWWTP)
3. STAGE 1 L.O.S.S. DRAINFIELD
4. STAGE 2-5 PERMANENT WASTEWATER TREATMENT PLANT (WWTP).
5. ALTERNATIVE FORCE MAIN FROM EXCEPTION PARCEL #2, NORTH TO PHASE 1 OR SOUTH TO PHASE 2 INTERCEPTOR. THIS ALTERNATIVE IS NOT REPRESENTED IN THE FLOW CALCULATION.
6. SEWER ROUTE IS SHOWN USING A LIFT STATION AND FORCE MAIN. AS AN ALTERNATIVE: THERE IS A CONCEPTUAL GRAVITY SEWER ROUTE CROSSES PROPERTY OUTSIDE OF THE TEHALEH BOUNDARIES AND IS CURRENTLY NOT LOCATED WITHIN ANY EXISTING RIGHTS-OF-WAY. THIS ALTERNATIVE WILL REQUIRE EASEMENTS TO CONSTRUCT THE GRAVITY MAIN.
7. PRELIMINARY GEOTECHNICAL EVALUATION INDICATES THE SOILS IN PARCEL 2C.2 AND 2C.3 ARE SUITABLE FOR USE AS SEWER BACKFILL MATERIAL. IT IS ANTICIPATED THAT PARCEL 2C.2 AND 2C.3, OR PORTIONS OF, WILL BE EXCAVATED 40-60 FT. TO PRODUCE SUFFICIENT QUANTITY FOR USE DURING THE TEHALEH PROJECT. SEWER MANHOLES RIMS, INVERT ELEVATIONS AND WWTP ELEVATION REFLECT THESE FUTURE GRADES.

PHASE 1 SEWER CAPACITY NOTES:

1. THE TEHALEH PHASE 1 SYSTEM AT THE DOWNSTREAM END HAS A NOMINAL CAPACITY OF 5.53 MGD BASED UPON STANDARD PIERCE COUNTY LOAD FACTORS.
2. CURRENTLY TEHALEH PHASE 1 IS PERMITTED 2,586 RESIDENTIAL UNITS.
3. SHOULD TEHALEH BE DEVELOPED TO ITS HIGHEST DENSITY THE TRIBUTARY AREA COULD POTENTIALLY CONTAIN AS MANY AS 9,700 REs.
4. PRIOR TO CONNECTION OF ANY REs OVER 3,000, THE SYSTEM SHALL BE RE-ANALYZED AND RE-ASSESSED AND A PLAN SHALL BE DEVELOPED TO PARALLEL, UPGRADE AND/OR BYPASS EXISTING SEWER MAINS, OR FLOWS SHALL BE RE-ROUTED SUCH THAT NO SEWER PIPELINE CAPACITY SHALL EXCEED 75% OF THE HYDRAULIC CAPACITY OF THE LINE.
5. SEWAGE LOADING CALCULATIONS AND PIPELINE HYDRAULIC CAPACITIES SHALL BE RE-EVALUATEDUSING THE BEST AVAILABLE DATA INCLUDING MONITORED INFLOW AND INFILTRATION RATES, RESIDENTIAL AND COMMERCIAL UNIT FLOW RATES, PARCEL DENSITIES AND UNIT COUNTS, AND PEAKING FACTORS.
6. ALL PROPOSED SEWER MAIN ALIGNMENTS ARE ILLUSTRATIVE AND MAY BE REVISED DURING FINAL DESIGN.
7. EXCEPTION PARCELS ARE INCLUDED IN HYDRAULIC CALCULATIONS. RESIDENTIAL EQUIVALENTS ARE BASED ON 4 DWELLING UNITS PER GROSS ACRE FOR ALL EXCEPTION PARCELS.

