5th Street Bicycle and Pedestrian Project

Mukilteo, WA

Final Stormwater Technical Information Report

November 2022

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Stormwater Report

Prepared for:

City of Mukilteo
11930 Cyrus Way
Mukilteo, WA 98275

Prepared by:

KPFF Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, WA 98101

11/04/22

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1.0 PROJECT OVERVIEW

The Mukilteo 5th Street Bicycle and Pedestrian Project is intended to improve the access modes along 5th Street / Mukilteo Boulevard by adding bicycle and pedestrian facilities. The limits of this project are along 5th Street / Mukilteo Boulevard, beginning at Lincoln Avenue, extending east across Japanese Gulch to the City limits; a length of approximately one mile. Improvements will connect the residents along this corridor to the Japanese Gulch Trail, Sound Transit Mukilteo Station, and other waterfront destinations. The project will also coordinate with the City of Everett's Edgewater Bridge Replacement project as it abuts Mukilteo 5th Street Project at its east end.

Main features of the improvements include the following:

- Widening 5th Street / Mukilteo Boulevard to add bicycle and pedestrian facilities
- Safety enhancements for existing pedestrian crossings
- Revising roadway access at driveways and intersection
- Storm drainage repairs
- Interface with the Edgewater Bridge project
- Adjusting existing utilities and installing new utilities as required within the limits of the project improvements. Utilities within the corridor include storm drainage, sewer, water, power, traffic, gas, and telecom franchise utilities

The project vicinity is shown below in Figure 1:

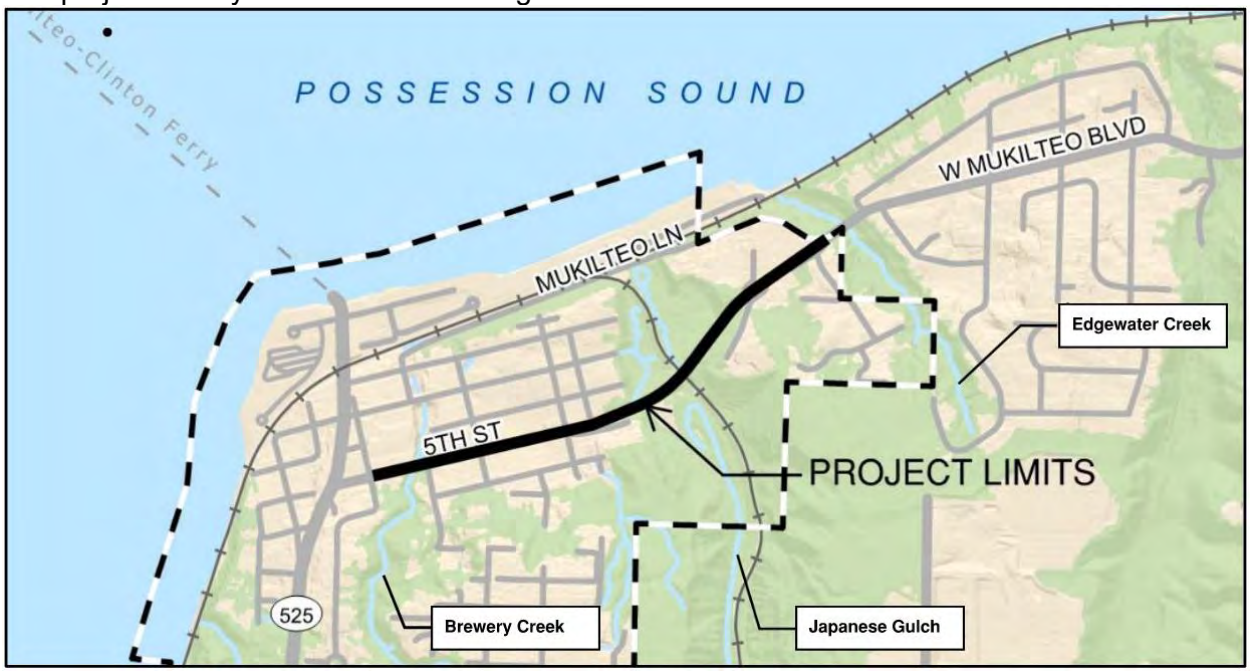


Figure 1: Project Vicinity Map

1.1 EXISTING CONDITIONS

Fifth Street is located in an urban residential area with medium-to-dense single-family housing along both sides of the City right-of-way. Most properties along this segment of the project corridor have established landscaping, gardens, access pathways/stairwells, walls, fences, etc. at or within the City right-of-way. The abutting parcels along Mukilteo Boulevard between Japanese Gulch bridge to the intersection with Leslie Lane are undeveloped. From the Leslie Lane intersection to the Mukilteo Lane/ LaMar Drive intersection, the abutting parcels along Mukilteo Boulevard are medium-density residential plots.

The existing 5th Street / Mukilteo Boulevard is a two-lane urban principal arterial connecting the City of Mukilteo with the City of Everett. 5th Street turns into Mukilteo Boulevard at the Japanese Gulch Bridge. There are shoulders on both sides of the roadway currently used for vehicle parking as well as pedestrians and bicyclists. The terrain of the corridor is flat with minimal elevation change along the alignment.

Approximately 70 percent of the existing site is surfaced with asphalt paving or gravel/soil. The existing roadway prism is approximately 46-feet wide. The roadway section generally consists of two 11-foot travel lanes with an 8-foot shoulder on the north side and a 16-foot shoulder on the south side.

There are two stream crossings within the project limits:

- Brewery Creek (between Lincoln Ave and Park Ave)
- Japanese Gulch Creek (east of Japanese Gulch Park)

The existing project area was delineated into 5 Threshold Discharge Areas (TDAs). Each TDA discharges to open channels that leave the project site. See Appendix A for TDA Basin Map.

The western portion of the project consists of TDAs 1-3. The roadway is crowned and slopes from west to east toward the intersection with Park Avenue. The runoff from this segment of the roadway is either collected in ditches or catch basins and discharges to Brewery Creek via a 12-inch concrete pipe outfall or sheet flow.

The road remains crowned from Park Avenue to Loveland Avenue and runoff from the north portion of 5th Street is collected in ditches and routed to a catch basin approximately 130-feet north of the intersection with Loveland Avenue. The collected runoff is then routed from the catch basin to the discharge point at Brewery Creek (East). The roadway reaches a low area at the mid-block between Loveland Avenue and Cornelia Avenue. All runoff flows to the north. The roadway begins to transition from crowned to superelevated at the intersection of 5th Street and Cornelia Avenue, reaching full superelevation at the intersection of 5th Street and Prospect Avenue where runoff flows to the north and collected by existing catch basins and routed to discharge at Brewery Creek (east).

The eastern portion of the project consists of TDA 4 and 5. The roadway superelevation changes directions at the Japanese Gulch bridge where runoff begins to flow toward the south until the intersection of Mukilteo Boulevard and Leslie Lane. Runoff is primarily collected in catch basins and routed to a discharge point northeast of the Japanese Gulch bridge. The roadway returns to a normal crown just after the intersection of Mukilteo Boulevard and Leslie Lane and remains crowned until the end of the project limits at the intersection of Mukilteo Lane and Mukilteo Boulevard.

Runoff from the north and south side of Mukilteo Boulevard is collected in catch basins and routed to a discharge point east of Scurlock Lane that outfalls into Edgewater Creek.

1.2 PROPOSED CONDITIONS

The proposed improvements along 5th Street include the addition of bike lanes, paved parking and shared use paths. The improvements will require widening of the existing roadway section, construction of walls, and relocation of existing stormwater infrastructure. Along Mukilteo Boulevard, east of the Japanese Gulch Creek bridge, the improvements are generally limited to re-channelizing the existing pavement section to include bike lanes on the outside of the existing travel lanes.

The project will add more than 5,000 square feet of new hard surfaces. This is a roadway project and the additional new hard surface will be less than 50% of the existing hard surface within the limits of proposed roadway improvements. Due to the new hard surfaces being less than 50% of the existing hard surfaces, the Minimum Requirements will not apply to the replaced hard surfaces. All minimum requirements will apply to the new hard surfaces and converted pervious surface areas. Proposed flow control and water quality facilities is discussed in Section 5.0 of this report.

The TDA Overview Map, attached as Appendix A of this report, shows site topography, project limits, threshold discharge areas, and discharge points. The Individual Basin Maps, attached as Appendix B of this report, show the proposed improvements and corresponding hard surfaces within each TDA. A summary of the target areas associated with each of the TDAs illustrated in the Appendices listed above is tabulated below in Table 1.

Table 1: TDA Areas

Surface Description	**TDA Areas**									
	1		2		3		4		5	
	sf	ac	sf	ac	sf	ac	sf	ac	sf	ac
Total TDA Area	23,230	0.533	36,490	0.838	140,110	3.21	111,830	2.57	46,810	1.07
Existing Hard Surface	22,638	0.519	23,730	0.545	97,486	2.23	87,070	1.99	28,320	0.650
New Hard Surface	200	0.005	3,105	0.071	14,085	0.323	2,021	0.046	666	0.015
Replaced Hard Surface	206	0.005	3,890	0.089	23,006	0.582	3,591	0.082	979	0.022
Converted Pervious	200	0.005	495	0.011	4,925	0.113	1,552	0.036	666	0.015

MINIMUM REQUIREMENTS

This section describes the stormwater Minimum Requirements (MR) that pertain to the 5th Street Bicycle and Pedestrian Project. The project will meet the requirements of the Washington Department of Ecology's (DOE) 2019 publication of the Stormwater Management Manual for Western Washington (SWMMWW, 2019).

