APPENDIX D:
STORMWATER TIR

Technical Information Report

Submitted to
City of Kirkland

January 2025

NE 85th Street Ped/Bike Connection – 114th Avenue NE to 6th Street Project

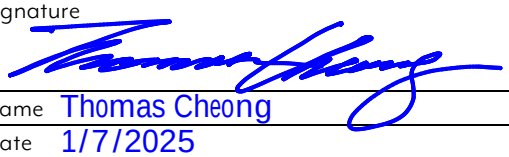
PERTEET.COM
801 2ND AVENUE, SUITE 302
SEATTLE, WA 98104
206.436.0515

PERTEET
Better communities, by design

TECHNICAL INFORMATION REPORT

Project:	NE 85th Street Ped/Bike Connection – 114th Avenue NE to 6th Street Project Kirkland, Washington
Date:	January 2025
Civil Engineer: (Seattle):	Perteet Inc. 801 2nd Avenue, Suite 302 Seattle, Washington 98104 Phone #: 206.436.0515
Stormwater Lead:	Thomas Cheong, PE
Stormwater Engineer:	Nathan Hahne, EIT

Signature



Name Thomas Cheong

Date 1/7/2025

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 PROJECT OVERVIEW

The City of Kirkland NE 85th Street Pedestrian and Bike Connection project is on a principal arterial road and area situated within the right-of-way limits of NE 85th Street between 6th Street and 114th Avenue NE. The project falls within the southeast portion of Section 5, Township 25 North, Range 5 East of the Willamette Principal Meridian. The approximate 5.55 acres of the project area is bounded by commercial buildings to the west, industrial buildings to the north and southeast, office and high-density residential buildings to the south and residential homes to the northeast. See Figure A.1 in Appendix A of this report for the vicinity map of the site location.

The project proposes a new pedestrian and bicycle path addition on the south side of NE 85th Street from 6th Street to 114th Avenue NE, creating a connection to the Cross Kirkland Corridor (CKC). In addition to the pedestrian and bicycle improvements, other improvements include a proposed storm drain conveyance system, illumination, landscaping, and a pedestrian bridge crossing over the CKC.

There are multiple existing drainage systems currently collecting stormwater from the site. Ultimately, these systems discharge runoff to the east and combine at an existing conveyance system near the southwest corner of the project site. Thus, a single Threshold Discharge Area (TDA) was identified in the project area. The drainage systems are discussed further in Section 4.1 – Existing Site Hydrology.

This project is designed to meet the requirements of the 2021 King County Surface Water Design Manual (KCSWDM) with modifications adopted by the City of Kirkland.

1.1 Existing Conditions

The project site is a developed four-lane roadway with moderate to steep slopes on both sides of the roadway west from the NE 85th Street and I-405 interchange. The roadway consists of a typical lane width of 11 feet and a 4 feet shoulder along both sides. On both ends of the project limits, at 6th Street and 114th Avenue NE, the roadway expands to six-lanes with two southbound protected left turn lanes at 6th Street, one westbound merge lane and one northbound protected left turn lane at 114th Avenue NE. The roadway is crowned at an offset from the existing centerline approaching the bridge over the CKC and transitions to a super-elevation toward 6th Street at STA 14+25. Curbs are identified along the guardrail adjacent at both ends of the roadway and were observed to be in good condition with no sign of erosion. Overall, the roadway seems to be in good condition with a fair amount of longitudinal cracking.

The roadway has a flat to moderate incline approaching the bridge with longitudinal and transverse slopes at a maximum grade of 6% and 3%, respectively. The existing slopes limit ponding and force runoff to sheet flow into a closed stormwater conveyance system composed of catch basins and storm drain pipe.

Table 1.1.1 below summarizes the delineation of land cover associated with the existing conditions of the site.

Table 1.1.1. Existing Conditions.

TDA	Area				
	Pollution Generating Impervious Surface (PGIS)	Non-Pollution Generating Impervious Surface (NPGIS)	Total Existing Impervious Surface	Existing Pervious	Total TDA Area
TDA 1	147,487 SF	15,780 SF	163,267 SF	84,919 SF	**248,138 SF**

1.2 Proposed Conditions

The proposed improvements include the introduction of a new pedestrian and bike path on the south side of the project site, replacing the existing storm drainage and providing on-site stormwater management. The typical cross section of the path is 4' of exposed aggregate/planter boxes and 13.5' of sidewalk. This accounts for the increase in NPGIS below, as well as the decrease in pervious surfaces, and roadway surface (PGIS). The existing roadway geometry will remain unchanged, and the new path will slope back toward the roadway. Stormwater will be collected and routed by a series of catch basins along the gutter line of NE 85th Street. A flow splitter, at the west end of the project site, will be proposed to split flows between the detention vault and the storm network that bypasses the detention vault. Proximity to a steep slope and infiltration testing, performed as a part of the geotechnical report in Appendix F, determined that infiltration is not feasible within the project area. Thus, all runoff will be captured in catch basins and conveyed to the west in storm drain pipes. The existing connection to the storm drain system at the intersection of NE 85th Street and 6th Street will remain. See Sections 4.1 and 4.2 for a discussion of the existing and proposed facilities. The proposed detention vault facility is discussed below in Section 4.5.

Tables 1.2.1 and 4.2.1 below detail the proposed land cover conditions. See Appendix B for the proposed conditions figures.

Table 1.2.1. Proposed Conditions.

TDA	Area				
	Pollution Generating Impervious Surface (PGIS)	Non-Pollution Generating Impervious Surface (NPGIS)	Total Impervious Surface	Pervious	Total TDA Area *
TDA 1	141,029 SF	49,974 SF	191,003 SF	57,135 SF	**248,138 SF**

*The total proposed area is equal to the summation of total new and replaced impervious and new pervious surfaces.

1.3 Site Soils

Based on review of the US Department of Agriculture National Resources Conservation Services (NRCS) Web Soils Survey (WSS), the soils within the TDA consist of the following:

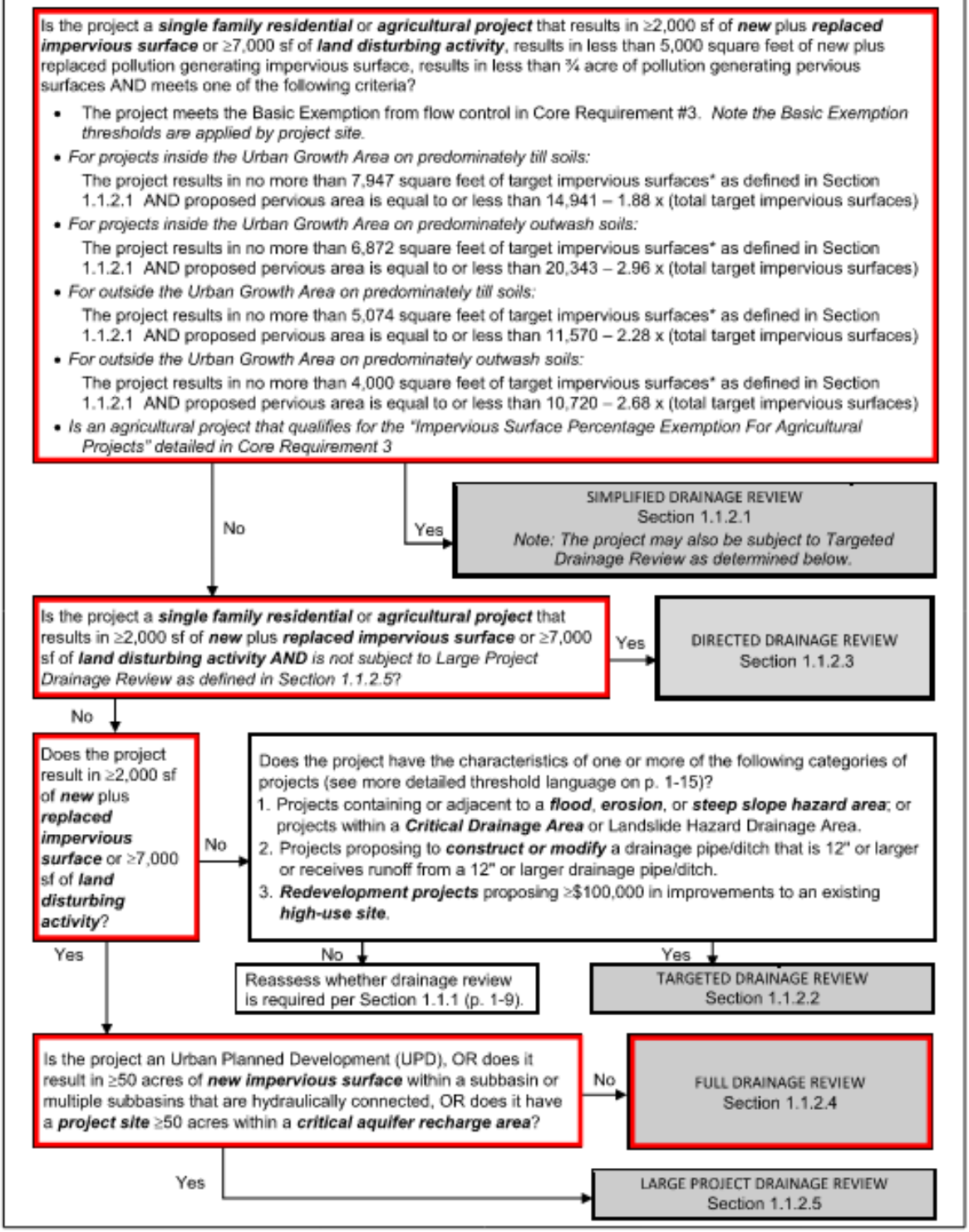
On-site soils within the project site consist of 100% of Alderwood Gravelly Sandy Loam (AgC) at 8-15 percent slopes. This soil type is listed as hydrologic Soil Group B, but is known to be a Group C soil. The site estimates that the depth of the water table is roughly two feet. See Appendix Figure A.3 for the Soils Map.

2.0 CONDITIONS AND REQUIREMENT SUMMARY

The NE 85th Street Ped/Bike Connection project is designed to meet the requirements outlined in the 2021 King County Surface Design Manual (2021 KCSWDM) and the City of Kirkland's Addendum to the 2021 KCSWDM This project is proposing 28,371 SF and 15,577 SF of new and replaced impervious surfaces, respectively. Twelve-inch storm drainage pipes will be proposed along the project, while maintaining existing systems. Since the project will install over 2,000 SF of new plus replaced impervious surfaces it will be subject to a full drainage review under the City of Kirkland's Policy D-3 (see Figure 2.1 for the Drainage Review Flow Chart) and will be exempt from some of the Core Requirements and Special Requirements. For a summary of which requirements will be required or exempt and an associated explanation, refer to Table 2.0.2. Tables 2.0.2 and 2.0.3 summarize the Core and Special Requirements with which the project must comply.

SECTION 1.1 DRAINAGE REVIEW

FIGURE 1.1.2.A FLOW CHART FOR DETERMINING TYPE OF DRAINAGE REVIEW REQUIRED



4/24/2016 2016 Surface Water Design Manual

Figure 2.1. Drainage Review Flow Chart.

Table 2.0.2. Explanation of Core Requirements.

Core Requirement (CR)/Special Requirement (SR)	Required or Exempt?	Explanation
CR #1 – Discharge at Natural Location	Required	All stormwater runoff from the project must be discharged at the natural location so as not to be diverted onto or away from down slope properties and runoff must not create a significant adverse impact to downhill properties. There are no exemptions to this requirement.
CR #2 – Off-Site Analysis	Required	There will be no exemptions to this requirement since the project is located on an erosion, steep slope, and landslide hazard area. See Section 3 of this memo.
CR #3 – Flow Control	Required	The project creates more than 5,000 SF of new plus replaced impervious surfaces, so Flow Control is required for the Project. The project is partially in a Conservation Flow Control area, meaning that Level 2 Flow Control is required. The targeted surfaces for this project are new impervious, and not replaced, because new impervious surfaces add less than 50% to the existing impervious surfaces within the project site.
CR #4 – Conveyance System	Required	All engineered conveyance system elements for proposed projects must be analyzed, designed, and constructed to provide a minimum level of protection against overtopping, flooding, erosion, and structural failure.
CR #5 – Erosion and Sediment Control (ESC)	Required	All proposed projects that will clear, grade, or otherwise disturb the site must provide erosion and sediment controls to prevent sediment from leaving the site as much as possible.
CR #6 – Maintenance and Operations	Required	Maintenance and operation of all drainage facilities is the responsibility of the City of Kirkland who assumes maintenance and operation in the Kirkland Municipal Code (KMC) 15.52.070. Drainage facilities must be maintained and operated in accordance with the maintenance standards.
CR #7 – Financial Guarantees and Liability	Required	All stormwater facilities will be owned and maintained by the City of Kirkland per KMC 15.52.080.
CR #8 – Water Quality Facilities	Exempt	The project creates less than 5,000 SF of new pollution generating impervious surfaces (PGIS) and will be exempt from this Core Requirement.
CR #9 – Flow Control BMPs	Required	This is not feasible due to proximity to steep slopes.

Table 2.0.3. Explanation of Special Requirements.

Special Requirement (SR)	Required or Exempt?	Explanation
SR #1 – Other Adopted Area-Specific Requirements	Exempt	Project is not in an area with specific requirements.
SR #2 – Flood Hazard Area Delineation	Exempt	The project is not located in a flood hazard area.
SR #3 – Flood Protection Facilities	Exempt	According to the City of Kirkland's Addendum to the 2021 KCSWDM, this section does not apply.
SR #4 – Source Controls	Exempt	The project is a roadway project with no commercial buildings.
SR #5 – Oil Control	Exempt	The project is not located in a high-use site and creates less than 5,000 SF of new pollution generating impervious surfaces (PGIS). Therefore, this project is exempt from this Special Requirement.

3.0 OFF-SITE ANALYSIS

The Kirkland NE 85th Street Ped/Bike Connection project expands the southern end of the corridor along NE 85th Street from 6th Street to 114th Avenue NE. Currently utilized as a major east-west corridor for vehicle traffic. The proposed work on the project is to install a bike and pedestrian path to promote multimodal transportation along NE 85th Street.

A level 1 site reconnaissance investigation was completed on February 28, 2023. The purpose of the investigation was to confirm the on-site and off-site storm drainage systems and storm drainage patterns, as well as to qualitatively analyze the related existing downstream stormwater conveyance systems. The weather was rainy with a temperature of 50 degrees Fahrenheit. Prior to being on-site, the topography and existing conveyance systems were observed using information from the topographic survey basemap and the City of Kirkland GIS system.

In TDA 1, the project is located in the East Lake Washington – Bellevue North Basin where runoff will discharge directly into Lake Washington from a piped conveyance system downstream of the project, which is considered a stream by the City of Kirkland. See Figures A.1 and A.2 for the Site Vicinity Map, TDA Location Map, respectively.

3.1 Resource Review

Floodplain/Floodway (FEMA) Maps

This site is not delineated within a floodplain or floodway.

Sensitive Area

Refer to Figure A.4 in Appendix A for the critical areas that affect and are closest to the project area. This map combines maps of the project's area, the surrounding waters, floodplains, wetlands, and environmentally sensitive areas.

Streams:	The downstream "stream in pipe" is the main stream in the project's vicinity.
Floodplains:	The site is not delineated within a floodplain or floodway.
Wetlands:	There are no wetlands on or near the site.
Erosion Hazard Areas:	According to King County GIS, the site is not recorded as an Erosion Hazard Area. However, there is known erosion concern due to steep slopes.
Landslide Hazard Areas:	The site is located within a Landslide Hazard Area.

DNRP Drainage Complaints and Studies

Per the King County Water and Land Resources Division, there are three relevant (resolved within the last 10 years) drainage complaints surrounding the site. The following complaints are listed below:

- 2018-0990: flooding complaint, resolved.
- 2018-0991: flooding complaint, resolved.
- 2018-0992: flooding complaint, resolved.

City of Kirkland Drainage Complaints

According to Kirkland Public Records, there are no drainage complaints within a mile downstream of the project site.

Road Drainage Problems
There are no known roadway drainage problems.

Soils Survey
The NRCS WSS is briefly discussed in Section 1.3 (see Figure A.3 for an overview of the soil's classification surrounding the project site).

Department of Ecology Water Quality Assessment
Ecology's Water Quality Atlas contains 303 (d) listings for Lake Washington:

- Lead (Category 2)
- Ammonia-N (Categories 1 and 2)
- Bacteria – Fecal Coliform (Categories 1, 2, and 5)
- Mercury (Category 2)
- Non-Native Aquatic Plants (Category 4C)

King County Designated Water Quality Program
There are no known water quality issues.

Other Adopted Area-Specific Requirements
There are no known water quality issues.

3.2 Field Inspection

A field inspection was performed on February 28, 2023, with representatives from Perteet present. The day was overcast, and conditions were wet due to continuous precipitation leading up to and during the investigation. On-site conditions were inspected to identify any drainage problems not found during resource review. The entire length of the project was inspected, and drainage structures, roadway features, and existing conditions were documented below. The locations of the following photos are depicted in Figure A.5 in Appendix A.

Photo 1. North side of the road, looking east. Taken at west end of project near 6th.

Photo 2. North side of the road, looking west. Taken at the west end of the project near 6th.

Photo 3. Discharge location on north side of project.

Photo 4. Drainage ditch under bridge on CKC near east end of project. Leaves TDA limits and flows north.

Photo 5. Outfall location on north side of project, east of the bridge.

Photo 6. Discharge location near intersection of 85th and 114th.

Photo 7. Catch basin on south side of road just east of the bridge.

Photo 8. Discharge point on south side, just west of the bridge.

Photo 9. Existing ditch south of 85th.

Photo 10. Outfall location south of 85th.

Photo 11. Catch basin on pedestrian path south of 85th.

Photo 12. Catch basin along pedestrian path.

Photo 13. Ditch enters tightline conveyance system south of 85th.

Photo 14. 6th Street looking south. Shown on the middle right side of the picture in the middle lane is the catch basin where the downstream discharge routes combine.

3.3 Drainage System Description and Problem Description

This section describes possible upstream impacts of the project and analyzes downstream flow paths and potential issues ¼ mile downstream from the project site.

3.3.1 Upstream Analysis

Off-site runoff enters the project limits from one location at the intersection of NE 85th Street and 114th Avenue NE. Runoff from the sidewalk and roadway surfaces sheet flows in a westerly direction from the intersection and is captured by an existing conveyance system, via catch basins at the northeast and southeast corners of the bridge crossing the CKC. The northeastern catch basin outfalls into a stream flowing in a westerly direction. While the southeastern catch basin outfalls to a ditch system and flows northernly until connecting with the stream. Both outfalls are connected to one of three stormwater systems that crosses the project site, but does not connect into the stormwater system along NE 85th Street. Therefore, all runoff collected in the surrounding area from the various land use is routed around or through the project site. See Section 3.3.2 for a defined delineation of the discharge points and downstream flow paths.

3.3.2 Downstream Analysis

There are 12 discharge points shown and numbered within the project site on Figure A.5 in Appendix A. 11 of the 12 discharge points leave the site and outfall within three stormwater systems as mentioned in Section 3.3.1, which eventually meet in an existing conveyance system within a quarter mile. Each of the stormwater systems collects runoff from the surrounding upstream area and from the project's discharge points, routing runoff around and through the project site without connection to the stormwater system along NE 85th Street.

The first stormwater system to the north collects runoff from Discharge Points 7-12 and upstream area from I-405, residential, commercial, and industrial buildings to the north and east of the project site. Discharge Point 12 on the east end of the project enters an existing tightline system that then outfalls to the north into an existing stream. Discharge Point 11 enters the stream from the south, after flowing north from NE 85th Street for approximately 120 feet. Discharge Point 7 collects runoff from a catch basin near the southeast corner of the bridge and outfalls to a ditch on the east side of the CKC. The ditch directs the runoff north for approximately 150 feet before intercepting an easterly flowing stream. Then traveling west through a conveyance system, meeting up with a lateral line flowing from Discharge Point 10. Discharge Points 8 and 9, the westernmost of these, each flow roughly 100 feet in an outfall pipe that will meet the combined streamflow. Just after the stream's confluence with Discharge Point 8, the streamflow will travel through a culvert for roughly 300 feet south, crossing the project site, before intercepting the second stormwater system through a conveyance system at CB #8494.

The second stormwater system to the south collects runoff from Discharge Points 3-6 and upstream area from the highly dense residential and commercial buildings from the south. Discharge Points 4, 5, and 6 each flow roughly between 80-130 feet before outfalling into a ditch, meeting with the second stormwater system. The combined flows travel easterly, parallel to the south side of the project site, through a piped system just after Discharge Point 4 and meets up with the flow from Discharge Point 3 and the first stormwater system at CB #8494. Stormwater will continue westward and combine with the third stormwater system and Discharge Point 2 at CB #7855. The third stormwater system collects runoff from Discharge 1 and upstream area from commercial buildings located near the northwestern corner of the project site. The stormwater system crosses the project along east side of intersection of NE 8th Street and 6th Street. Discharge Point 2 collects roadway runoff from the southwest side of the project site.

The third stormwater system at Discharge Point 2 will exit the project site through a piped conveyance system and merge with the rest of the flows from the first and second stormwater systems at CB #7855. After the convergent point, the combined flow heads west for approximately 250 feet in the piped conveyance system before traveling along the south side of Central Way. The flow path continues southeasterly for approximately 1,050 feet until the ¼ mile mark is reached.

3.4 Mitigation of Existing or Potential Problems

The primary problems encountered during resource review and field inspection are water quality concerns and flooding issues near the downstream system. The review of the 303d listings for Lake Washington shows several different Category 5 issues. The proposed system will remove sediment via catch basins and the detention facility, which will decrease the project's impact on these existing drainage issues. The detention of runoff from NE 85th Street will mitigate flow from the project site, reducing the impact of the project. The drainage complaints found near the flow path downstream of the project have all been resolved, and most of them have been resolved over a decade ago. Also, there are detention facilities visible on Central Way and 6th Street that should aid in prevention of potential flooding, in addition to the facility added with this project. No downstream impacts are expected to occur as part of this project.

4.0 FLOW CONTROL, LOW IMPACT DEVELOPMENT (LID), AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

4.1 Existing Site Hydrology

The entire corridor is curbed where water is conveyed toward the gutter on either side of the roadway. The roadway is crowned with a longitudinal and transverse slope of roughly 6% and 2%, respectively. Along NE 85th Street, the main stormwater system collects runoff from a series of catch basins. These catch basins direct runoff down the hillside through 8" PVC pipes and immediately outfall into a stream system on the north side or ditch system on the south side. Refer to Section 3.3.2 for details on the downstream analysis. There is no typical lateral and trunk line configuration presented on NE 85th Street until the southwest end of the project near 6th Street. At this location, stormwater will be collected by a conveyance system just downstream from the median island and discharge from the project site at a distance of 250 ft from the initial point of the conveyance system.

4.2 Proposed Site Hydrology

The project site consists of a single Threshold Discharge Area (TDA) with the improvements being proposed on the south side of the project area. One of the improvements is a stormwater conveyance system along the south side of NE 85th Street, where a series of catch basins will be added to the new flowline to capture runoff. The road slopes consistently toward the west without forming any low points. Runoff from the roadway will flow south toward the gutter, while runoff from the pedestrian and bicycle path, as well as the pedestrian bridge, will flow north into the stormwater conveyance system. The pedestrian bridge will not include structures to capture runoff, as the path on the bridge will not be affected by flow spread or depth. Captured runoff will be routed west through a piped conveyance system, replacing the existing downhill outfalls. The proposed flow control system location will be infeasible to install and maintain access within the proposed project area or within the hillside. Therefore, the proposed location is at the base of the hill within a flat surface. This suitable area is available at the southeast corner of the intersection of NE 85th Street and 6th Street, between NE 85th Street and the parking lot adjacent to the pedestrian path in order to prevent significant disturbance to the existing pavement.

The flow control system proposed for this project is to provide the required detention of stormwater. However, the amount of runoff collected from NE 85th Street will exceed the system's allowable capacity without installing a flow splitter to regulate mitigated and unmitigated flows, see Figure C.1-C.4 in Appendix C. A flow splitter will be necessary prior to the proposed detention vault. WWHM was used as a tool to assist in creating the flow splitter rating table due to its ease and speed to perform that type of hydraulic calculation. Perteet's design splits the respective 100-year flow rates between the proposed flow control system and the existing conveyance system along NE 85th Street at approximately the same elevation head. Refer to Section 4.4 and Section 5.0 for more information on detention vault sizing and conveyance analysis, respectively.

4.3 Performance Standards

Table 4.2.1 below summarizes the proposed land cover areas as well as flow control and water quality thresholds for each TDA within the project. Note that this project is in a Conservation Flow Control Area according to the City of Kirkland's Flow Control Map and will be subjected to a Level 2 flow control standard. The project site is shown in a Conservation Flow Control Area because the City classifies the conveyance system runs along the north side of 85th and crosses 6th Ave as a stream, as mentioned in Section 3.1. The project is characterized as a transportation redevelopment project. All of the applicable core requirements (1-7 and 9) apply to new hard surfaces only.

Table 4.2.1. Proposed Land Cover.

	Surface	Area TDA 1
A	New PGIS	0 SF
B	New NPGIS	29,036 SF
C	Converted PGIS (previously NPGIS)*	40 SF
D	Replaced PGIS	7,720 SF
E	Replaced NPGIS	10,383 SF
F	New Pervious	1,094 SF
	Total	48,068 SF
	Project Analysis	
	Surface	Area TDA 1
Table 2-1	Existing Impervious Surface	163,250 SF
A + B	**New Impervious Surface**	**29,036 SF**
	Percent New Impervious Surface/ Existing Impervious Surface	**17.8%**
	TDA Analysis	
	Surface	Area TDA 1
A + B + F	**New Impervious and Pervious Surfaces**	**30,130 SF**
	Flow Control Required:	**Yes**
A + C	**New Plus Converted PGIS**	**40 SF**
	Water Quality Required:	**No**

*This is the total area of existing NPGIS that has been converted to PGIS in the proposed condition. This area is counted as new PGIS for water quality treatment and Replaced Impervious for flow control calculations.

As determined by the threshold analysis from the table above, flow control will apply to the project because more than 5,000 square feet of new plus replaced impervious surface is created within the project. The targeted surfaces for flow control on this project are new impervious and pervious surfaces only. Water quality treatment will not be applied to the project because less than 5,000 square feet of Pollution Generating Impervious Surfaces (PGIS) is created within the project. Per KCSWDM, redevelopment projects in a Conservation Flow Control Area that add less than 50% to the existing impervious area do not have to provide flow control and water quality treatment for the replaced surfaces, only the new surfaces.

The proposed land cover conditions are shown in Figure B.1 in Appendix B. This figure provides a delineation of new impervious (PGIS and NPGIS) and pervious surfaces targeted for detention.

4.4 Flow Control System

Drainage from the project area goes to a stormwater trunk line in NE 85th Street that drains to Lake Washington via a constructed drainage network. Since Lake Washington is defined by Ecology as an exempt water body, a direct discharge option was explored for the project in lieu of on-site flow control conducted by Northwest Hydraulic Consultants (NHC), in a separate memorandum cover called, “NE 85th Street Trunk Line Hydraulic Model Development”. Preliminary hydrologic and hydraulic modeling of the watershed and trunk line indicated that a more thorough investigation would be required to determine capacity of downstream system. Due to the

size and complexity of the basin and time constraints, the project is not undergoing more thorough investigation into the direct discharge exemption and detention will be provided.

The project triggers flow control requirements. Since the project is in a Conservation Flow Control Area with documented conveyance system issues downstream of the site, it will be required to match historic durations of 50% of the two-year through 50-year peaks in addition to the historic two-year and 10-year peaks. A detention vault has been designed to provide flow control for this added impervious surface. An equivalent area on the south side of the street approximately between STA 12+30 and STA 29+10 will be captured and routed through the conveyance system of 11 catch basins in series. As mentioned in Section 4.2, the total equivalent area upstream will surpass the system's allowable capacity without installing a parallel conveyance system. This will require a flow splitter to split flow rates between the detention vault and the existing conveyance system along NE 85th Street that bypasses the detention vault.

To determine the flow rate splits within the flow splitter, the total contributing area collected by the conveyance system upstream of the flow splitter was divided among two paths: 1.) Runoff directed to the detention vault that consists of the targeted surface area (new impervious surface) and flow-through area. The maximum flow that is allowed to "flow through" the vault is determined by the following rule found in the 2021 KCSWDM on page 1-52: "If the existing 100-year peak flow rate from any upstream area is greater than 50% of the 100-year developed peak flow rate for the area that must be mitigated, then the runoff from the upstream area must bypass the facility". The area captured by the detention vault will include area allowed by this "50 percent rule" to the maximum extent feasible. 2.) The remaining runoff bypasses the vault via existing conveyance system along NE 85th Street. The flow restrictors within the catch basin were configured so that the flow rate generated by the required targeted surfaces plus the flow-through area would enter the vault. The area required for flow control and the flow-through area is identified in Table 4.4.1. with a modeled 50-year flow rate of 1.127 cfs. The total area bypassing the detention vault produces a flow rate of 1.011 cfs. For more detail on the flow splitter calculations, refer to Appendix C.

The vault has been sized using MGSFlood, a continuous flow simulation modeling program. The resulting structure is 84' x 12' x 6' with a capacity of 6,048 CF in 6' of live storage and is located at the southeast corner of the intersection of NE 85th Street and 6th Street, between NE 85th Street and the parking lot near the pedestrian path.

Table 4.4.1 TDA 1 On-Site Capture Area (Flow Control).

Stormwater Facility	Capture Impervious Area *	50-year Flow Rate
Targeted Surface Area	0.692 AC	1.127 cfs
Flow through Area (50% rule)	0.336 AC	
Total Area Bypassing the Detention Vault	0.922 AC	1.011 cfs
Total Equivalent Area:	1.950 AC	

*The Captured Impervious Areas are shown in the Equivalent Area Map in Appendix C

4.5 Water Quality System

Water quality is not required for this project based on the threshold analyses performed.

4.6 Flow Control Best Management Practices (BMPs)

The chosen Flow Control BMP for this project is a detention vault, due primarily to constructability and space concerns that rule out most other options. The vault was modeled with continuous simulation in MGSFlood with 15-minute timesteps. Pre-development landcover, as mentioned above, was assumed as historic conditions, so the pre-development basin was modeled as forested. The post-development basin was modeled as an impervious roadway surface. Also included in both scenarios is flow-through area per the KCSDWM 50% rule stated in section 4.4 (areas shown in the Equivalent Area Map in Appendix C) due to there being more contributing area to the vault than was necessary. This model was then run for multiple iterations until the size of the vault had been optimized while still meeting the Level 2 Flow Control requirement detailed above.

Table 4.3.1. Flow Control BMP Feasibility Summary.

BMP	Category	Feasible (Yes/No)	Explanation
Full Dispersion	1	No	The total pervious landcover is very limited with the presence of steep slopes.
Full Infiltration	2	No	The total pervious landcover is very limited with the presence of steep slopes.
Limited Infiltration	2	No	Infiltration BMPs are infeasible, see the geotechnical report in Appendix F.
Bioretention	2	No	The total pervious landcover is very limited with the presence of steep slopes.
Permeable Pavement	2	No	Steep slopes are present.
Basic Dispersion	3	No	In addition to the presence of steep slopes, the available space within the project area will be developed.
New Pervious Surfaces Moisture Holding Capacity	4	Yes	Post construction soil moisture holding capacity shall be protected in accordance with King County Code (KCC) 16.82.100 (F) and (G).

5.0 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

The project proposes a piped conveyance system along the south side of NE 85th Street routing runoff westerly toward 6th Street as shown on the Drainage Plans in Appendix E. The new conveyance system will replace the existing system that collects and directs runoff downhill before outfalling into an existing ditch. All connections to the existing catch basins at 6th Street will remain unchanged. The proposed system also includes a proposed detention vault located at the southwest end of the project near 6th Street between NE 85th Street and the existing pedestrian path. Due to proposed conditions, the total contributing area will exceed the system's allowable flow capacity and will require a flow splitter catch basin. Flows will be split between the detention vault and the existing conveyance system that bypasses the detention vault. See Appendix C for additional information for detention vault and flow splitter calculations.

A StormShed3G model has been developed to determine the hydraulic grade line at each structure in the proposed system. The system was broken into three separate modeling layouts, due to the constraints of StormShed3G. The section upstream of the flow splitter was modeled using the Rational Method. While the two downstream sections, discharging from the flow splitter on NE 85th Street were modeled with fixed flow. It was determined that the proposed system has the capacity to convey the 25-year storm, as required by the 2021 King County Surface Water Design Manual, the regulatory manual for this project.

For the portion of the project tributary to the proposed detention vault and the flow splitter, the conveyance modeled in StormShed3G has been used to confirm that the system has adequate capacity to capture and convey the 25-year storm.
The project also includes a proposed piped conveyance system along the south side of NE 85th Street, east of the proposed pedestrian bridge. The new conveyance system will replace the existing system that collects and directs runoff downhill before outfalling into an existing ditch near the CKC.

Conveyance calculations for this analysis can be found in Appendix D of this TIR.

6.0 SPECIAL REPORTS AND STUDIES

A draft geotechnical engineering report was prepared by HWA GeoSciences, Inc. in March 2023. The draft report and field explorations are included in Appendix F of this report.

7.0 OTHER PERMITS

- NEPA
- SEPA
- NPDES

8.0 CSWPP ANALYSIS AND DESIGN

The project plans include site preparation and erosion control plans which show erosion and water pollution control elements. A CSWPPP will be created by the contractor prior to construction. Table 8 below summarizes how erosion and sediment control will likely be addressed during construction of this project; however, it will be up to the Contractor's Erosion and Sediment Control (ESC) Lead to determine the most appropriate BMPs and to ensure they are installed correctly and maintained.

Table 8. Summary of ESC Measures.

ESC Category	Proposed Measures
Clearing Limits	Silt fencing or high visibility fencing will be placed at the south end of the project site at the clearing limits.
Cover Measures	Fill material will be placed on top of cleared formerly vegetated steep slope to the south of the project to create the pedestrian path. Erosion control nets and blankets or plastic covering should be placed to prevent erosion after clearing occurs, and after filling to prevent sediment transport down the slope.
Perimeter Protection	Silt fence will be installed at the bottom of the fill slope from 85th and around detention vault excavation.
Traffic Area Stabilization	Stabilized construction entrances will be installed at all locations where construction vehicles will be entering and exiting the project site.
Sediment Retention	Storm drain inlet protection will be used at all new and existing catch basins to protect downstream water.
Surface Water Collection	Existing storm drains will be used when possible, but interceptor dikes and swales should be used upstream of the cleared areas to prevent 85th runoff from flowing down the slope.
Dewatering Control	Dewatering may be necessary if groundwater is encountered during construction of drainage facilities.
Dust Control	If dust becomes an issue, the contractor will spray water on exposed soils without creating runoff.
Flow Control	Temporary storage tanks such as Baker Tanks shall be used as needed.
Control Pollutants	The contractor will be required to have a certified erosion and sediment control lead on site. Filtration systems are recommended downstream of temporary storage tanks if necessary. The ESC lead will be required to follow the project Stormwater Pollution Prevention Plan which will address how pollutants will be controlled.
Protect Existing and Proposed Flow Control BMPs	The proposed detention vault will be protected.
Maintain BMPs	Any BMP installed will be maintained at a minimum to the standards outlined in the *2021 KCSWDM.*
Manage the Project	The project specifications will call for a certified erosion and sediment control lead to be on-site.

9.0 BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

All proposed facilities will be owned and maintained by the City of Kirkland. No bond will be required.