SANITARY SEWER BASIN TABLE

BASIN	AREA (AC.)	PHASE	LAND USE	DENSITY (DU/AC)	RE'S	FLOW TO SSMH
D	25.0	1	RESIDENTIAL-SF	5.0	125	P-114
E1 (Edmunds Park)	11.3	1	RESIDENTIAL-SF	5.6	63	P-115
E2 (Edmunds Park)	10.2	1	RESIDENTIAL-SF	4.5	46	P-115
F1 (Edmunds Park)	24.3	1	RESIDENTIAL-SF	5.6	136	P-115
G (Berkeley Park)	22.9	1	RESIDENTIAL-SF	5.3	122	14424
H1(Inspiration Ridge)	37.7	1	RESIDENTIAL-SF	5.0	188	15980/15992
H2 (Inspiration Ridge)	21.7	1	RESIDENTIAL-SF	4.4	96	15980/15992
I1(Pyramid Ridge)	12.6	1	RESIDENTIAL-SF	0.9	11	14875
I2 (Cathedral Ridge)	14.6	1	RESIDENTIAL-SF	4.4	64	15986
I3 (Cathedral Ridge)	15.6	1	RESIDENTIAL-SF	4.4	68	15983
J (Pinnacle Ridge)	32.9	1	RESIDENTIAL-SF	3.6	120	14803
K1 (Columbia Vista)	17.8	1	RESIDENTIAL-SF	4.8	85	14780
K2 (Columbia Vista)	25.3	1	RESIDENTIAL-SF	4.5	114	14787/14798
L (Liberty Ridge)	24.7	1	RESIDENTIAL-SF	4.8	119	14432/14878
L1 (Winthrop)	12.9	1	RESIDENTIAL-SF	4.7	61	14441/14445
M1 (Whitman)	23.0	1	RESIDENTIAL-SF	5.3	121	14839/14835
Trilogy Clubhouse	5.3	1	PUBLIC FACILITY	1.7	9	15932
M2 (Trilogy)	13.4	1	RESIDENTIAL-SF	4.5	60	15933
M3 (Trilogy)	17.6	1	RESIDENTIAL-SF	4.9	86	15961/15944
M4 (Trilogy)	21.0	1	RESIDENTIAL-SF	4.4	92	15936
M5 (Trilogy West)	26.8	1	RESIDENTIAL-SF	3.8	103	15962
N (Panorama Point)	15.9	1	RESIDENTIAL-SF	2.7	43	14459
Observation Ridge (O2.1-3)	39.7	1	RESIDENTIAL-SF	4.5	177	P-110
O3	29.3	1	RESIDENTIAL-SF	5.0	147	P-006
O4	45.3	1	RESIDENTIAL-SF	5.0	228	P-007
O5	50.5	1	RESIDENTIAL-SF	5.0	250	P-010
O6	17.7	1	RESIDENTIAL-SF	5.0	88	P-004
O7	19.1	1	RESIDENTIAL-SF	5.0	95	P-003
O8	12.6	1	RESIDENTIAL-SF	5.0	63	P-009
O9	33.3	1	RESIDENTIAL-SF	5.0	165	P-011
O10	24.8	1	RESIDENTIAL-SF	2.0	50	P-008
O11	18.0	1	RESIDENTIAL-SF	1.0	18	P-002
O12	41.5	1	RESIDENTIAL-SF	1.0	42	P-003
O13	8.3	1	RESIDENTIAL-SF	5.1	42	P-005
SC.1	15.5	1	SCHOOL		87	P-226
NC.5	2.0	1	COMMERCIAL-NC		9	P-004
P1B	7.5	1	RESIDENTIAL-MF	20.1	150	16704