The project is split into 5 TDAs, so the applicability of minimum requirements is evaluated for each TDA below in sections 2.1-2.9. SWMMWW Figure I-3.3: Flow Chart for Determining Requirements for Redevelopment for each TDA have been included in Appendix C.

1.3 MR1: PREPARATION OF STORMWATER SITE PLANS

Stormwater site plans have been included in Appendix D.

1.4 MR2: CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A SWPPP has been developed and submitted separately. The SWPPP was designed to meet all requirements of the 2019 SWMMWW. Erosion and Sediment Control plans will be submitted as part of project construction plans.

1.5 MR3: SOURCE CONTROL OF POLLUTION

Source control BMPs will be installed during construction for specific pollution-generating activities to prevent prohibited discharges and contaminants from coming into contact with stormwater runoff.

1.6 MR4: PRESERVATION OF NATURAL DRAINAGE SYTEMS AND OUTFALLS

Proposed stormwater runoff patterns will match the existing runoff patterns and will continue to discharge to existing outfall locations. See Appendix A for a figure of outfall locations. A table of receiving water bodies is below in Table 2.

Table 2: Receiving Water Bodies

TDA	Receiving Water Body
1	Puget Sound
2	Brewery Creek
3	Brewery Creek (East)
4	Japanese Gulch
5	Edgewater Creek

1.7 MR5: ON-SITE STORMWATER MANAGEMENT

The project triggers MR 1 through 9 and is not flow control exempt as stated in section 2.7 of this report. See below for Figure 2: Flow Chart for Determining MR#5 Requirements from Chapter 3, Volume 1 of 2019 SWMMWW.

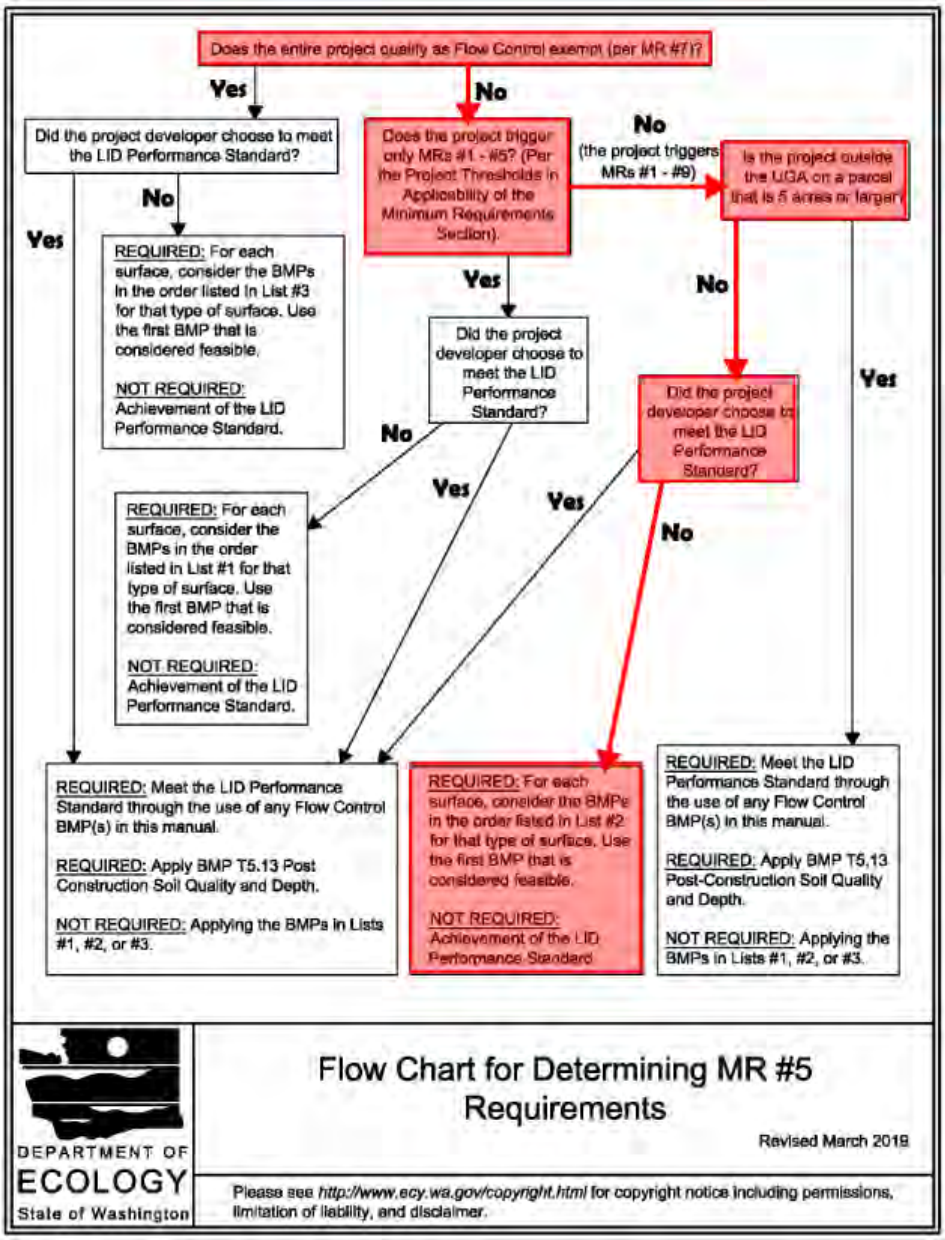


Figure 2: Flowchart for Determining MR#5 Requirements

Per the 2019 SWMMWW, the on-site stormwater management for projects triggering MR 1-5, outside the UGA on a parcel that is 5 acres or larger, where the developer chooses not to meet the LID performance standard is required to consider BMPs in list #2. The following BMPs are identified for the different surface types in the project per Table I-3.2 of SWMMWW. See Table 3 below showing the recommended BMPs for each surface type.

Table 3: List Approach for MR#1-MR#9 Projects That Are Not Flow Control Exempt

Surface Type	Recommended BMPs
Lawn and Landscaped Areas	BMP T5.13: Post-Construction Soil Quality and Depth
Roofs	1. BMP T5.30: full Dispersion or BMP T5.10A: Downspout Full Infiltration 2. BMP T7.30: Bioretention 3. BMP T5.10B: Downspout Dispersion Systems 4. BMP T5.10C: Perforated Stub-out Connections
Other Hard Surfaces	1. BMP T5.30: Full Dispersion 2. BMP T5.15 Permeable Pavements 3. BMP T7.30 Bioretention 4. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion

This section evaluates the feasibility of the above BMPs for each type of surface within the project.

1. **Lawn and Landscaped Areas:**
    - Post-Construction soil quality and depth (BMP T5.13) will be implemented for the proposed landscape.
2. **Roofs:**
    - This is a sidewalk improvement project and does not include any roof surfaces. None of the recommended BMPs for this surface type are applicable on this project.
3. **Other Hard Surfaces:**
    - **Full Dispersion:** This is an urban project and there are no forest or native vegetative areas that provide a minimum 100 feet flow path the fully disperse runoff from the public roadway, so full dispersion is not feasible.
    - **Permeable Pavements:** Geotechnical evaluation completed by HWA GeoSciences recommends that infiltration not be used on this project due to the presence of glacially-consolidated soils and steep slopes. See Appendix G for Geotechnical Report.
    - **Bioretention:** In addition to the infiltration concerns described above, there is also potential for infiltrating water to impact nearby existing basements. As this is an urbanized area, there is insufficient space within the existing public right-of-way for bioretention BMPs.

- **Sheet Flow Dispersion** is infeasible due to insufficient space and the flow with will not meet the minimum requirement of 10 feet of vegetation. **Concentrated Flow Dispersion** is also infeasible as there is no space on-site where the existing pavement could be dispersed to 25 feet of vegetation.

1.8 MR6: RUNOFF TREATMENT

Based on the 2019 SWMMWW, runoff treatment must be provided if there is more than 5,000 square feet of new hard surfaces in a TDA. New hard surface areas for each TDA can be found in Table 1 and show that TDA's 1,2,5 and 4 propose new hard surface areas that are less than 5,000 square feet. Therefore, runoff treatment is not required for those TDA's. However, water quality treatment is triggered in TDA 3 as the proposed roadway improvements result in a new hard surface area of 0.323 acres (14,085 square feet), which is greater than 5,000 square feet.

As per DOE's 2019 SWMMWW, oil water Separation is required for a roadway intersection with a measured Average Daily Traffic (ADT) count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle improvements. The intersection of 5th Street and Mukilteo Boulevard has an ADT of less than 25,000 vehicles and all intersecting roads in the project area have an ADT of less than 15,000 vehicles. In addition, this project primarily proposes pedestrian and bicyclist improvements, therefore it is exempt from providing oil control.

As discussed in section 1.7, due to the presence of glacially consolidated soils, steep slopes, and localized shallow perched groundwater, stormwater infiltration should not be used on this project.

According to local government body regulations, phosphorous control is often a requirement when the project is discharging to one of the following:

- Those waterbodies reported under section 305(b) of the Clean Water Act, and designated as not supporting beneficial uses due to phosphorous or other water quality criteria related to excessive phosphorous.

- Those listed in Washington State's Nonpoint Source Assessment required under section 319(a) of the Clean Water Act due to nutrients.

The project discharges into the water bodies listed above in Table 2. None of the water bodies have been determined as sensitive to phosphorous. Therefore, phosphorous treatment will not be required for this project.