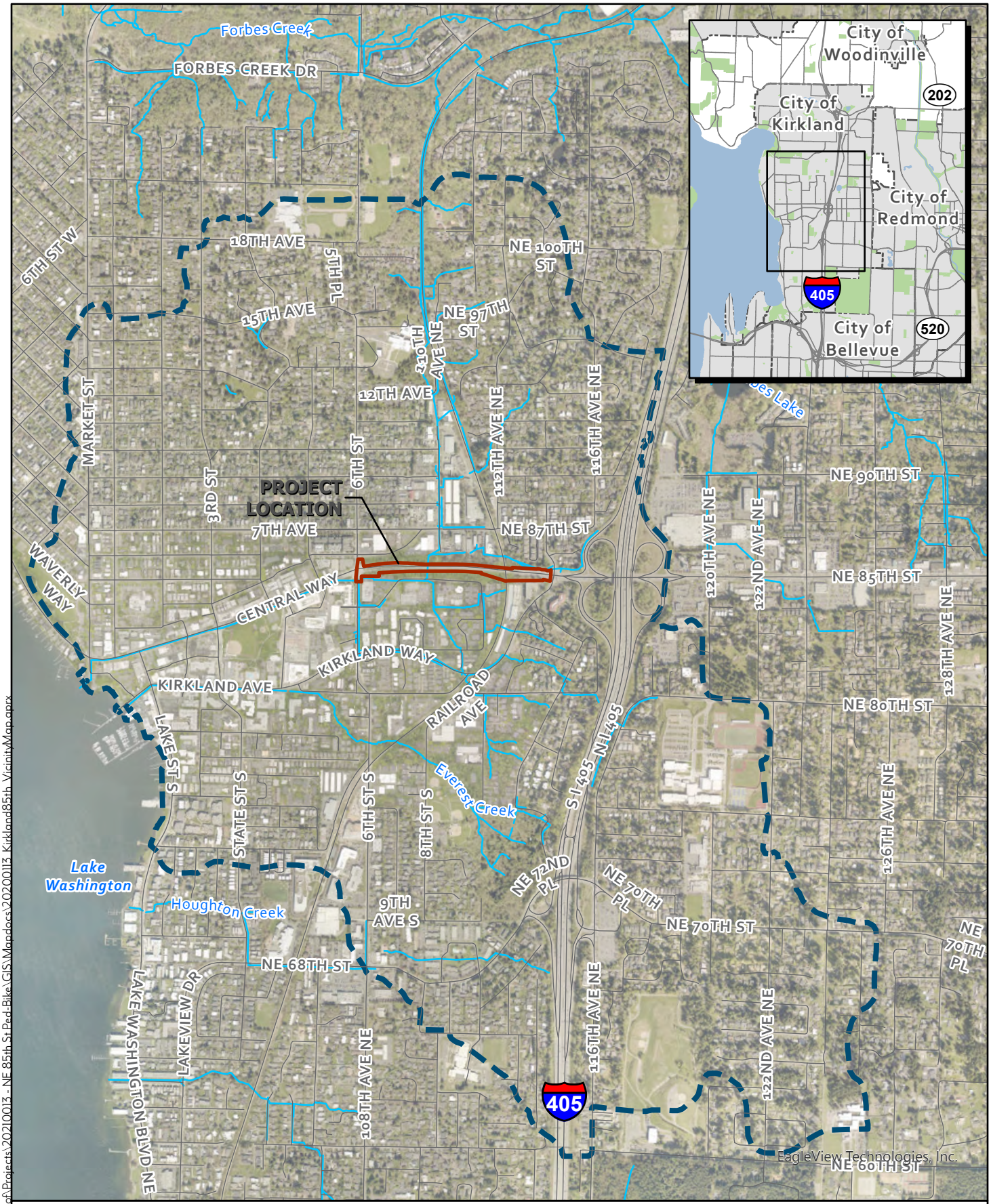
10.0 OPERATIONS AND MAINTENANCE MANUAL

The City will be responsible for maintaining the drainage components. Items to be maintained include but are not limited to: removing debris and blockages at inlets/grates to storm collection structures; removing sediment accumulation from catch basins, pipes, and storm collection structures; maintaining landscaping; and stabilization of pervious areas.

Maintenance requirements for all proposed stormwater related facilities are included in Appendix G. The proposed drainage system consists of the following elements:

- Catch Basins
- Flow Control Structure
- Flow Splitter Structure
- Storm Drain Pipe
- Detention Vault

APPENDIX A
Existing Conditions Figures



PERTEET

0 750 1,500
Feet

Legend
- Project Location
- Stream
- Basin Boundary

City of Kirkland
NE 85th Street Ped/Bike Connection
Vicinity Map
Figure A.1

Path: X:\Kirkland_City of\Projects\20210013 - NE 85th St Ped-Bike\GIS\Mapdocs\20200113_Kirkland85th_VicinityMap.aprx

Date Exported: 6/17/2024 3:07 PM Source: King County;

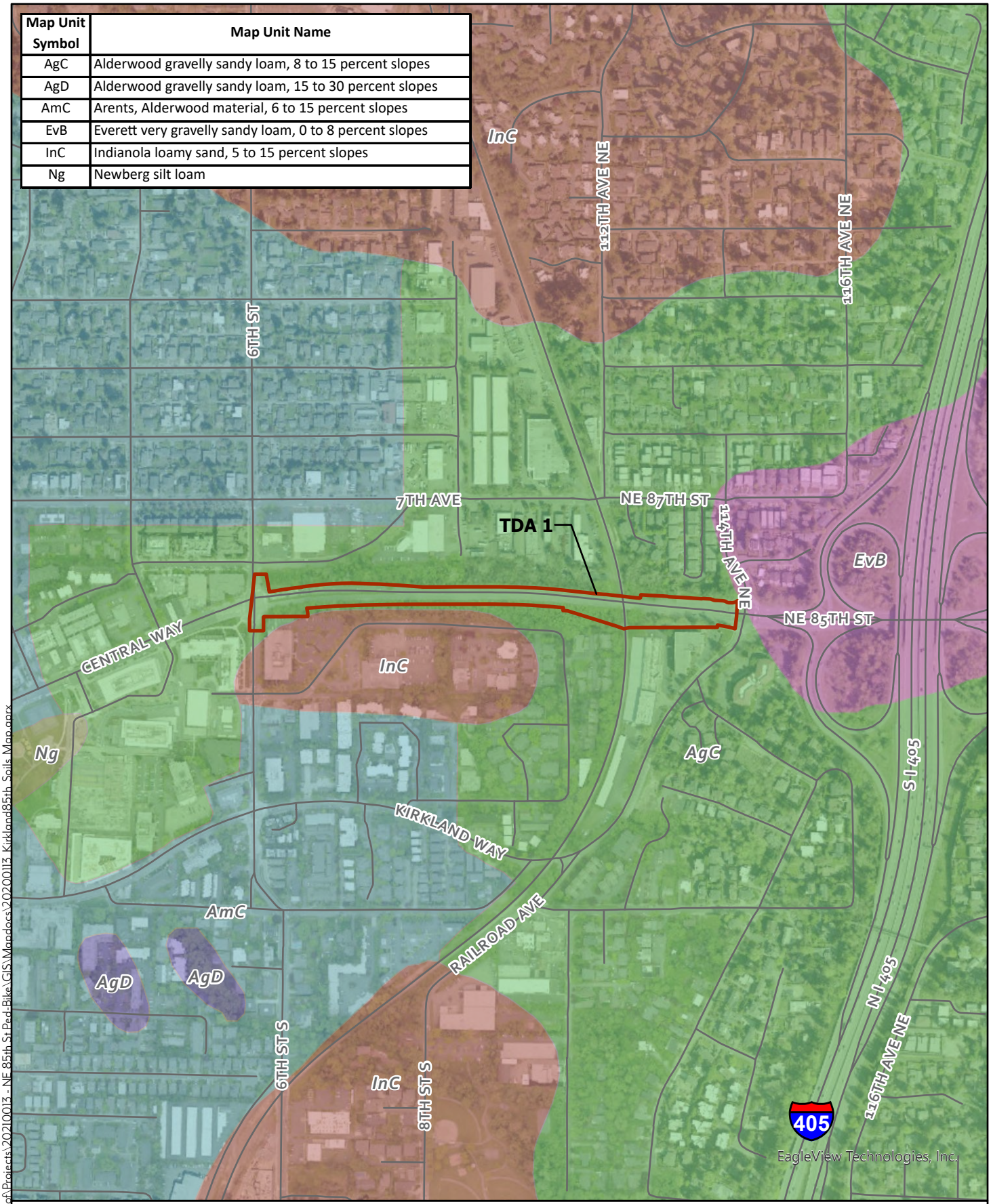
Path: X:\Kirkland_City of\Projects\20210013 - NE 85th St Ped-Bike\GIS\Mapdocs\20220113_Kirkland85th_TDALocationMap.aprx

PERTEET

0 300 600
Feet

City of Kirkland
NE 85th Street Ped/Bike Connection
TDA Location Map
Figure A.2

Date Exported: 6/17/2024 3:15 PM Source: City of Kirkland; King County



PERTEET

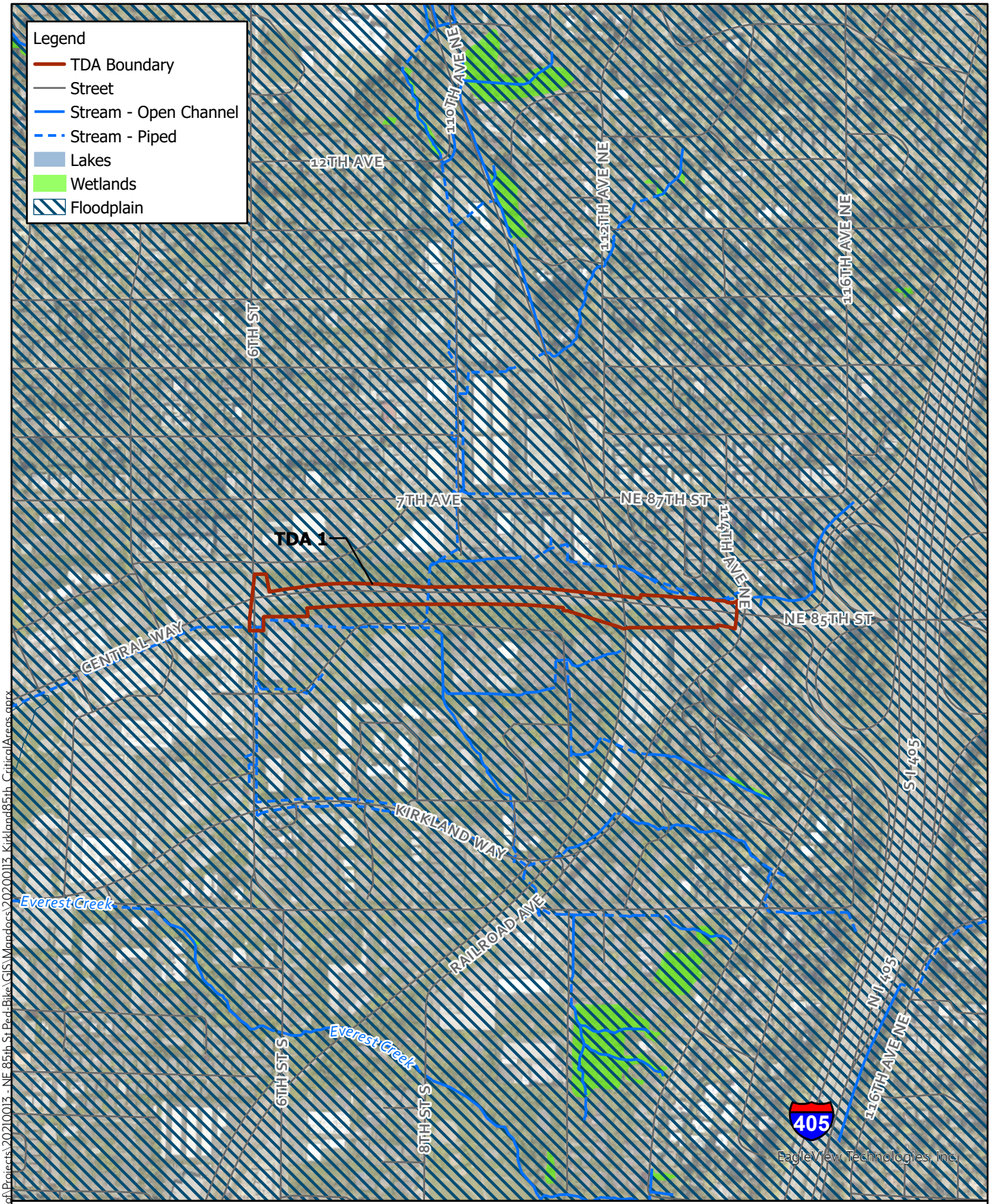
0 300 600
Feet

Legend
TDA Boundary

City of Kirkland
NE 85th Street Ped/Bike Connection
NRCS Soils Map
Figure A.3

Path: X:\Kirkland_City_of\Projects\20210013 - NE 85th St Ped-Bike\GIS\Mapdocs\20210113_Kirkland85th_Soils_Map.aprx

Date Exported: 6/17/2024 3:19 PM Source: City of Kirkland; King County, Natural Resource Conservation Service



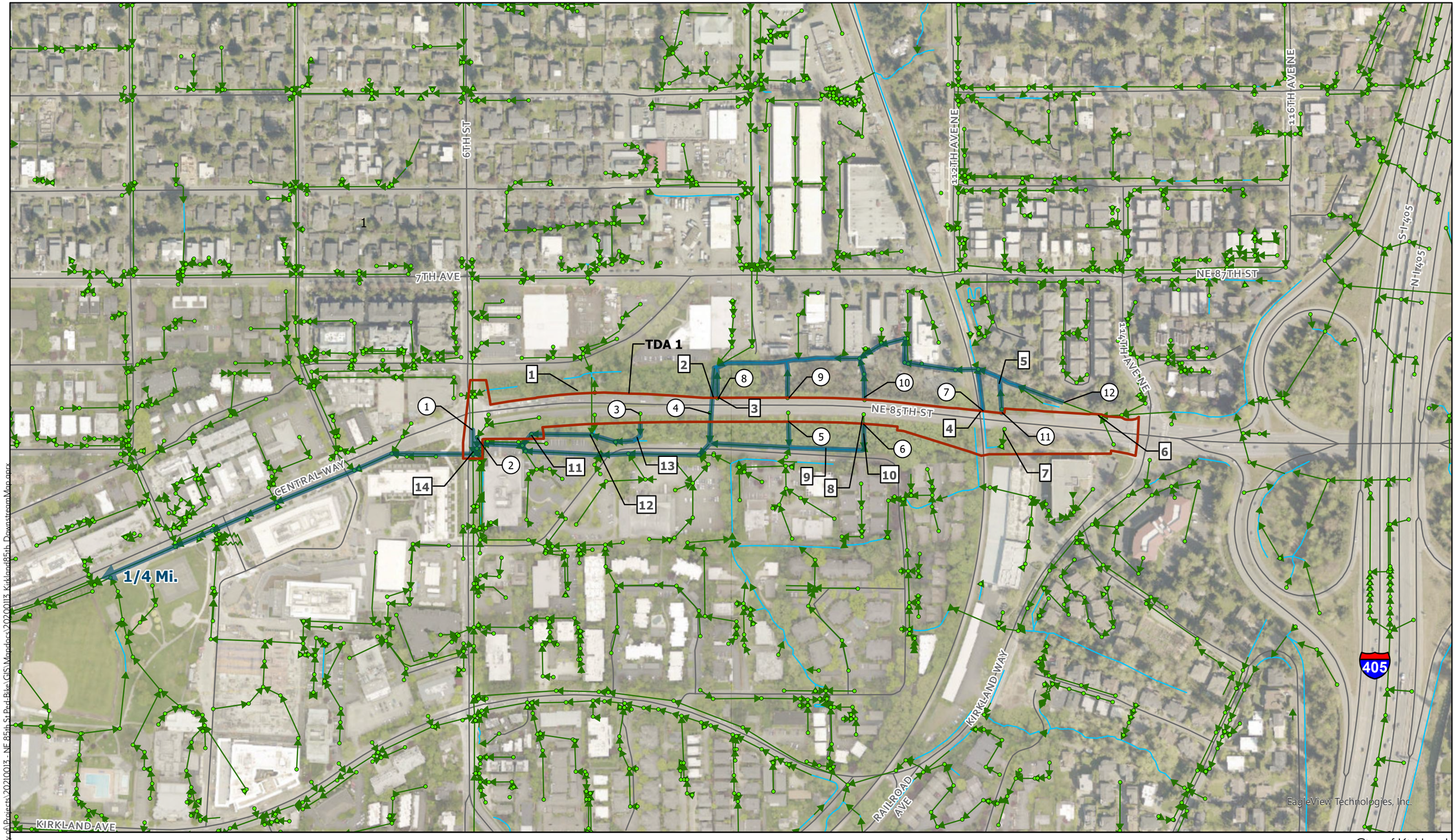
PERTEET

0 300 600
Feet

City of Kirkland
NE 85th Street Ped/Bike Connection
Critical Areas Map
Figure A.4

Path: X:\Kirkland_City of\Projects\20210013 - NE 85th St Ped-Bike\GIS\Mapdocs\20200113_Kirkland85th_CriticalAreas.aprx

Date Exported: 6/17/2024 3:10 PM Source: City of Kirkland; King County



PERTEET

0 150 300
Feet

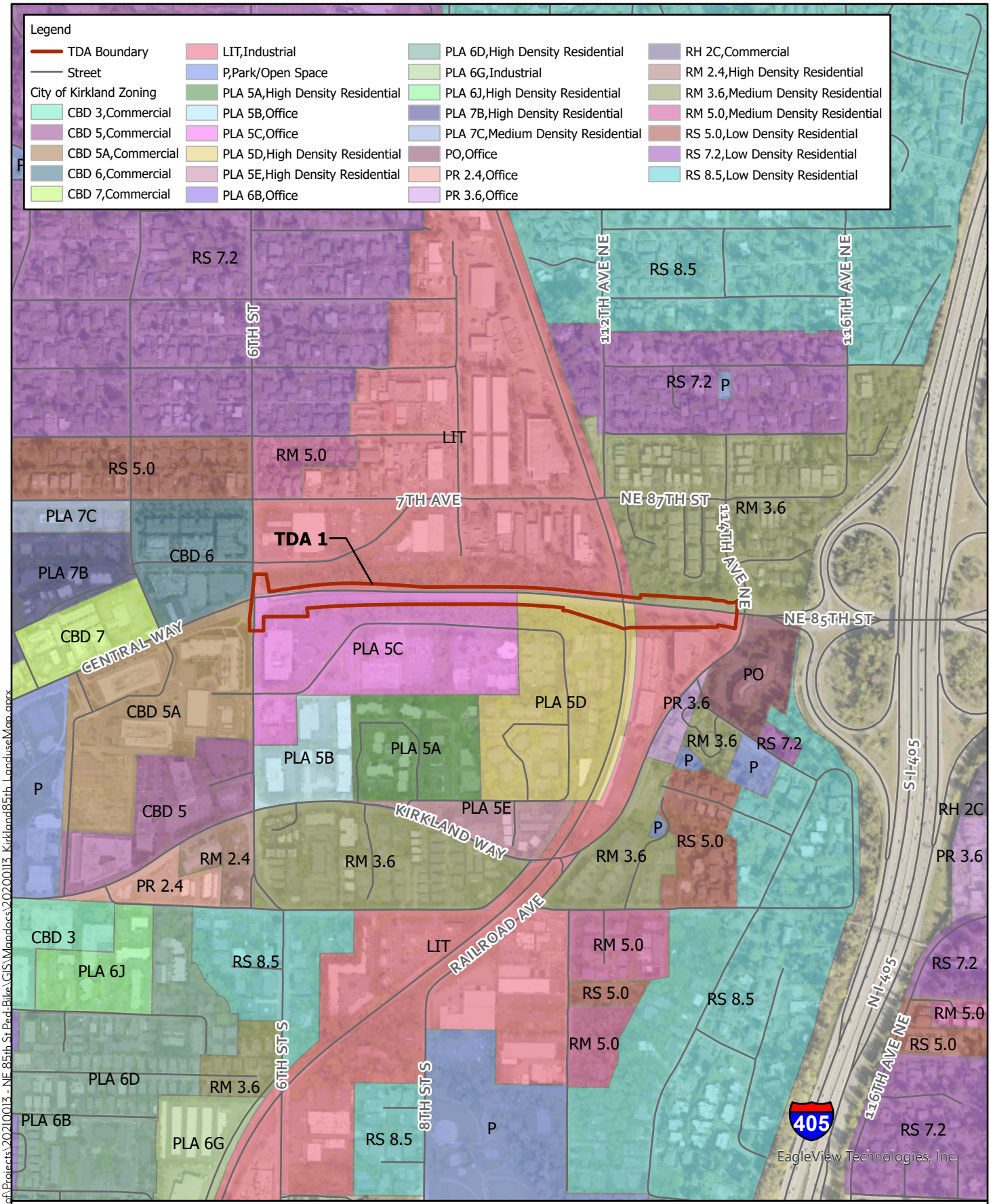
Legend

- TDA Boundary
- Downstream Path
- Storm Manhole
- Open Channel
- Storm Main
- Discharge Point
- # Photo Location

City of Kirkland
NE 85th Street Ped/Bike Connection
Downstream Map
Figure A.5

Path: X:\Kirkland City of\Projects\20210013 - NE 85th St Ped Bike\GIS\Mapdocs\20200113_Kirkland85th_DownstreamMap.aprx

Date Exported: 6/17/2024 3:12 PM Source: City of Kirkland; King County, Natural Resource Conservation Service



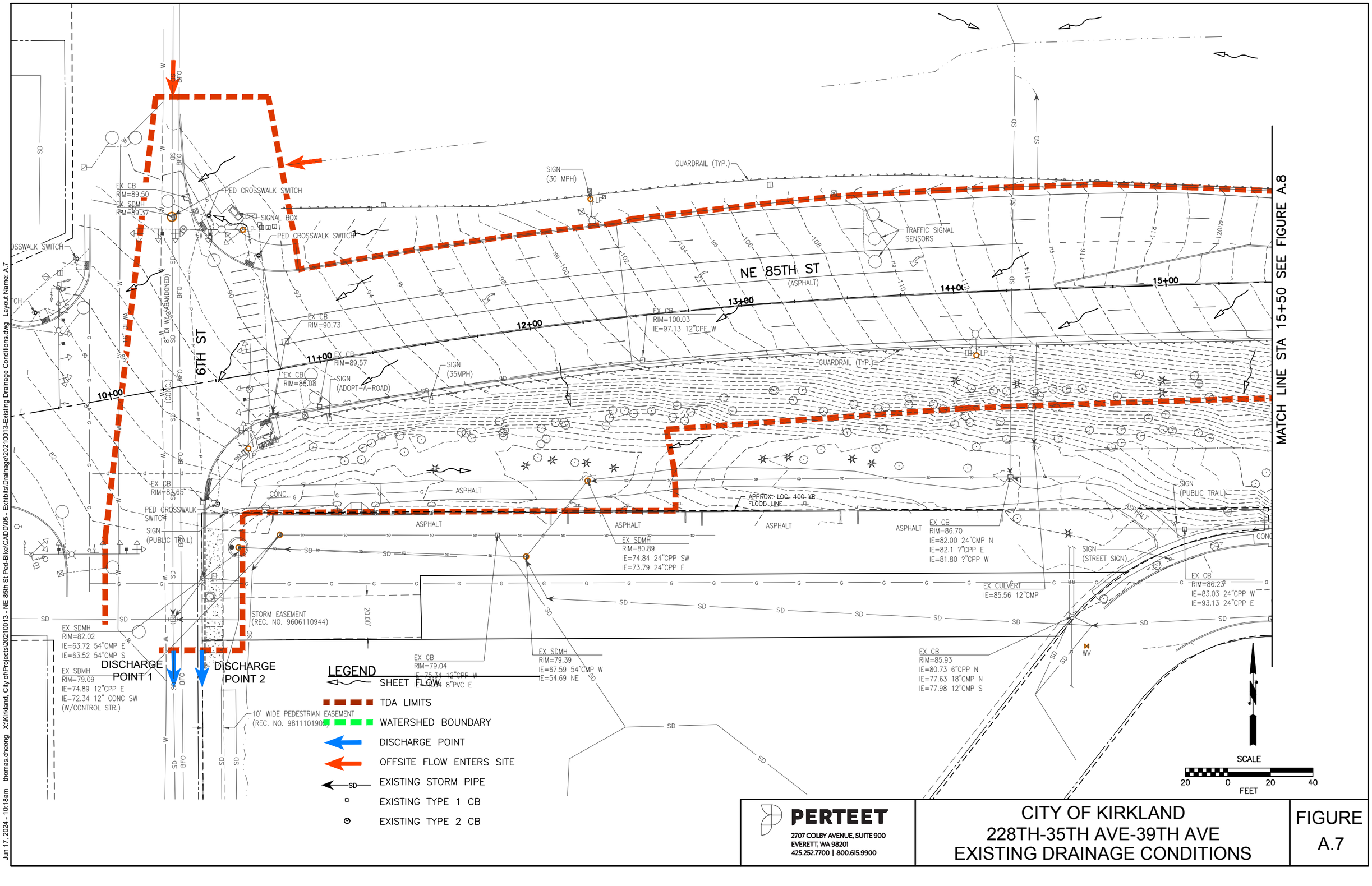
PERTEET

0 300 600
Feet

City of Kirkland
NE 85th Street Ped/Bike Connection
Landuse Map
Figure A.6

Path: X:\Kirkland_City of\Projects\20210013 - NE 85th St Ped-Bike\GIS\Mapdocs\20220113_Kirkland85th LanduseMap.aprx

Date Exported: 6/17/2024 3:10 PM Source: City of Kirkland; King County

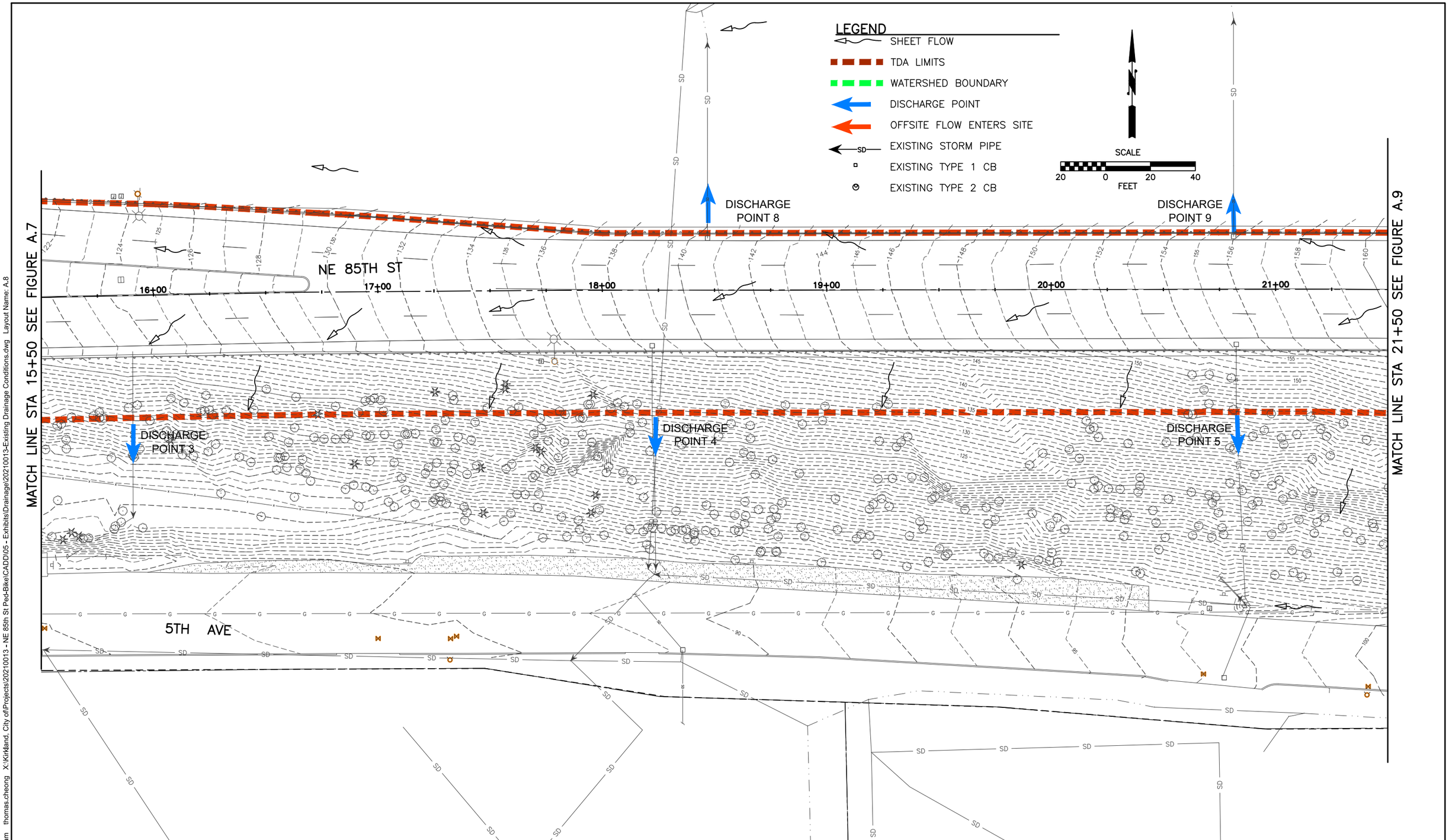


Jun 17, 2024 - 10:18am thomas.cheong X:\Kirkland, City of\Projects\20210013 - NE 85th St Ped-Bike\CADD\05 - Exhibits\Drainage\20210013-Existing Drainage Conditions.dwg Layout Name: A.7

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING DRAINAGE CONDITIONS

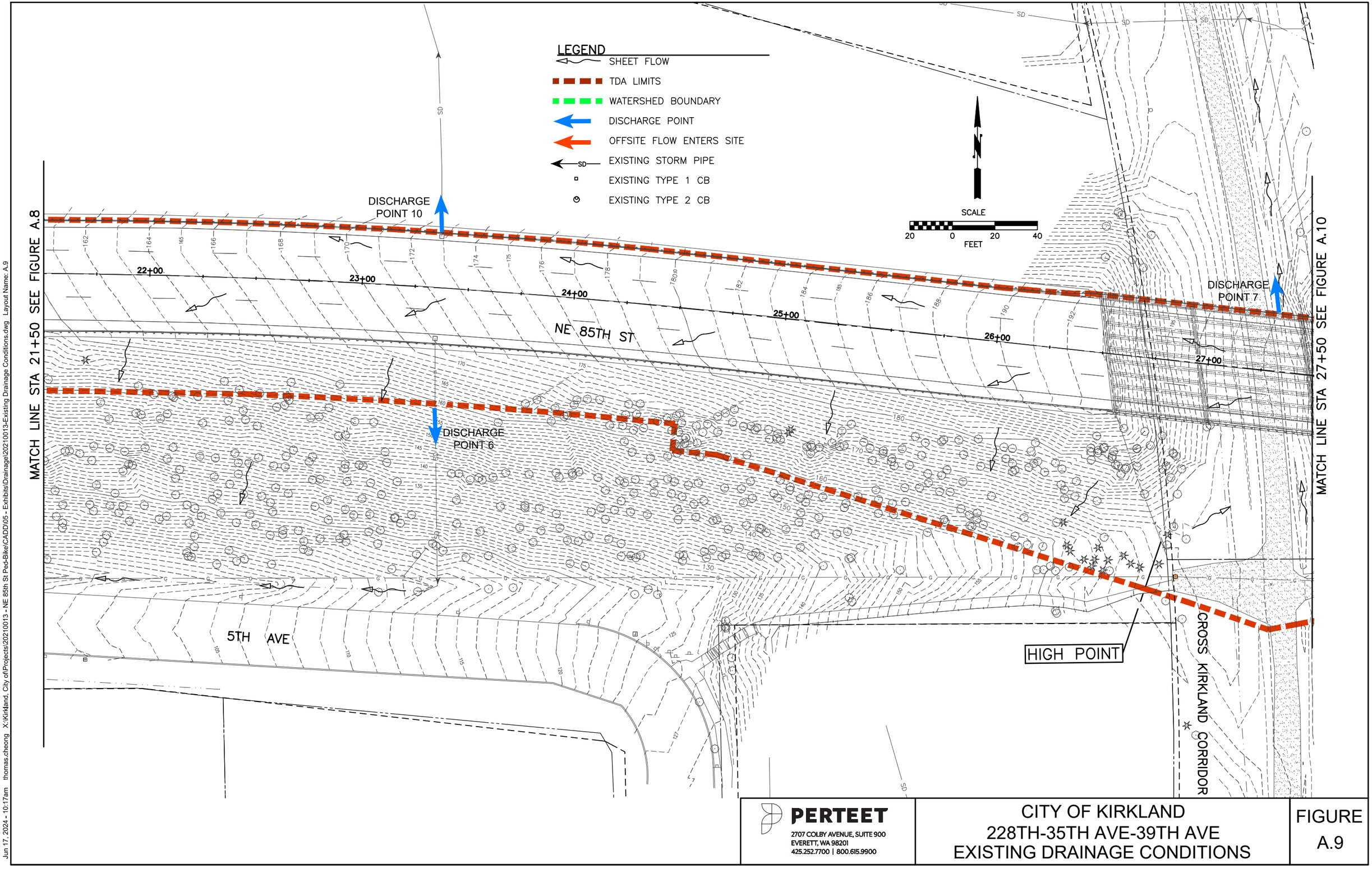
FIGURE
A.7



PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING DRAINAGE CONDITIONS

FIGURE
A.8



PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING DRAINAGE CONDITIONS

FIGURE
A.9

MATCH LINE STA 27+50 SEE FIGURE A.9

STREAM

DISCHARGE POINT 11

DISCHARGE POINT 12

NE 85TH ST

114TH AVE NE

KIRKLAND WAY

28+00 29+00 30+00 31+00 32+00 33+00

SCALE
20 0 20 40
FEET

FENCE (TYP.)