P1A (SCHOOL)	14.1	1	SCHOOL		131	16706
P2.1 (Berkeley Park)	11.8	1	RESIDENTIAL-SF	4.9	58	14420
P2.2 (Berkeley Park)	15.4	1	RESIDENTIAL-SF	5.1	79	14420
P3.2 (Berkeley Park)	5.8	1	RESIDENTIAL-SF	2.8	16	14422
P3.1 (WWTP UIC)	6.0	1	PUBLIC FACILITY		27	
Q1	15.4	1	RESIDENTIAL-SF	5.0	77	P-121
Q2	13.3	1	RESIDENTIAL-SF	5.0	66	P-122
R1A	15.1	1	RESIDENTIAL-SF	5.0	75	P-120
R1B	10.0	1	RESIDENTIAL-MF	21.8	218	P-120
R2 (Drain Field)	22.5	1	PUBLIC FACILITY/ SCHOOL		131	P-124
R3 (Drain Field)	13.4	1	PUBLIC FACILITY/ COMMERCIAL		61	P-118
T1 (Trilogy West)	15.6	1	RESIDENTIAL-SF	3.4	53	P-116
T2 (Trilogy West)	39.0	1	RESIDENTIAL-SF	4.0	155	16427
U1	20.3	1	RESIDENTIAL-SF	5.0	101	P-117
U2 (Trilogy West)	9.5	1	RESIDENTIAL-SF	4.4	42	P-116
U2 (Undeveloped)	4.3	1	RESIDENTIAL-SF	5.1	22	P-117
V1	35.0	1	COMMERCIAL-BP		159	P-206
V2	58.2	1	COMMERCIAL-BP		265	P-208
DEES	14.1	1	SCHOOL		27	14448
FIRE STATION7 & 8	3.3	1	PUBLIC FACILITY		15	15962
Post	1.4	1	COMMERCIAL-CC		3	14451
NC.2	3.2	1	COMMERCIAL-NC		43	14451
NC.1	4.1	1	COMMERCIAL-NC		83	14451
O1 Comercial	4.4	1	COMMERCIAL-CC		20	P-109
RV Site	8.1	1	COMMERCIAL-CC		37	P-108
EXCEPTION #1 (WEST)	40.3	1	RESIDENTIAL-SF	4.0	161	P-112
EXCEPTION #1 (EAST)	80.7	1	RESIDENTIAL-SF	4.0	323	P-111
EXCEPTION #2	48.7	1	RESIDENTIAL-SF	4.0	194	
BL 26 PLAT	32.6	1	RESIDENTIAL-SF	5.0	163	P-108A
OPEN SPACE #1	15.2	1	OPEN SPACE (I&I only)			P-101
OPEN SPACE #2	27.2	1	OPEN SPACE (I&I only)			14429
OPEN SPACE #3	33.3	1	OPEN SPACE (I&I only)			14413
2A.1	27.4	2	RESIDENTIAL-SF	5.0	138	P-114
2A.2	10.1	2	RESIDENTIAL-SF	5.0	50	P-114
2A.3	11.9	2	RESIDENTIAL-SF	5.0	59	P-114
2A.4	13.6	2	RESIDENTIAL-SF	5.0	68	P-114
2B.1	42.4	2	COMMERCIAL-BP		193	P-123
2B.2	75.6	2	COMMERCIAL-BP		344	P-123
2C.1	9.5	2	COMMERCIAL-BP		43	P-204
2C.2	74.4	2	COMMERCIAL-BP		338	P-203
2C.3	50.8	2	COMMERCIAL-BP		231	P-203
2D.1	32.6	2	RESIDENTIAL-SF	1.0	33	P-207
2D.2	10.2	2	RESIDENTIAL-SF	1.0	10	P-207