As seen in Figure 3: Runoff Treatment BMP Selection Flow Chart, from Volume I of 2019 SWMMWW, the final step is to determine if Enhanced Treatment is required for the runoff generated from the new hard surface area within the project. Enhanced treatment provides a reduction in dissolved metals and is required for projects that discharge directly to fresh waters designated for aquatic life use or that have an aquatic life use. Runoff collected from TDA 3 is routed via catch basins and storm pipes to discharge directly into Brewery Creek (east), which contains existing aquatic life. Therefore, enhanced treatment is required for this project. See section 5.2 for water quality discussion.

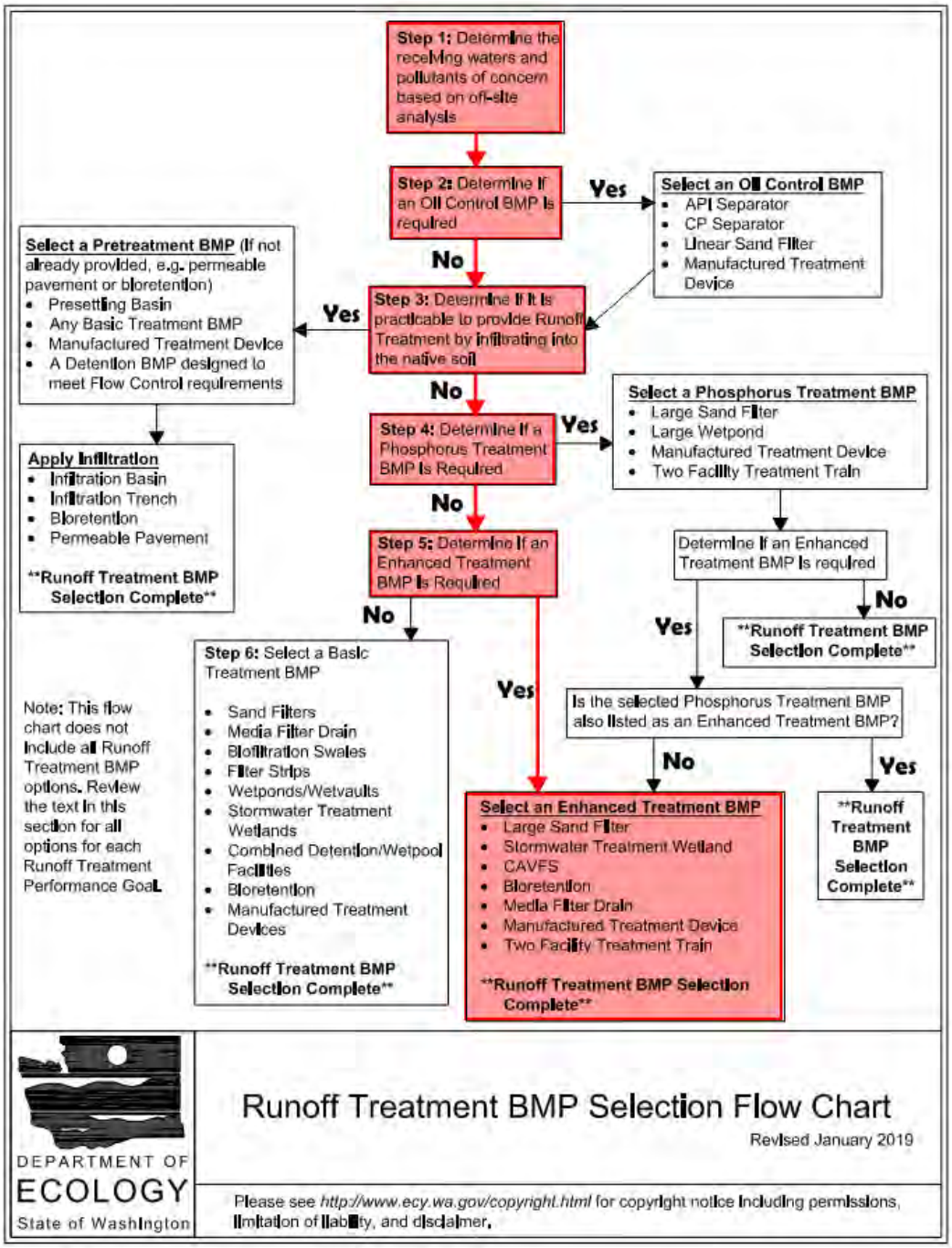


Figure 3: Runoff Treatment BMP Selection Flow Chart

1.9 MR7: FLOW CONTROL

There is one outfall in TDA 3 that drains to Brewery Creek (east) before discharging into Puget Sound. Brewery Creek is not a flow control exempt water body. Per the 2019 SWMMWW, the flow control requirement is triggered if the new impervious surface is more than 5,000 square feet. TDA's 1, 2, 5 and 4 propose new hard surface areas that are less than 5,000 square feet.

Therefore, those TDA's are not required to provide flow control. However, TDA 3 proposes 14,085 square feet of new hard surface. Therefore, flow control must be provided in TDA 3. See section 5.1 for flow control discussion and Figure 4 (below) for minimum requirements flow chart for TDA 3.

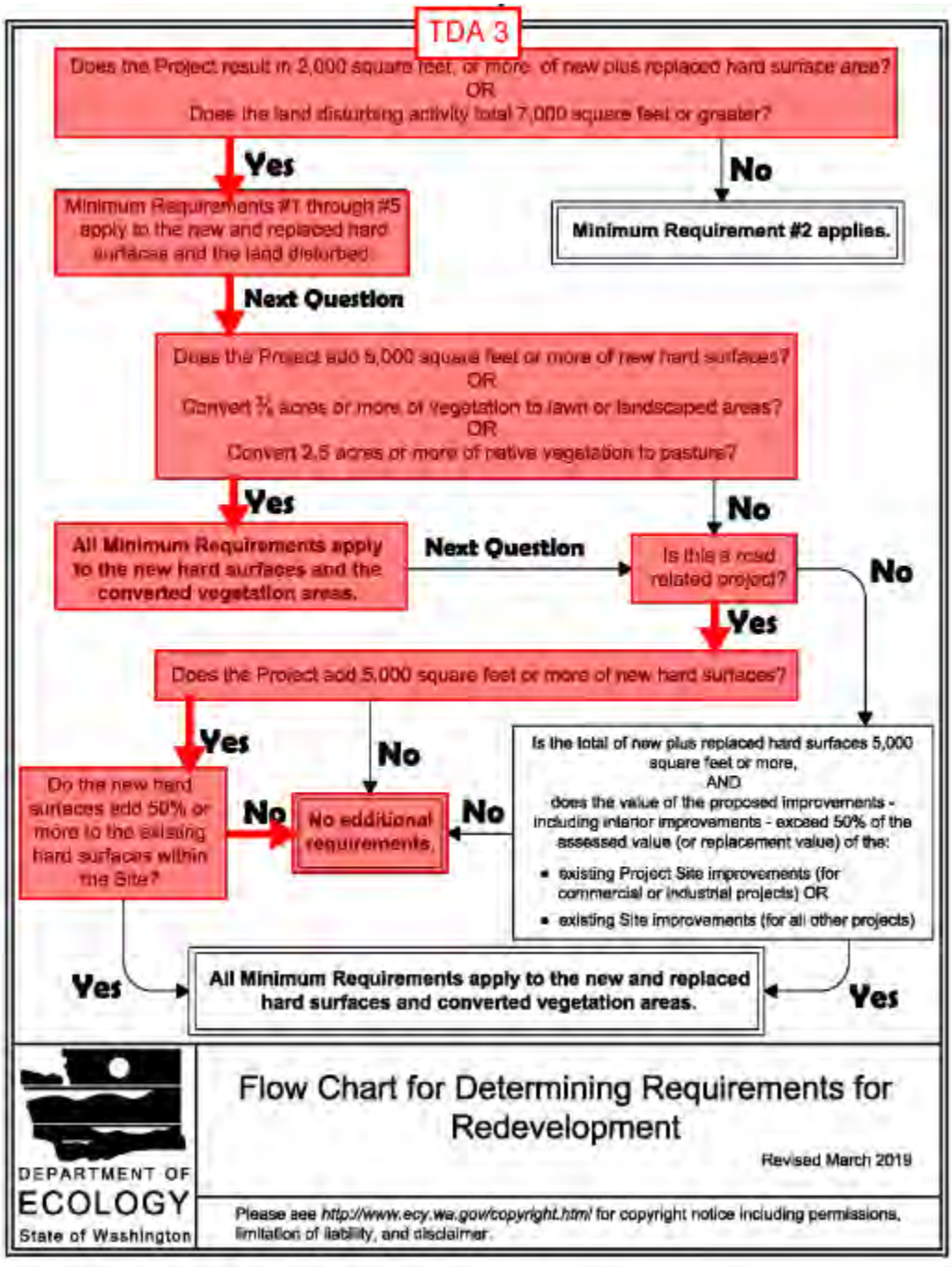


Figure 4: TDA 3 Flow Chart for Determining Requirements for Redevelopment

1.10 MR8: WETLANDS PROTECTION

The runoff from the project maintains the existing outfall locations for each TDA and does not require any stormwater BMPs for wetland protection.

1.11 MR9: OPERATION AND MAINTENANCE

An operation and maintenance manual for the proposed stormwater facilities and BMPs has been included in Appendix K.

2.0 SITE AND BASIN ASSESSMENT

This is a bicycle and pedestrian project with minimal impacts to the existing topography. The portion west of the Japanese Gulch Creek bridge includes widening the roadway to include bicycle and pedestrian facilities in each direction. This work will include primarily roadway overlay with some full depth paving for the new at-grade paths. Fifth Street is graded to maintain existing drainage patterns, where it is crowned throughout the corridor except between Cornelia Ave and Leslie Lane where it transitions to a superelevated condition.