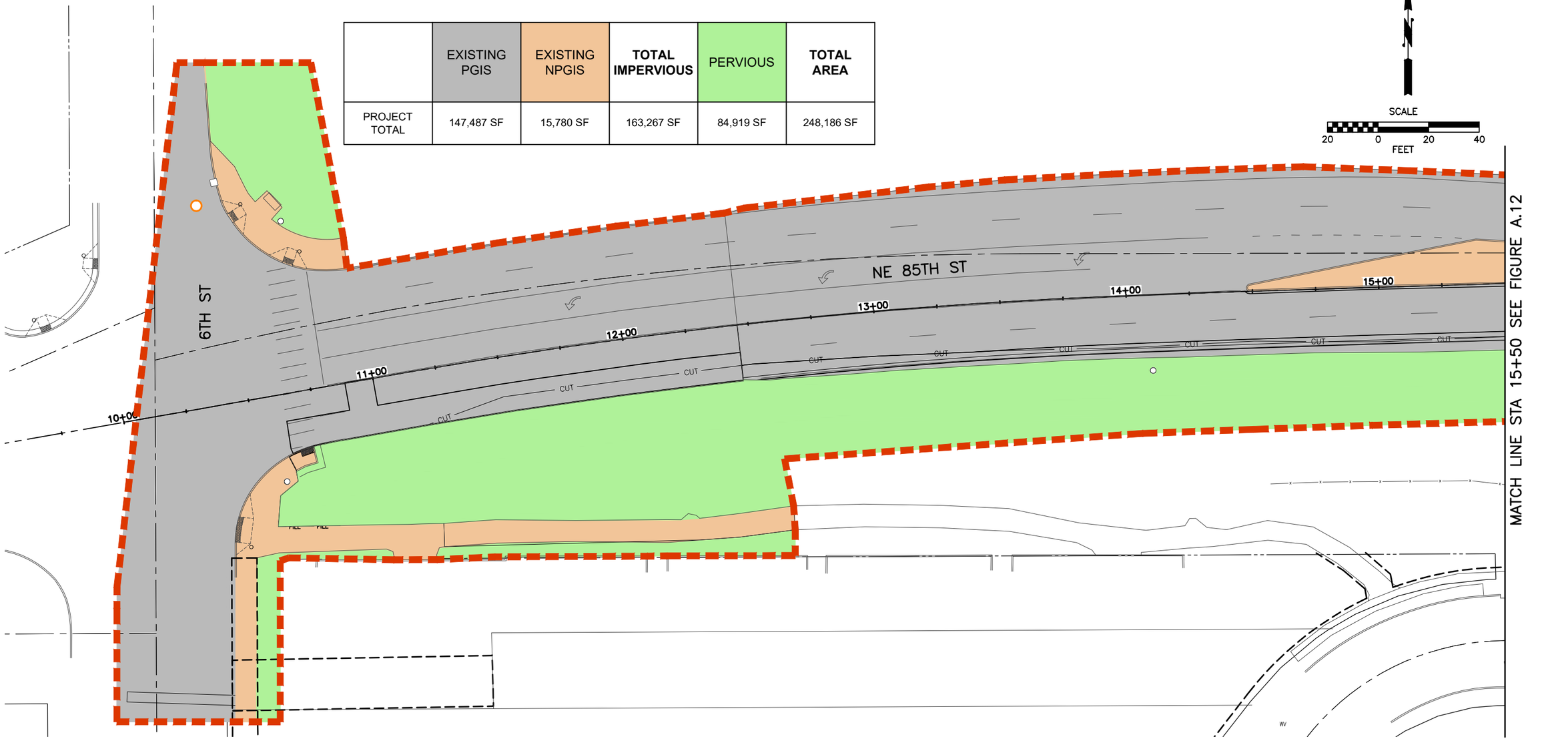
LEGEND
- SHEET FLOW
- TDA LIMITS
- WATERSHED BOUNDARY
- DISCHARGE POINT
- OFFSITE FLOW ENTERS SITE
- SD — EXISTING STORM PIPE
- EXISTING TYPE 1 CB
- EXISTING TYPE 2 CB

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING DRAINAGE CONDITIONS

FIGURE A.10

	EXISTING PGIS	EXISTING NPGIS	**TOTAL IMPERVIOUS**	PERVIOUS	**TOTAL AREA**
PROJECT TOTAL	147,487 SF	15,780 SF	163,267 SF	84,919 SF	248,186 SF



SCALE
20 0 20 40
FEET

LEGEND
- NPGIS
- PGIS
- PERVIOUS
- NPGIS (CURB)
- PROJECT LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING IMPERVIOUS AREAS

FIGURE
A.11

	EXISTING PGIS	EXISTING NPGIS	**TOTAL IMPERVIOUS**	PERVIOUS	**TOTAL AREA**
PROJECT TOTAL	147,487 SF	15,780 SF	163,267 SF	84,919 SF	248,186 SF

SCALE
20 0 20 40
FEET

MATCH LINE STA 15+50 SEE FIGURE A.11

NE 85TH ST

16+00 17+00 18+00 19+00 20+00 21+00

CUT

5TH AVE

WV

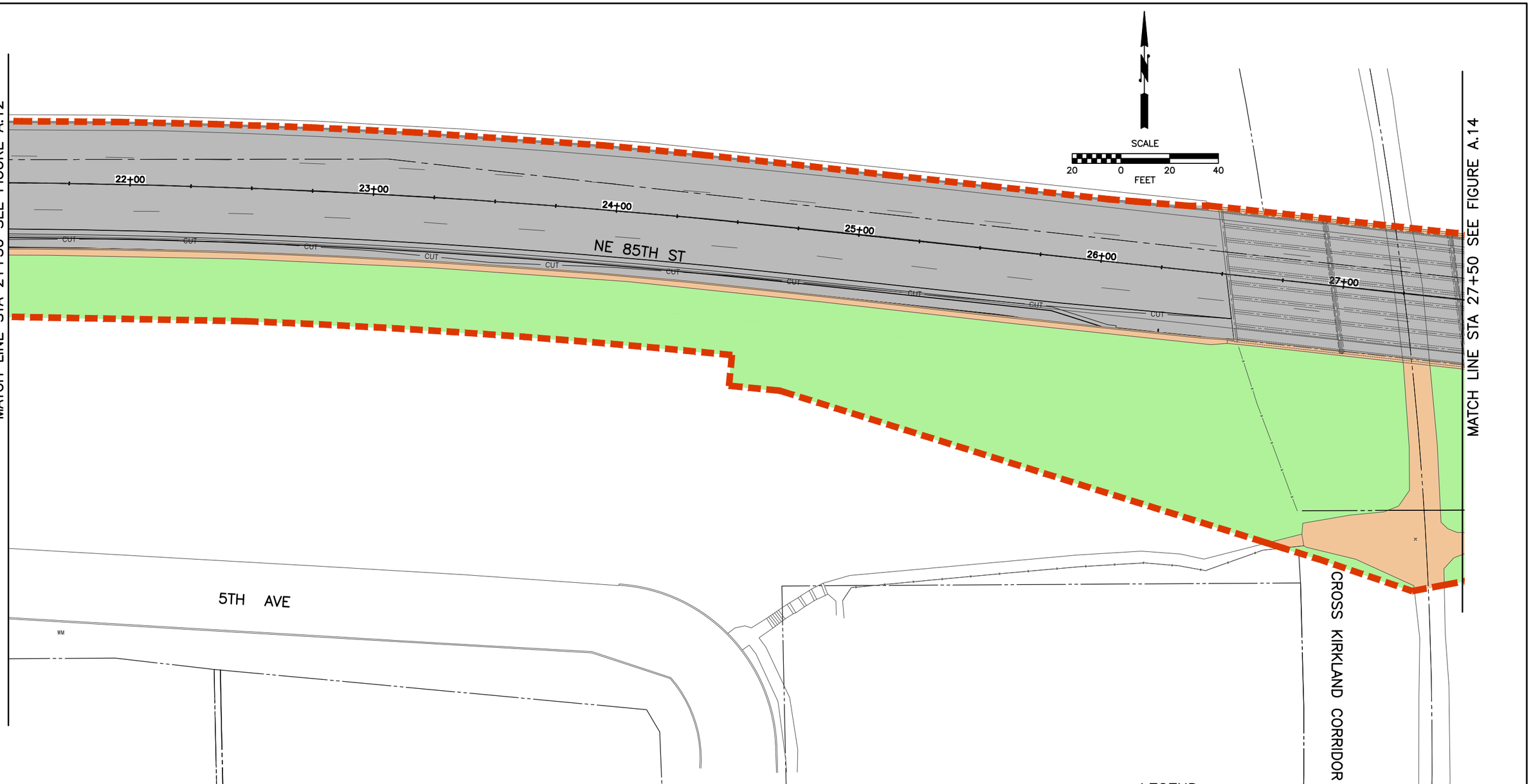
MATCH LINE STA 21+50 SEE FIGURE A.13

LEGEND
- NPGIS
- PGIS
- PERVIOUS
- NPGIS (CURB)
- PROJECT LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING IMPERVIOUS AREAS

FIGURE A.12



	EXISTING PGIS	EXISTING NPGIS	**TOTAL IMPERVIOUS**	PERVIOUS	**TOTAL AREA**
PROJECT TOTAL	147,487 SF	15,780 SF	163,267 SF	84,919 SF	248,186 SF

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING IMPERVIOUS AREAS

FIGURE A.13

	EXISTING PGIS	EXISTING NPGIS	**TOTAL IMPERVIOUS**	PERVIOUS	**TOTAL AREA**
PROJECT TOTAL	147,487 SF	15,780 SF	163,267 SF	84,919 SF	248,186 SF

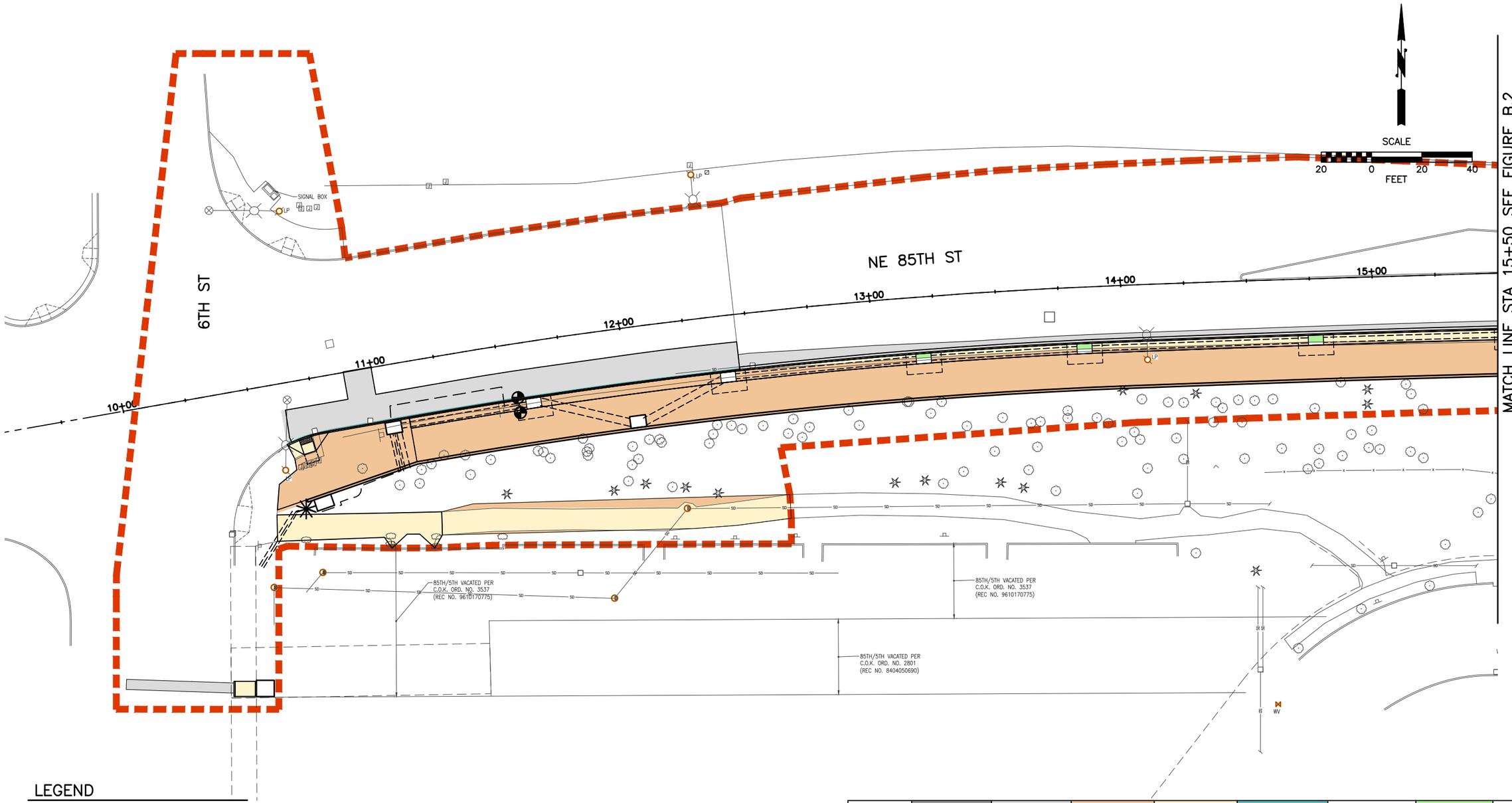
PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EXISTING IMPERVIOUS AREAS

FIGURE A.14

APPENDIX B
Proposed Conditions Figures

PROPOSED IMPERVIOUS AREA MAP – FIGURE B.1-B.4



LEGEND

- NEW NPGIS
- REPLACED NPGIS
- NEW PGIS
- REPLACED PGIS
- CONVERTED NPGIS
- PERVIOUS
- PROJECT LIMITS

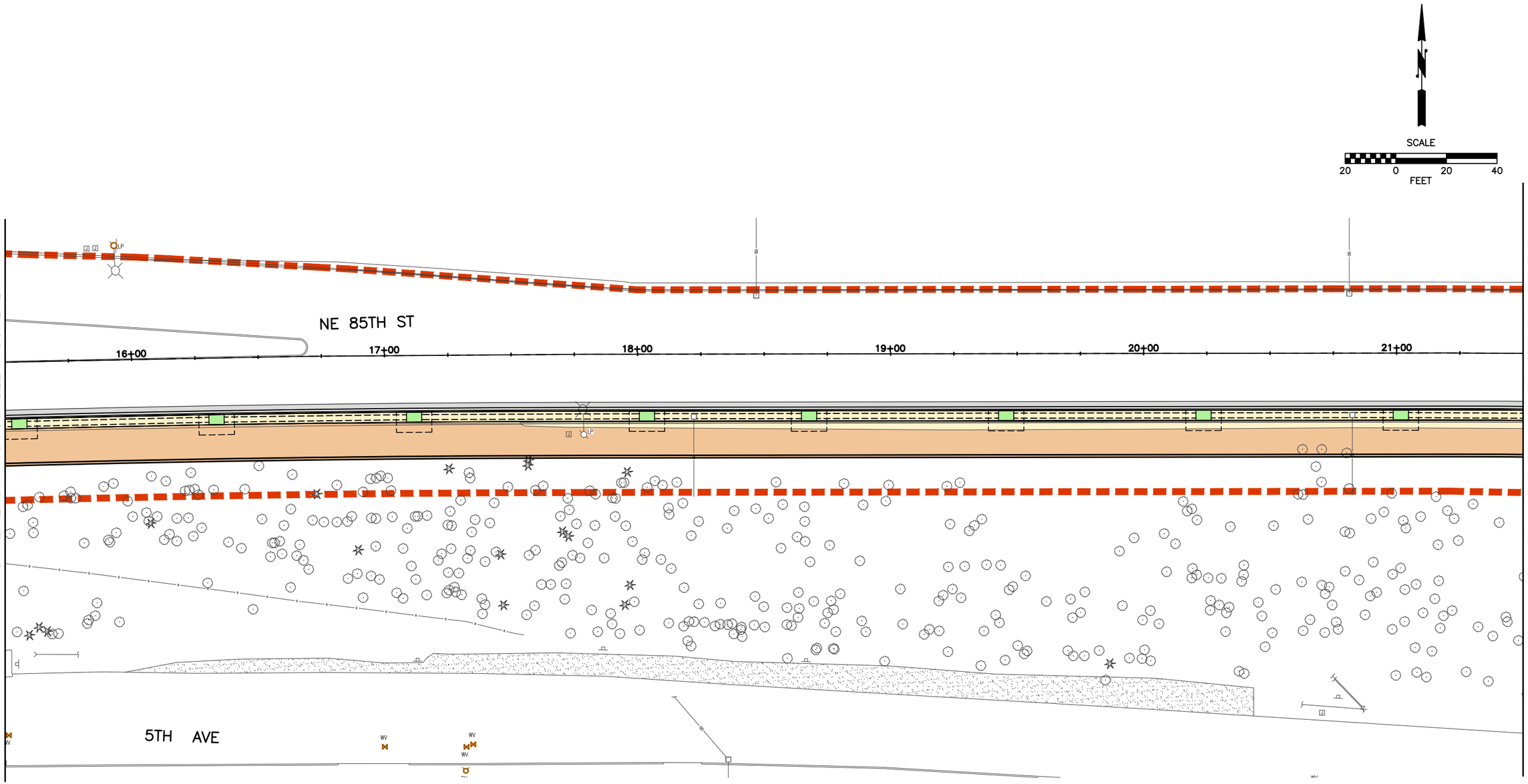
	NEW PGIS	REPLACED PGIS	NEW NPGIS	REPLACED NPGIS	NPGIS CONVERTED TO PGIS	**TOTAL NEW AND REPLACED IMPERVIOUS**	PERVIOUS	**TOTAL PROPOSED AREA**
PROJECT TOTAL	0	7,720 SF	29,036 SF	10,383 SF	40 SF	47,179 SF	1,094 SF	48,273 SF

TOTAL PROPOSED AREA EQUALS ALL OF THE TOTAL NEW AND REPLACED IMPERVIOUS AND NEW PERVIOUS SURFACES

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
PROPOSED IMPERVIOUS AREAS

FIGURE B.1



LEGEND

- NEW NPGIS
- REPLACED NPGIS
- NEW PGIS
- REPLACED PGIS
- CONVERTED NPGIS
- PERVIOUS
- PROJECT LIMITS

	NEW PGIS	REPLACED PGIS	NEW NPGIS	REPLACED NPGIS	NPGIS CONVERTED TO PGIS	**TOTAL NEW AND REPLACED IMPERVIOUS**	PERVIOUS	**TOTAL PROPOSED AREA**
PROJECT TOTAL	0	7,720 SF	29,036 SF	10,383 SF	40 SF	47,179 SF	1,094 SF	48,273 SF

TOTAL PROPOSED AREA EQUALS ALL OF THE TOTAL NEW AND REPLACED IMPERVIOUS AND NEW PERVIOUS SURFACES

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
PROPOSED IMPERVIOUS AREAS

FIGURE B.2

MATCH LINE STA 21+50 SEE FIGURE B.2

MATCH LINE STA 27+50 SEE FIGURE B.4

SCALE
20 0 20 40
FEET

22+00
23+00
24+00
25+00
26+00
27+00

NE 85TH ST

5TH AVE

CROSS KIRKLAND CORRIDOR

WM
GV
GRAVEL

LEGEND

- NEW NPGIS
- REPLACED NPGIS
- NEW PGIS
- REPLACED PGIS
- CONVERTED NPGIS
- PERVIOUS
- PROJECT LIMITS

	NEW PGIS	REPLACED PGIS	NEW NPGIS	REPLACED NPGIS	NPGIS CONVERTED TO PGIS	**TOTAL NEW AND REPLACED IMPERVIOUS**	PERVIOUS	**TOTAL PROPOSED AREA**
PROJECT TOTAL	0	7,720 SF	29,036 SF	10,383 SF	40 SF	47,179 SF	1,094 SF	48,273 SF

TOTAL PROPOSED AREA EQUALS ALL OF THE TOTAL NEW AND REPLACED IMPERVIOUS AND NEW PERVIOUS SURFACES

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
PROPOSED IMPERVIOUS AREAS

FIGURE B.3

MATCH LINE STA 27+50 SEE FIGURE B.3

114TH AVE NE

NE 85TH ST

28+00 29+00 30+00 31+00 32+00 33+00

SCALE
20 0 20 40
FEET

FILL FILL FILL

FENCE (TYP.)

EX SSMH
RIM=183.05
IE=176.65 8"PVC S
IE=176.05 8"PVC W
IE=176.15 8"PVC E

KIRKLAND WAY

LEGEND

- NEW NPGIS
- REPLACED NPGIS
- NEW PGIS
- REPLACED PGIS
- CONVERTED NPGIS
- PERVIOUS
- PROJECT LIMITS

	NEW PGIS	REPLACED PGIS	NEW NPGIS	REPLACED NPGIS	NPGIS CONVERTED TO PGIS	**TOTAL NEW AND REPLACED IMPERVIOUS**	PERVIOUS	**TOTAL PROPOSED AREA**
PROJECT TOTAL	0	7,720 SF	29,036 SF	10,383 SF	40 SF	47,179 SF	1,094 SF	48,273 SF

TOTAL PROPOSED AREA EQUALS ALL OF THE TOTAL NEW AND REPLACED IMPERVIOUS AND NEW PERVIOUS SURFACES

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
PROPOSED IMPERVIOUS AREAS

FIGURE B.4

APPENDIX C

Flow Control and Water Quality Calculations

DETENTION VAULT AND FLOW SPLITTER CALCULATIONS

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Project Number: 20210013
Project Name: Kirkland NE 85th Street Ped and Bike Improvement project

CALCULATION REPORT	
Calculated By: Nathan Hahne, EIT	Date: 12/04/2024
Checked By: Thomas Cheong, PE	Date: 12/04/2024

Calculation Objective:

- Determine a flow splitter design that approximately splits the 50-year flow rate into the detention vault and the existing conveyance system, and also approximately matches at the 2-year, 10-year, and 25-year storms.
- Determine the size of the detention vault facility to satisfy flow control requirement.

Key Design Factors and Assumptions:

- Hydrologic analysis was performed using MGSFlood software, a continuous simulation model, to design the detention vault. WWHM was used as a tool to assist in creating a flow splitter rating table.
- WWHM was performed to create the flow splitter rating table inputs for MGSFlood.
- Rainfall data for the project was obtained from the Extended Timeseries Region Map within the MGSFlood model. Region "Puget East 40" was used for this entire project.
- Level 2 Flow Control (Conservation Flow Control Area) is required, project area in the pre-developed condition will be modeled as forested.
- Pre-developed and Post-developed conditions for flow through and bypass basins will be modeled with the same contributing areas.
- Flow through area is included in the analysis of the detention vault sizing and complies with the WSDOT 50% rule.

Summary of Results:

The project is proposing to abandon the downhill conveyance system at the east end of the project site. Runoff that has previously been directed toward a ditch at the base of the hillside will now be routed along NE 85th street through a proposed conveyance system. The project will also include a detention vault at the west end of the project to detain all of the upstream area, that sheet flows toward the southern gutter line within the project site. The detention vault will be analyzed through the 50% rule, found in the 2021 KCSWDM on page 1-52: "If the existing 100-year peak flow rate from any upstream area is greater than 50% of the 100-year developed peak flow rate for the area that must be mitigated, then the runoff from the upstream area must bypass the facility". If all of the upstream area is captured and directed to the vault, the detention vault will exceed the limitations set by the "50 percent rule". Therefore, in order to detain this project's impacts downstream of the project site, a flow splitter is necessary to route the required project's 100-year flow rate to a detention pond. While the remainder of the flows will bypass the detention vault and connect into the existing conveyance system.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

The following land cover was modeled and resulted in the 50-year flow rates directed both into the detention vault and the existing conveyance system. The area captured by the detention vault will utilize the above 50% rule to the maximum extent. See the attachment figures for a depiction of the contributing areas along the project site.

Table 1. Flow Splitter Land Cover and Flow Rates.

Location	Impervious (Area)	Online/Offline	50-Year flow rate (cfs)	Runoff Flow Direction
Detention Vault + Flow Through	0.692 + 0.336	Offline	1.127	Detention Vault
Existing Conveyance System on NE 85th Street	0.922	Online	1.011	Bypass on NE 85th Street

The resulting flow splitter design and stage storage relationship is summarized in Table 2 and Table 3 respectively, below:

Table 2. Flow Splitter Design.

Discharges to	Riser		Orifice 1		Orifice 2	
	Diameter (inches)	Height (feet)	Diameter (inches)	Height (feet)	Diameter (inches)	Height (feet)
Detention Vault	12	2	5.375	0	0.8125	0.95
Existing Conveyance System	12	2	5.0625	0	1.00	0.97

Table 3. Stage Storage of Flow Splitter.

Stage (ft)	Area (Acres)	Storage (ac-ft.)	Discharge 1 (cfs)	Discharge 2 (cfs)
0.000	0.000574	0.000000	0.000	0.000
0.033	0.000574	0.000019	0.143	0.127
0.066	0.000574	0.000038	0.202	0.179
0.100	0.000574	0.000057	0.247	0.219
0.133	0.000574	0.000077	0.286	0.254
0.166	0.000574	0.000096	0.320	0.283
0.200	0.000574	0.000115	0.350	0.311
0.233	0.000574	0.000134	0.378	0.336
0.266	0.000574	0.000153	0.404	0.359
0.300	0.000574	0.000172	0.429	0.380
0.333	0.000574	0.000191	0.452	0.401
0.366	0.000574	0.000210	0.474	0.421
0.400	0.000574	0.000230	0.495	0.439

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Stage (ft)	Area (Acres)	Storage (ac-ft.)	Discharge 1 (cfs)	Discharge 2 (cfs)
0.433	0.000574	0.000249	0.516	0.457
0.466	0.000574	0.000268	0.535	0.475
0.500	0.000574	0.000287	0.554	0.491
0.533	0.000574	0.000306	0.572	0.507
0.566	0.000574	0.000325	0.590	0.523
0.600	0.000574	0.000344	0.607	0.538
0.633	0.000574	0.000363	0.623	0.553
0.666	0.000574	0.000383	0.640	0.567
0.700	0.000574	0.000402	0.655	0.581
0.733	0.000574	0.000421	0.671	0.595
0.766	0.000574	0.000440	0.686	0.609
0.800	0.000574	0.000459	0.701	0.622
0.833	0.000574	0.000478	0.715	0.634
0.866	0.000574	0.000497	0.729	0.647
0.900	0.000574	0.000517	0.743	0.659
0.933	0.000574	0.000536	0.757	0.671
0.966	0.000574	0.000555	0.773	0.683
1.000	0.000574	0.000574	0.788	0.700
1.033	0.000574	0.000593	0.802	0.713
1.066	0.000574	0.000612	0.815	0.726
1.100	0.000574	0.000631	0.829	0.739
1.133	0.000574	0.000650	0.842	0.751
1.166	0.000574	0.000670	0.855	0.763
1.200	0.000574	0.000689	0.867	0.774
1.233	0.000574	0.000708	0.880	0.786
1.266	0.000574	0.000727	0.892	0.797
1.300	0.000574	0.000746	0.904	0.808
1.333	0.000574	0.000765	0.916	0.819
1.366	0.000574	0.000784	0.928	0.830
1.400	0.000574	0.000803	0.939	0.840
1.433	0.000574	0.000823	0.951	0.851
1.466	0.000574	0.000842	0.962	0.861
1.500	0.000574	0.000861	0.973	0.871

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Stage (ft)	Area (Acres)	Storage (ac-ft.)	Discharge 1 (cfs)	Discharge 2 (cfs)
1.533	0.000574	0.000880	0.984	0.881
1.566	0.000574	0.000899	0.995	0.891
1.600	0.000574	0.000918	1.006	0.901
1.633	0.000574	0.000937	1.016	0.910
1.666	0.000574	0.000957	1.027	0.920
1.700	0.000574	0.000976	1.037	0.930
1.733	0.000574	0.000995	1.048	0.939
1.766	0.000574	0.001014	1.058	0.948
1.800	0.000574	0.001033	1.068	0.957
1.833	0.000574	0.001052	1.078	0.966
1.866	0.000574	0.001071	1.088	0.975
1.900	0.000574	0.001090	1.098	0.984
1.933	0.000574	0.001110	1.107	0.993
1.966	0.000574	0.001129	1.117	1.002
2.000	0.000574	0.001148	1.127	1.011
2.033	0.000574	0.001167	1.201	1.084
2.066	0.000574	0.001186	1.328	1.210
2.100	0.000574	0.001205	1.488	1.370
2.133	0.000574	0.001224	1.674	1.554
2.166	0.000574	0.001243	1.877	1.756
2.200	0.000574	0.001263	2.090	1.969
2.233	0.000574	0.001282	2.307	2.184
2.266	0.000574	0.001301	2.519	2.396
2.300	0.000574	0.001320	2.719	2.595
2.333	0.000574	0.001339	2.902	2.777
2.366	0.000574	0.001358	3.062	2.936
2.400	0.000574	0.001377	3.196	3.069
2.433	0.000574	0.001397	3.304	3.177
2.466	0.000574	0.001416	3.391	3.263
2.500	0.000574	0.001435	3.489	3.360
2.533	0.000574	0.001454	3.570	3.441
2.566	0.000574	0.001473	3.649	3.519
2.600	0.000574	0.001492	3.726	3.595

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Stage (ft)	Area (Acres)	Storage (ac-ft.)	Discharge 1 (cfs)	Discharge 2 (cfs)
2.633	0.000574	0.001511	3.802	3.670
2.666	0.000574	0.001530	3.875	3.742
2.700	0.000574	0.001550	3.947	3.813
2.733	0.000574	0.001569	4.017	3.883
2.766	0.000574	0.001588	4.086	3.951
2.800	0.000574	0.001607	4.153	4.017
2.833	0.000574	0.001626	4.219	4.082
2.866	0.000574	0.001645	4.284	4.147
2.900	0.000574	0.001664	4.348	4.210
2.933	0.000574	0.001684	4.410	4.272
2.966	0.000574	0.001703	4.472	4.332
3.000	0.000574	0.001722	4.533	4.392

Discharge 1 and Discharge 2 function proportionally and targets the 50-year flow rate at stage 2.00 feet. Discharge 1 targets the flow rate of 1.127 cfs directed into the detention vault. Discharge 2 targets the flow rate of 1.011 cfs directed into the existing conveyance system.

The resulting detention vault design is summarized in Table 4, below:

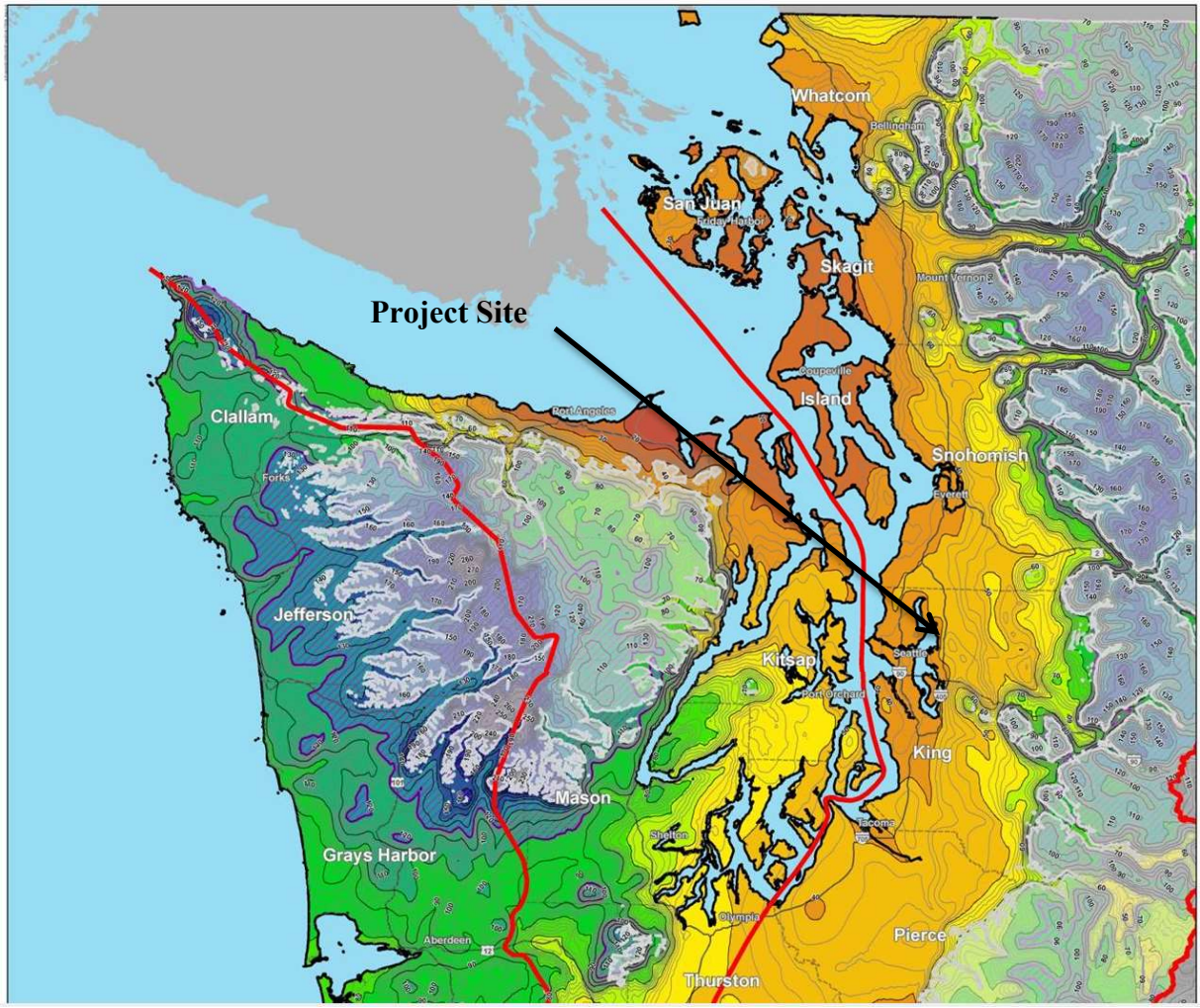
Table 4. Detention Vault Design

Pond Dimension		Riser		Orifice 1		Orifice 2		Orifice 3	
Width (inches)	Length (feet)	Diameter (inches)	Height (feet)	Diameter (inches)	Height (feet)	Diameter (inches)	Height (feet)	Diameter (inches)	Height (feet)
12	84	12	6	1.3125	70.76	0.8125	74.60	1.5	76.01

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

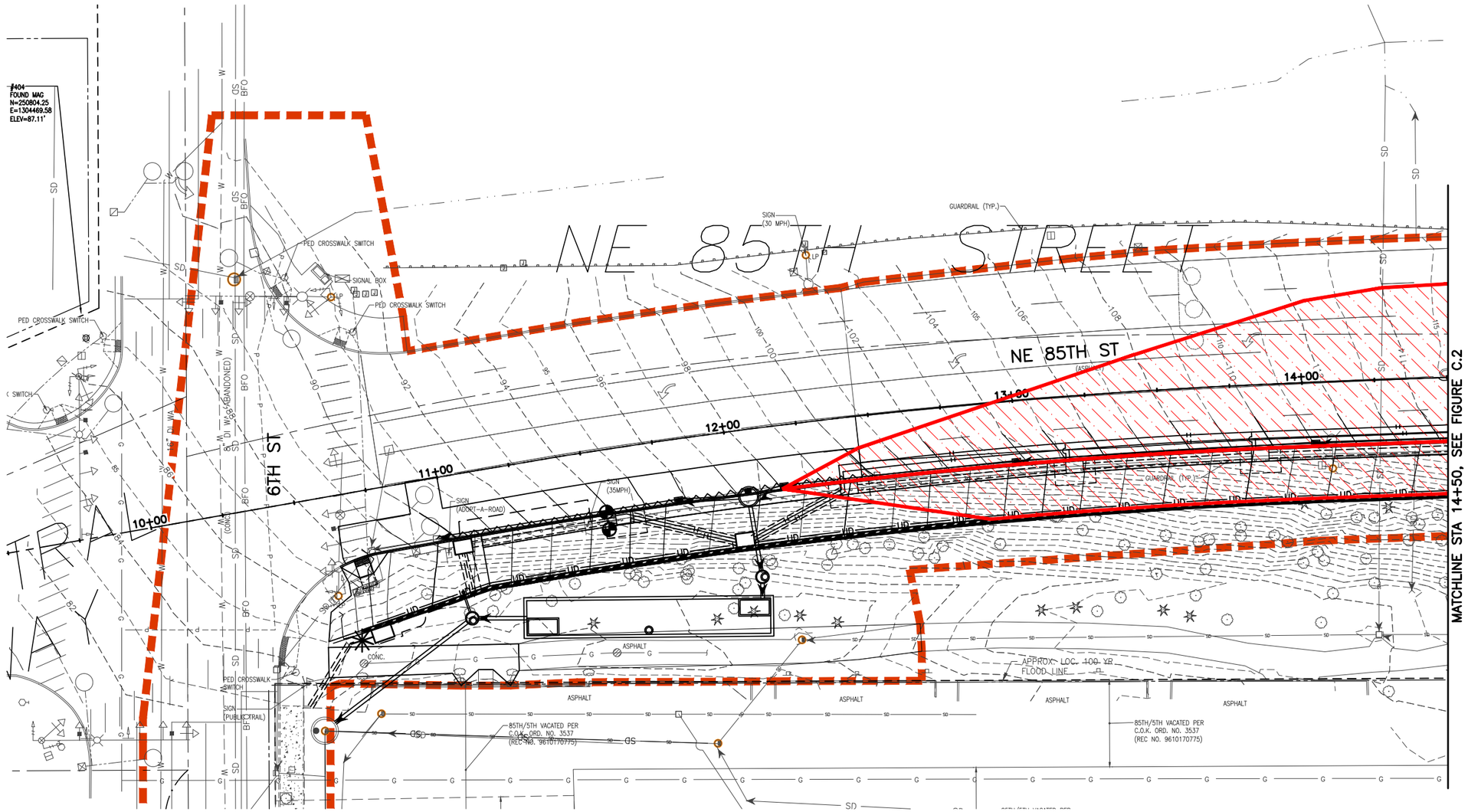
Precipitation Data:

- Mean Annual precipitation (MAP) = Puget 40 East inches in MAP.
- Note: MAP was also checked using Latitude/Longitude Coordinates (47.6794, -122.1919), inputting the coordinates into MGSFlood software, and verifying precipitation.