2D.4	38.1	2	RESIDENTIAL-SF	1.0	38	P-207
2D.5	33.7	2	RESIDENTIAL-SF	3.0	100	P-207
2D.6	24.7	2	RESIDENTIAL-SF	5.0	124	P-209
2D.8	15.9	2	RESIDENTIAL-SF	5.0	80	P-211
2D.9	28.9	2	RESIDENTIAL-SF	5.0	145	P-213
2D.10	18.8	2	RESIDENTIAL-SF	1.0	19	P-207
2E.1	14.2	2	RESIDENTIAL-SF	5.0	71	P-215
2E.2	15.1	2	RESIDENTIAL-SF	5.0	75	P-216
2E.3	12.8	2	RESIDENTIAL-SF	5.0	64	P-217
2E.4	29.4	2	RESIDENTIAL-SF	8.0	235	P-217
2E.6	20.9	2	RESIDENTIAL-SF	8.0	167	P-218
2E.7	13.2	2	RESIDENTIAL-SF	5.0	66	P-105
2E.8	14.8	2	RESIDENTIAL-SF	5.0	74	9-104
2E.9	10.4	2	RESIDENTIAL-SF	5.0	52	P-103
2E.10	17.0	2	RESIDENTIAL-SF	5.0	85	P-104
2F.1	19.9	2	RESIDENTIAL-MF	12.0	239	P-215
2F.2	32.0	2	RESIDENTIAL-MF	18.0	576	P-214
2F.3	53.3	2	RESIDENTIAL-SF	5.0	267	P-220
2F.4	21.4	2	RESIDENTIAL-SF	5.0	108	P-221
2F.5	47.7	2	RESIDENTIAL-SF	6.0	285	P-227
2F.6	14.6	2	RESIDENTIAL-SF	5.0	73	P-227
2F.8	8.1	2	RESIDENTIAL-SF	5.1	41	9-105
2F.9	13.9	2	RESIDENTIAL-SF	5.0	70	P-106
2F.10	14.3	2	RESIDENTIAL-SF	5.0	72	P-106
2G.1	20.3	2	RESIDENTIAL-SF	5.0	102	P-107
2G.2	43.0	2	RESIDENTIAL-SF	6.5	280	P-229
2G.3	14.9	2	RESIDENTIAL-SF	5.0	75	P-107
2G.4	7.9	2	RESIDENTIAL-SF	6.5	51	P-234
2G.5	37.4	2	RESIDENTIAL-SF	6.5	243	P-233
2H.1	29.9	2	RESIDENTIAL-SF	3.0	89	P-224
2H.2	30.1	2	RESIDENTIAL-SF	3.0	89	P-223
2H.3	23.2	2	RESIDENTIAL-SF	3.0	70	P-222
2H.4	12.6	2	RESIDENTIAL-SF	1.0	13	P-230
2H.5	42.7	2	RESIDENTIAL-SF	3.0	128	P-230
2H.6	40.2	2	RESIDENTIAL-SF	6.5	260	P-228
2H.7	27.4	2	RESIDENTIAL-SF	3.0	82	P-223
2H.8	40.8	2	RESIDENTIAL-SF	3.0	124	P-231
2H.10	46.0	2	RESIDENTIAL-SF	3.0	136	P-232
2K.1	24.4	2	RESIDENTIAL-SF	3.0	74	P-207
NC.3	2.0	2	COMMERCIAL-NC		9	P-210
NC.4	12.5	2	COMMERCIAL-NC		57	P-214
SC.2	25.0	2	SCHOOL		131	P-219
SC.3	14.0	2	SCHOOL		131	P-211
EXCEPTION #3 (NW)	45.8	2	RESIDENTIAL-SF	4.0	183	P-105
EXCEPTION #3 (SE)	73.1	2	RESIDENTIAL-SF	4.0	293	P-228
EXCEPTION #4	79.1	2	RESIDENTIAL-SF	4.0	316	P-222
Total Acreage	3,023			Total REs		13,917