The portion of the corridor east of the Japanese Gulch Creek bridge maintains existing drainage patterns and is collected and conveyed by the existing storm drainage structures and pipes.

The portion of the corridor West of the Japanese Gulch Creek bridge, where the roadway section is being widened, is comprised of the following proposed collection and conveyance system:

- From Park Avenue to Loveland Avenue, catch basins will be installed along the north and south side of the road. This portion of the storm system is laid out with the purpose of collecting runoff within TDA 3 and routing it to the underground detention vault. This system is limited to the segment of 5th Street between Park Ave and Loveland Ave where it first routes collected runoff to a 7'x9' Modular Wetland System (MWS) for enhanced water quality treatment before entering the detention vault.
- On 5th Street from Lincoln Avenue to Park Avenue, catch basins will be installed along the south side of the road in the proposed landscape strip. The system will discharge to the existing storm systems. Runoff along the north side of the road will follow existing drainage patterns and sheet flow off-site to the north.
- On 5th Street from Loveland Avenue to Cornelia Avenue, catch basins will be installed along both sides of the road and connect to the existing storm system that runs north to discharge into Brewery Creek (east).
- From Cornelia Street to the end of TDA 3, runoff flows to the north side of the road due to the superelevated roadway condition. This runoff is collected in new and existing catch basins that outfall to Brewery Creek (east).
- From the end of TDA 3 to Mukilteo Lane, the existing drainage pattern is maintained, and runoff is collected by the existing storm system. There are no new drainage structures or pipes proposed in this segment of the project.

2.1 OFF-SITE ANALYSIS

Offsite residential areas abutting the north and south side of the roadway contribute runoff to the catch basins and pipes within the existing and proposed storm systems along the north and south sides of the alignment. The existing conveyance along the south side of the road between Loveland Avenue and Cornelia Avenue includes a shallow paved dich line with catch basins to collect and route runoff too discharge into the existing storm system. Due to the proposed roadway widening, the existing flow line will be replaced by the new sidewalk limits. The proposed flow line runs through the center of the landscape strips and runoff is collected in catch basins and routed to maintain the same discharge point into the existing storm system.

Similarly, the existing ditch on the north side of the road from Prospect Avenue to Centennial Park will be covered by the proposed sidewalk limits. The City has documented the existing culvert pipe that runs under the existing gravel parking area at Centennial Park and discharges into the existing ditch has been damaged and needs to be replaced. This pipe currently routes water from the ditch east to outfall into Japanese Gulch via 12” CMP pipe. As this ditch is being replaced by new sidewalk, the runoff will now be collected by a series of catch basins and pipes along the new low points and flow line. The runoff will then discharge into an existing catch basin and maintain the existing outfall pipe and location. The existing culvert will be abandoned in place.

2.2 SOILS/INFILTRATION RATES

Geotechnical investigations were conducted by HWA GeoSciences in March 2022. The subsurface investigation revealed near surface soils primarily consisting of medium dense to very dense, slightly silty to silty sand with gravel. The use of infiltration for stormwater design is not recommended for the project given the presence of glacially-consolidated soils and nearby steep slopes. Groundwater seepage was encountered at depths ranging from 5 to 7.5 feet. Detention vault calculations for buoyancy assumed a groundwater depth of 5 feet, respectively. See Appendix G for the complete geotechnical report of the project site.

2.3 CRITICAL AREAS AND FLOOD PLAIN

See Figures 5 and 6 below for the City of Mukilteo iMap showing the critical areas and landslide hazards within and adjacent to the project limits. No wetlands or flood plains existing within the project limits. Wetlands and stream buffers have been identified adjacent to the project limits at stream crossing locations.

The proposed design is not anticipated to increase existing issues within the project limits. Flow control will be implemented in TDA 3 to manage additional runoff from the new impervious surface proposed. This will result in decreased runoff rates and controlled flows where the proposed conveyance system connects to the existing system on the west side of Loveland Avenue (north of 5th Street). Changes to existing drainage patterns and runoff rates in TDA 1-2 and 4-5 will be minimal to none and should not impact the critical areas discussed.

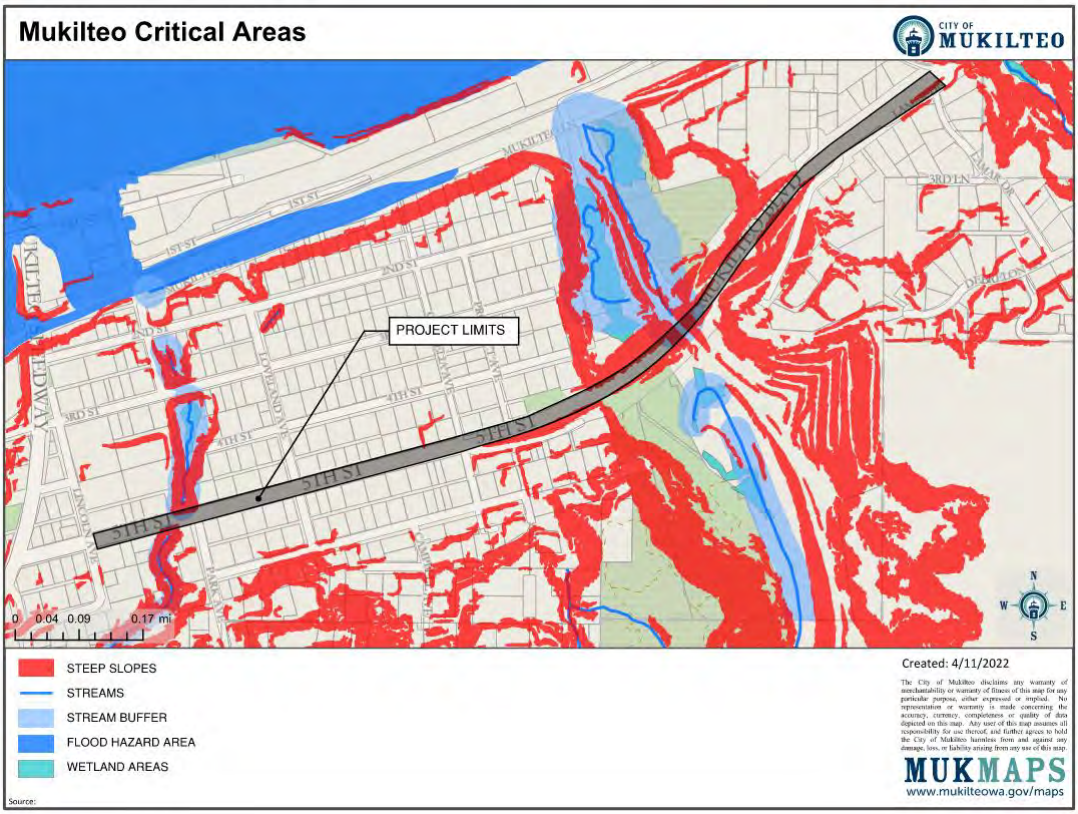


Figure 5: Critical Areas

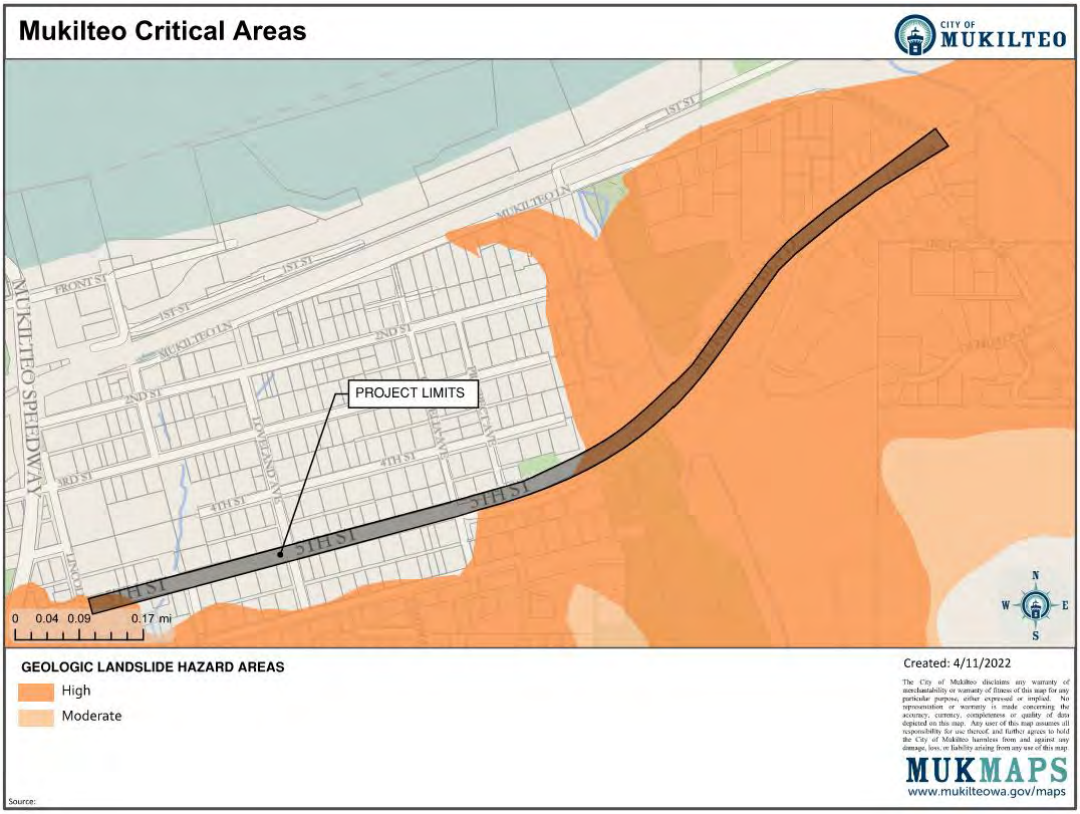


Figure 6: Landslide Hazard Areas

2.4 DOWNSTREAM ANALYSIS

A downstream analysis is necessary if changes in flows could impair or alter conveyance systems, stream banks, bed sediment, or aquatic habitat. Downstream analysis includes analyzing capacities of conveyance and outfall systems and checking for probable flooding and erosion problems downstream due to increased flows in the proposed condition. If there is flooding or erosion in the existing condition, the proposed systems would need to be designed to ensure these problems are not aggravated.