Attachments:

a. MGSFlood Results
b. Contributing Area Summary
c. WWHM Flow splitter analysis



SCALE
20 0 20 40
FEET

FLOW CONTROL AREA	
	IMPERVIOUS
REQUIRED AREA	0.692 AC
FLOW THROUGH AREA	0.336 AC

BYPASS AREA	
	IMPERVIOUS
BYPASS AREA	0.922 AC

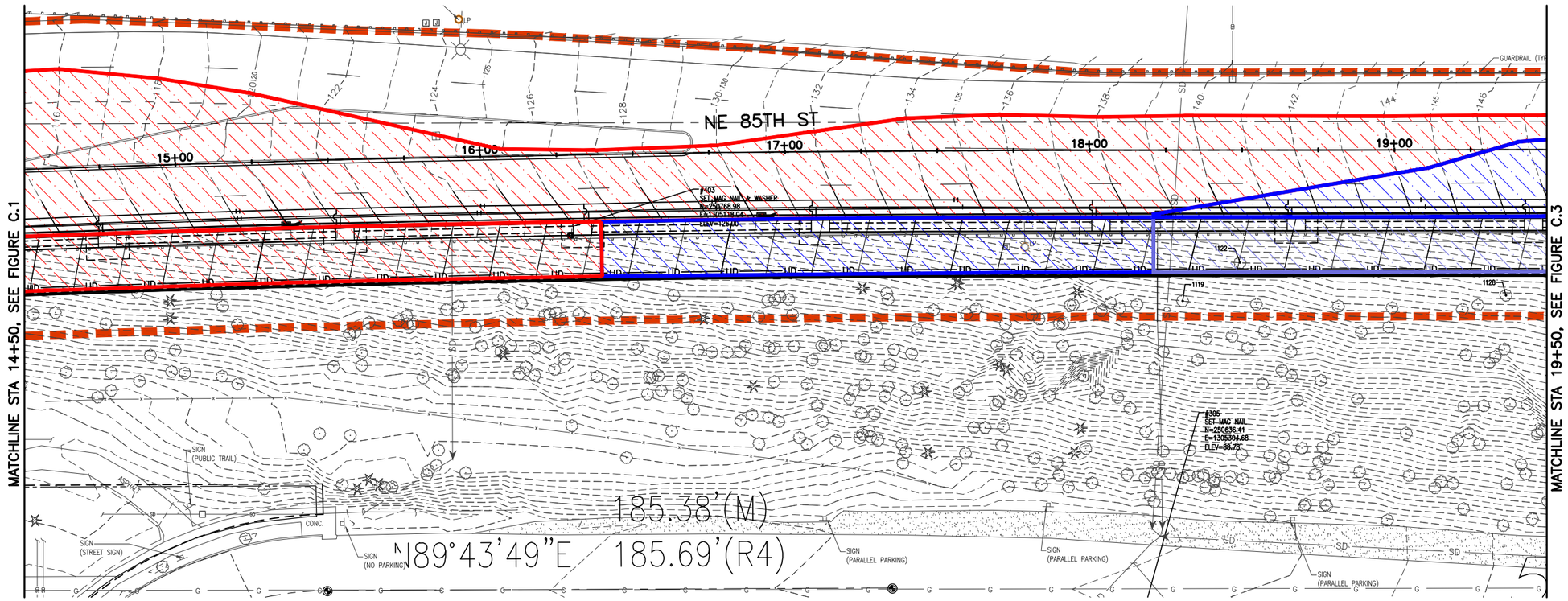
LEGEND

- REQUIRED CAPTURE AREA (SF)
- FLOW THROUGH CAPTURE AREA (SF)
- BYPASS CAPTURE AREA (SF)
- TDA LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EQUIVALENT AREA MAP

FIGURE
C.1



FLOW CONTROL AREA	
	IMPERVIOUS
REQUIRED AREA	0.692 AC
FLOW THROUGH AREA	0.336 AC

BYPASS AREA	
	IMPERVIOUS
BYPASS AREA	0.922 AC

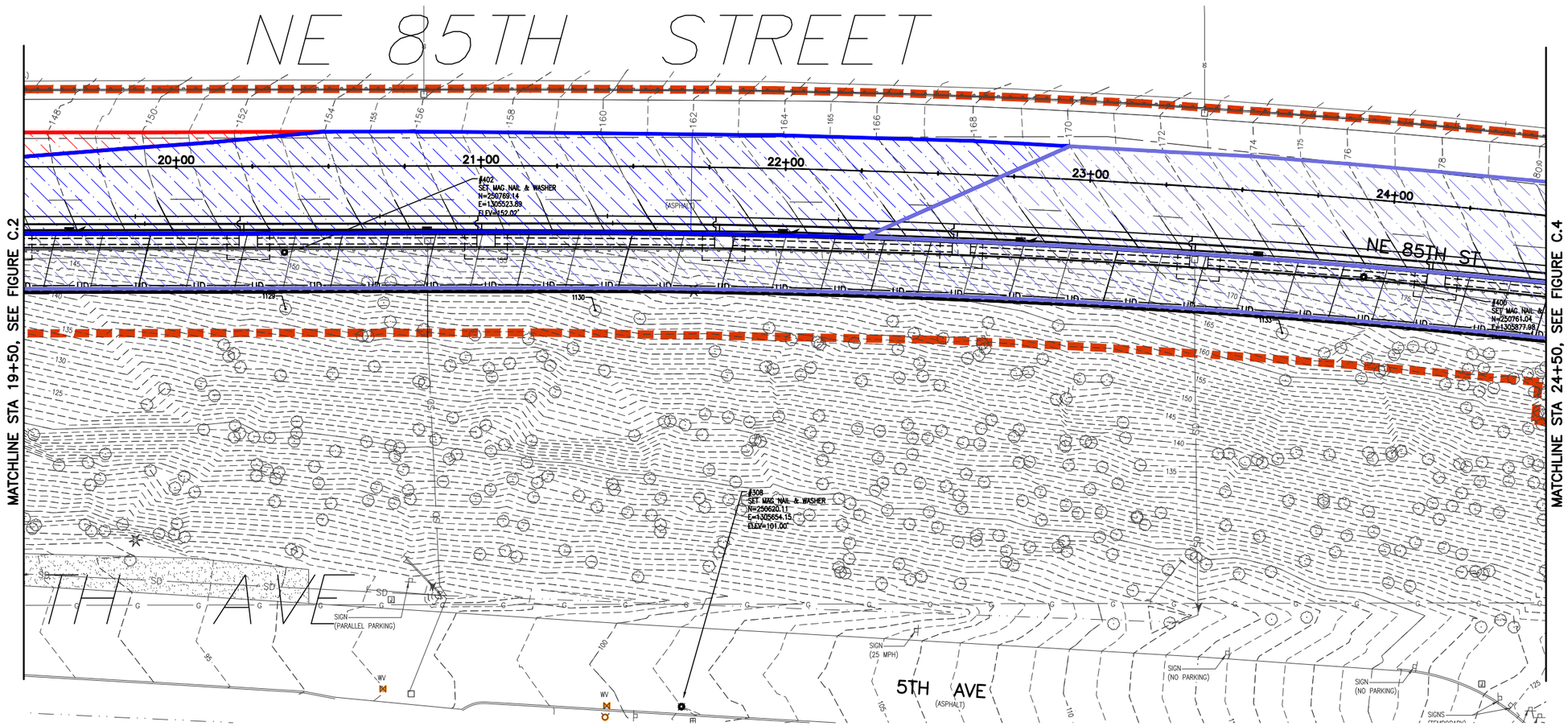
LEGEND

- REQUIRED CAPTURE AREA (SF)
- FLOW THROUGH CAPTURE AREA (SF)
- BYPASS CAPTURE AREA (SF)
- TDA LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EQUIVALENT AREA MAP

FIGURE
C.2



SCALE
20 0 20 40
FEET

FLOW CONTROL AREA	
	IMPERVIOUS
REQUIRED AREA	0.692 AC
FLOW THROUGH AREA	0.336 AC

BYPASS AREA	
	IMPERVIOUS
BYPASS AREA	0.922 AC

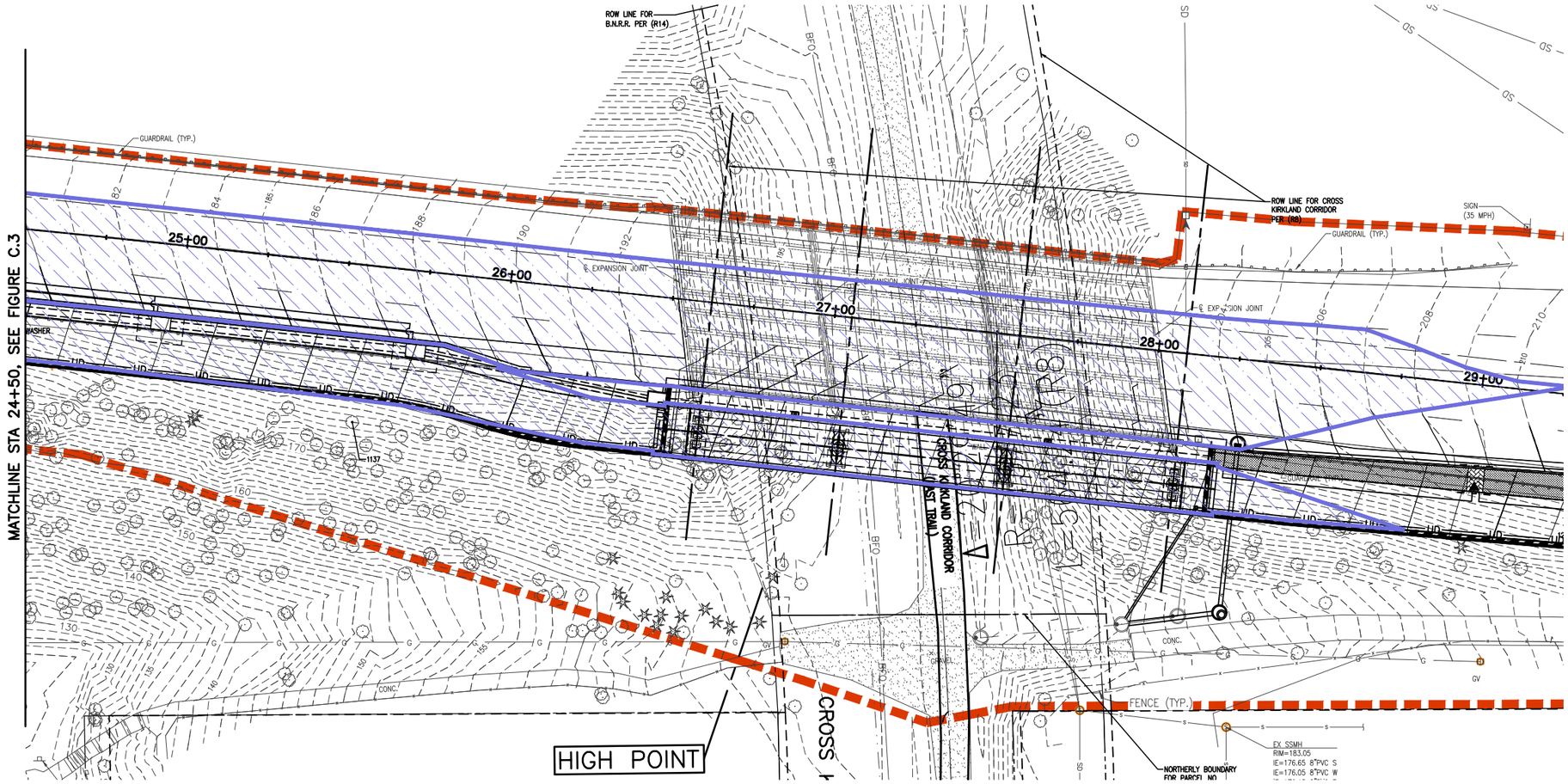
LEGEND

- REQUIRED CAPTURE AREA (SF)
- FLOW THROUGH CAPTURE AREA (SF)
- BYPASS CAPTURE AREA (SF)
- TDA LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EQUIVALENT AREA MAP

FIGURE
C.3



SCALE
20 0 20 40
FEET

FLOW CONTROL AREA	
	IMPERVIOUS
REQUIRED AREA	0.692 AC
FLOW THROUGH AREA	0.336 AC

BYPASS AREA	
	IMPERVIOUS
BYPASS AREA	0.922 AC

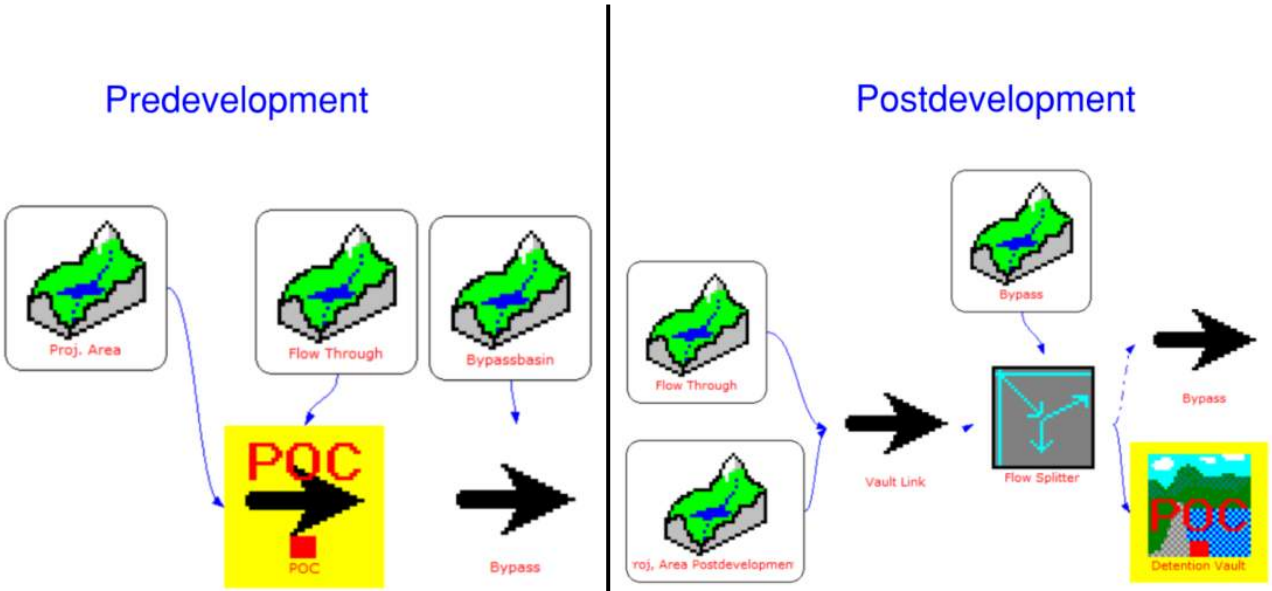
LEGEND

- REQUIRED CAPTURE AREA (SF)
- FLOW THROUGH CAPTURE AREA (SF)
- BYPASS CAPTURE AREA (SF)
- TDA LIMITS

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
EQUIVALENT AREA MAP

FIGURE C.4



MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.57
Program License Number: 200310001
Project Simulation Performed on: 12/04/2024 3:47 PM
Report Generation Date: 12/04/2024 3:48 PM

Input File Name: DetentionVault_FlowThrough_50-yr_match.fld
Project Name: Kirkland 85th Ped/Bike
Analysis Title: Detention Vault Modeling
Comments: Detention vault with flow splitter

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : Ecology Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** **WATERSHED DEFINITION** **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	1.950	1.950
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	1.950	1.950

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 3

---------- Subbasin : Proj. Area ----------

	-------Area (Acres) --------
C, Forest, Mod	0.692
Subbasin Total	0.692

---------- Subbasin : Flow Through ----------

	-------Area (Acres) --------
ROADS/MOD	0.261
SIDEWALKS/MOD	0.075
Subbasin Total	0.336

---------- Subbasin : Bypassbasin ----------

	-------Area (Acres) --------
ROADS/MOD	0.506
SIDEWALKS/MOD	0.416
Subbasin Total	0.922

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 3

---------- Subbasin : Proj, Area Postdevelopment ----------

	-------Area (Acres) --------
ROADS/MOD	0.533
SIDEWALKS/MOD	0.159
Subbasin Total	0.692

---------- Subbasin : Flow Through ----------

	-------Area (Acres) --------
ROADS/MOD	0.261
SIDEWALKS/MOD	0.075
Subbasin Total	0.336

---------- Subbasin : Bypass ----------

	-------Area (Acres) --------
ROADS/MOD	0.506
SIDEWALKS/MOD	0.416
Subbasin Total	0.922

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 2

Link Name: POC
Link Type: Copy
Downstream Link: None

Link Name: Bypass
Link Type: Copy
Downstream Link: None

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 4

Link Name: Detention Vault
Link Type: Structure
Downstream Link: None

Prismatic Pond Option Used

Pond Floor Elevation (ft)	:	100.00
Riser Crest Elevation (ft)	:	106.00
Max Pond Elevation (ft)	:	106.50
Storage Depth (ft)	:	6.00
Pond Bottom Length (ft)	:	84.0
Pond Bottom Width (ft)	:	12.0
Pond Side Slopes (ft/ft)	:	Z1= 0.00 Z2= 0.00 Z3= 0.00 Z4= 0.00
Bottom Area (sq-ft)	:	1008.
Area at Riser Crest El (sq-ft)	:	1,008.
(acres)	:	0.023
Volume at Riser Crest (cu-ft)	:	6,048.
(ac-ft)	:	0.139
Area at Max Elevation (sq-ft)	:	1008.
(acres)	:	0.023
Vol at Max Elevation (cu-ft)	:	6,552.
(ac-ft)	:	0.150

Hydraulic Conductivity (in/hr) : 0.00

Massmann Regression Used to Estimate Hydralic Gradient
Depth to Water Table (ft) : 100.00
Bio-Fouling Potential : Low
Maintenance : Average or Better

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 18.00
Common Length (ft) : 0.000
Riser Crest Elevation : 106.00 ft

Hydraulic Structure Geometry

Number of Devices: 3

---Device Number 1 ---
Device Type : Circular Orifice
Control Elevation (ft) : 100.00
Diameter (in) : 1.25
Orientation : Horizontal
Elbow : No

---Device Number 2 ---
Device Type : Circular Orifice
Control Elevation (ft) : 103.50
Diameter (in) : 0.8125
Orientation : Horizontal
Elbow : Yes

---Device Number 3 ---
Device Type : Circular Orifice
Control Elevation (ft) : 105.25
Diameter (in) : 1.50
Orientation : Horizontal
Elbow : Yes

Link Name: Bypass
Link Type: Copy
Downstream Link: None

Link Name: Flow Splitter
Link Type: Flow Splitter

Outflow 1 Connected to Link: Lnk3 - Detention Vault
Outflow 2 Connected to Link: Lnk2 - Bypass

Splitter Rating Table

Inflow (cfs)	Outflow 1 (cfs)	Ouflow 2 (cfs)
0.000	0.000	0.000
0.270	0.143	0.127

0.381	0.202	0.179
0.466	0.247	0.219
0.540	0.286	0.254
0.603	0.320	0.283
0.661	0.350	0.311
0.714	0.378	0.336
0.763	0.404	0.359
0.809	0.429	0.380
0.853	0.452	0.401
0.895	0.474	0.421
0.934	0.495	0.439
0.973	0.516	0.457
1.010	0.535	0.475
1.045	0.554	0.491
1.079	0.572	0.507
1.113	0.590	0.523
1.145	0.607	0.538
1.176	0.623	0.553
1.207	0.640	0.567
1.236	0.655	0.581
1.266	0.671	0.595
1.295	0.686	0.609
1.323	0.701	0.622
1.349	0.715	0.634
1.376	0.729	0.647
1.402	0.743	0.659
1.428	0.757	0.671
1.456	0.773	0.683
1.488	0.788	0.700
1.515	0.802	0.713
1.541	0.815	0.726
1.568	0.829	0.739
1.593	0.842	0.751
1.618	0.855	0.763
1.641	0.867	0.774
1.666	0.880	0.786
1.689	0.892	0.797
1.712	0.904	0.808
1.735	0.916	0.819
1.758	0.928	0.830
1.779	0.939	0.840
1.802	0.951	0.851
1.823	0.962	0.861
1.844	0.973	0.871
1.865	0.984	0.881
1.886	0.995	0.891
1.907	1.006	0.901
1.926	1.016	0.910
1.947	1.027	0.920
1.967	1.037	0.930
1.987	1.048	0.939
2.006	1.058	0.948
2.025	1.068	0.957
2.044	1.078	0.966
2.063	1.088	0.975
2.082	1.098	0.984

2.100	1.107	0.993	
2.119	1.117	1.002	
2.138	1.127	1.011	(Targeting the 50-year flow rate at Stage 2.00 feet)
2.285	1.201	1.084	
2.538	1.328	1.210	
2.858	1.488	1.370	
3.228	1.674	1.554	
3.633	1.877	1.756	
4.059	2.090	1.969	
4.491	2.307	2.184	
4.915	2.519	2.396	
5.314	2.719	2.595	
5.679	2.902	2.777	
5.998	3.062	2.936	
6.265	3.196	3.069	
6.481	3.304	3.177	
6.654	3.391	3.263	
6.849	3.489	3.360	
7.011	3.570	3.441	
7.168	3.649	3.519	
7.321	3.726	3.595	
7.472	3.802	3.670	
7.617	3.875	3.742	
7.760	3.947	3.813	
7.900	4.017	3.883	
8.037	4.086	3.951	
8.170	4.153	4.017	
8.301	4.219	4.082	
8.431	4.284	4.147	
8.558	4.348	4.210	
8.682	4.410	4.272	
8.804	4.472	4.332	
8.925	4.533	4.392	
9.045	4.593	4.452	

Link Name: Vault Link
Link Type: Copy
Downstream Link Name: Flow Splitter

**************************FLOOD FREQUENCY AND DURATION STATISTICS*********************

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 3
Number of Links: 2

************ Subbasin: Proj. Area ************

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.475E-02
5-Year	2.403E-02

10-Year	3.238E-02
25-Year	4.106E-02
50-Year	5.240E-02
100-Year	5.678E-02
200-Year	8.838E-02
500-Year	0.131

********** **Subbasin: Flow Through** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.154
5-Year	0.207
10-Year	0.260
25-Year	0.333
50-Year	0.368
100-Year	0.490
200-Year	0.551
500-Year	0.630

********** **Subbasin: Bypassbasin** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.423
5-Year	0.567
10-Year	0.715
25-Year	0.913
50-Year	1.011
100-Year	1.346
200-Year	1.513
500-Year	1.729

********** Link: POC ********** Link Inflow
Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.164
5-Year	0.221
10-Year	0.268
25-Year	0.336
50-Year	0.412
100-Year	0.499
200-Year	0.555
500-Year	0.629

********** Link: Bypass ********** Link Outflow 1

Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.423
5-Year	0.567
10-Year	0.715
25-Year	0.913
50-Year	1.011
100-Year	1.346
200-Year	1.513
500-Year	1.729

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 3
Number of Links: 4

********** Subbasin: Proj, Area Postdevelopment **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.318
5-Year	0.425
10-Year	0.536
25-Year	0.685
50-Year	0.759
100-Year	1.010
200-Year	1.136
500-Year	1.298

50% Rule Check
100-year Undetained Flow Rate from Area Receiving Flow Control.

********** Subbasin: Flow Through **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.154
5-Year	0.207
10-Year	0.260
25-Year	0.333
50-Year	0.368
100-Year	0.490
200-Year	0.551
500-Year	0.630

50% Rule Check
100-year Undetained Flow Rate from Flow Through Area

<50% of the Undetained Flow Rate from Area Receiving Flow Control = PASSES 50% RULE (0.490 cfs < 1.010 cfs)

********** Subbasin: Bypass **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.423
5-Year	0.567
10-Year	0.715
25-Year	0.913
50-Year	1.011
100-Year	1.346
200-Year	1.513
500-Year	1.729

********** Link: Bypass ********** Link

Outflow 1 Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.421
5-Year	0.563
10-Year	0.711
25-Year	0.912
50-Year	1.012
100-Year	1.364
200-Year	1.541
500-Year	1.768

Flow Splitter Check
Actual flows to bypass to existing conveyance system to match the targeted 50-year flow rate (1.011 cfs) from the *Subbasin: Bypass*. (Note: The small difference between the actual and targeted flow rate is considered negligible)

********** Link: Vault Link ********** Link

Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.472
5-Year	0.632
10-Year	0.797
25-Year	1.018
50-Year	1.127
100-Year	1.501
200-Year	1.687
500-Year	1.928

Flow Splitter Check
Actual flows to detention vault to match the combined targeted 50-year flow rate (0.759 cfs + 0.368 cfs = 1.127 cfs) from the *Subbasin: Proj. Area Postdeveloped* and *Subbasin: Flow Through*.

********** Link: Flow Splitter ********** Link

Inflow Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.895
5-Year	1.199
10-Year	1.512
25-Year	1.931
50-Year	2.138
100-Year	2.846
200-Year	3.201
500-Year	3.657

Flow Splitter inflow from upstream conveyance system

********** Link: Detention Vault ********** Link

WSEL Stats

WSEL Frequency Data(ft)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	101.949
1.11-Year	102.113
1.25-Year	102.417
2.00-Year	103.098
3.33-Year	103.700
5-Year	104.214
10-Year	104.959
25-Year	106.005
50-Year	106.048
100-Year	106.058

************Groundwater Recharge Summary **************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Total Predeveloped Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: Proj. Area		119.351
Subbasin: Flow Through		0.000
Subbasin: Bypassbasin		0.000
Link:	POC	0.000
Link:	Bypass	0.000
Total:		119.351

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: Proj, Area Postdevel		0.000
Subbasin: Flow Through		0.000
Subbasin: Bypass		0.000
Link:	Detention Vault	0.000
Link:	Bypass	0.000
Link:	Flow Splitter	0.000
Link:	Vault Link	0.000
Total:		0.000

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.755 ac-ft/year, Post Developed: 0.000 ac-ft/year

************Water Quality Facility Data **************

----------SCENARIO: PREDEVELOPED

Number of Links: 2

********** Link: POC **********

2-Year Discharge Rate : 0.164 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.05 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.03 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 214.73
Inflow Volume Including PPT-Evap (ac-ft): 214.73
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 214.73
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

********** Link: Bypass **********

2-Year Discharge Rate : 0.423 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.15 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.08 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 416.29
Inflow Volume Including PPT-Evap (ac-ft): 416.29
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 416.29
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

----------SCENARIO: POSTDEVELOPED

Number of Links: 4

********** Link: Detention Vault **********

Basic Wet Pond Volume (91% Exceedance): 4566. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 6848. cu-ft

2-Year Discharge Rate : 0.073 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.17 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.09 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 466.34
Inflow Volume Including PPT-Evap (ac-ft): 466.34
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 466.34
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

********** Link: Bypass **********

2-Year Discharge Rate : 0.421 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.15 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.08 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 414.10
Inflow Volume Including PPT-Evap (ac-ft): 414.10
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 414.10
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

********** Link: Flow Splitter **********

2-Year Discharge Rate : 0.474 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.32 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.18 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 880.44
Inflow Volume Including PPT-Evap (ac-ft): 880.44
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 466.34
Secondary Outflow To Downstream System (ac-ft): 414.10
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

********** Link: Vault Link **********

2-Year Discharge Rate : 0.472 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.17 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.09 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 464.15
Inflow Volume Including PPT-Evap (ac-ft): 464.15
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 464.15
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

**********Compliance Point Results **********

Scenario Predeveloped Compliance Link: POC
Scenario Postdeveloped Compliance Link: Detention Vault

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

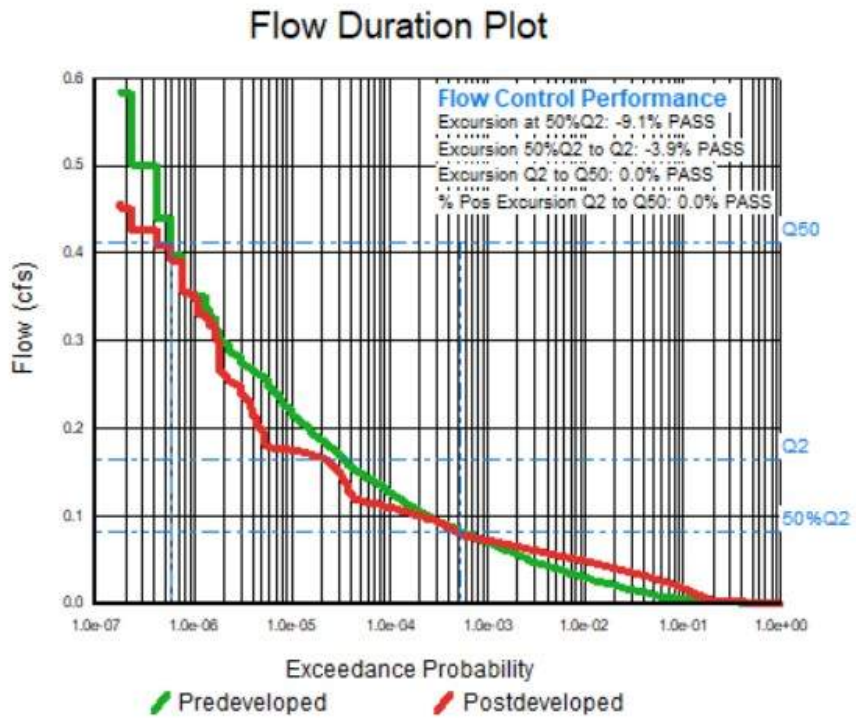
Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	0.164	2-Year	7.339E-02
5-Year	0.221	5-Year	9.975E-02
10-Year	0.268	10-Year	0.113
25-Year	0.336	25-Year	0.194
50-Year	0.412	50-Year	0.350
100-Year	0.499	100-Year	0.405
200-Year	0.555	200-Year	0.439
500-Year	0.629	500-Year	0.484

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******

Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	-9.1%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	-3.9%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	0.0%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS



APPENDIX D

Conveyance Calculations

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

CALCULATION REPORT

Calculated By: Nathan Hahne, EIT Date: 1/7/2025

Checked By: Thomas Cheong, PE Date: 1/7/2025

Conveyance Calculations: NE 85th Street (Upstream Conveyance from Flow Splitter)

Objective:

To analyze the hydraulic grade line and check conveyance capacity in the 25-year storm event of the proposed system tributary to the flow splitter.

Key Design Factors and Assumptions:

- Stormshed 3G model is used for analyzing the system.
- Minimum Time of Concentration (TC) is set to 6.30 minutes at the upstream end.
- Smooth wall pipe with manning's coefficients of 0.012 is used for this analysis.
- "Max El" corresponds to rim elevation at the structure or pipe crown.
- "Start El" corresponds to the lowest pipe invert in a particular structure or outfall elevation.
- StormShed3G is used to analyzed for a 25-year storm event using the fixed flow rate. 25-year storm event developed from calculations from the Rational Method equations as found in the 2021 King County Surface Water Design Manual. See fixed flow rate tables in the section for "Contributing Drainage Areas".
- Tailwater is set to the crown of the 12" outfall pipe from structure CB #103.