MacKay Sposito
ENERGY PUBLIC WORKS LAND DEVELOPMENT
www.mackaysposito.com

PRELIMINARY NOT FOR CONSTRUCTION

TEHALEH E.B.P.C.
PIERCE COUNTY, WA

SANITARY SEWER MASTER PLAN

REVISIONS:
1 REV_DATE

JOB NO.:	16076
DATE:	JUNE 2016
SCALE:	1" = 1000'
DESIGNED BY:	DRG
DRAWN BY:	DRG
CHECKED BY:	

EXHIBIT 01

EX-01

NO. 1 OF 1

FILE: J:\CASCADIA\16076 - TEHALEH PHASE 2 EIS\CIVIL\EXHIBITS\MASTER PLANS\SANITARY SEWER MASTER PLAN.DWG

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Appendix C

INFILTRATION ASSESSMENT COMMUNITY DRAINFIELD
PREPARED BY TERRA ASSOCIATES, INC.
DATED OCTOBER 6, 2015

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TERRA ASSOCIATES, Inc.
Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

October 6, 2015
Project No. T-5632-13-1

Mr. Tom Uren
Newland Communities
505 South 336th Street, Suite 430
Federal Way, Washington 98003

Subject: Infiltration Assessment
Community Drainfield
Tehaleh
Pierce County, Washington

References:
1. Letter, Large On-site Sewage System (LOSS), prepared by Jensen Engineering, Inc., dated June 29, 2015
2. Report, Monitoring Well Installation, Cascadia Wastewater Treatment Plant Drainfield, Pierce County, Washington, Project No. T-5632-13, prepared by Terra Associates, Inc., dated June 18, 2009

Dear Mr. Uren:

As requested, we have completed an assessment of the infiltration capacity of the existing community drainfield system at the Tehaleh development. Based on information outlined in the referenced June 29, 2015 Jensen letter the drainfield is currently used for treatment and discharge of a peak effluent flow of 100,000 gallons per day (gpd). As we understand, it is proposed to increase this discharge rate to 1,000,000 gpd from the on-site waste water treatment plant when it is completed. The following summarizes our review of the system, underlying soil and groundwater conditions, and conclusions regarding the long-term infiltration capacity of the system.

System Description

The existing community drainfield is a pressurized system and consists of 100 individual 10' x 100' drainfields. Each drainfield has three 1 ¼-inch perforated pipes that are placed on a two-foot thick imported sand bed. Based on review of project drawings, the sand beds extend 2 feet beyond the 10' x 100' drainfield dimension. The distribution piping was then backfilled with 12 inches of washed gravel aggregate. A filter fabric was placed over the gravel and then backfilled with native soils to current grade. Effluent is delivered to the drainfield by five sets of alternating duplex pumps. Each pump set is connected to 20 drainfields with switching valves rotating discharge to the fields giving each an equal discharge amount per day.

Subsurface Conditions

In June 2009, we observed the installation of three deep groundwater monitoring wells at the drainfield site. Findings including well logs and a well location map are summarized in the referenced June 18, 2009 report. In general, soil conditions observed during drilling consisted of dense to very dense gravel with sand and silt to clean gravel with sand. The regional groundwater table was encountered at a depth of approximately 220 to 225 feet below the ground surface.

On September 4, 2015, we excavated 5 shallow test holes at the drainfield site for the purpose of observing the condition of the drainfield sand beds and obtaining samples for laboratory testing. The location of the test holes is shown on attached Figure 1. We noted that the sand exposed in the test holes was relatively uniform and there was no evidence of biological matting or fouling of the sand that would reduce its permeability. Laboratory testing on the sand samples consisted of determining the materials particle size distribution. Resulting particle size distribution curves are attached as Figures 2 and 3. Results confirm that the sand is uniform and consists predominantly of medium to coarse grained particles with a soil fines content generally of less than five percent.

Discussion

Based on review of the referenced Jensen letter, discharge to the community drainfield at the higher rate of 1,000,000 gpd would occur in a manner similar to what is currently done. Each 20 drainfield combinations would be dosed at a rate of 200,000 gpd with individual drainfield beds uniformly dosed at 10,000 gpd. Discounting the available storage volume in the gravel bedding placed above the discharge piping in the drainfield beds, over the 10' x 100' dimension of the individual drainfield bed, this dosing rate would require a minimum infiltration rate of .67 inches per hour. If we include the extended two foot dimension of the sand bed as shown on the project drawings the required infiltration rate reduces to .46 inches per hour.