The project proposes 14,085 square feet of new hard surface, which is above the 5,000 square foot new hard surface threshold (see Figure 4). Flow control will be provided in TDA 3 which will reduce overall flows entering the existing downstream systems. TDA's 2 and 4 propose 3,105 and 2,021 square feet of new hard surface, respectively. Therefore, both TDA's are under the 5,000 square foot threshold and should result in minimal increases to flows.

To confirm that the conveyance system has adequate capacity for proposed flows, conveyance pipe sizing calculations have been completed and have been included in Appendix H.

4.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A SWPPP was developed following 2019 SWMMWW requirements and the City of Mukilteo Development Standards, as amended in 2019. This documented will be updated by the contractor during construction. See Appendix L for SWPPP.

5.0 PERMANENT STORMWATER CONTROL

5.1 FLOW CONTROL

As discussed in section 2.0 of this report, all minimum requirements will apply to the new hard surfaces created within TDA 3. The flow control minimum requirement is met by constructing an underground vault placed between Park Avenue and Loveland Avenue. Stormwater facility size is listed in Table 4.

Table 4: FC-1 Stormwater Facility Size

Stormwater Facility	Live Storage Depth (ft)	Interior Area (sf)	Flow Control Live Storage (cf)	Max. Volume (cf)
FC 2-1	6'-9"	1,992	13,446	15,438

The proposed detention vault has been sized to meet MR 7 for 31,233 square feet, which includes 0.45 acres of impervious and 0.192 acres of pervious area. The results from the model are shown below. See MGSFlood output files in Appendix E.

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

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: New Structure Lnk1

***** 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	1.522E-02	2-Year	6.866E-03
5-Year	2.415E-02	5-Year	8.118E-03
10-Year	3.121E-02	10-Year	9.112E-03
25-Year	4.057E-02	25-Year	2.172E-02
50-Year	4.475E-02	50-Year	2.918E-02
100-Year	5.105E-02	100-Year	3.363E-02
200-Year	7.042E-02	200-Year	3.775E-02
500-Year	9.645E-02	500-Year	4.319E-02

** 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%):	-24.9%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	-24.9%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-52.6%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

Runoff is collected and routed through a system of proposed catch basins and pipes west of the detention vault. The proposed system bypasses the existing drainage system and enters an MWS for enhanced treatment before discharging into the detention vault. Vault FC2-1 will be a pre-cast panel vault with a main vault total inside depth of 8.33 feet and sump total inside depth of 12.5 feet. The vault has been designed to provide six inches of sediment storage and 1.08 feet of freeboard above the overflow water surface. Vault layout and storage elevations can be found in Appendix D: Stormwater Site Plans.

5.2 WATER QUALITY

As discussed in section 1.7 of this report, TDA 3 is required to provide enhanced water quality treatment for runoff. Water quality is achieved by a modular wetland system (MWS). MWS units are composed of a pretreatment chamber containing filtration cartridges and a horizontal-flow biofiltration chamber with a peripheral void area that provide enhanced water quality treatment. The unit will have a solid lid and be located in the westbound lane of 5th Street.

The proposed MWS filtration cartridge vaults and biofiltration chamber are sized based on the offline water quality flow rate of 0.04 cfs flow rate. The results from the model are shown below. See MGSFlood output files in Appendix E.

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

Number of Links: 1

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

2-Year Discharge Rate : 0.183 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.07 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.04 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 217.22
Inflow Volume Including PPT-Evap (ac-ft): 217.22
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): 217.22
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%

5.3 SOURCE CONTROL

No potential pollutants requiring source control have been identified in this project. Water quality treatment will be provided by the MWS as required by the Minimum Requirements.

5.4 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

Inlet spacing on 5th Street was determined per the City of Mukilteo Development standards as follows:

3.6.3 Catch Basins and Junctions

1. *Catch Basins shall be spaced no greater than 150 feet.*

2. *Where the width of the tributary road surface exceeds 35 feet, the cross slope exceeds four percent, catch basin analysis is required. The analysis must show the depth of the water at the edge of traveled way does not exceed 0.12 feet or extend more than five feet into the traveled way for the 10-year storm event.*

This project does not propose catch basins in areas where the tributary road surface exceeds 35 feet, and the cross slope exceeds four percent so catch basin analysis is not required. The proposed valley gutter along the south side of 5th Street has been evaluated to meet spread requirements along the roadway and sidewalk. Inlet spacing and spread calculations have been included in Appendix I. All pipes included in the proposed conveyance design for this project have been sized to provide adequate capacity for the 25-year storm event. Pipe sizing calculations have been included in Appendix H.

Due to the increased roadway section width, some of the existing ditches along the north side of 5th Street have been shifted and realigned just north of the existing locations in order to maintain existing drainage patterns. Ditch capacity analysis has been completed for all proposed ditches to confirm that adequate capacity is provided. Ditch analysis has been included in Appendix J.

6.0 OTHER PERMITS

No additional permits are anticipated for the project.

APPENDIX A TDA BASIN MAP

LEGEND

- THRESHOLD DISCHARGE AREA (TDA)
- FLOW PATH
- DISCHARGE LOCATION (#)

TDA OVERVIEW

TDA	RECEIVING WATER BODY
1	PUGET SOUND
2	BREWERY CREEK
3	BREWERY CREEK (EAST)
4	JAPANESE GULCH
5	EDGEWATER CREEK

0 200' 400' 800'

1 inch = 400' feet

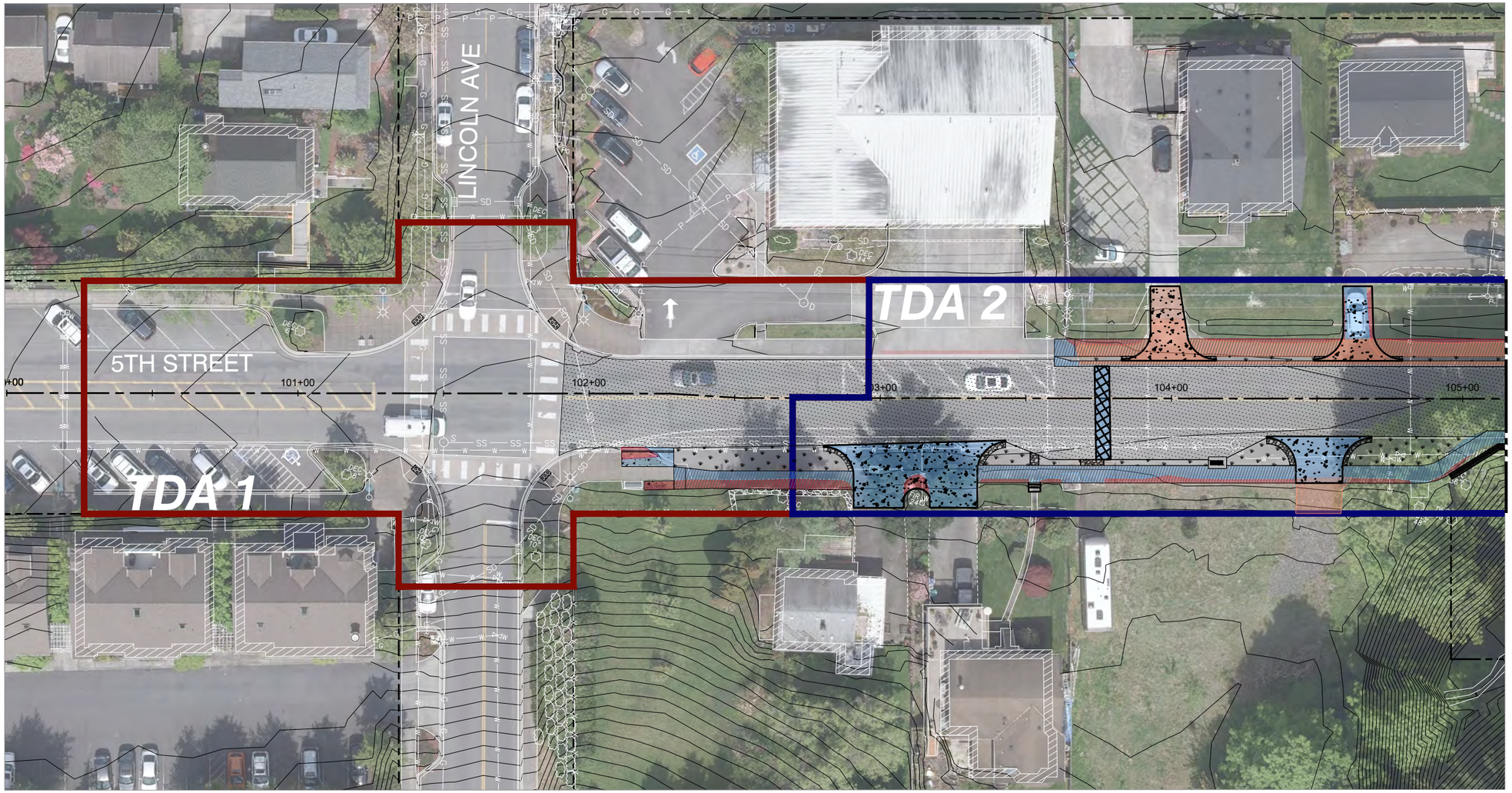
N

Project Title: 5TH STREET PEDESTRIAN IMPROVEMENTS	Drawing Title: TDA OVERVIEW MAP
Client: CITY OF MUKILTEO	kpff, 1601 5th Avenue, Suite 1600, Seattle, WA 98101, 206.622.5822, www.kpff.com
ASI/RFI/CSK Number	
Drawing Reference	Scale
Date	Drawn/Ck'd By: CHA

Oct 28, 2022 - 1:51pm chrisstineh Z:\2000001-2009999\2000722 Mukilteo 5th St Bicycle & Pedestrian\Engineer\CHA\TDA Overview.dwg

APPENDIX B INDIVIDUAL TDA BASIN MAPS

S4 T28N R4E W.M.