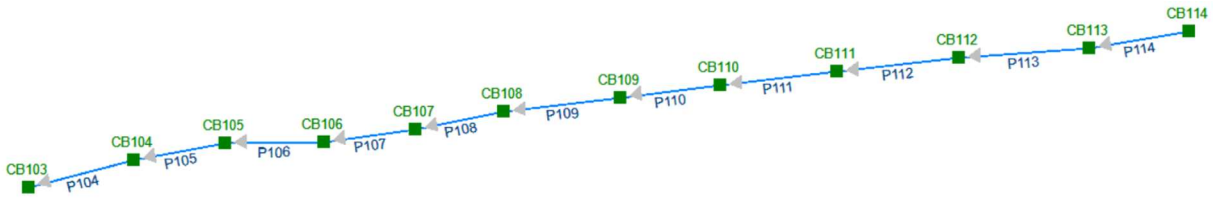
Summary of Results:

Hydrologic Flow Rates

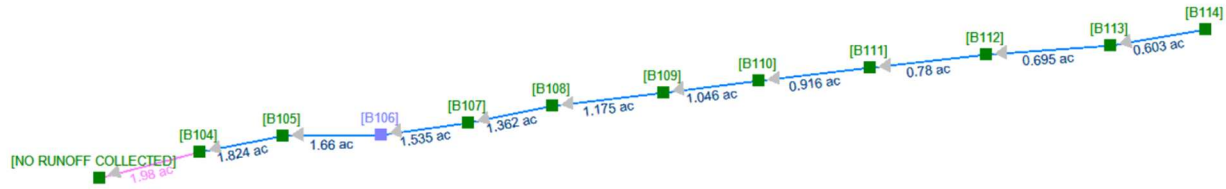
Event Frequency	Flow Rate (CFS)
2-Year	1.75
10-Year	3.75
25-Year	4.58
100-Year	5.39

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

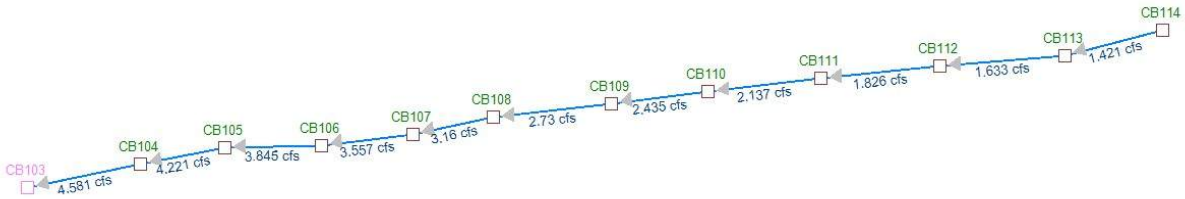
Layout Report: 85th Conveyance System



Nodes and Reach Labels



Contributing Basins and Areas



Nodes and Flow Rates

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Appended on: Tuesday, January 7, 2025 11:15:53 AM

ROUTEHYD [] THRU [85th Conveyance System] USING [25 year] AND [] NOTZERO RELATIVE Fixed Flow

Gravity Analysis using fixed flowrates

Reach ID	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CFlow
P114	1.421	10.0787	0.141	0.2534	12 in Diam	9.0818	12.8326	1.421
P113	1.633	9.7985	0.1667	0.2758	12 in Diam	9.267	12.4759	0.212
P112	1.826	9.5605	0.191	0.2962	12 in Diam	9.3775	12.1728	0.193
P111	2.137	9.805	0.2179	0.3173	12 in Diam	9.9777	12.4841	0.311
P110	2.435	9.8294	0.2477	0.339	12 in Diam	10.3813	12.5151	0.298
P109	2.73	9.7907	0.2788	0.3611	12 in Diam	10.6792	12.4658	0.295
P108	3.16	9.9057	0.319	0.386	12 in Diam	11.2962	12.6123	0.43
P107	3.557	10.0605	0.3536	0.4104	12 in Diam	11.7158	12.8094	0.397
P106	3.845	10.1323	0.3795	0.4273	12 in Diam	12.0059	12.9008	0.288
P105	4.221	10.3031	0.4097	0.446	12 in Diam	12.4577	13.1183	0.376
P104	4.581	14.1192	0.3245	0.3887	12 in Diam	16.2284	17.9771	0.36

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							93.78
CB104	CB103	96.3366	------	0.0025	------	96.3391	97.9800
CB105	CB104	101.8130	------	0.0158	------	101.8289	103.6400
CB106	CB105	108.9278	------	0.0076	------	108.9354	110.9400
CB107	CB106	117.7462	------	0.0054	------	117.7516	119.8600
CB108	CB107	127.8386	------	0.0045	------	127.8430	130.0800
CB109	CB108	136.1576	------	0.0009	------	136.1585	138.5600
CB110	CB109	145.2270	------	0.0006	------	145.2275	147.7100
CB111	CB110	152.6466	------	0.0079	------	152.6545	155.2400
CB112	CB111	159.6936	------	0.0093	------	159.7029	162.3700
CB113	CB112	164.6329	------	0.0561	------	164.6890	167.3700
CB114	CB113	169.8549	------	------	------	169.8549	172.5600

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
P104	1.8266	1.8266	4.58	1.0000	0.8921	0.3887	SuperCrit flow, Inlet end controls
P105	1.6330	1.6330	4.22	1.8291	0.8660	0.4460	SuperCrit flow, Inlet end controls
P106	1.4878	1.4878	3.85	1.4489	0.8336	0.4273	SuperCrit flow, Inlet end controls
P107	1.3862	1.3862	3.56	1.4954	0.8054	0.4104	SuperCrit flow, Inlet end controls
P108	1.2586	1.2586	3.16	1.3916	0.7619	0.3860	SuperCrit flow, Inlet end controls
P109	1.0976	1.0976	2.73	1.1630	0.7085	0.3611	SuperCrit flow, Inlet end controls
P110	1.0070	1.0070	2.44	1.0985	0.6685	0.3390	SuperCrit flow, Inlet end controls
P111	0.9166	0.9166	2.14	1.0075	0.6247	0.3173	SuperCrit flow, Inlet end controls
P112	0.8236	0.8236	1.83	0.9245	0.5757	0.2962	SuperCrit flow, Inlet end controls
P113	0.7629	0.7629	1.63	0.8329	0.5429	0.2758	SuperCrit flow, Inlet end controls
P114	0.6949	0.6949	1.42	0.8190	0.5048	0.2534	SuperCrit flow, Inlet end controls

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Reach Records

Record Id: P104

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB103	UpNode	CB104
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	13.00 ft	Slope	13.31%
Up Invert	94.51 ft	Dn Invert	92.78 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P105

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB104	UpNode	CB105
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	80.00 ft	Slope	7.09%
Up Invert	100.18 ft	Dn Invert	94.51 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: P106

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB105	UpNode	CB106
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	103.00 ft	Slope	6.85%
Up Invert	107.44 ft	Dn Invert	100.38 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P107

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB106	UpNode	CB107
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	132.00 ft	Slope	6.76%
Up Invert	116.36 ft	Dn Invert	107.44 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: P108

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB107	UpNode	CB108
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	156.00 ft	Slope	6.55%
Up Invert	126.58 ft	Dn Invert	116.36 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P109

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB108	UpNode	CB109
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	131.00 ft	Slope	6.40%
Up Invert	135.06 ft	Dn Invert	126.68 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: P110

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB109	UpNode	CB110
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	142.00 ft	Slope	6.45%
Up Invert	144.22 ft	Dn Invert	135.06 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P111

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB110	UpNode	CB111
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	117.00 ft	Slope	6.42%
Up Invert	151.73 ft	Dn Invert	144.22 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: P112

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB111	UpNode	CB112
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	117.00 ft	Slope	6.10%
Up Invert	158.87 ft	Dn Invert	151.73 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P113

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB112	UpNode	CB113
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	78.00 ft	Slope	6.41%
Up Invert	163.87 ft	Dn Invert	158.87 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: P114

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB113	UpNode	CB114
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	78.00 ft	Slope	6.78%
Up Invert	169.16 ft	Dn Invert	163.87 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Node Records

Record Id: CB103

Descrip:	Flow Splitter	Increment	0.10 ft
Start El.	92.78 ft	Max El.	97.79 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 2--72
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	28.274 sf
MH/CB Type Node			

Record Id: CB104

Descrip:		Increment	0.10 ft
Start El.	94.51 ft	Max El.	97.98 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB105

Descrip:		Increment	0.10 ft
Start El.	100.18 ft	Max El.	103.64 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Record Id: CB106

Descrip:		Increment	0.10 ft
Start El.	107.44 ft	Max El.	110.94 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB107

Descrip:		Increment	0.10 ft
Start El.	116.36 ft	Max El.	119.86 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB108

Descrip:		Increment	0.10 ft
Start El.	126.58 ft	Max El.	130.08 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB109

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Descrip:		Increment	0.10 ft
Start El.	135.06 ft	Max El.	138.56 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB110

Descrip:		Increment	0.10 ft
Start El.	144.22 ft	Max El.	147.71 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB111

Descrip:		Increment	0.10 ft
Start El.	151.73 ft	Max El.	155.24 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB112

Descrip:		Increment	0.10 ft

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Start El.	158.87 ft	Max El.	162.37 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB113

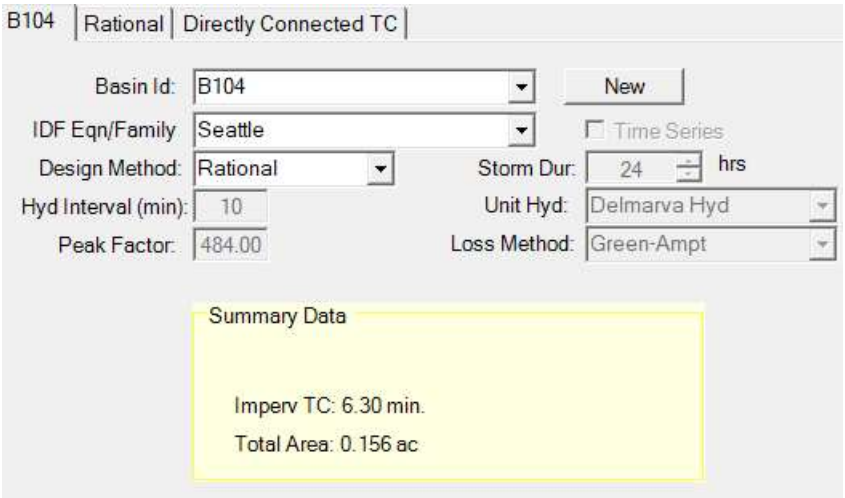
Descrip:		Increment	0.10 ft
Start El.	163.87 ft	Max El.	167.37 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB114

Descrip:		Increment	0.10 ft
Start El.	169.16 ft	Max El.	172.56 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

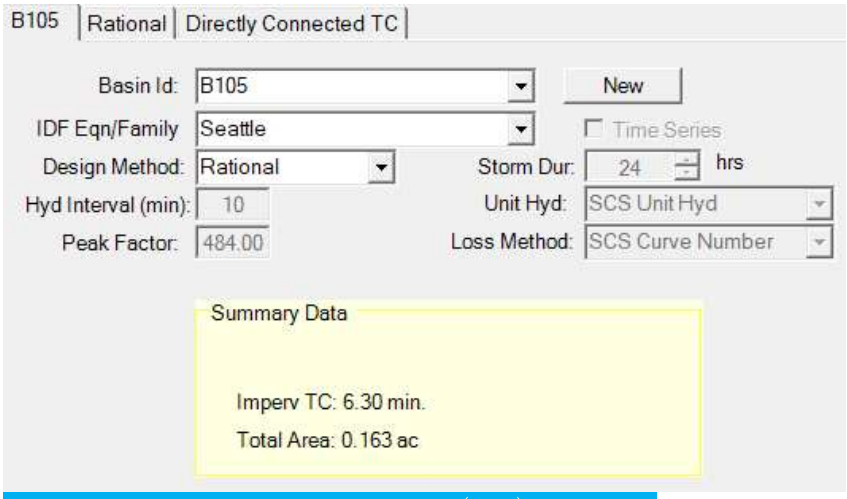
801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Contributing Drainage Areas



Event Frequency	Flow Rate (CFS)*
2-Year	0.137
5-Year	0.294
25-Year	0.360
100-Year	0.424

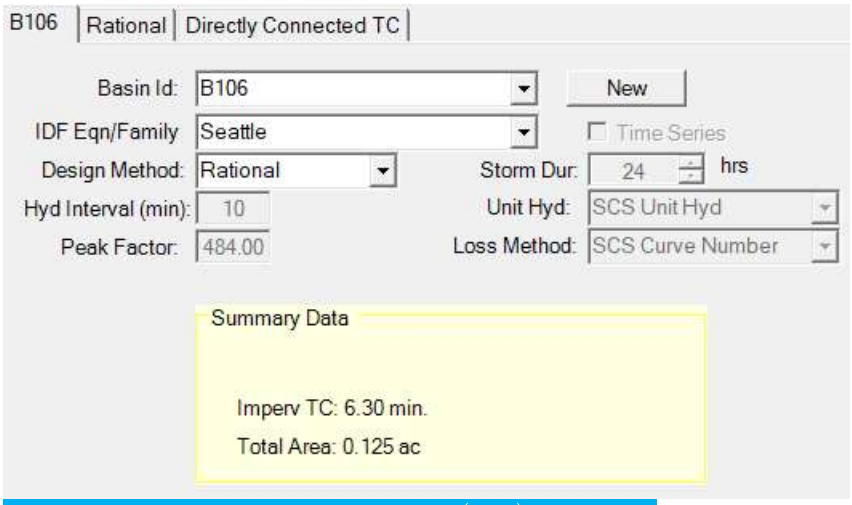
*Flow rate input for fixed flow rate.



Event Frequency	Flow Rate (CFS)*
2-Year	0.143
5-Year	0.308
25-Year	0.376
100-Year	0.443

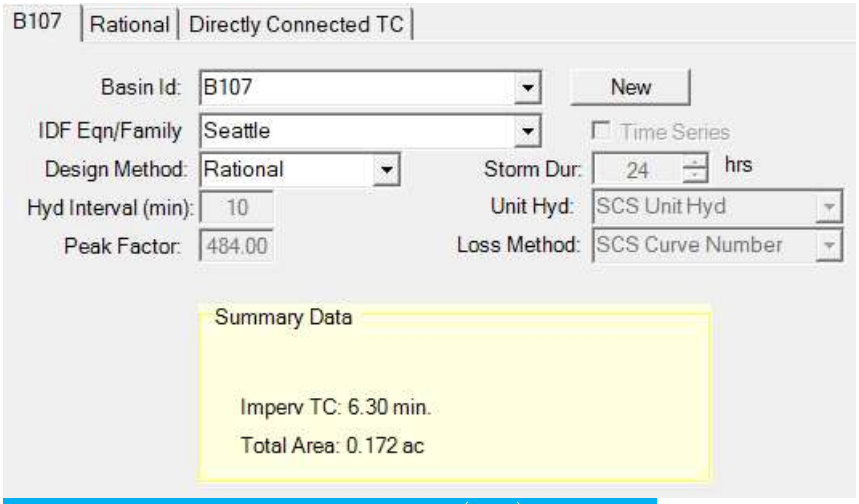
*Flow rate input for fixed flow rate.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Event Frequency	Flow Rate (CFS)*
2-Year	0.110
5-Year	0.236
25-Year	0.288
100-Year	0.339

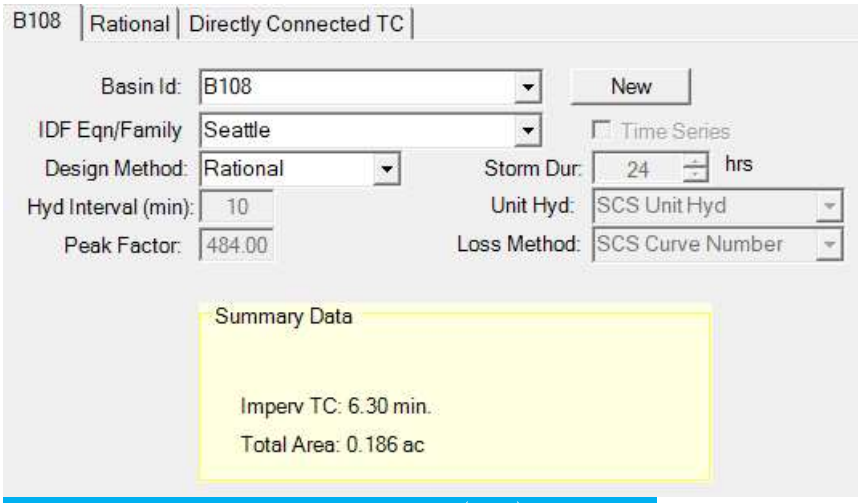
*Flow rate input for fixed flow rate.



Event Frequency	Flow Rate (CFS)*
2-Year	0.151
5-Year	0.325
25-Year	0.397
100-Year	0.467

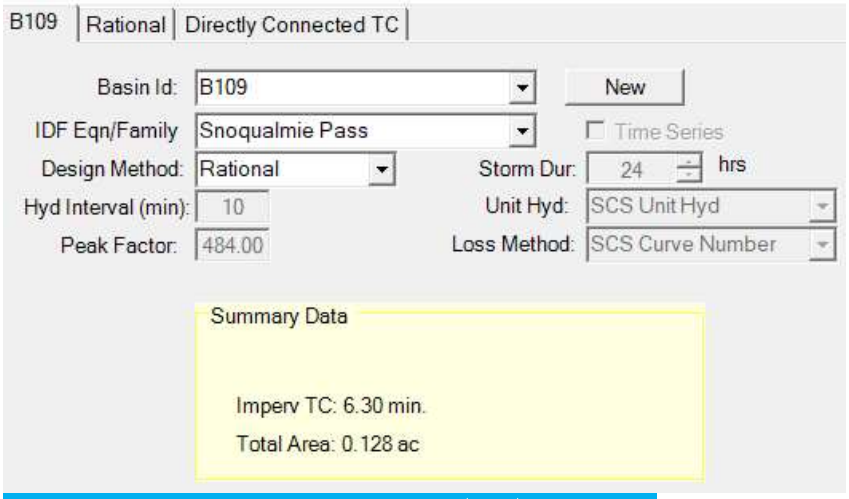
*Flow rate input for fixed flow rate.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Event Frequency	Flow Rate (CFS)*
2-Year	0.164
5-Year	0.351
25-Year	0.430
100-Year	0.506

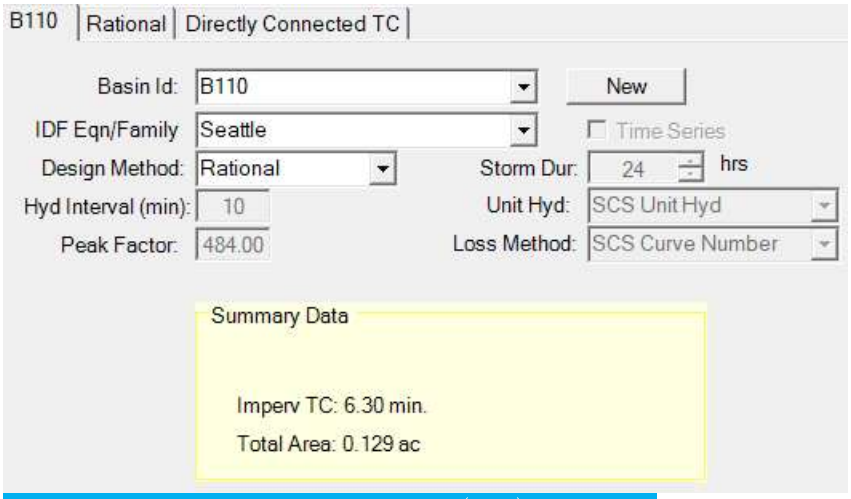
*Flow rate input for fixed flow rate.



Event Frequency	Flow Rate (CFS)*
2-Year	0.113
5-Year	0.241
25-Year	0.298
100-Year	0.347

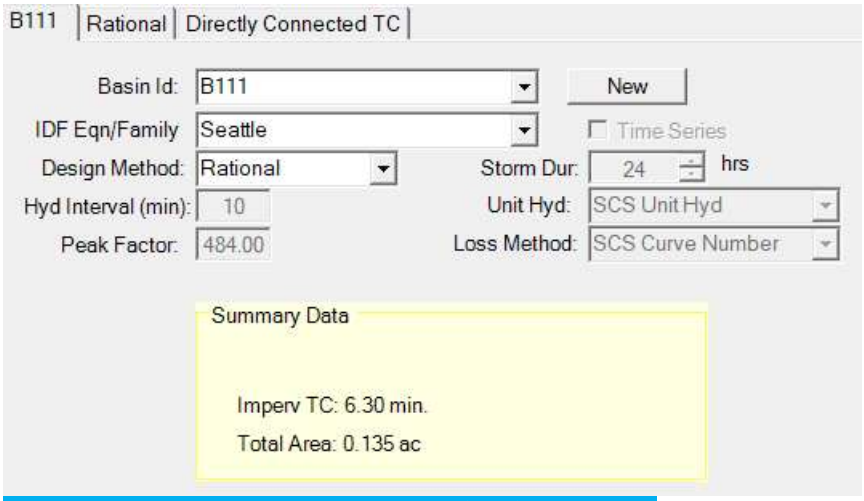
*Flow rate input for fixed flow rate.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Event Frequency	Flow Rate (CFS)*
2-Year	0.113
5-Year	0.243
25-Year	0.298
100-Year	0.350

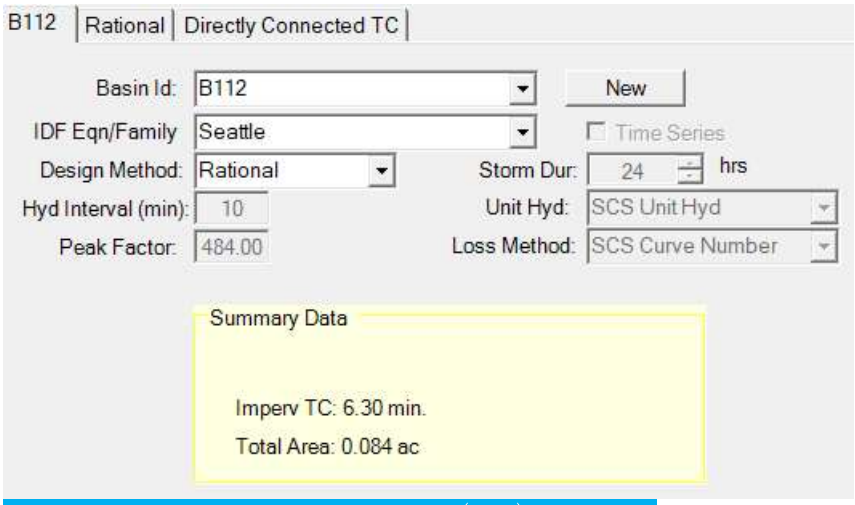
*Flow rate input for fixed flow rate.



Event Frequency	Flow Rate (CFS)*
2-Year	0.119
5-Year	0.255
25-Year	0.311
100-Year	0.367

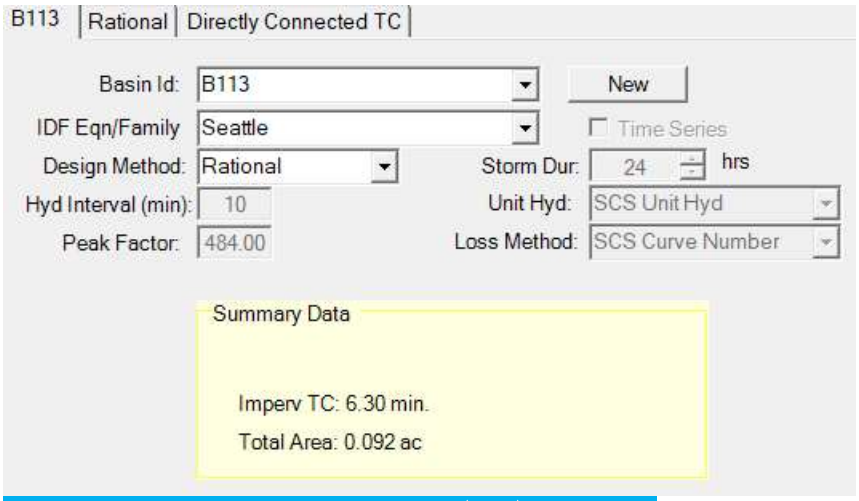
*Flow rate input for fixed flow rate.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Event Frequency	Flow Rate (CFS)*
2-Year	0.074
5-Year	0.157
25-Year	0.193
100-Year	0.228

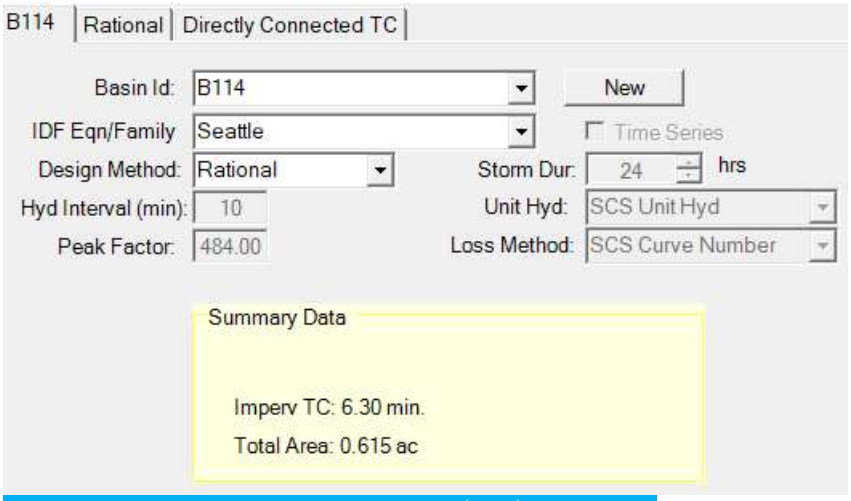
*Flow rate input for fixed flow rate.



Event Frequency	Flow Rate (CFS)*
2-Year	0.081
5-Year	0.173
25-Year	0.212
100-Year	0.249

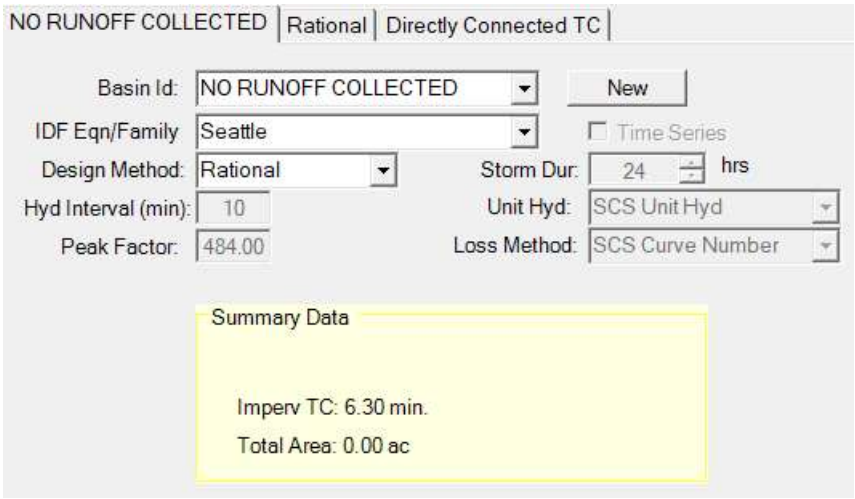
*Flow rate input for fixed flow rate.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Event Frequency	Flow Rate (CFS)*
2-Year	0.541
5-Year	1.162
25-Year	1.421
100-Year	1.673

*Flow rate input for fixed flow rate.



801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

CALCULATION REPORT

Calculated By: Nathan Hahne, EIT Date: 8/21/2024

Checked By: Thomas Cheong, PE Date: 8/21/2024

Conveyance Calculations: NE 85th Street (Downstream Conveyance from Detention Vault)

Objective:

To analyze the hydraulic grade line and check conveyance capacity in the 25-year storm event of the proposed system.

Key Design Factors and Assumptions:

- Stormshed 3G model is used for analyzing the system.
- Minimum Time of Concentration (TC) is set to 6.30 minutes.
- Smooth wall pipe with manning's coefficients of 0.012 is used for this analysis.
- "Max El" corresponds to rim elevation at the structure or pipe crown.
- "Start El" corresponds to the lowest pipe invert in a particular structure or outfall elevation.
- StormShed3G is used to analyzed for a 25-year storm event using a fixed flow rate. 25-year storm event developed from MGSFlood (continuous method) directed into the Detention Vault.

********** Link: Vault Link **********

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.472
5-Year	0.632
10-Year	0.797
25-Year	1.018
50-Year	1.127
100-Year	1.501
200-Year	1.687
500-Year	1.928

- Runoff from the detention vault discharges to a closed conveyance system with solid covered catch basins connecting to the existing conveyance system downstream.
- Tailwater is set to the crown of the 54" outfall pipe to existing structure CB #7905.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

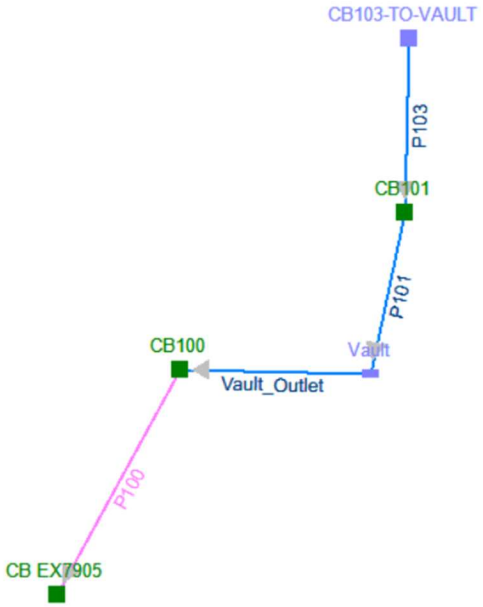
Summary of Results:

Hydrologic Flow Rates

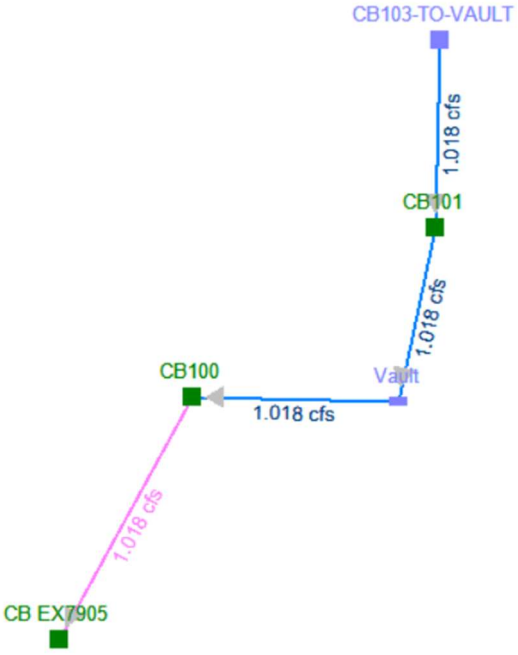
Event Frequency	Flow Rate (CFS)
2-Year	0.47
5-Year	0.63
10-Year	0.80
25-Year	1.02
100-Year	1.50

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Layout Report: Flow Splitter to Vault



Nodes and Reach Labels



Nodes and Flow Rates

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

ROUTEHYD [] THRU [Flow Splitter to Vault] USING [25 year] AND [] NOTZERO RELATIVE Fixed Flow

Gravity Analysis using fixed flowrates

Reach ID	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CFlow
P-103	1.018	27.9934	0.0364	0.1302	12 in Diam	16.9303	35.6423	1.018
P101	1.018	5.851	0.174	0.2818	12 in Diam	5.6046	7.4497	0.00
Vault_Outlet	1.018	3.8701	0.263	0.35	12 in Diam	4.1559	4.9276	0.00
P100	1.018	3.6523	0.2787	0.3611	12 in Diam	3.9833	4.6502	0.00

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							70.424
CB100	CB EX7905	71.1628	------	0.1830	------	71.3458	82.9100
Vault	CB100	71.6517	--na--	--na--	--na--	1.1000	1.0000
No approach losses at node CB103-TO-VAULT because inverts and/or crowns are offset.							
CB101	Vault	76.5058	------	0.2080	------	76.7138	83.4200
CB103-TO-VAULT	CB101	93.1156	------	------	------	93.1156	97.7800

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
P100	0.5928	0.5928	1.02	0.4240	0.4240	0.3611	SuperCrit flow, Inlet end controls
Vault_Outlet	0.8917	0.8917	1.02	0.7758	0.4240	0.3500	Outlet Control M1 Backwater
P101	0.5858	0.5858	1.02	0.4240	0.4240	0.2818	SuperCrit flow, Inlet end controls
P-103	0.3356	0.3356	1.02	0.4240	0.4240	0.1302	SuperCrit flow, Inlet end controls

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Reach Records

Record Id: P100

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB EX7905	UpNode	CB100
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	64.00 ft	Slope	0.73%
Up Invert	70.47 ft	Dn Invert	70.00 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P101

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	Vault	UpNode	CB101
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	7.00 ft	Slope	2.29%
Up Invert	75.92 ft	Dn Invert	75.76 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P-103

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.024
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB101	UpNode	CB103-TO-VAULT
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	25.00 ft	Slope	52.32%
Up Invert	92.78 ft	Dn Invert	79.70 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: Vault_Outlet

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB100	UpNode	Vault
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	19.00 ft	Slope	1.00%
Up Invert	70.76 ft	Dn Invert	70.57 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Node Records

Record Id: CB EX7905

Descrip:		Increment	0.10 ft
Start El.	70.00 ft	Max El.	83.14 ft
Void Ratio	100.00		
Condition	Existing	Structure Type	CB-TYPE 2-96
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	50.265 sf
MH/CB Type Node			

Record Id: CB100

Descrip:		Increment	0.10 ft
Start El.	70.57 ft	Max El.	82.91 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 2-48
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	12.5664 sf
MH/CB Type Node			

Record Id: CB101

Descrip:		Increment	0.10 ft
Start El.	75.92 ft	Max El.	83.42 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 2-54
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	15.904 sf
MH/CB Type Node			

Record Id: CB103-TO-VAULT

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Descrip:		Increment	0.00 ft
Start El.	92.78 ft	Max El.	97.78 ft
Void Ratio	0.00		
Condition	Proposed	Structure Type	CB-TYPE 2--72
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	28.274 sf
MH/CB Type Node			

Record Id: Vault

Descrip:		Increment	0.10 ft
Start El.	70.76 ft	Max El.	77.26 ft
Void Ratio	100.00		
Length	84.00 ft	Width	12.00 ft
Vault Type Node			

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Contributing Drainage Areas

Flow rates were generated by MGSFlood to determine the fixed flow rate from the detention vault. No contributing areas have been developed with the conveyance modeling downstream from the detention vault.

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

CALCULATION REPORT

Calculated By: Nathan Hahne, EIT Date: 8/21/2024

Checked By: Thomas Cheong, PE Date: 8/21/2024

Conveyance Calculations: NE 85th Street (Downstream Conveyance from Flow Splitter following Gutterline)

Objective:

To analyze the hydraulic grade line and check conveyance capacity in the 25-year storm event of the proposed system tributary to the flow splitter.

Key Design Factors and Assumptions:

- Stormshed 3G model is used for analyzing the system.
- Minimum Time of Concentration (TC) is set to 6.30 minutes as required by King County.
- Smooth wall pipe with manning's coefficients of 0.012 is used for this analysis.
- "Max El" corresponds to rim elevation at the structure or pipe crown.
- "Start El" corresponds to the lowest pipe invert in a particular structure or outfall elevation.
- StormShed3G is used to analyzed for a 25-year storm event using a fixed flow rate. 25-year storm event developed from MGSFlood (continuous method) directed into the existing conveyance system.

********** **Subbasin: Bypass** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.418
5-Year	0.560
10-Year	0.706
25-Year	0.902
50-Year	0.999
100-Year	1.330
200-Year	1.495
500-Year	1.709

- Runoff from flow splitter discharges to an open conveyance system with grated lid catch basins connecting to the existing conveyance system downstream along the gutterline of NE 85th Street.
- Runoff collected from catch basins downstream from the flow splitter was determined through the rational method and flow rate values has been inputted to the fixed flow rate tables for each catch basin. 25-year storm event developed from calculations from the Rational Method equations as found in the 2021 King County Surface Water Design Manual. See fixed flow rate tables in the section for "Contributing Drainage Areas".

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

- Tailwater is set to the crown of the 12" outfall pipe to the existing conveyance system along the gutterline of NE 85th Street.

Summary of Results:

Hydrologic Flow Rates

Event Frequency	Flow Rate (CFS)
2-Year	0.49
10-Year	0.82
25-Year	1.04
100-Year	1.50

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Layout Report: CB103 to Existing

Nodes and Reach Labels

Nodes and Flow Rates

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

ROUTEHYD [] THRU [CB103 to Existing] USING [25 year] AND [] NOTZERO RELATIVE Fixed Flow

Gravity Analysis using fixed flowrates

Reach ID	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CFlow
P-103-85th	0.902	5.8948	0.153	0.2639	12 in Diam	5.4433	7.5054	0.902
P-102	1.038	9.7983	0.1059	0.2191	12 in Diam	8.1484	12.4756	0.136

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							87.65
CB102	CB EX 1	92.6720	------	0.0124	------	92.6844	95.7000
CB103	CB102	93.3255	------	------	------	93.3255	97.7800

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
P-102	0.5720	0.5720	1.04	1.0000	0.4282	0.2191	SuperCrit flow, Inlet end controls
P-103-85th	0.5455	0.5455	0.90	0.4844	0.3982	0.2639	SuperCrit flow, Inlet end controls

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Reach Records

Record Id: P-102

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB EX 1	UpNode	CB102
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	85.00 ft	Slope	6.41%
Up Invert	92.10 ft	Dn Invert	86.65 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P-103-85th

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB102	UpNode	CB103
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	25.00 ft	Slope	2.32%
Up Invert	92.78 ft	Dn Invert	92.20 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Node Records

Record Id: CB EX 1

Descrip:		Increment	0.10 ft
Start El.	86.65 ft	Max El.	89.56 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB102

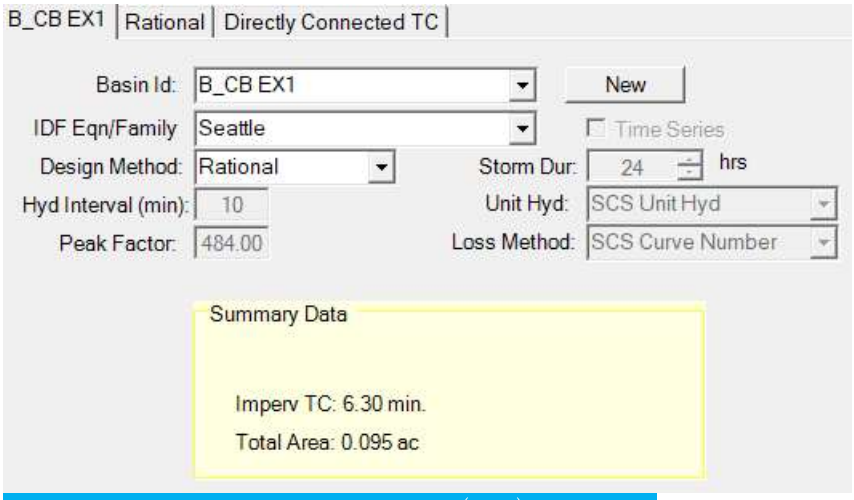
Descrip:		Increment	0.10 ft
Start El.	92.10 ft	Max El.	95.70 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB103

Descrip:		Increment	0.10 ft
Start El.	92.78 ft	Max El.	97.78 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 2--72
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	28.274 sf
MH/CB Type Node			

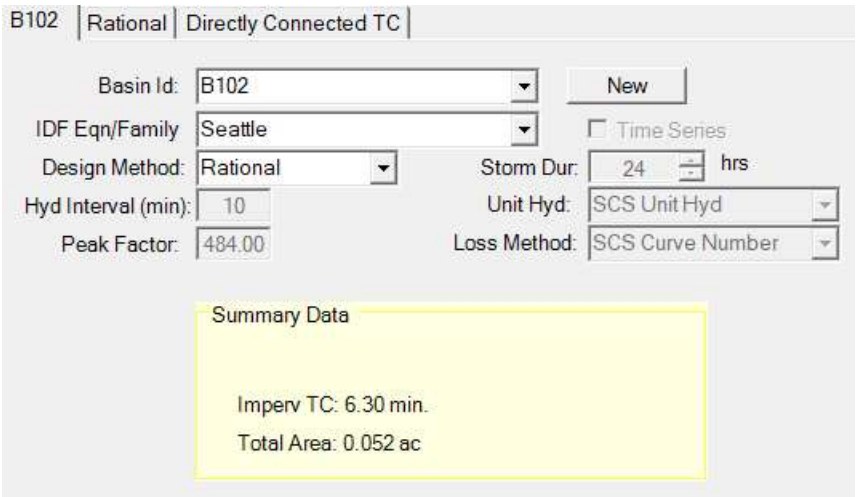
801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Contributing Drainage Areas



Event Frequency	Flow Rate (CFS)*
2-Year	0.133
10-Year	0.205
25-Year	0.248
100-Year	0.328

*Flow rate input for fixed flow modeling



Event Frequency	Flow Rate (CFS)*
2-Year	0.073
10-Year	0.113
25-Year	0.136
100-Year	0.171

*Flow rate input for fixed flow modeling

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

CALCULATION REPORT

Calculated By: Nathan Hahne, EIT Date:12/04/2024

Checked By: Thomas Cheong, PE Date: 12/04/2024

Conveyance Calculations: NE 85th Street (Upstream Ped Bridge)

Objective:

To analyze the hydraulic grade line and check conveyance capacity in the 25-year storm event of the proposed system.