We evaluated the infiltration capacity of the drainfield beds and underlying geology in accordance with the Pierce County Stormwater Management and Site Development Manual, Appendix III-A, Method 3. Based on grain size distribution results as shown on Figures 2 and 3, per Table A.2 of the Pierce County manual the sand used to construct the drainfield beds has a long-term design infiltration rate of 6.5 to 9 inches per hour. As described on the well logs attached to the referenced June 18 report, soil conditions below the drainfield consist predominantly of gravel with sand with a varying silt content. Based on particle size distribution and our experience with similar geologic conditions these soils would support a long-term infiltration rate in the range of 1 to 4 inches per hour.

Based on our assessment, we conclude the infiltration capacity of the existing community drainfield system would be capable of supporting an increase effluent discharge of 1,000,000 gpd.

We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

10-6-15

Theodore J. Schepper, P.E.
Principal

cc: Mr. Eric Abbott, MacKay & Sposito

Attachments: Figure 1 – Sand Sample Location Plan
Figures 2, 3 – Particle Size Distribution Report

NOT TO SCALE

NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: DRAINFIELD AS BUILT, CASCADIA BY GOLDSMITH AND ASSOCIATES

LEGEND:

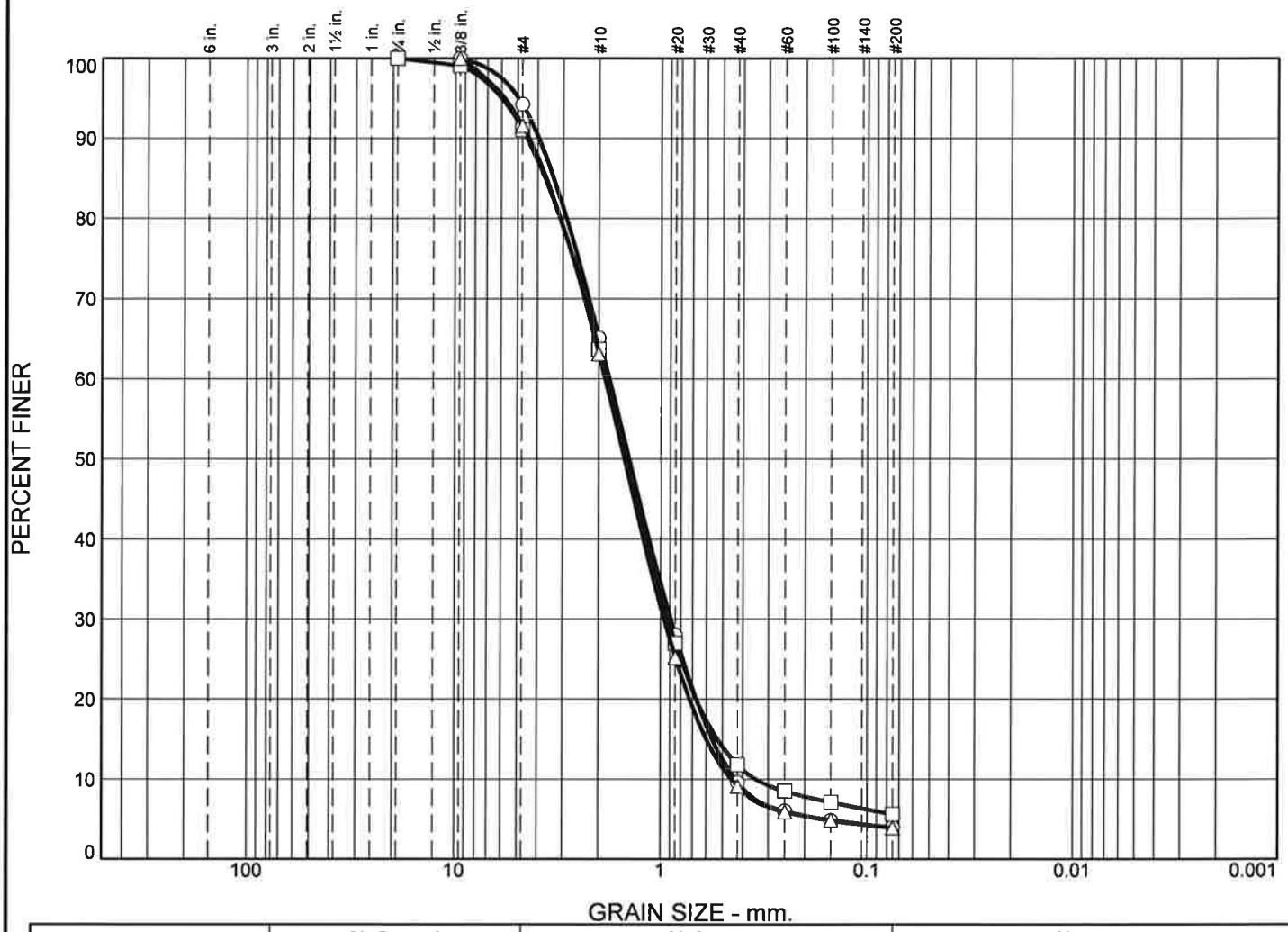
APPROXIMATE SAND SAMPLE AND TEST HOLE LOCATION

Terra Associates, Inc.
Consultants in Geotechnical Engineering Geology and Environmental Earth Sciences

SAND SAMPLE LOCATION PLAN
COMMUNITY DRAINFIELD
TEHALEH

T-5632-13-1	Date OCT 2015	Figure 1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	5.8	29.1	55.5	5.6	4.0	
□	0.0	0.0	8.9	27.4	51.9	6.2	5.6	
△	0.0	0.0	8.4	28.5	54.0	5.2	3.9	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				3.3358	1.7825	1.4288	0.8958	0.5609	0.4368	1.03	4.08
□				3.6716	1.8359	1.4712	0.9238	0.5319	0.3459	1.34	5.31
△				3.6268	1.8658	1.5044	0.9637	0.5997	0.4561	1.09	4.09