TDA 1		
AREA DESCRIPTION	AREA (SQ FT)	AREA (AC)
TOTAL	23,230	0.5333
EXISTING IMPERVIOUS	22,638	0.5197
EXISTING PERVIOUS	592	0.0136
NEW IMPERVIOUS	200	0.0046
REPLACED IMPERVIOUS	206	0.0047

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
JOB No. :2000722

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

SCALE: 1" = 20'

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MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

SHT. 02 OF 124

INDIVIDUAL TDA BASIN MAPS

TDA01

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christineh
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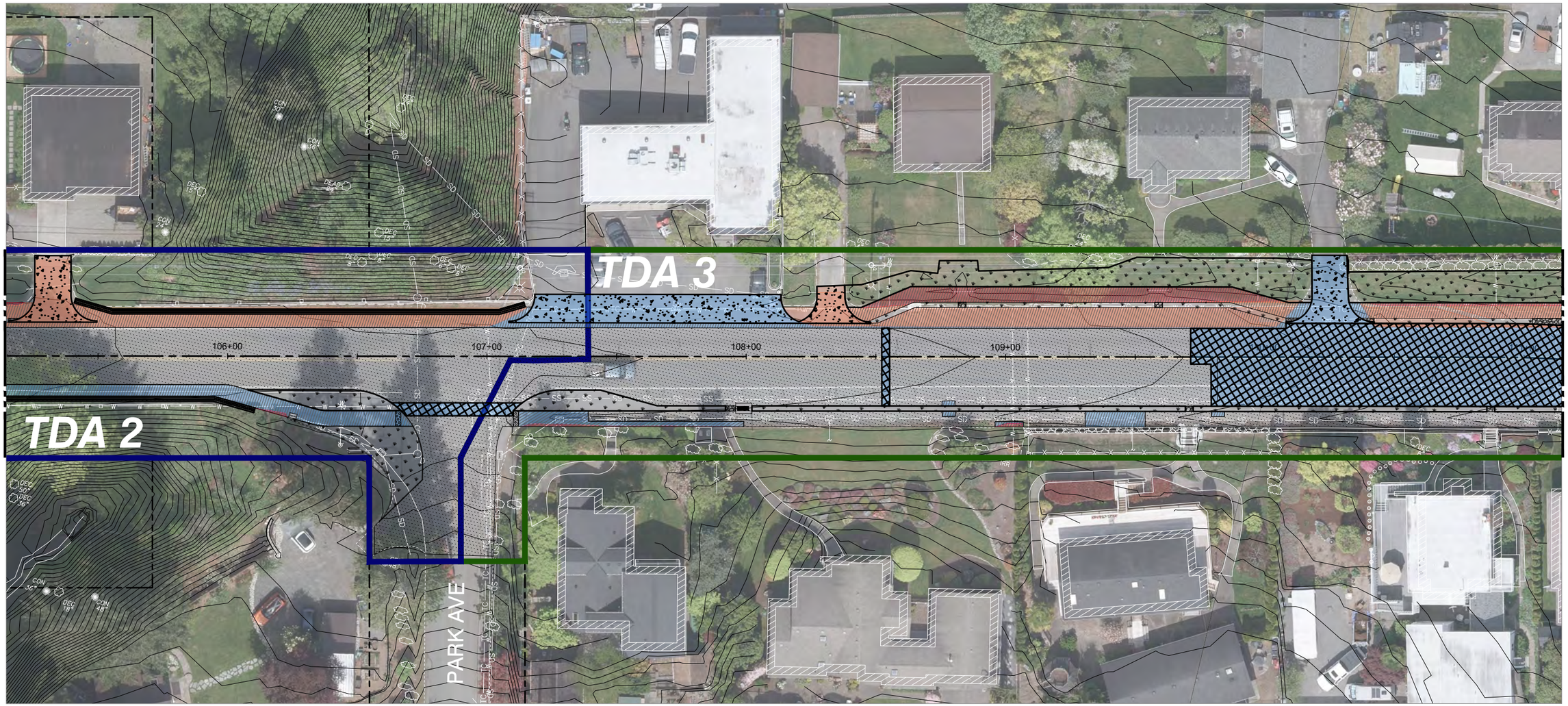

TDA 2		
AREA DESCRIPTION	AREA (SQ FT)	AREA (AC)
TOTAL	36,490	0.8377
EXISTING IMPERVIOUS	23,730	0.5448
EXISTING PERVIOUS	12,760	0.2929
NEW IMPERVIOUS	3,105	0.0713
REPLACED IMPERVIOUS	3,890	0.0893

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
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INDIVIDUAL TDA BASIN MAPS

TDA02

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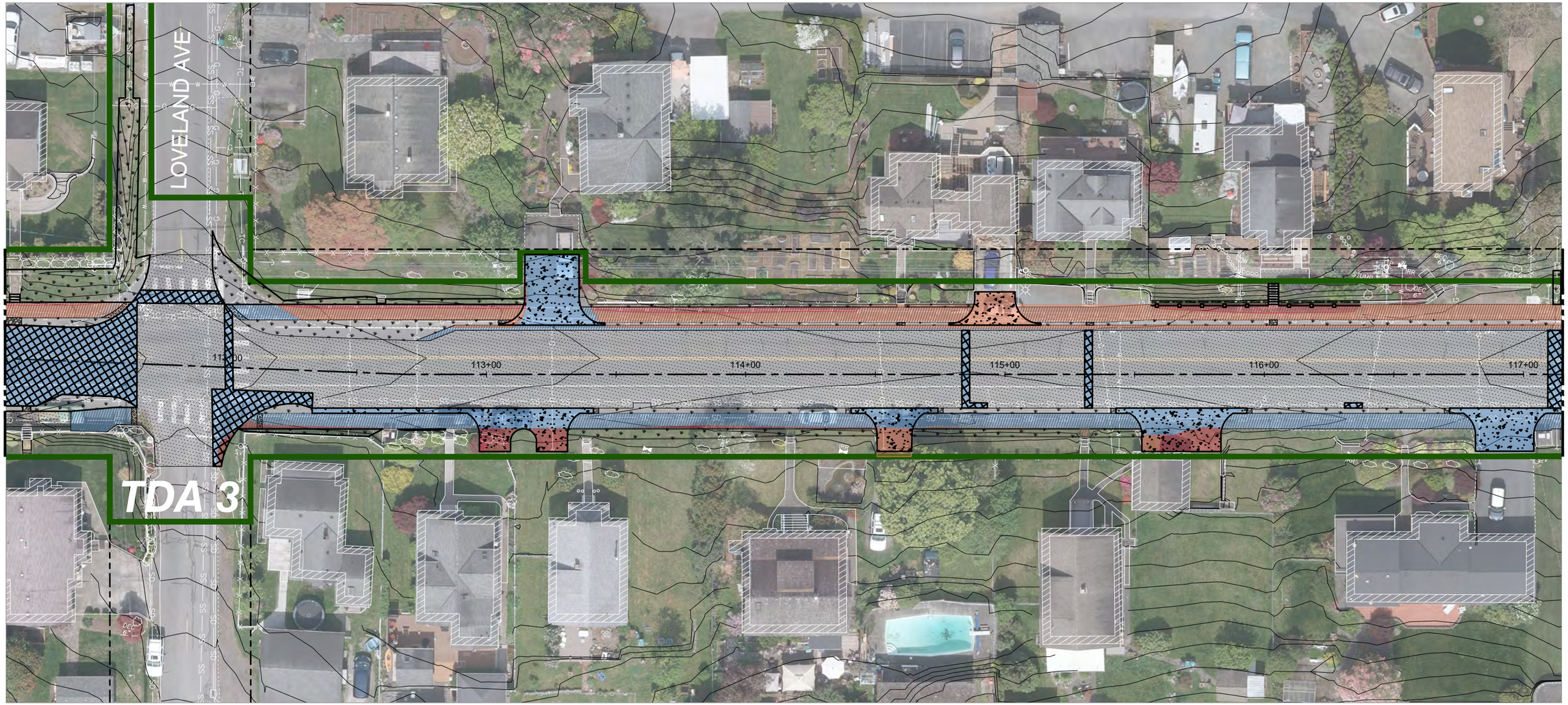