Key Design Factors and Assumptions:

- Minimum Time of Concentration (TC) is set to 6.30 minutes at the upstream end.
- Smooth wall pipe with manning's coefficients of 0.012 is used for this analysis.
- "Max El" corresponds to rim elevation at the structure or pipe crown.
- "Start El" corresponds to the lowest pipe invert in a particular structure or outfall elevation.
- StormShed3G is used to analyze a 25-year storm event using the Rational Method.
- Stormshed 3G model is used for analyzing the system.
- Rainfall IDF Family Seattle is used.
- Tailwater is set to the invert elevation of the 12" outfall pipe (Outfall 44243).

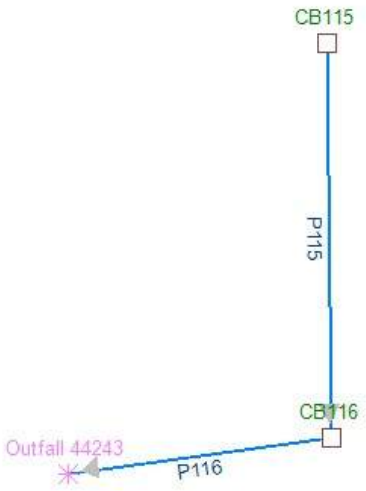
Summary of Results:

Hydrologic Flow Rates

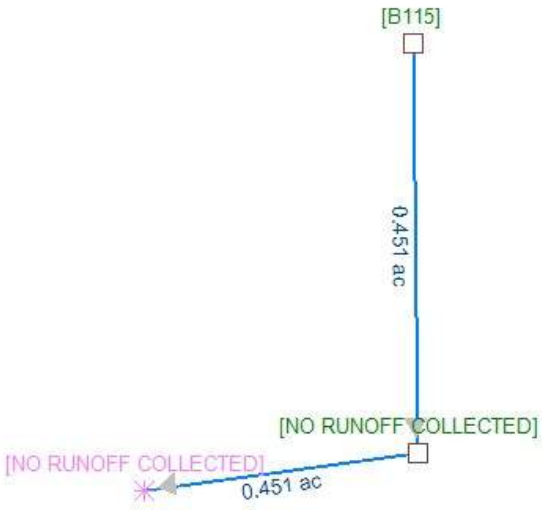
Event Frequency	Flow Rate (CFS)
2-Year	0.53
5-Year	0.70
10-Year	0.81
25-Year	0.98
50-Year	1.11
100-Year	1.23

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Layout Report: Upstream Ped Bridge

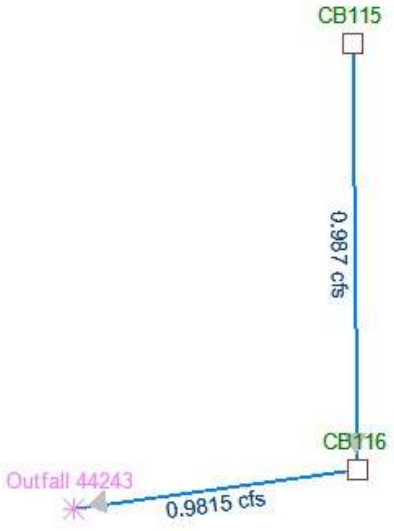


Nodes and Reach Labels



Contributing Basins and Areas

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515



Nodes and Flow Rates

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Appended on: Thursday, December 5, 2024 11:30:07 AM

ROUTEHYD [] THRU [Upstream Ped Bridge] USING [25 yr] AND [Seattle] NOTZERO RELATIVE RATIONAL

Rational Method analysis

Reach ID	Area (ac)	TC (min)	i (in/hr)	Flow (cfs)	Full Q (cfs)	Full ratio	nDepth (ft)	Size	nVel (ft/s)	fVel (ft/s)	CArea
P115	0.451	6.30	2.5549	0.987	20.6048	0.0479	0.1487	12 in Diam	13.528	26.2349	B115
P116	0.451	6.3641	2.541	0.9816	8.098	0.1212	0.2354	12 in Diam	6.9614	10.3107	NO RUNOFF COLLECTED

HGL Analysis

From Node	To Node	HG El (ft)	App (ft)	Bend (ft)	Junct Loss (ft)	Adjusted HG El (ft)	Max El (ft)
							174.3194
CB116	Outfall 44243	176.1329	------	3.2336	------	179.3665	180.5700
CB115	CB116	190.8549	------	------	------	190.8549	203.9900

Conduit Notes

Reach	HW Depth (ft)	HW/D ratio	Q (cfs)	TW Depth (ft)	Dc (ft)	Dn (ft)	Comment
P116	0.5629	0.5629	0.98	0.4161	0.4161	0.2354	SuperCrit flow, Inlet end controls
P115	0.4449	0.4449	0.99	3.6965	0.4173	0.1487	SuperCrit flow, Inlet end controls

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Reach Records

Record Id: P115

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	CB116	UpNode	CB115
Material	unspecified	Size	12 in Diam
Ent Losses	Groove End w/Headwall		
Length	52.00 ft	Slope	27.60%
Up Invert	190.41 ft	Dn Invert	175.57 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

Record Id: P116

Section Shape:	Circular		
Uniform Flow Method:	Manning's	Coefficient:	0.012
Routing Method:	Travel Time Shift	Contributing Hyd	
DnNode	Outfall 44243	UpNode	CB116
Material	unspecified	Size	18 in Diam
Ent Losses	Groove End w/Headwall		

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Length	37.00 ft	Slope	7.08%
Up Invert	175.57 ft	Dn Invert	173.95 ft

Conduit Constraints				
Min Vel	Max Vel	Min Slope	Max Slope	Min Cover
2.00 ft/s	15.00 ft/s	0.50%	2.00%	3.00 ft

Drop across MH	0.00 ft	Ex/Infil Rate	0.00 in/hr

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Node Records

Record Id: CB115

Descrip:		Increment	0.10 ft
Start El.	190.41 ft	Max El.	203.99 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: CB116

Descrip:		Increment	0.10 ft
Start El.	175.57 ft	Max El.	180.57 ft
Void Ratio	100.00		
Condition	Proposed	Structure Type	CB-TYPE 1
		Channelization	No Special Shape
Catch	0.00 ft	Bottom Area	3.97 sf
MH/CB Type Node			

Record Id: Outfall 44243

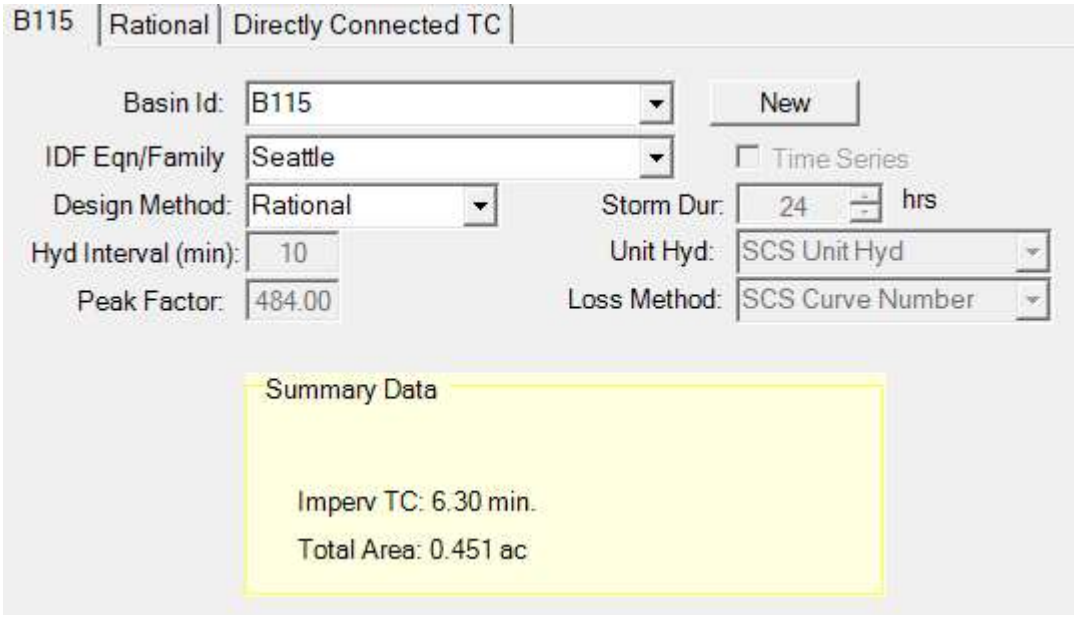
Descrip:		Increment	0.10 ft
Start El.	173.95 ft	Max El.	174.95 ft
Void Ratio	100.00		

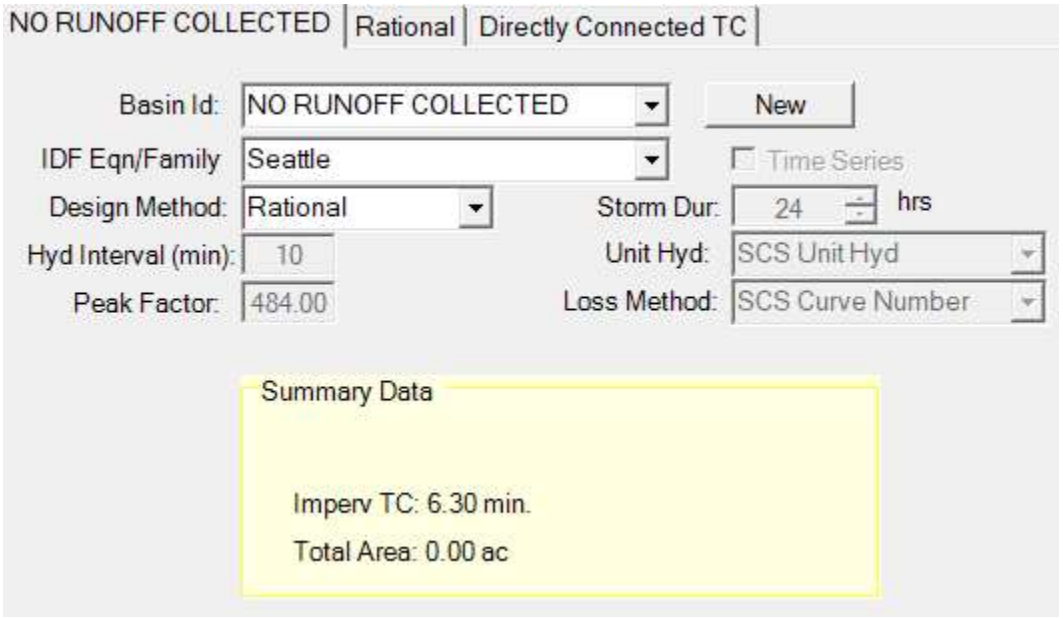
801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

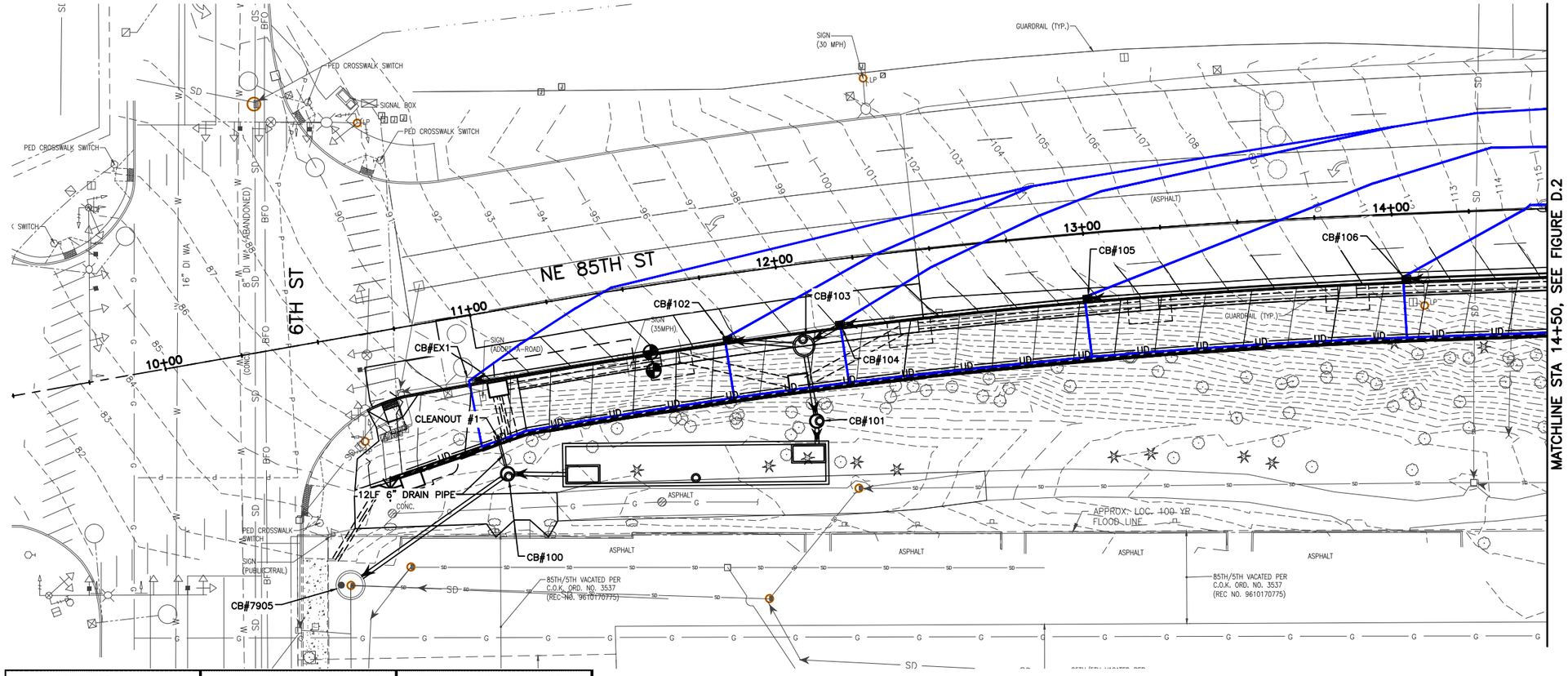
Dummy Type Node

801 2nd Avenue, Suite 302 Seattle, WA 98104 | P 206-436-0515

Contributing Drainage Areas





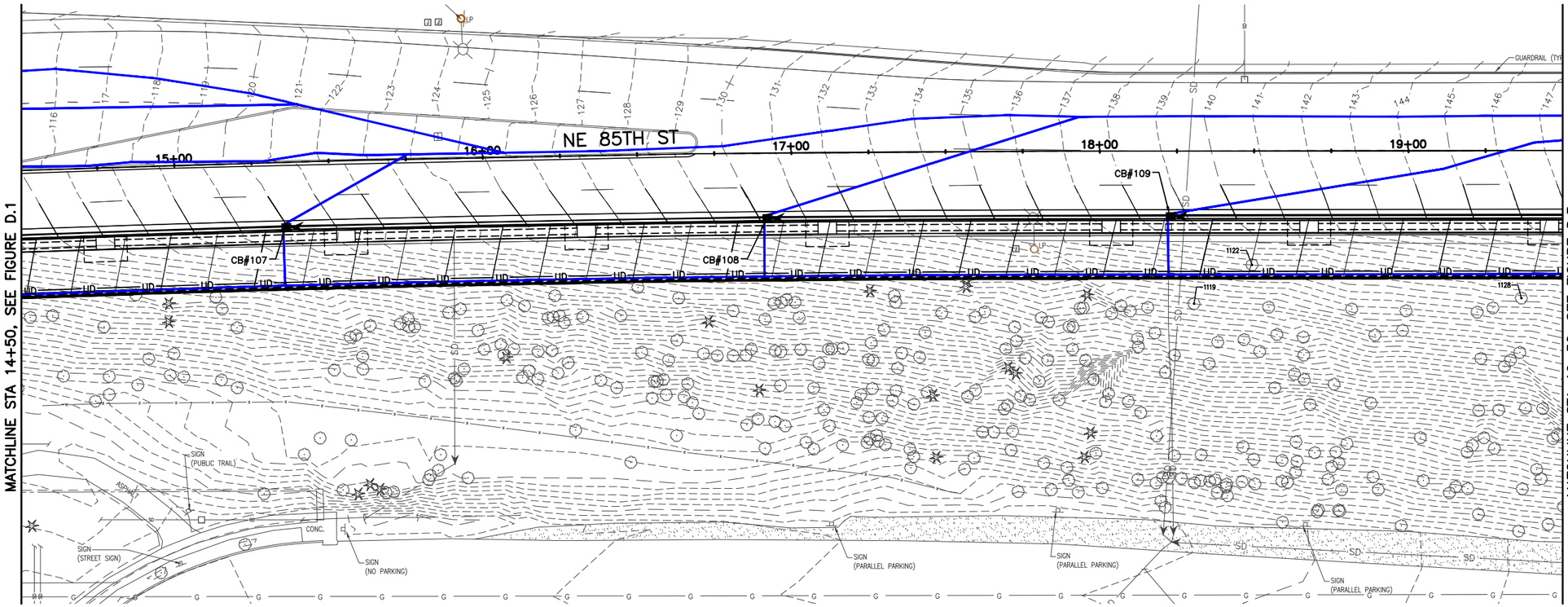


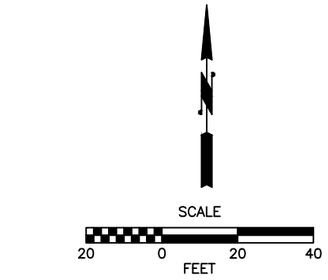
CB/Pipe #	IMPERVIOUS (AC)	PERVIOUS (AC)
100	0.000	0.000
101	0.000	0.000
102	0.051	0.001
103	0.000	0.000
104	0.155	0.001
105	0.162	0.001
106	0.124	0.001
107	0.171	0.001
108	0.185	0.001
109	0.127	0.001
110	0.128	0.001
111	0.134	0.001
112	0.083	0.001
113	0.091	0.001
114	0.613	0.002
115	0.423	0.028
116	0.000	0.000
CB EX 1	0.094	0.001
CB EX 7905	0.000	0.000

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
CATCHMENT AREA MAP

FIGURE
D.1





LEGEND

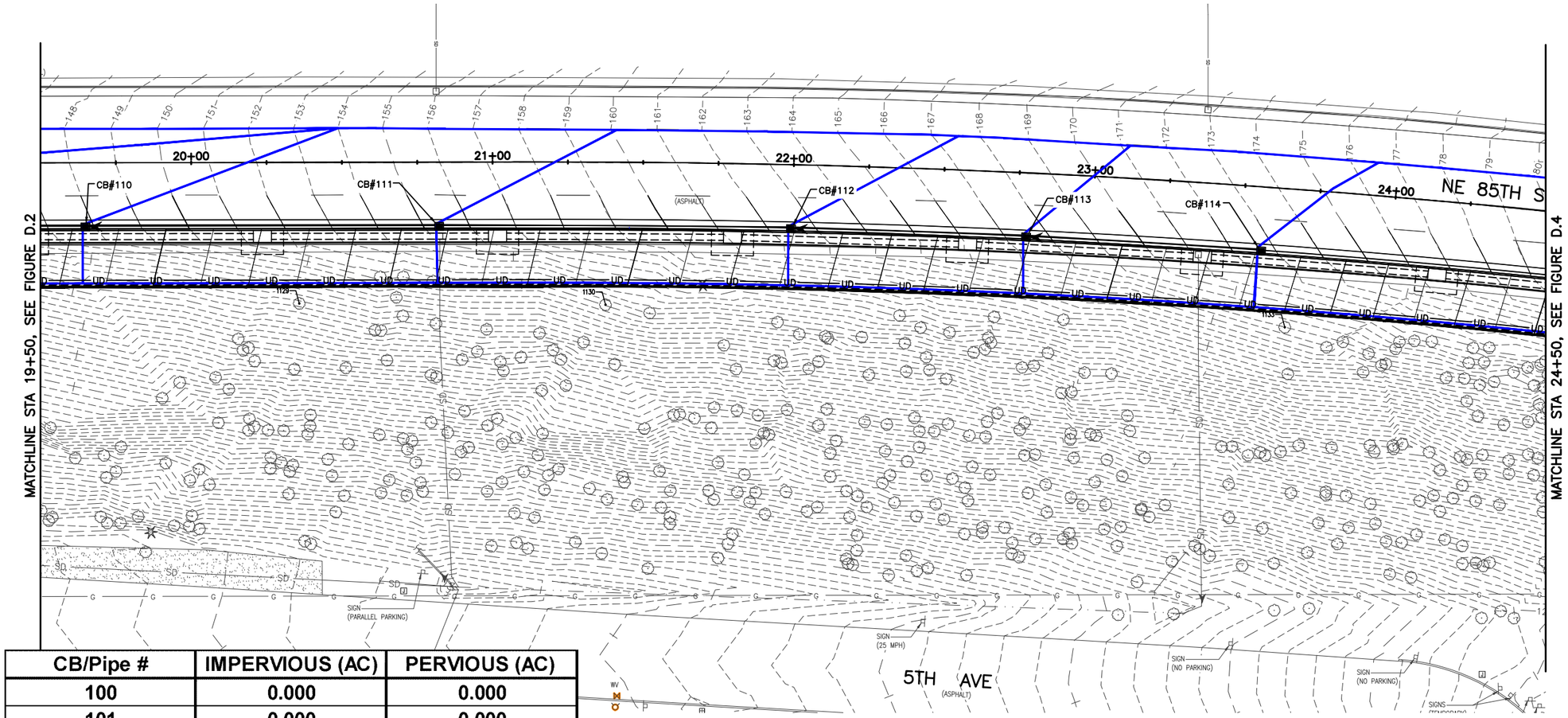
CATCHMENT AREA (SF)

CB/Pipe #	IMPERVIOUS (AC)	PERVIOUS (AC)
100	0.000	0.000
101	0.000	0.000
102	0.051	0.001
103	0.000	0.000
104	0.155	0.001
105	0.162	0.001
106	0.124	0.001
107	0.171	0.001
108	0.185	0.001
109	0.127	0.001
110	0.128	0.001
111	0.134	0.001
112	0.083	0.001
113	0.091	0.001
114	0.613	0.002
115	0.423	0.028
116	0.000	0.000
CB EX 1	0.094	0.001
CB EX 7905	0.000	0.000

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
CATCHMENT AREA MAP

FIGURE
D.2

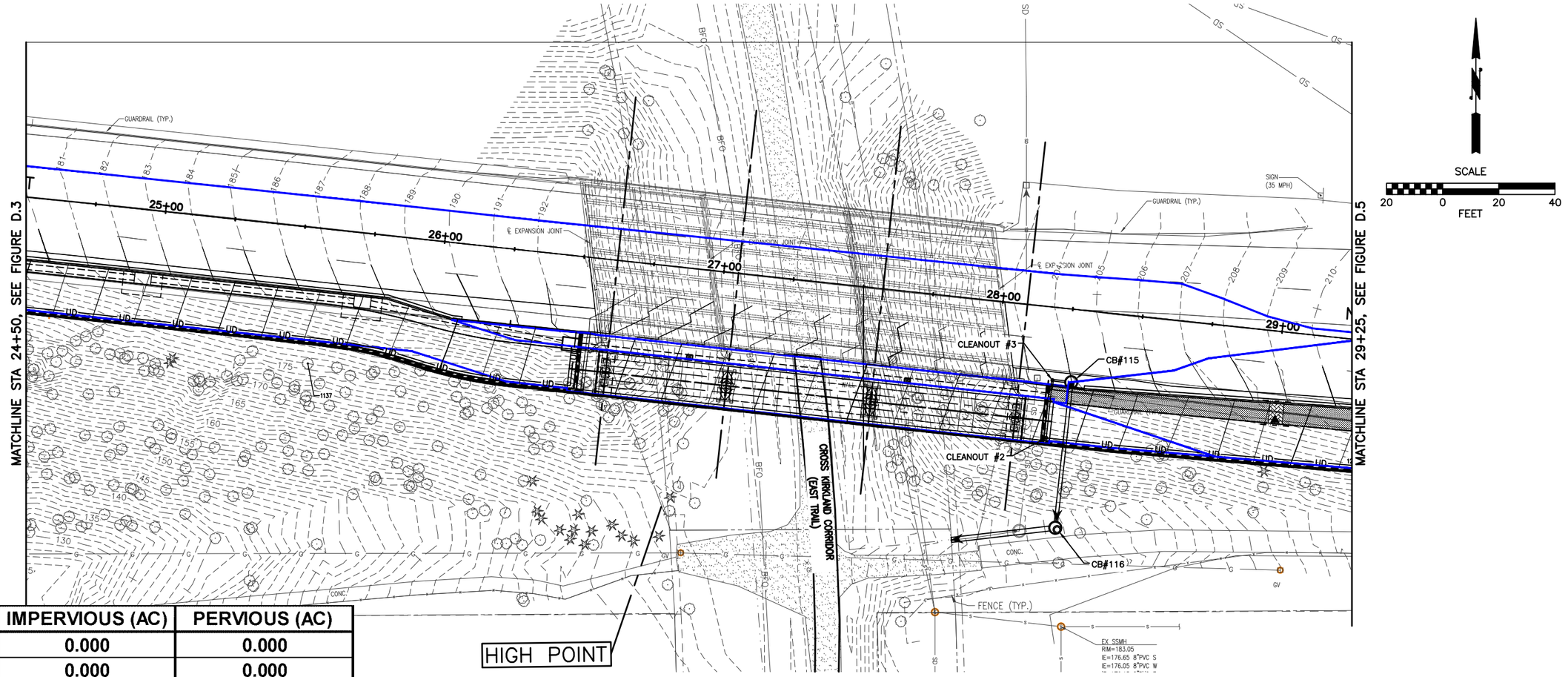


CB/Pipe #	IMPERVIOUS (AC)	PERVIOUS (AC)
100	0.000	0.000
101	0.000	0.000
102	0.051	0.001
103	0.000	0.000
104	0.155	0.001
105	0.162	0.001
106	0.124	0.001
107	0.171	0.001
108	0.185	0.001
109	0.127	0.001
110	0.128	0.001
111	0.134	0.001
112	0.083	0.001
113	0.091	0.001
114	0.613	0.002
115	0.423	0.028
116	0.000	0.000
CB EX 1	0.094	0.001
CB EX 7905	0.000	0.000

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
CATCHMENT AREA MAP

FIGURE
D.3



CB/Pipe #	IMPERVIOUS (AC)	PERVIOUS (AC)
100	0.000	0.000
101	0.000	0.000
102	0.051	0.001
103	0.000	0.000
104	0.155	0.001
105	0.162	0.001
106	0.124	0.001
107	0.171	0.001
108	0.185	0.001
109	0.127	0.001
110	0.128	0.001
111	0.134	0.001
112	0.083	0.001
113	0.091	0.001
114	0.613	0.002
115	0.423	0.028
116	0.000	0.000
CB EX 1	0.094	0.001
CB EX 7905	0.000	0.000

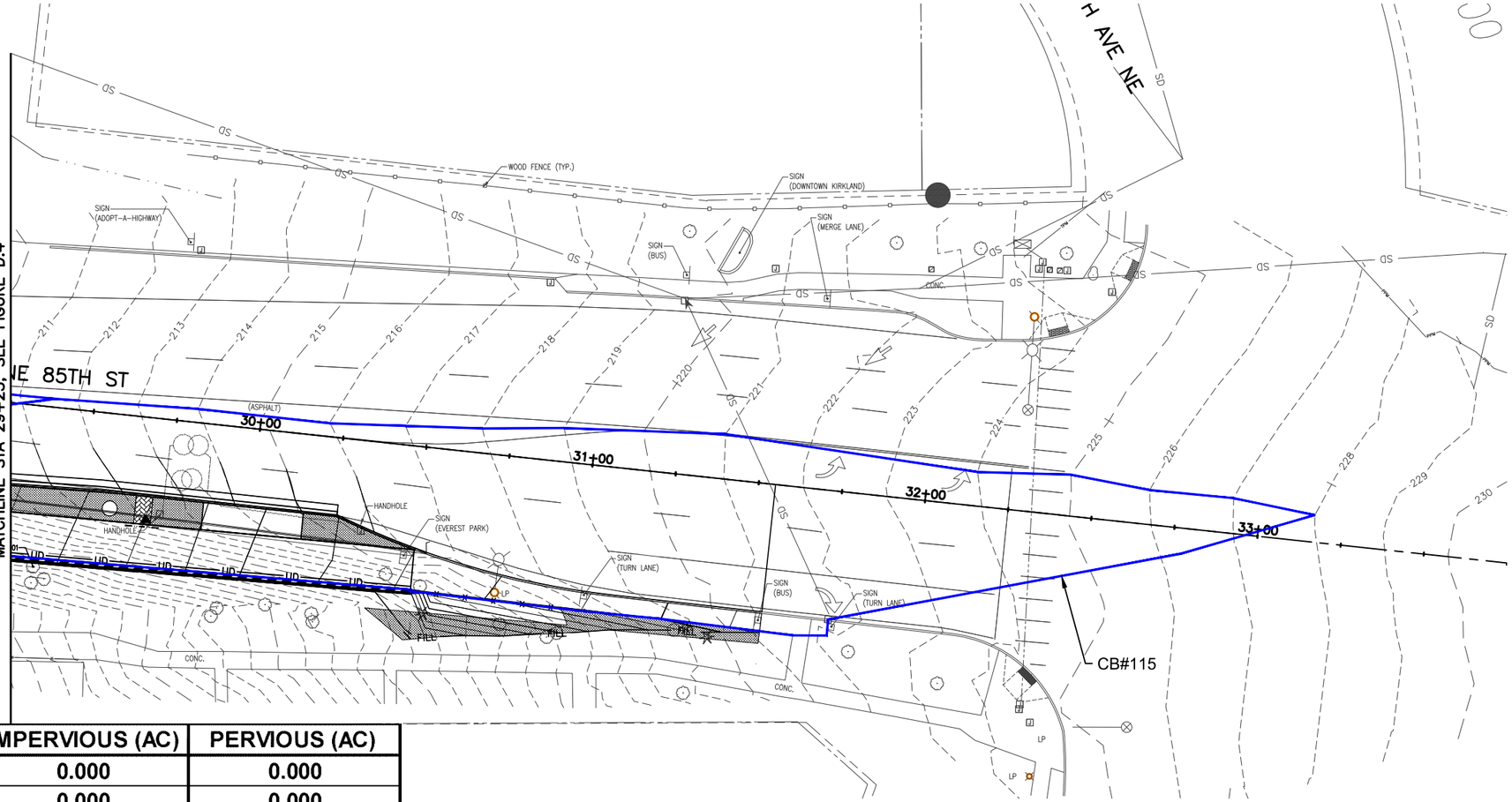
LEGEND

CATCHMENT AREA (SF)

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
CATCHMENT AREA MAP

FIGURE
D.4



SCALE
20 0 20 40
FEET

CB/Pipe #	IMPERVIOUS (AC)	PERVIOUS (AC)
100	0.000	0.000
101	0.000	0.000
102	0.051	0.001
103	0.000	0.000
104	0.155	0.001
105	0.162	0.001
106	0.124	0.001
107	0.171	0.001
108	0.185	0.001
109	0.127	0.001
110	0.128	0.001
111	0.134	0.001
112	0.083	0.001
113	0.091	0.001
114	0.613	0.002
115	0.423	0.028
116	0.000	0.000
CB EX 1	0.094	0.001
CB EX 7905	0.000	0.000

LEGEND

CATCHMENT AREA (SF)

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

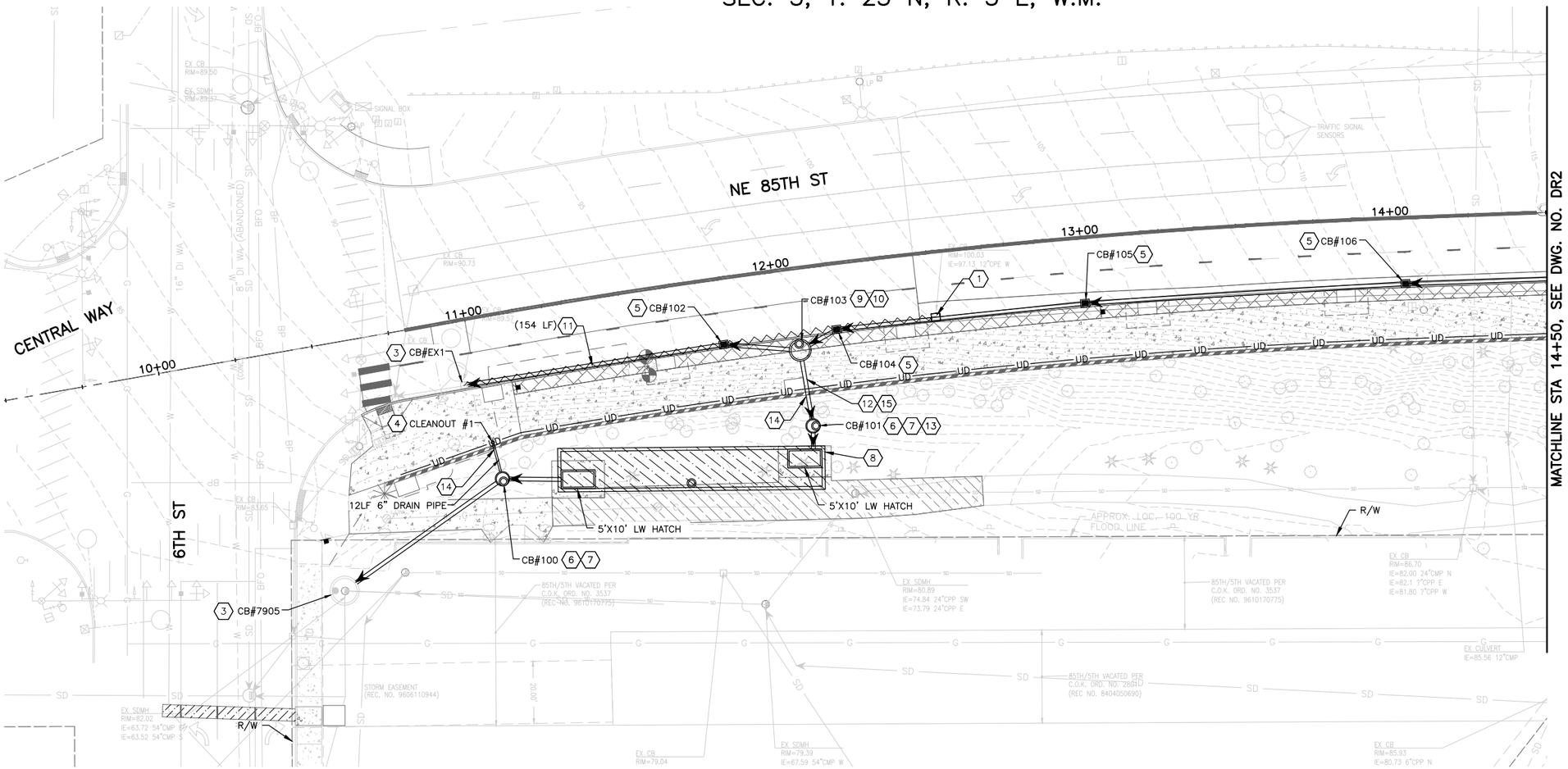
CITY OF KIRKLAND
228TH-35TH AVE-39TH AVE
CATCHMENT AREA MAP

FIGURE
D.5

APPENDIX E

Drainage Plans

SEC. 5, T. 25 N, R. 5 E, W.M.