Material Description	USCS	AASHTO
○ Sand	SP	
□ Sand	SP-SM	
△ Sand	SP	

Project No. T-5632-13-1 **Client:** Newland Communities

Project: Community Drainfield Discharge Capacity

○ **Location:** Existing Community Drainfield **Sample Number:** 1

□ **Location:** Existing Community Drainfield **Sample Number:** 2

△ **Location:** Existing Community Drainfield **Sample Number:** 3

Date: ○ □ △

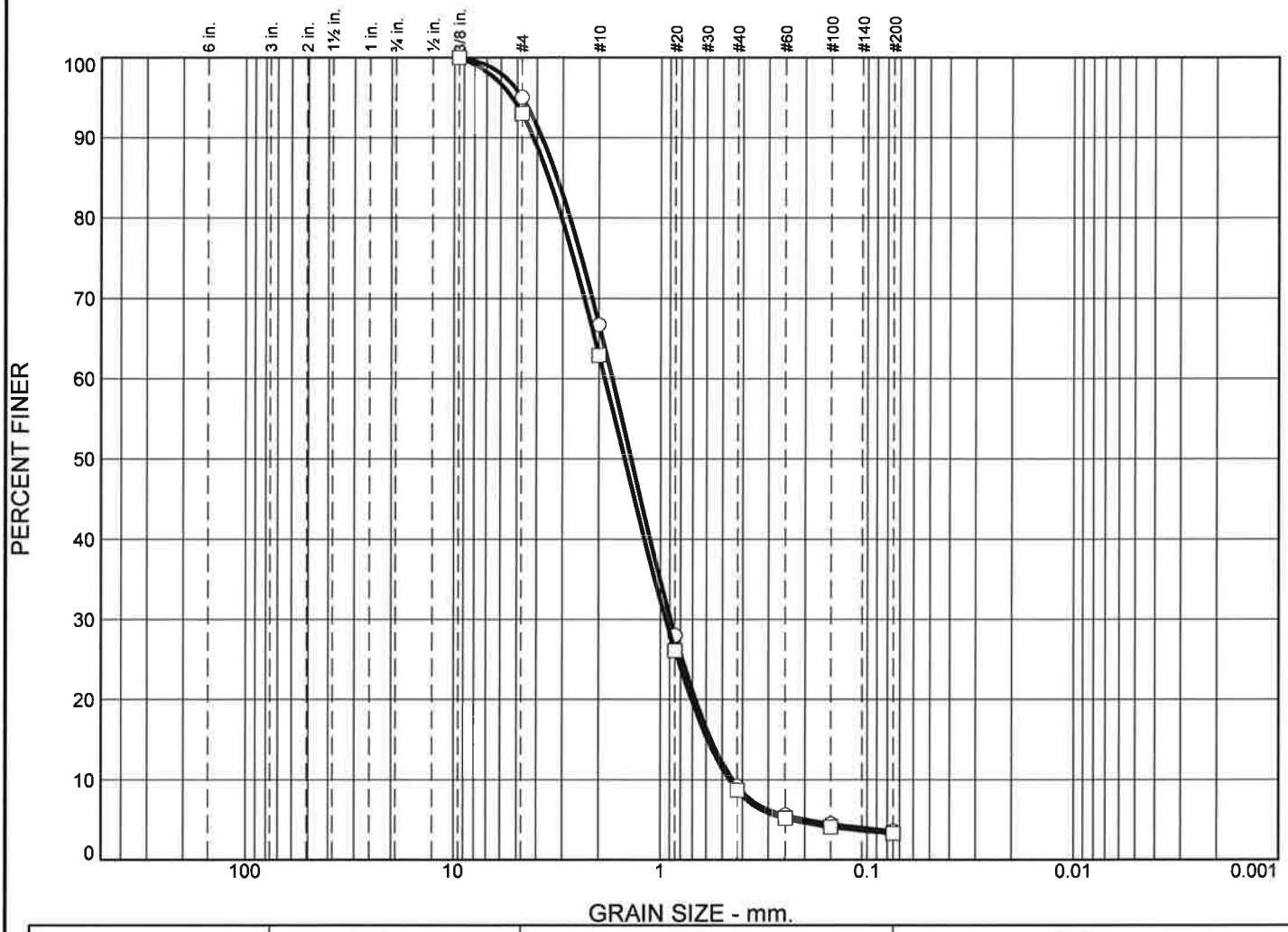
Remarks:

Terra Associates, Inc.

Kirkland, WA

Figure 2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	5.0	28.3	57.5	5.6	3.6	
□	0.0	0.0	7.0	30.1	54.2	5.4	3.3	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				3.1990	1.7264	1.3962	0.8939	0.5689	0.4479	1.03	3.85
□				3.5142	1.8739	1.5024	0.9430	0.5909	0.4638	1.02	4.04

Material Description	USCS	AASHTO
○ Sand	SP	
□ Sand	SP	

Project No. T-5632-13-1 **Client:** Newland Communities

Project: Community Drainfield Discharge Capacity

○ **Location:** Existing Community Drainfield **Sample Number:** 4

□ **Location:** Existing Community Drainfield **Sample Number:** 5

Date: ○ □

Remarks:

Terra Associates, Inc.

Kirkland, WA

Figure 3

Appendix D

TEHALEH E.B.P.C. INTERIM WATERWATER TREATMENT PLANT
PRESSURE SWEAGE LIFT STATION ENGINEERING REPORT
PREPARED BY MACKAY SPOSITO, INC.
DATED MAY 2016

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Report can be provided upon request

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