TDA 3		
AREA DESCRIPTION	AREA (SQ FT)	AREA (AC)
TOTAL	140,110	3.2165
EXISTING IMPERVIOUS	97,486	2.2380
EXISTING PERVIOUS	42,624	0.9785
NEW IMPERVIOUS	14,085	0.3233
REPLACED IMPERVIOUS	23,006	0.5281

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

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NO.	DATE	BY	CHD.	APPR.	REVISION

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DATE 08/2022
J O B No. :2000722

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INDIVIDUAL TDA BASIN MAPS

TDA03

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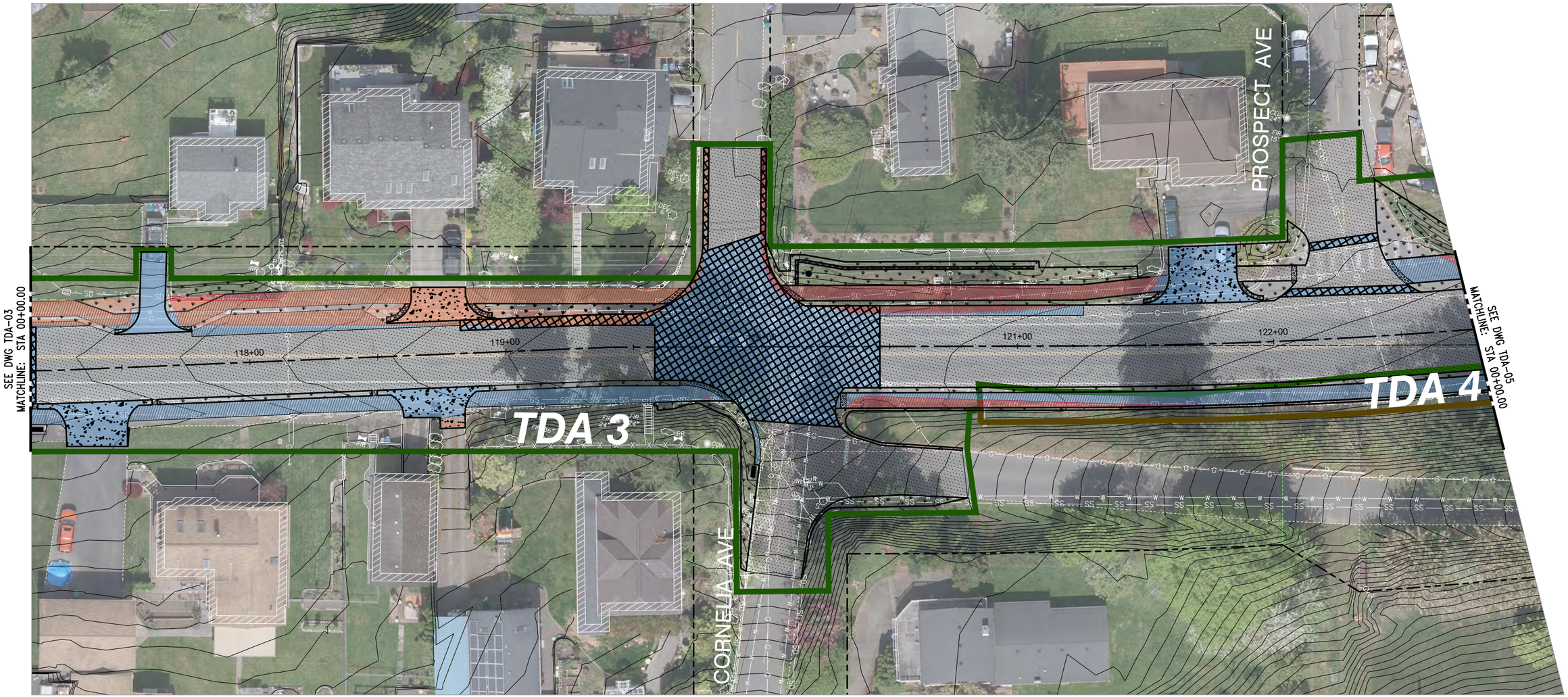

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

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INDIVIDUAL TDA BASIN MAPS

TDA04

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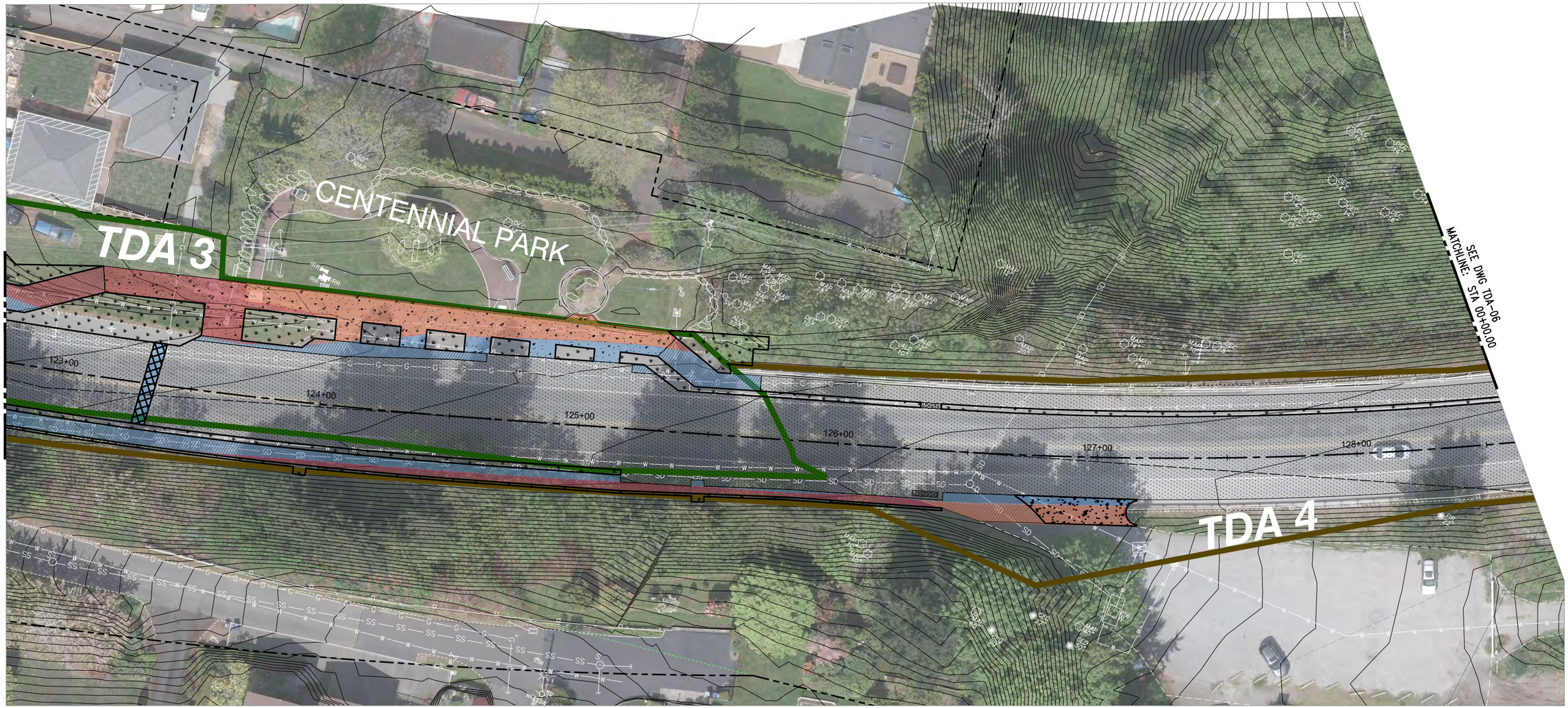

TDA 4		
AREA DESCRIPTION	AREA (SQ FT)	AREA (AC)
TOTAL	111,830	2.5673
EXISTING IMPERVIOUS	87,070	1.9989
EXISTING PERVIOUS	24,760	0.5684
NEW IMPERVIOUS	2,021	0.0464
REPLACED IMPERVIOUS	3,591	0.0824

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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J O B No. :2000722

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INDIVIDUAL TDA BASIN MAPS

TDA05

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LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

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TDA06

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LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

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NO.	DATE	BY	CHD.	APPR.	REVISION