CONSTRUCTION NOTES:

1. REMOVE EXISTING CATCH BASIN.
2. FOR CORRUGATED METAL PIPE (CMP) – CONTRACTOR SHALL INSPECT AND CCTV EXISTING PIPE TO DETERMINE PIPE CONDITION. FOR CMP IN GOOD CONDITION, PIPE SHALL BE FILLED WITH CDF AND PIPE ENDS SHALL BE PLUGGED WITH COMMERCIAL CEMENT CONCRETE. FOR ALL EXISTING PIPE IN BAD CONDITION, DISCUSS WITH THE CITY STORMWATER DIVISION FOR FURTHER ACTION.
   FOR CONCRETE PIPE AND DUCTILE IRON PIPE – CONTRACTOR SHALL FILL PIPE WITH CDF AND BRICK, AND PIPE ENDS SHALL BE PLUGGED WITH CEMENT–BASE GROUT.
3. CONNECT NEW PIPE TO EXISTING CATCH BASIN.
4. INSTALL 6" CLEANOUT PER DETAIL ON DWG. NO. DD1.
5. INSTALL CATCH BASIN TYPE 1 PER COK STD PLAN CK–D.07.
6. INSTALL CATCH BASIN TYPE 2–48" PER COK STD PLAN CK–D.09.
7. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18.
8. INSTALL DETENTION VAULT FACILITY PER DETAIL ON DWG. NO. DD1.
9. INSTALL FLOW SPLITTER PER DETAIL ON DWG. NO. DD2.
10. INSTALL SOLID LOCKING LID WITH ANTI–SLIP COATING AND COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A, SUPPLIED BY EJ GROUP INC, OR APPROVED EQUAL.
11. REMOVE EXISTING PIPE.
12. INSTALL CL. 50 DUCTILE IRON STORM SEWER PIPE 12 IN. DIAM. WITH RESTRAINED MECHANICAL JOINTS.
13. INSIDE OF CATCH BASIN TO BE EPOXY COATED FOR SCOUR PROTECTION.
14. INSTALL PIPE THROUGH WALL PER DETAIL ON DWG. NO. WD1.
15. INSTALL PIPE ANCHOR AT EVERY PIPE JOINT PER DETAIL ON DWG. NO. DD1.
16. INSTALL MANHOLE TYPE 3–48" PER WSDOT STD PLAN B–15.60.
17. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A.

GENERAL NOTES:

1. THE OFFSETS OF ALL CATCH BASINS ARE MEASURED TO THE CENTER OF STRUCTURE, UNLESS OTHERWISE NOTED.
2. ALL EXISTING STORM DRAIN PIPE, EXISTING CATCH BASINS AND STORM MANHOLES SHOWN IN THESE PLANS ARE TO BE PROTECTED, UNLESS OTHERWISE NOTED.
3. ALL DRAINAGE STRUCTURES ARE PER COK STANDARD PLANS UNLESS NOTED OTHERWISE.
4. WALL UNDERDRAIN INVERTS AND SLOPES ARE APPROXIMATE AND PROFILES ARE NOT SHOWN ON THE PLANS. CONTRACTOR TO ADJUST WALL UNDERDRAIN SLOPES AND INVERTS AS NECESSARY TO AVOID UTILITY CONFLICTS. MINIMUM PIPE SLOPE IS 0.5%. CLEANOUTS SHALL BE SPACED EVERY 100 FEET ALONG THE LENGTH OF THE WALL. CLEANOUTS SHALL BE INSTALLED PER COK STD PLAN CK–D.05B.
5. ALL PIPE AND APPURTENANCES SHALL BE LAID ON A PROPERLY PREPARED FOUNDATION IN ACCORDANCE WITH WSDOT SPECIFICATIONS. THIS SHALL INCLUDE LEVELING AND COMPACTING THE TRENCH BOTTOM, THE TOP OF THE FOUNDATION MATERIAL, AND ANY REQUIRED PIPE BEDDING, TO A UNIFORM GRADE SO THAT THE ENTIRE PIPE IS SUPPORTED BY A UNIFORMLY DENSE UNYIELDING BASE.
6. ALL STORM SEWER PIPE SHALL BE SCHEDULE A SMOOTH INTERIOR WALL HIGH–PERFORMANCE POLYPROPYLENE STORM SEWER PIPE UNLESS OTHERWISE NOTED.
7. ALL DRAINAGE STRUCTURES, SUCH AS CATCH BASINS, NOT LOCATED WITHIN A TRAVELED ROADWAY OR SIDEWALK, SHALL HAVE SOLID LOCKING LIDS. ALL DRAINAGE STRUCTURES ASSOCIATED WITH A PERMANENT DETENTION FACILITY SHALL HAVE SOLID LOCKING LIDS.
8. ALL PROPOSED CATCH BASINS SHALL HAVE VANED GRATES PER COK STD PLAN CK–D.15 AND CK–D.16 UNLESS NOTED OTHERWISE.

LEGEND:

- SD — EXISTING STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE
- REMOVE PIPE
- UD — UD — WALL UNDERDRAIN
- CATCH BASIN, TYPE 1
- CATCH BASIN, TYPE 2
- CONCRETE DETENTION VAULT

0 20 40
1" = 20'
HORIZONTAL SCALE:

0 5 10
1" = 5'
VERTICAL SCALE:

DWG. NO. DR1

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG — STATE OF WASHINGTON — 23035307 — REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DR1	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033–6189 – (425)587–3800

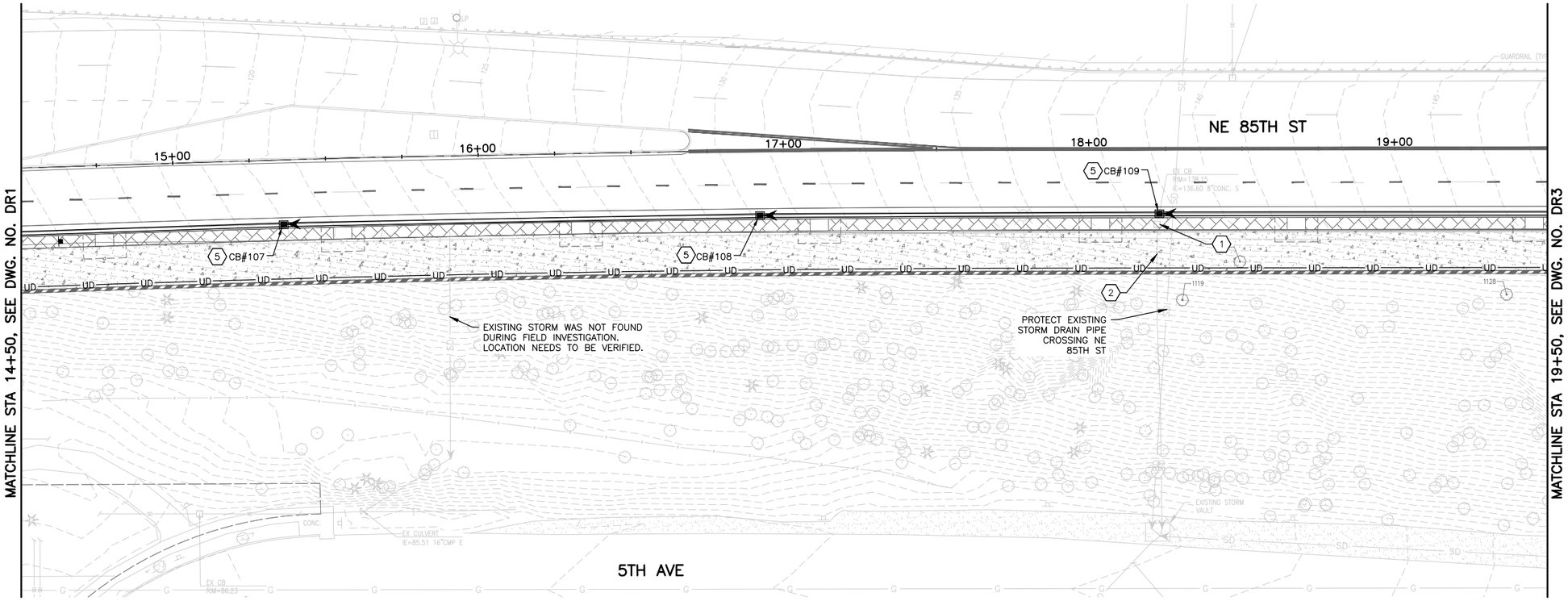
NE 85TH ST PED–BIKE CONNECTION

DRAINAGE PLAN

SHEET 21 / 100

Jan 06, 2025 - 4:19pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DR.dwg Layout Name: DR1

SEC. 5, T. 25 N, R. 5 E, W.M.



CONSTRUCTION NOTES:

1. REMOVE EXISTING CATCH BASIN.
2. FOR CORRUGATED METAL PIPE (CMP) – CONTRACTOR SHALL INSPECT AND CCTV EXISTING PIPE TO DETERMINE PIPE CONDITION. FOR CMP IN GOOD CONDITION, PIPE SHALL BE FILLED WITH CDF AND PIPE ENDS SHALL BE PLUGGED WITH COMMERCIAL CEMENT CONCRETE. FOR ALL EXISTING PIPE IN BAD CONDITION, DISCUSS WITH THE CITY STORMWATER DIVISION FOR FURTHER ACTION.
   FOR CONCRETE PIPE AND DUCTILE IRON PIPE – CONTRACTOR SHALL FILL PIPE WITH CDF AND BRICK, AND PIPE ENDS SHALL BE PLUGGED WITH CEMENT–BASE GROUT.
3. CONNECT NEW PIPE TO EXISTING CATCH BASIN.
4. INSTALL 6" CLEANOUT PER DETAIL ON DWG. NO. DD1.
5. INSTALL CATCH BASIN TYPE 1 PER COK STD PLAN CK–D.07.
6. INSTALL CATCH BASIN TYPE 2–48" PER COK STD PLAN CK–D.09.
7. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18.
8. INSTALL DETENTION VAULT FACILITY PER DETAIL ON DWG. NO. DD1.
9. INSTALL FLOW SPLITTER PER DETAIL ON DWG. NO. DD2.
10. INSTALL SOLID LOCKING LID WITH ANTI–SLIP COATING AND COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A, SUPPLIED BY EJ GROUP INC, OR APPROVED EQUAL.
11. REMOVE EXISTING PIPE.
12. INSTALL CL. 50 DUCTILE IRON STORM SEWER PIPE 12 IN. DIAM. WITH RESTRAINED MECHANICAL JOINTS.
13. INSIDE OF CATCH BASIN TO BE EPOXY COATED FOR SCOUR PROTECTION.
14. INSTALL PIPE THROUGH WALL PER DETAIL ON DWG. NO. WD1.
15. INSTALL PIPE ANCHOR AT EVERY PIPE JOINT PER DETAIL ON DWG. NO. DD1.
16. INSTALL MANHOLE TYPE 3–48" PER WSDOT STD PLAN B–15.60.
17. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A.

GENERAL NOTES:

1. THE OFFSETS OF ALL CATCH BASINS ARE MEASURED TO THE CENTER OF STRUCTURE, UNLESS OTHERWISE NOTED.
2. ALL EXISTING STORM DRAIN PIPE, EXISTING CATCH BASINS AND STORM MANHOLES SHOWN IN THESE PLANS ARE TO BE PROTECTED, UNLESS OTHERWISE NOTED.
3. ALL DRAINAGE STRUCTURES ARE PER COK STANDARD PLANS UNLESS NOTED OTHERWISE.
4. WALL UNDERDRAIN INVERTS AND SLOPES ARE APPROXIMATE AND PROFILES ARE NOT SHOWN ON THE PLANS. CONTRACTOR TO ADJUST WALL UNDERDRAIN SLOPES AND INVERTS AS NECESSARY TO AVOID UTILITY CONFLICTS. MINIMUM PIPE SLOPE IS 0.5%. CLEANOUTS SHALL BE SPACED EVERY 100 FEET ALONG THE LENGTH OF THE WALL. CLEANOUTS SHALL BE INSTALLED PER COK STD PLAN CK–D.05B.
5. ALL PIPE AND APPURTENANCES SHALL BE LAID ON A PROPERLY PREPARED FOUNDATION IN ACCORDANCE WITH WSDOT SPECIFICATIONS. THIS SHALL INCLUDE LEVELING AND COMPACTING THE TRENCH BOTTOM, THE TOP OF THE FOUNDATION MATERIAL, AND ANY REQUIRED PIPE BEDDING, TO A UNIFORM GRADE SO THAT THE ENTIRE PIPE IS SUPPORTED BY A UNIFORMLY DENSE UNYIELDING BASE.
6. ALL STORM SEWER PIPE SHALL BE SCHEDULE A SMOOTH INTERIOR WALL HIGH–PERFORMANCE POLYPROPYLENE STORM SEWER PIPE UNLESS OTHERWISE NOTED.
7. ALL DRAINAGE STRUCTURES, SUCH AS CATCH BASINS, NOT LOCATED WITHIN A TRAVELED ROADWAY OR SIDEWALK, SHALL HAVE SOLID LOCKING LIDS. ALL DRAINAGE STRUCTURES ASSOCIATED WITH A PERMANENT DETENTION FACILITY SHALL HAVE SOLID LOCKING LIDS.
8. ALL PROPOSED CATCH BASINS SHALL HAVE VANED GRATES PER COK STD PLAN CK–D.15 AND CK–D.16 UNLESS NOTED OTHERWISE.

LEGEND:

- SD — EXISTING STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE
- REMOVE PIPE
- UD — UD — WALL UNDERDRAIN
- CATCH BASIN, TYPE 1
- CATCH BASIN, TYPE 2
- CONCRETE DETENTION VAULT

0 20 40
1" = 20'
HORIZONTAL SCALE:

0 5 10
1" = 5'
VERTICAL SCALE:

DWG. NO. DR2

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG — STATE OF WASHINGTON — 23035307 — REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DR2	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033–6189 – (425)587–3800

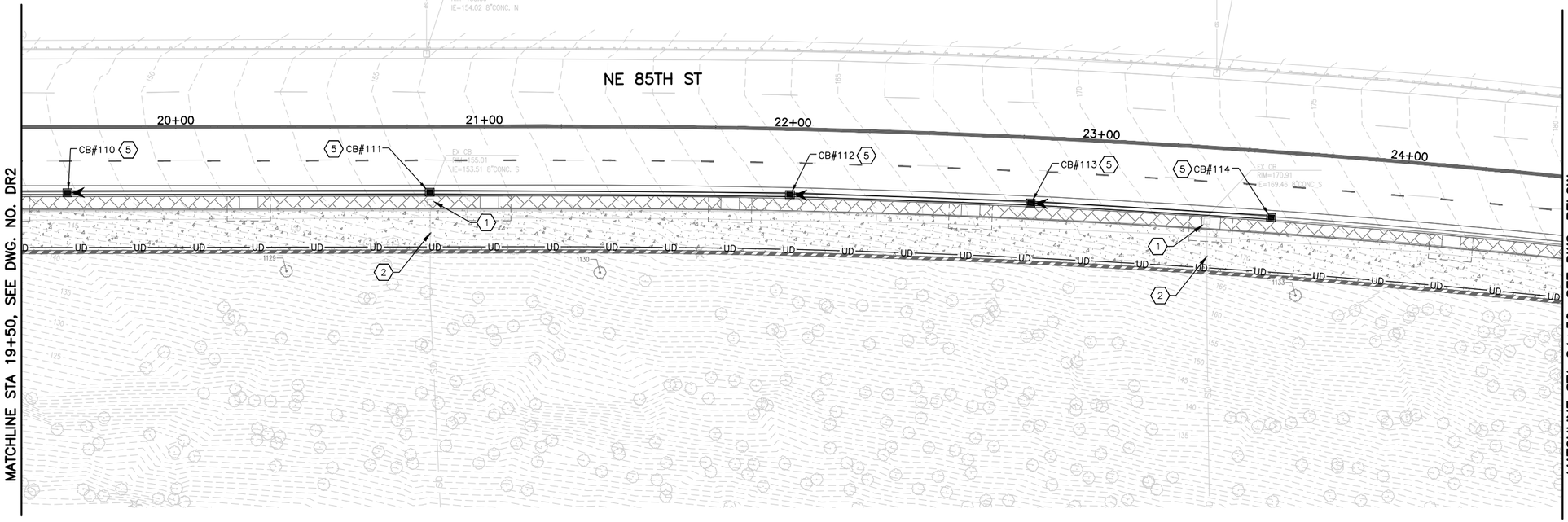
NE 85TH ST PED–BIKE CONNECTION

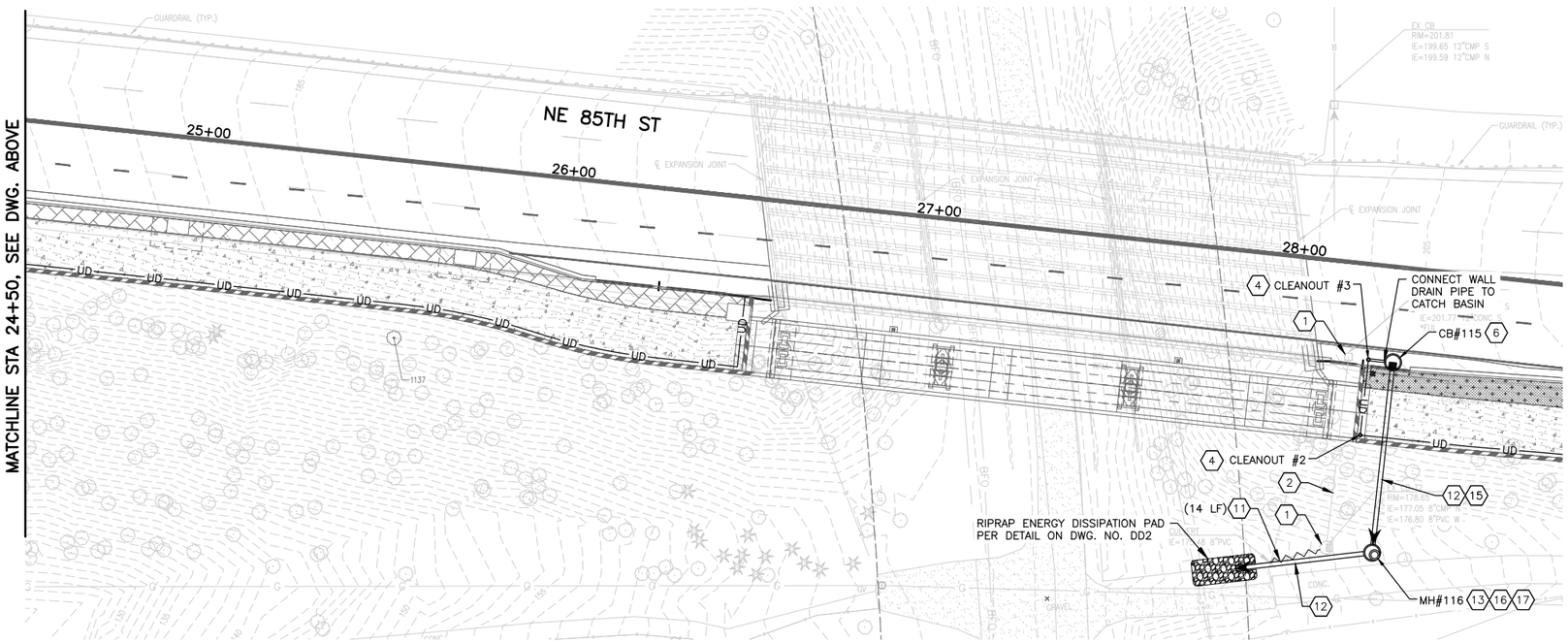
DRAINAGE PLAN

SHEET 22 / 100

Jan 06, 2025 - 4:19pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DR.dwg Layout Name: DR2

SEC. 5, T. 25 N, R. 5 E, W.M.





CONSTRUCTION NOTES:

1. REMOVE EXISTING CATCH BASIN.
2. FOR CORRUGATED METAL PIPE (CMP) – CONTRACTOR SHALL INSPECT AND CCTV EXISTING PIPE TO DETERMINE PIPE CONDITION. FOR CMP IN GOOD CONDITION, PIPE SHALL BE FILLED WITH CDF AND PIPE ENDS SHALL BE PLUGGED WITH COMMERCIAL CEMENT CONCRETE. FOR ALL EXISTING PIPE IN BAD CONDITION, DISCUSS WITH THE CITY STORMWATER DIVISION FOR FURTHER ACTION.
   FOR CONCRETE PIPE AND DUCTILE IRON PIPE – CONTRACTOR SHALL FILL PIPE WITH CDF AND BRICK, AND PIPE ENDS SHALL BE PLUGGED WITH CEMENT–BASE GROUT.
3. CONNECT NEW PIPE TO EXISTING CATCH BASIN.
4. INSTALL 6" CLEANOUT PER DETAIL ON DWG. NO. DD1.
5. INSTALL CATCH BASIN TYPE 1 PER COK STD PLAN CK–D.07.
6. INSTALL CATCH BASIN TYPE 2–48" PER COK STD PLAN CK–D.09.
7. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18.
8. INSTALL DETENTION VAULT FACILITY PER DETAIL ON DWG. NO. DD1.
9. INSTALL FLOW SPLITTER PER DETAIL ON DWG. NO. DD2.
10. INSTALL SOLID LOCKING LID WITH ANTI–SLIP COATING AND COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A, SUPPLIED BY EJ GROUP INC, OR APPROVED EQUAL.
11. REMOVE EXISTING PIPE.
12. INSTALL CL. 50 DUCTILE IRON STORM SEWER PIPE 12 IN. DIAM. WITH RESTRAINED MECHANICAL JOINTS.
13. INSIDE OF CATCH BASIN TO BE EPOXY COATED FOR SCOUR PROTECTION.
14. INSTALL PIPE THROUGH WALL PER DETAIL ON DWG. NO. WD1.
15. INSTALL PIPE ANCHOR AT EVERY PIPE JOINT PER DETAIL ON DWG. NO. DD1.
16. INSTALL MANHOLE TYPE 3–48" PER WSDOT STD PLAN B–15.60.
17. INSTALL SOLID LOCKING LID WITH COK STORM DRAIN LOGO PER COK STD PLAN CK–D.18A.

GENERAL NOTES:

1. THE OFFSETS OF ALL CATCH BASINS ARE MEASURED TO THE CENTER OF STRUCTURE, UNLESS OTHERWISE NOTED.
2. ALL EXISTING STORM DRAIN PIPE, EXISTING CATCH BASINS AND STORM MANHOLES SHOWN IN THESE PLANS ARE TO BE PROTECTED, UNLESS OTHERWISE NOTED.
3. ALL DRAINAGE STRUCTURES ARE PER COK STANDARD PLANS UNLESS NOTED OTHERWISE.
4. WALL UNDERDRAIN INVERTS AND SLOPES ARE APPROXIMATE AND PROFILES ARE NOT SHOWN ON THE PLANS. CONTRACTOR TO ADJUST WALL UNDERDRAIN SLOPES AND INVERTS AS NECESSARY TO AVOID UTILITY CONFLICTS. MINIMUM PIPE SLOPE IS 0.5%. CLEANOUTS SHALL BE SPACED EVERY 100 FEET ALONG THE LENGTH OF THE WALL. CLEANOUTS SHALL BE INSTALLED PER COK STD PLAN CK–D.05B.
5. ALL PIPE AND APPURTENANCES SHALL BE LAID ON A PROPERLY PREPARED FOUNDATION IN ACCORDANCE WITH WSDOT SPECIFICATIONS. THIS SHALL INCLUDE LEVELING AND COMPACTING THE TRENCH BOTTOM, THE TOP OF THE FOUNDATION MATERIAL, AND ANY REQUIRED PIPE BEDDING, TO A UNIFORM GRADE SO THAT THE ENTIRE PIPE IS SUPPORTED BY A UNIFORMLY DENSE UNYIELDING BASE.
6. ALL STORM SEWER PIPE SHALL BE SCHEDULE A SMOOTH INTERIOR WALL HIGH–PERFORMANCE POLYPROPYLENE STORM SEWER PIPE UNLESS OTHERWISE NOTED.
7. ALL DRAINAGE STRUCTURES, SUCH AS CATCH BASINS, NOT LOCATED WITHIN A TRAVELED ROADWAY OR SIDEWALK, SHALL HAVE SOLID LOCKING LIDS. ALL DRAINAGE STRUCTURES ASSOCIATED WITH A PERMANENT DETENTION FACILITY SHALL HAVE SOLID LOCKING LIDS.
8. ALL PROPOSED CATCH BASINS SHALL HAVE VANED GRATES PER COK STD PLAN CK–D.15 AND CK–D.16 UNLESS NOTED OTHERWISE.

LEGEND:

- SD — EXISTING STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE
- REMOVE PIPE
- UD — UD — WALL UNDERDRAIN
- CATCH BASIN, TYPE 1
- CATCH BASIN, TYPE 2
- CONCRETE DETENTION VAULT

0 20 40
1" = 20'
HORIZONTAL SCALE:

0 5 10
1" = 5'
VERTICAL SCALE:

DWG. NO. DR3

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG — STATE OF WASHINGTON — 23035307 — REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DR3	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033–6189 – (425)587–3800

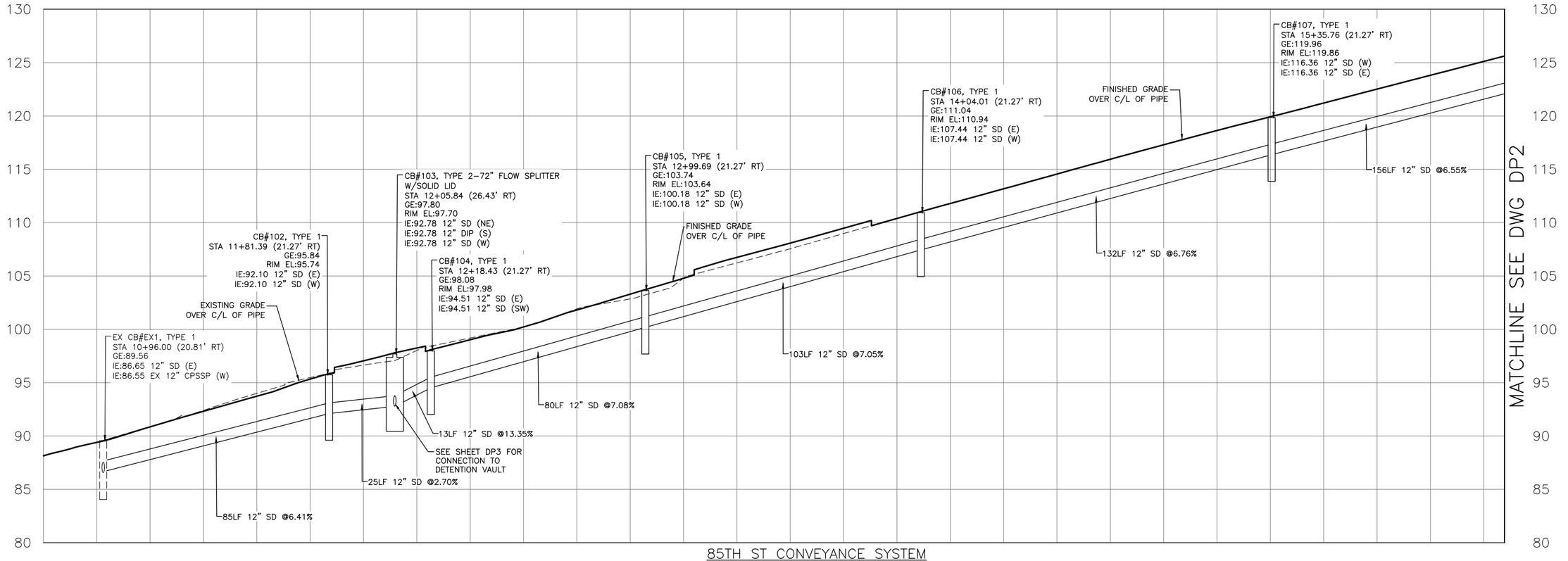
NE 85TH ST PED–BIKE CONNECTION

DRAINAGE PLAN

SHEET 23 / 100

Jan 06, 2025 - 4:19pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DR.dwg Layout Name: DR3

SEC. 5, T. 25 N, R. 5 E, W.M.



85TH ST CONVEYANCE SYSTEM

HORIZONTAL SCALE
20 0 20 40
FEET
VERTICAL SCALE
5 0 5 10
FEET

DWG. NO. DP1

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG
STATE OF WASHINGTON
21035307
REGISTERED
PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DP1	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033-6189 – (425)587-3800

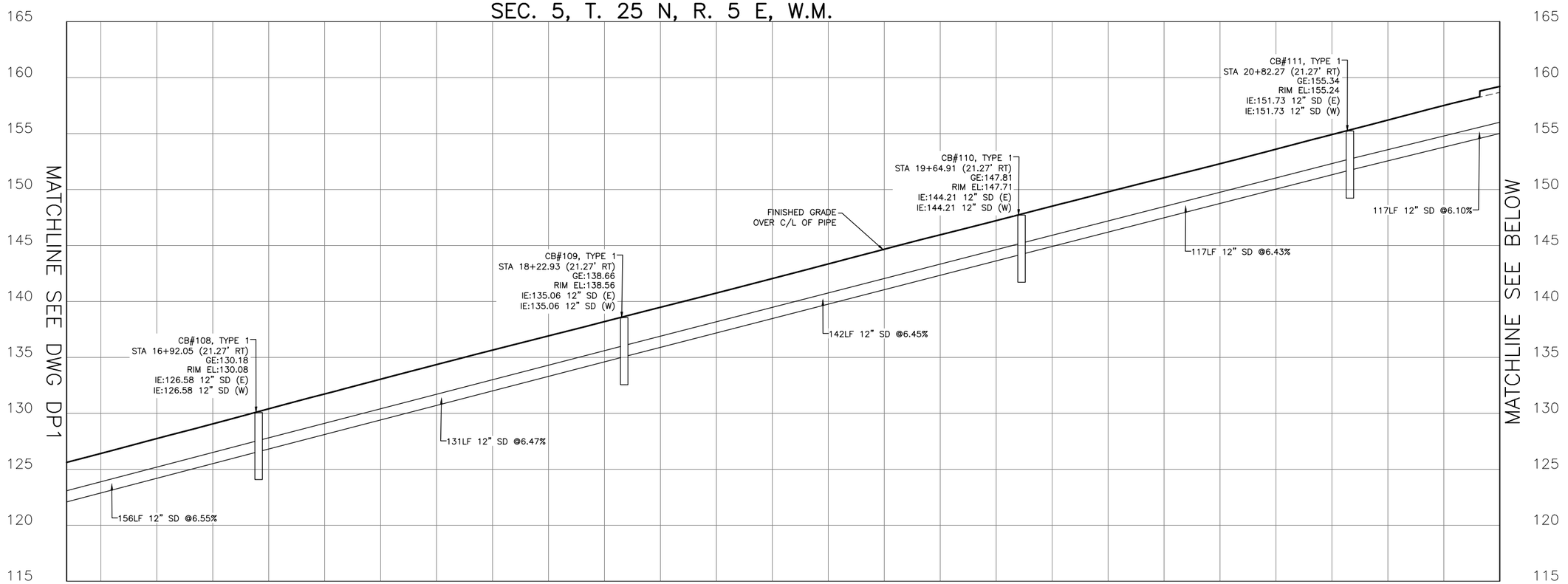
NE 85TH ST PED-BIKE CONNECTION

DRAINAGE PROFILES

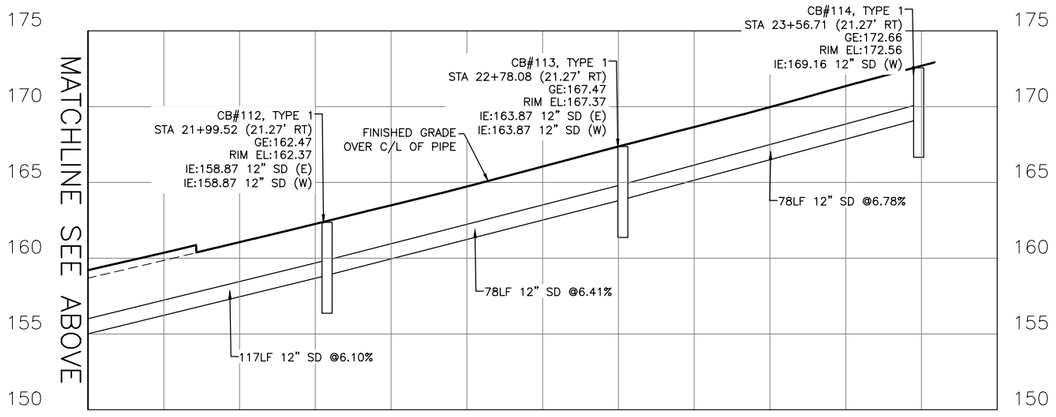
SHEET 24 / 100

Jan 06, 2025 - 4:19pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DP.dwg Layout Name: DP1

SEC. 5, T. 25 N, R. 5 E, W.M.



85TH ST CONVEYANCE SYSTEM



85TH ST CONVEYANCE SYSTEM

HORIZONTAL SCALE
20 0 20 40
FEET

VERTICAL SCALE
5 0 5 10
FEET

DWG. NO. DP2

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG
STATE OF WASHINGTON
21035307
REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DP2	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

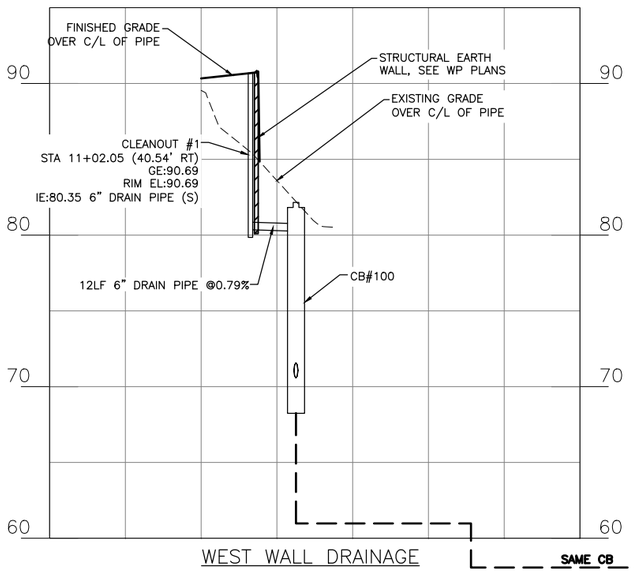
CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033–6189 – (425)587–3800

NE 85TH ST PED–BIKE CONNECTION

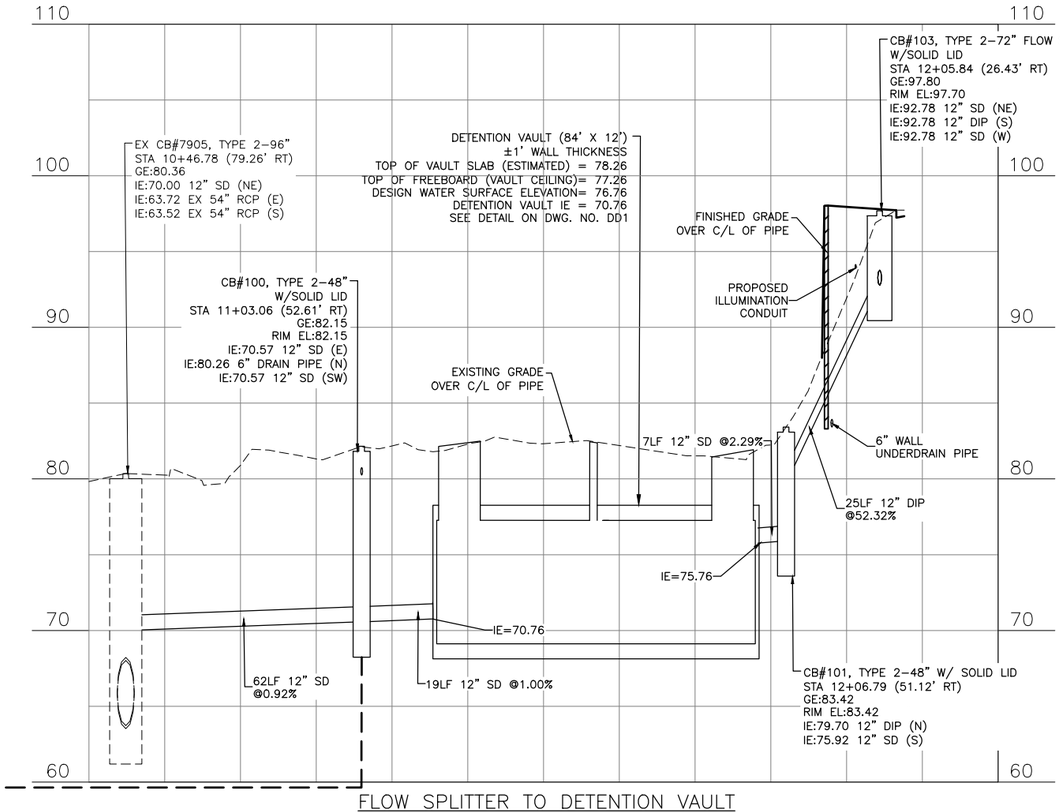
DRAINAGE PROFILES

SHEET 25 / 100

Jan 06, 2025 - 4:19pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DP.dwg Layout Name: DP2



WEST WALL DRAINAGE



FLOW SPLITTER TO DETENTION VAULT

HORIZONTAL SCALE
20 0 20 40
FEET

VERTICAL SCALE
5 0 5 10
FEET

DWG. NO. DP3

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG
STATE OF WASHINGTON
23035307
REGISTERED
PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DP3	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

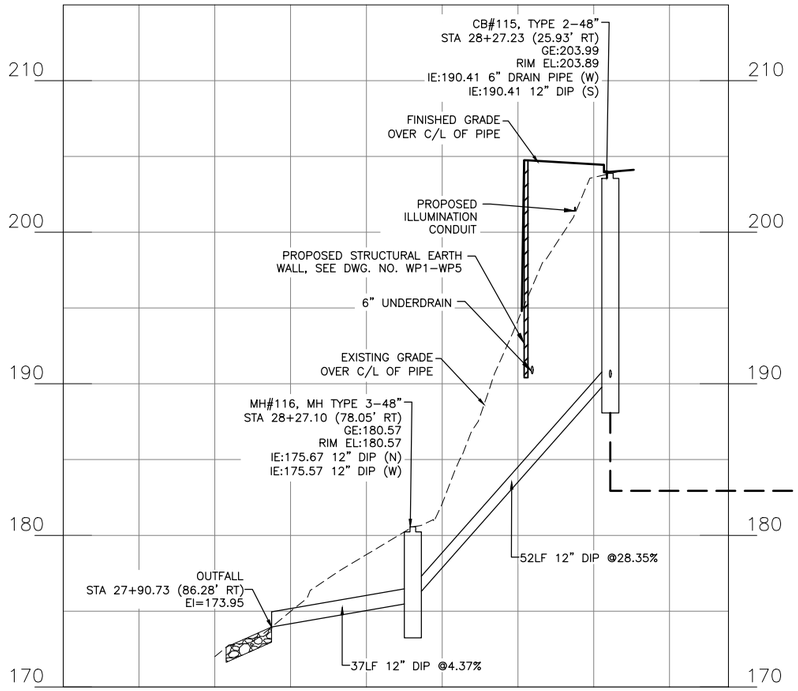
CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033-6189 – (425)587-3800

NE 85TH ST PED-BIKE CONNECTION

DRAINAGE PROFILES

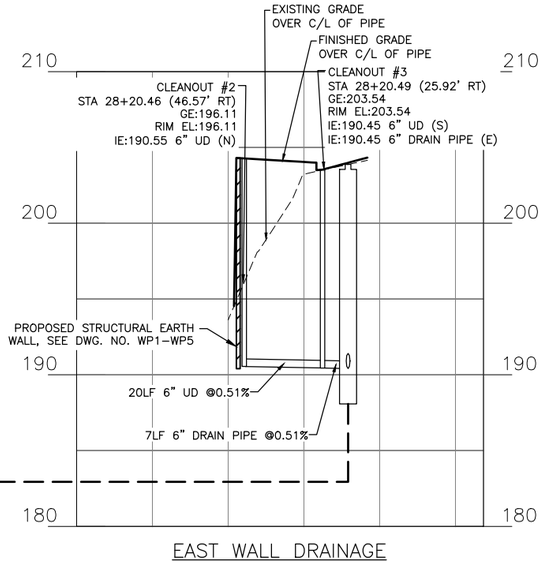
SHEET 26 / 100

Jan 06, 2025 - 4:20pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DP.dwg Layout Name: DP3



CB#115 TO OUTFALL

SAME CB



EAST WALL DRAINAGE

HORIZONTAL SCALE
20 0 20 40
FEET

VERTICAL SCALE
5 0 5 10
FEET

DWG. NO. DP4

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG
STATE OF WASHINGTON
23035307
REGISTERED
PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DP4	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

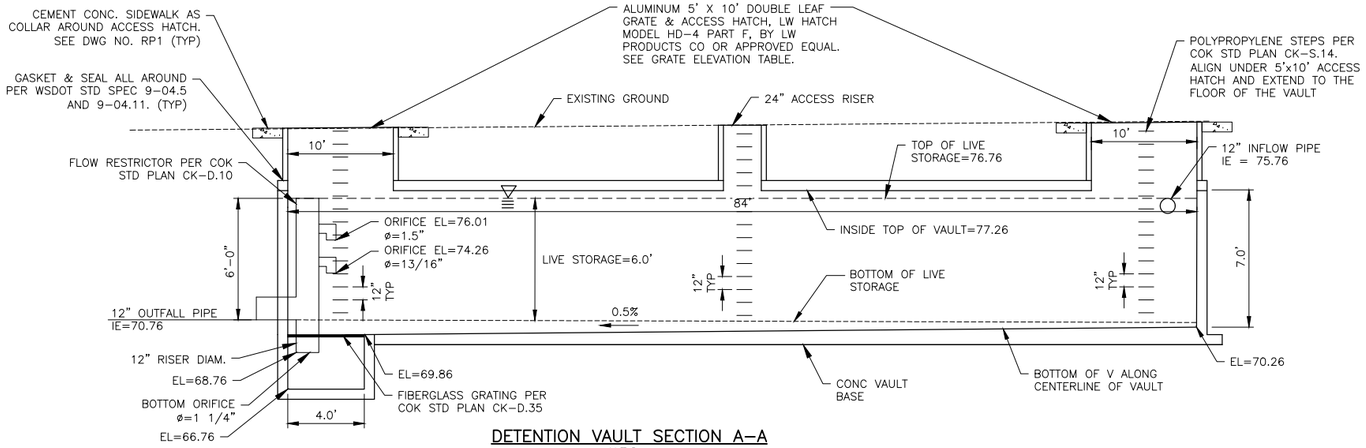
CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE - KIRKLAND, WA 98033-6189 - (425)587-3800

NE 85TH ST PED-BIKE CONNECTION

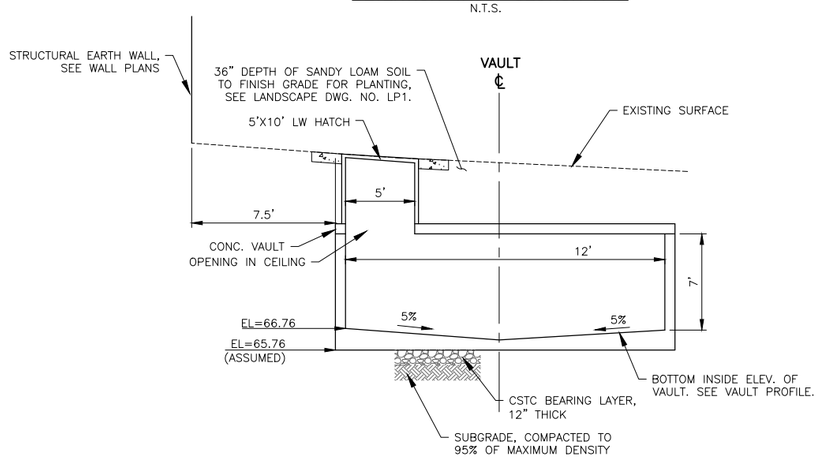
DRAINAGE PROFILES

SHEET 27 / 100

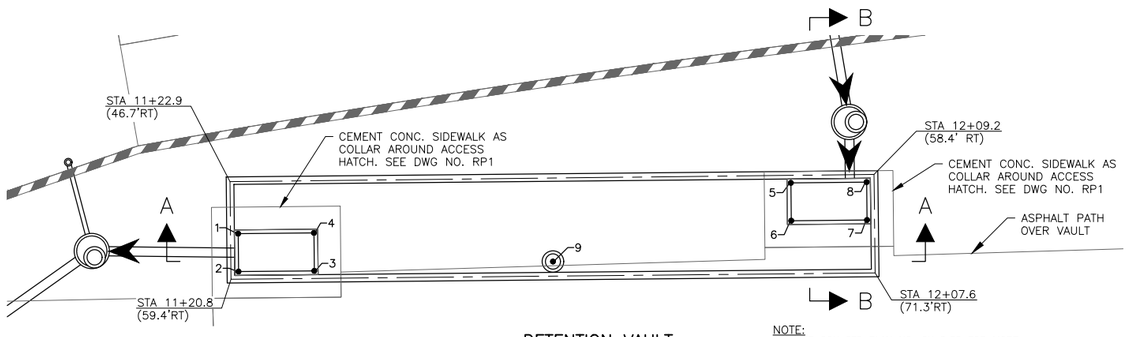
Jan 06, 2025 - 4:20pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DP.dwg Layout Name: DP4



DETENTION VAULT SECTION A-A
N.T.S.



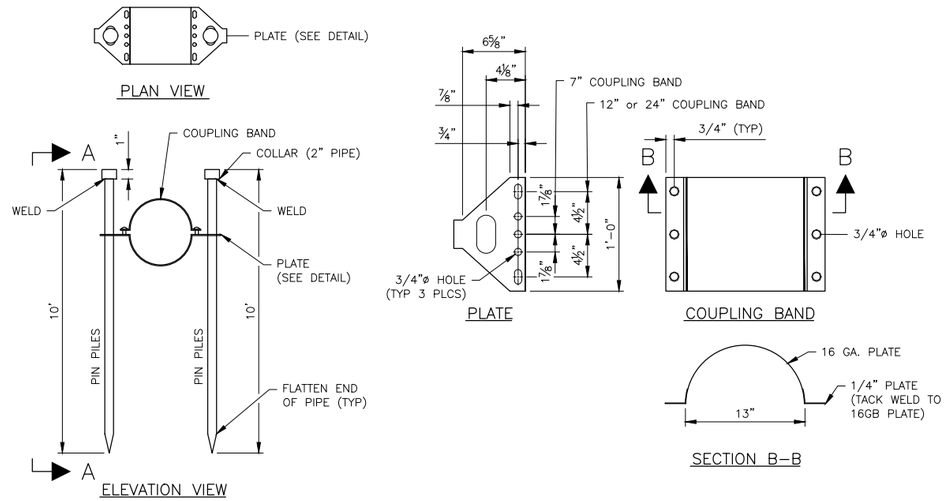
DETENTION VAULT SECTION B-B
N.T.S.



DETENTION VAULT
N.T.S.

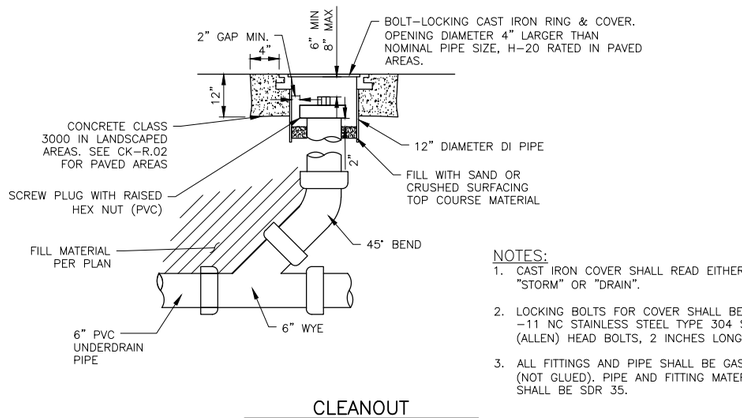
NOTE:
1. SEE COK STD PLAN NO. CK D.35 FOR MORE INFORMATION.
2. STATION CALLOUT IS AT THE CENTERLINE OF THE DETENTION VAULT WALL.

ACCESS HATCH ELEVATION TABLE			
POINT NO	STATION	OFFSET	ELEV
1	11+22.77	53.68' RT	82.07
2	11+21.95	58.61' RT	81.55
3	11+32.11	60.18' RT	82.02
4	11+32.91	55.24' RT	82.26
5	11+97.88	58.06' RT	81.87
6	12+07.47	63.02' RT	81.34
7	12+07.47	64.24' RT	81.39
8	12+08.09	59.27' RT	81.86
9	11+64.36	63.91' RT	82.34



NOTE:
1. THE FIRST ANCHOR SHALL BE INSTALLED ON THE FIRST SECTION OF THE LOWER END OF THE PIPE AND THE REMAINING ANCHORS EVENLY SPACED THROUGHOUT THE INSTALLATION.
2. IF THE PIPE BEING INSTALLED HAS A CATCH BASIN ON THE LOWER END OF THE PIPE, THE FIRST PIPE ANCHOR MAY BE ELIMINATED.
3. WHEN CMP IS USED, THE ANCHORS MAY BE ATTACHED TO THE COUPLING BANDS USED TO JOIN THE PIPE, AS LONG AS THE SPECIFIED SPACING IS NOT EXCEEDED.
4. ALL PIPE ANCHORS SHALL BE SECURELY INSTALLED BEFORE BACKFILLING AROUND THE PIPE.
5. PLATE AND PIN PILE MATERIAL SHALL CONFORM TO ASTM A36 GALVANIZED AFTER FABRICATION PER ASTM A123.

PIPE ANCHORING DETAIL
N.T.S.



NOTES:
1. CAST IRON COVER SHALL READ EITHER "STORM" OR "DRAIN".
2. LOCKING BOLTS FOR COVER SHALL BE 5/8" -11 NC STAINLESS STEEL TYPE 304 SOCKET (ALLEN) HEAD BOLTS, 2 INCHES LONG
3. ALL FITTINGS AND PIPE SHALL BE GASKETED (NOT GLUED). PIPE AND FITTING MATERIAL SHALL BE SDR 35.

CLEANOUT
N.T.S.

DWG. NO. DD1

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG STATE OF WASHINGTON 23035307 REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DD1	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

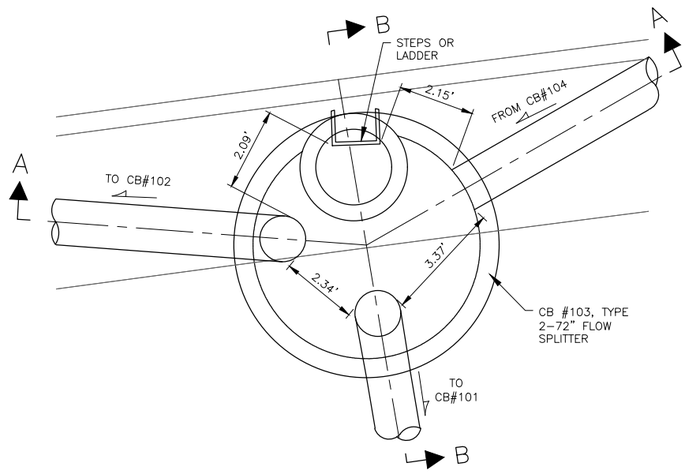
CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE - KIRKLAND, WA 98033-6189 - (425)587-3800

NE 85TH ST PED-BIKE CONNECTION

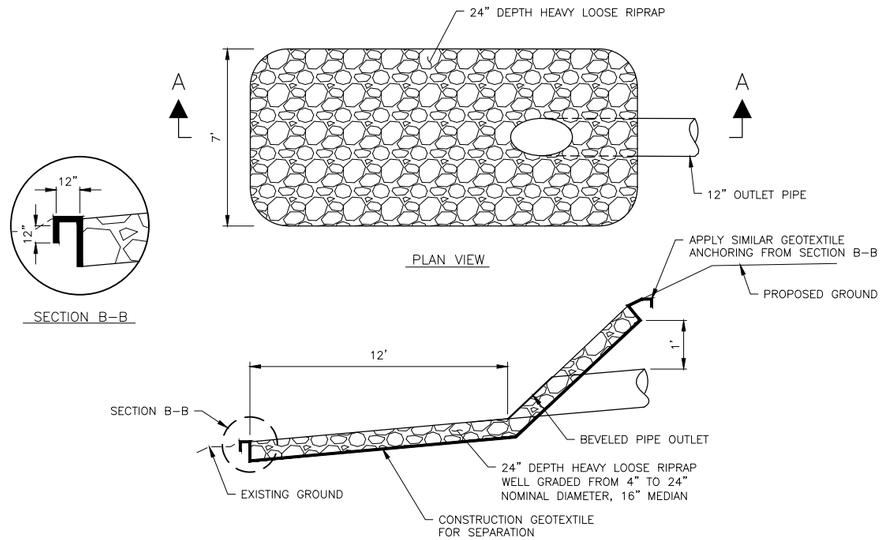
DRAINAGE DETAILS

SHEET 28 / 100

Jan 06, 2025 - 4:20pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DD.dwg Layout Name: DD1



PLAN

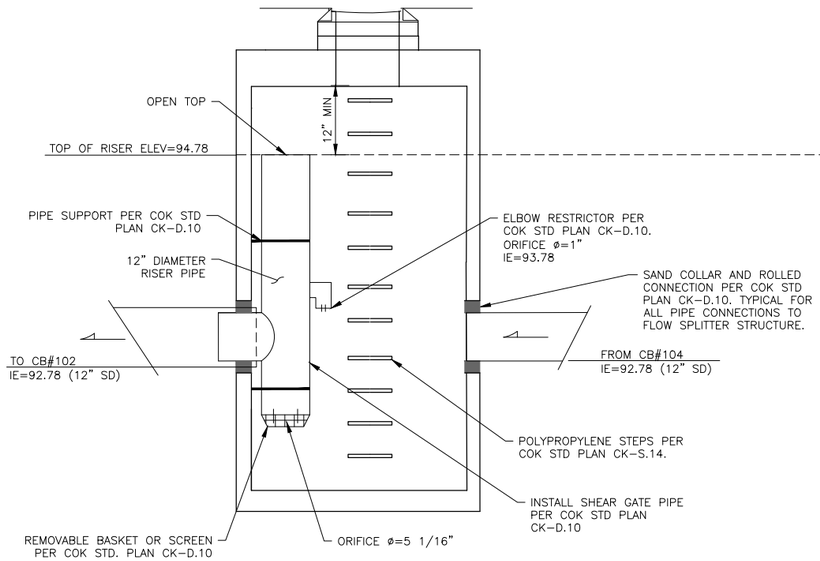


PLAN VIEW

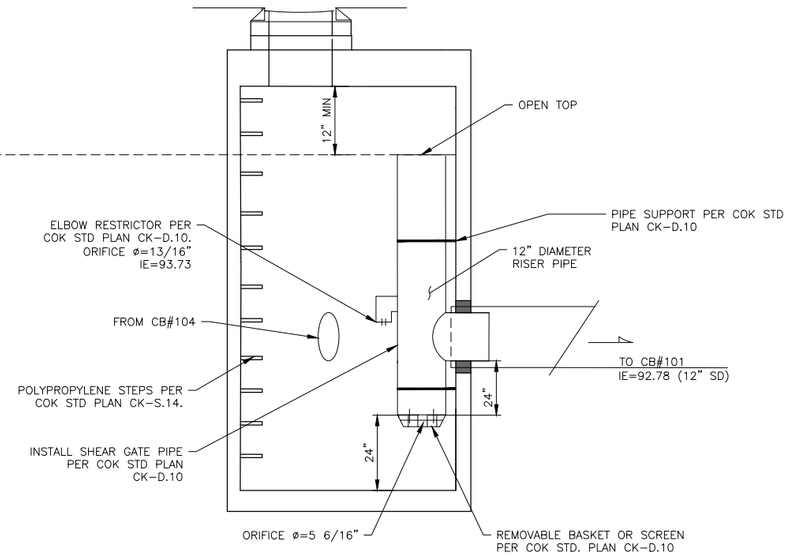
SECTION B–B

SECTION A–A

ENERGY DISSIPATION PAD
N.T.S



ELEVATION
SECTION A–A



ELEVATION
SECTION B–B

NOTES:
1. MATERIALS OF COMPONENTS SHOWN SHALL MATCH THOSE SPECIFIED IN CITY OF KIRKLAND PRE-APPROVED PLAN CK-D.10.

FLOW SPLITTER TYPE 2–72"
N.T.S.

DWG. NO. DD2

PERTEET
2707 COLBY AVENUE, SUITE 900
EVERETT, WA 98201
425.252.7700 | 800.615.9900

811 Know what's below. Call before you dig.

THOMAS WAIMAN CHEONG STATE OF WASHINGTON 23035307 REGISTERED PROFESSIONAL ENGINEER
1/6/25

FILE	ENGR.	REVIEW	SCALE	DATE
DD2	##	##	AS SHOWN	JANUARY 2025

NO.	REVISION	BY	REVIEW	DATE

CITY OF KIRKLAND WASHINGTON

CITY OF KIRKLAND
PUBLIC WORKS DEPARTMENT
123 FIFTH AVENUE – KIRKLAND, WA 98033–6189 – (425)587–3800

NE 85TH ST PED–BIKE CONNECTION

DRAINAGE DETAILS

SHEET 29 / 100

Jan 06, 2025 - 4:20pm nancy.eaton X:\kirkland, city of\Projects\20210013 - ne 85th st ped-bike\CADD\02 - plan sheets\20210013 DD.dwg Layout Name: DD2

APPENDIX F

Geotechnical Report

SEE GEOTECHNICAL REPORT IN CONTRACT DOCUMENTS

APPENDIX G
Operations and Maintenance

OPERATIONS AND MAINTENANCE OF DRAINAGE STRUCTURES

Routine maintenance is an important part of any stormwater control plan. The major facilities listed below should be inspected and maintained as described. All other drainage features should also be regularly inspected (every 6 months or more frequently) and maintained as needed to maintain the effectiveness of the drainage system as a whole.

Inspection Point	Inspection Frequency	Maintenance Threshold
Catch basins / Pipes/Control Structure/Flow Splitter	Yearly	Conveyance elements should be cleaned when flow is impeded. It is advisable to remove sediment from catch basins on a regular schedule, preferably every 2-3 years.
Detention Vault	Yearly, with casual observation on occasion.	Clean vault when sediment depth reaches 6" in bottom of vault. Repair damage to vault immediately. Clear obstructions which impact vault function as soon as feasible.

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open manhole requires immediate maintenance.**	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or missing	Cleanout gate is missing.	Replace cleanout gate.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Cleanout gate is not watertight.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Orifice Plate	Damaged or missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris.
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and is structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris.
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance**.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

APPENDIX H

Drainage Design Criteria

DESIGN CRITERIA MATRIX
DRAINAGE ANALYSIS & DESIGN CRITERIA SUMMARY

Project Name:	NE 85th Street Ped/Bike Connection 144th Avenue NE to 6th Street	Perteet Job No:	20210013
		Date:	May 5th, 2023
Project Manager:	Brian Caferro, P.E.		
Drainage Engineer:	Thomas Cheong, E.I.T.		
Client:	City of Kirkland		
City or County:	Kirkland		

Project Description:
This project will create the pedestrian/bike connection to the Cross Kirkland Corridor (CKC) on the south side of Northeast 85th Street between 114th Avenue and 6th Street.

A. Summary of Recommendations

Provided below is a summary of the major drainage design standards which will be followed on the Northeast 85th Street Project.

- 2021 King County Surface Water Design Manual (KCSWDM)
- January 1, 2023 City of Kirkland Addendum to the 2021 KCSWDM
- 2012 Low Impact Development Technical Guidance Manual for Puget Sound (LID Manual)
- Flow Control and Water Quality Treatment Model: MGSFlood V4 or WWHM.
- Conveyance Model: StormShed3G – Rational method.

B. Documentation Summary of Drainage Design Standards

Design Element	Standard Requirement	Source
Threshold Analysis/ Minimum Requirements:	This project triggers a full drainage review and shall follow the threshold and core requirement determination procedures as outlined in Section 1.1 of the KCSWDM.	KCSWDM pg. 1-15
Hydrologic Model:		
Flow Control:	Continuous Simulation Modeling, MGS Flood or WWHM	KCSWDM 3-7
Water Quality:	Continuous Simulation Modeling, MGS Flood or WWHM	KCSWDM 3-7
Conveyance:	Rational Method (StomShed3G): For areas under 10 acres SBUH Method (StormShed3G): For areas 10 acres or larger Minimum Time of Concentration (Tc) is 6.3 minutes	KCSWDM 3-11 KCSWDM 3-11 KCSWDM 3-13
Design Storm Events:		
Detention:	Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The predeveloped condition to be matched shall be a historic (forested) land cover unless the project meets the exceptions as listed in the KCSWDM.	KCSWDM pg. 1-45
Conveyance:	Storm Drains: New pipe systems shall be designed with sufficient capacity to convey and contain (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas.	KCSWDM pg. 1-55
	Culverts: New culverts shall be designed with sufficient capacity to meet headwater requirements in Section 4.3.1 and convey (at minimum) the 25-year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas. Must also convey as much as the 100-year peak flow as is necessary to preclude creating or aggravating severe flooding or severe erosion problems.	KCSWDM pg. 1-55
	Ditches/Channels: New ditches/channels shall be designed with sufficient capacity to convey and contain, at minimum, the 25- year peak flow, assuming developed conditions for onsite tributary areas and existing conditions for any offsite tributary areas. Must also convey as much of the 100-year peak flow as is necessary to preclude creating or aggravating a severe flooding or severe erosion problem.	KCSWDM pg. 1-56
Water Quality:	Flow Based - Preceding Detention Facilities or when Detention Facilities are not required: The flow rate at or below which 91% of the runoff volume, as estimated by an approved continuous simulation	KCSWDM pg. 6-17

Design Element	Standard Requirement	Source
	runoff model, will be treated. Flow Based - Downstream of Detention Facilities: The full 2-year release rate from the detention facility. Volume Based: The water quality design storm volume, when using an approved continuous runoff model, shall be equal to the simulated daily volume that represents the upper limit of the range of daily volumes that accounts for 91% of the entire runoff volume over a multi-decade period of record. Tightline Systems Traversing Steep Slopes: New tightline conveyance systems traversing slopes that are steeper than 15% and greater than 20 feet in height, or are within a steep slope hazard area as defined in KCC 21A.06, shall be designed with sufficient capacity to convey and contain (at minimum) the 100-year peak flow, assuming full build-out conditions for all tributary areas, both onsite and offsite. Tightline systems shall be designed as detailed in Section 4.2.2.	 KCSWDM pg. 6-17 KCSWDM pg. 6-19 KCSWDM pg. 1-56
Precipitation Data Source:	Rational Method: Rainfall intensity coefficients: Table 3.2.1.B Runoff coefficients ("C" values): Table 3.2.1.A SBUH Method (Type 1A storm): Precipitation isopoluvial maps: Figures 3.2.1.A through 3.2.1.D 2 yr: 1.80" 10 yr: 2.70" 25 yr: 3.10" 100 yr: 3.70" Continuous Simulation: Extended Time Series Region Map: Puget East 40 in MAP	KCSWDM pg.3-15 KCSWDM pgs. 3-16 to 3-19 Per Lat. & Long. location
Pre-Developed Conditions: (Forested, etc.)	Historic site conditions.	KCSWDM pg. 1-45
Criteria for Storm Conveyance Pipe	1. Acceptable pipe types are PVC 3034, Ductile Iron, HDPE for elevated use, or C900. 2. All pipes shall have a minimum 18 inches of cover. If there is less than 18 inches of cover the pipe shall be ductile iron (Class 50) or C-900. 3. Storm drain pipe laid deeper than 16 feet must be cement lined, ductile iron pipe, Class 50. 4. Minimum pipe size = 12" main line (0.5% min slope), 8" curb inlet crossing (1.0% min slope), 6" side line (2.0% slope), 6" perforated drain pipe. Minimum velocity at full flow shall be 3 fps. 5. Minimum horizontal clearance between storm drainage, sanitary sewer and water pipes shall be 5 feet. 6. Minimum vertical clearance where storm drainage, sanitary sewers and water mains cross shall be 18 inches between the pipes, unless an alternative design has been specifically approved by the development	City of Kirkland Storm Drainage Pre-Approved Notes, Design Criteria and Plans

Design Element	Standard Requirement	Source
	engineer. 7. No bends are allowed in main lines. 8. A catch basin is required when there is a change in the flow-line slope, a minimum distance of 300', a change in pipe size, joining of two or more main lines, a side-line service connection and a change in pipe material type. CB Spacing: Maximum of 300 feet for grades less than 8 percent, maximum of 200 feet for grades from 8 to 12 percent and maximum of 150 feet for grades greater than 12 percent.	

APPENDIX I

TIR WORKSHEET

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 1 PROJECT OWNER AND PROJECT ENGINEER

Project Owner: City of Kirkland
Phone: 425-587-3800
Address: 123 5th Avenue, Kirkland, WA 98033
Project Engineer: Thomas Cheong
Company: Perteet, Inc.
Phone: 206-438-4200

Part 2 PROJECT LOCATION AND DESCRIPTION

Project Name: NE 85th Street Ped/Bike Connection
DDES Permit #:
Location Township: 25 N
Range: 5 E
Section: 5
Site Address: NE 85th Street between 6th Street and 114th Street.

Part 3 TYPE OF PERMIT APPLICATION

- ☐ Landuse Services Subdivison / Short Subd. / UPD
- ☐ Building Services M/F / Commerical / SFR
- ☑ Clearing and Grading
- ☑ Right-of-Way Use
- ☐ Other

Part 4 OTHER REVIEWS AND PERMITS

- ☐ DFW HPA
- ☐ COE 404
- ☐ DOE Dam Safety
- ☐ FEMA Floodplain
- ☐ COE Wetlands
- ☐ Other
- ☐ Shoreline Management
- ☐ Structural Rockery/Vault/
- ☐ ESA Section 7

Part 5 PLAN AND REPORT INFORMATION

Technical Information Report

Type of Drainage Review (circle): (Full) / Targeted / Large Site
Date (include revision dates): 9/8/2023
Date of Final:

Site Improvement Plan (Engr. Plans)

Type (circle one): (Full) / Modified / Small Site
Date (include revision dates):
Date of Final:

Part 6 ADJUSTMENT APPROVALS

Type (circle one): (Standard) / Complex / Preapplication / Experimental / Blanket
Description: (include conditions in TIR Section 2)

Date of Approval:

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 7 MONITORING REQUIREMENTS

Monitoring Required: Yes / (No)

Start Date: _____

Completion Date: _____

Describe: _____

Part 8 SITE COMMUNITY AND DRAINAGE BASIN

Community Plan : _____

Special District Overlays: _____

Drainage Basin: East Lake Washington - Bellevue North basin

Stormwater Requirements: CR #1-CR #8, CR #9

Part 9 ONSITE AND ADJACENT SENSITIVE AREAS

- ☐ River/Stream _____
- ☐ Lake _____
- ☐ Wetlands _____
- ☐ Closed Depression _____
- ☐ Floodplain _____
- ☐ Other _____

_____

- ☐ Steep Slope _____
- ☐ Erosion Hazard _____
- ☐ Landslide Hazard _____
- ☐ Coal Mine Hazard _____
- ☐ Seismic Hazard _____
- ☐ Habitat Protection _____
- ☐ _____

Part 10 SOILS

Soil Type	Slopes	Erosion Potential
Fill	5-7%	Low
Glacial Till	5-7%	Low
Advanced Outwash	5-7%	Low
Glaciolacustrine	5-7%	Low

- ☐ High Groundwater Table (within 5 feet)
- ☐ Other _____
- ☐ Sole Source Aquifer
- ☐ Seeps/Springs

☐ Additional Sheets Attached

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 11 DRAINAGE DESIGN LIMITATIONS	
REFERENCE	LIMITATION / SITE CONSTRAINT
☐ Core 2 – Offsite Analysis	
☐ Sensitive/Critical Areas	
☐ SEPA	
☑ Other	Infiltration infeasibility
☐	
☐ Additional Sheets Attached	

Part 12 TIR SUMMARY SHEET (provide one TIR Summary Sheet per Threshold Discharge Area)	
Threshold Discharge Area: (name or description)	TDA 1
Core Requirements (all 8 apply)	CR #1-CR #8, CR #9
Discharge at Natural Location	Number of Natural Discharge Locations:
Offsite Analysis	Level: 1 / (2) / 3 dated: 02/28/2023
Flow Control (incl. facility summary sheet)	Level: 1 / (2) / 3 or Exemption Number _____ Small Site BMPs _____
Conveyance System	Spill containment located at: _____
Erosion and Sediment Control	ESC Site Supervisor: Contact Phone: TBD during construction After Hours Phone:
Maintenance and Operation	Responsibility: Private / (Public) If Private, Maintenance Log Required: Yes / No
Financial Guarantees and Liability	Provided: (Yes) / No
Water Quality (include facility summary sheet)	Type: Basic / Sens. Lake / Enhanced Basicm / Bog or Exemption No. Exempt Landscape Management Plan: Yes / (No)
Special Requirements (as applicable)	
Area Specific Drainage Requirements	Type: CDA / SDO / MDP / BP / LMP / Shared Fac. / None Name: _____
Floodplain/Floodway Delineation	Type: Major / Minor / Exemption / (None) 100-year Base Flood Elevation (or range): _____ Datum:
Flood Protection Facilities	Describe: Not Applicable
Source Control (comm./industrial landuse)	Describe landuse: Roadway Describe any structural controls: Not Applicable

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Oil Control Exempt	High-use Site: Yes / No Treatment BMP: _____ Maintenance Agreement: Yes / No with whom? _____
Other Drainage Structures	
Describe:	

Part 13 EROSION AND SEDIMENT CONTROL REQUIREMENTS

MINIMUM ESC REQUIREMENTS DURING CONSTRUCTION		MINIMUM ESC REQUIREMENTS AFTER CONSTRUCTION
☑ Clearing Limits		☑ Stabilize Exposed Surfaces
☑ Cover Measures		☑ Remove and Restore Temporary ESC Facilities
☑ Perimeter Protection		☑ Clean and Remove All Silt and Debris Ensure Operation of Permanent Facilities
☑ Traffic Area Stabilization		☐ Flag Limits of SAO and open space preservation areas
☑ Sediment Retention		☐ Other _____
☑ Surface Water Control		
☑ Dust Control		
☑ Construction Sequence		

Part 14 STORMWATER FACILITY DESCRIPTIONS (Note: Include Facility Summary and Sketch)

Flow Control	Type/Description		Water Quality	Type/Description
☑ Detention	Detention Vault		☐ Biofiltration	_____
☐ Infiltration	_____		☐ Wetpool	_____
☐ Regional Facility	_____		☐ Media Filtration	_____
☐ Shared Facility	_____		☐ Oil Control	_____
☐ Small Site BMPs	_____		☐ Spill Control	_____
☐ Other	_____		☐ Small Site BMPs	_____
			☐ Other	_____

TECHNICAL INFORMATION REPORT (TIR) WORKSHEET

Part 15 EASEMENTS/TRACTS		Part 16 STRUCTURAL ANALYSIS
☐ Drainage Easement ☐ Access Easement ☐ Native Growth Protection Covenant ☐ Tract ☐ Other		☑ Cast in Place Vault ☐ Retaining Wall ☐ Rockery > 4' High ☐ Structural on Steep Slope ☐ Other

Part 17 SIGNATURE OF PROFESSIONAL ENGINEER
I, or a civil engineer under my supervision, have visited the site. Actual site conditions as observed were incorporated into this worksheet and the attached Technical Information Report. To the best of my knowledge the information provided here is accurate. *Signed/Date*