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INDIVIDUAL TDA BASIN MAPS

TDA07

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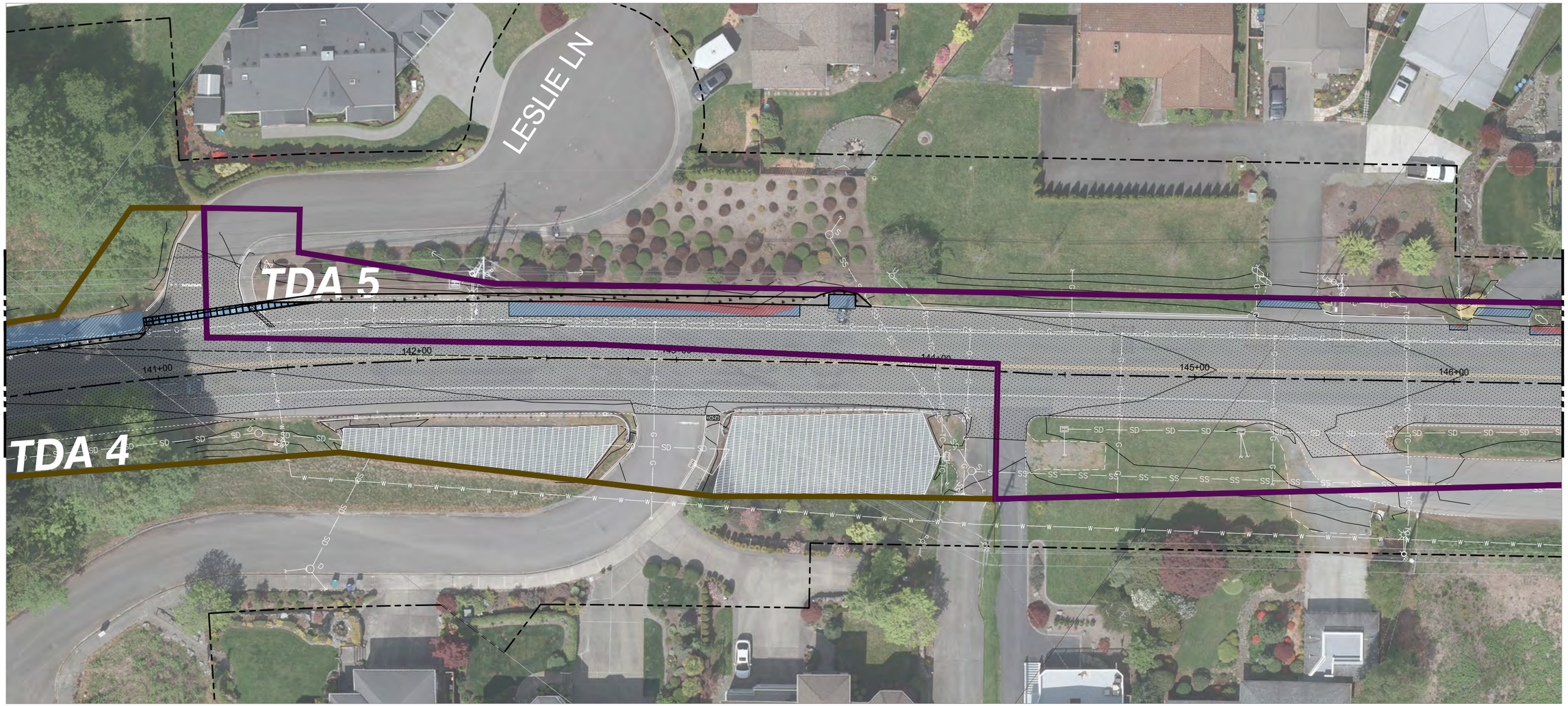

TDA 5		
AREA DESCRIPTION	AREA (SQ FT)	AREA (AC)
TOTAL	46,820	1.0748
EXISTING IMPERVIOUS	28,321	0.6502
EXISTING PERVIOUS	18,499	0.4247
NEW IMPERVIOUS	666	0.0153
REPLACED IMPERVIOUS	979	0.0225

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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INDIVIDUAL TDA BASIN MAPS

TDA08

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christineh
Nov 04, 2022 - 12:48pm

S4 T28N R4E W.M.

SEE DWG TDA-08
MATCHLINE: STA 00+00.00

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- NEW HARD SURFACE (FROM VEGETATION)
- NEW HARD SURFACE (FROM GRAVEL)
- REPLACED HARD SURFACE

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
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INDIVIDUAL TDA BASIN MAPS

TDA09

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chrisl.neh
Nov 04, 2022 - 12:48pm

April 2022

APPENDIX C MINIMUM REQUIREMENTS

LEGEND

- THRESHOLD DISCHARGE AREA (TDA)
- FLOW PATH
- DISCHARGE LOCATION (#)

TDA OVERVIEW

TDA	RECEIVING WATER BODY
1	PUGET SOUND
2	BREWERY CREEK
3	BREWERY CREEK (EAST)
4	JAPANESE GULCH
5	EDGEWATER CREEK

0 200' 400' 800'

1 inch = 400' feet

N

Project Title: 5TH STREET PEDESTRIAN IMPROVEMENTS	Drawing Title: TDA OVERVIEW MAP
Client: CITY OF MUKILTEO	kpff, 1601 5th Avenue, Suite 1600, Seattle, WA 98101, 206.622.5822, www.kpff.com
ASI/RFI/CSK Number	
Drawing Reference	Scale
Date	Drawn/Ck'd By: CHA

Oct 28, 2022 - 1:51pm chrisstineh Z:\2000001-2009999\2000722 Mukilteo 5th St Bicycle & Pedestrian\Engineer\CHA\TDA Overview.dwg

TOTAL PROJECT AREAS

TDA	Total Area (sf)	Total Area (acre)
1	23,230	0.5333
2	36,490	0.8377
3	140,110	3.2165
4	111,830	2.5673
5	46,810	1.0746
Project Total	**358,470**	**8.2293**

TDA	Total Area (sf)	Existing Impervious Area (sf)
1	23,230	22,638
2	36,490	23,730
3	140,110	97,486
4	111,830	87,070
5	46,810	28,321
Project Total	**358,470**	**259,245**

TDA	Receiving Water Body	Stream Classification[1]
1	Puget Sound	-
2	Brewery Creek	4(H)
3	Brewery Creek (East)	-
4	Japanese Gulch	3
5	Edgewater Creek	4

[1]https://www.codepublishing.com/WA/Mukilteo/#!/Mukilteo17/Mukilteo1752C.html

TOTAL PROJECT AREAS

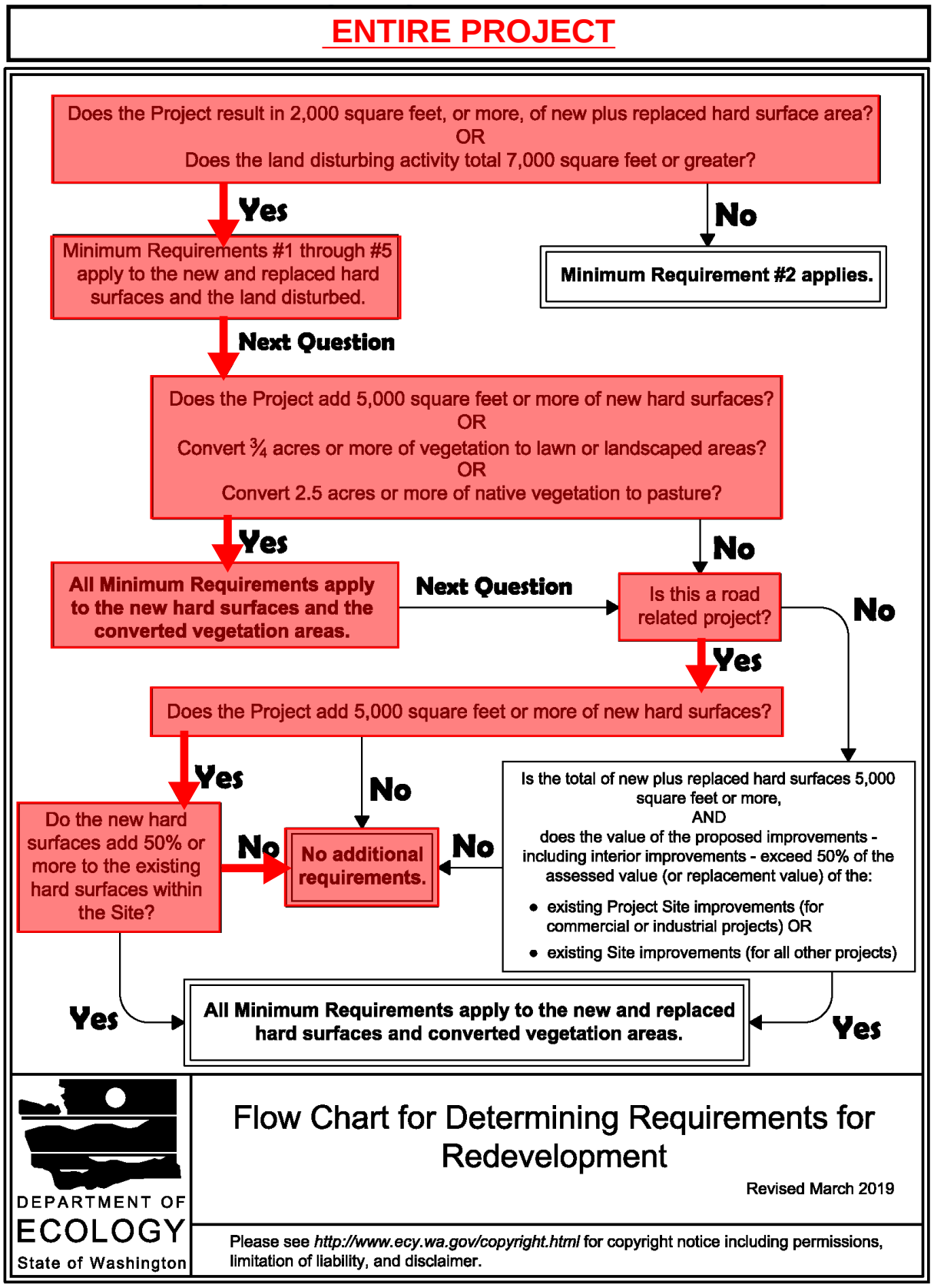
Receiving Water Body	TDA	New + Replaced Impervious (SF)	New Impervious (SF)	New Impervious, Landscape to Pavement (SF)	New Impervious, Gravel to Pavement (SF)	Replaced Impervious (SF)
Puget Sound	1	406	200	200	0	206
Brewery Creek	2	6,446	3,101	495	2,606	3,345
Brewery Creek (East)	**3**	34,031	**19,143**	**4,934**	**14,209**	**14,888**
Japanese Gulch Creek	4	5,374	2,021	1,552	469	3,353
Edgewater Creek	5	2,301	947	947	0	1,354
	Project Totals	48,558	25,412	8,128	17,284	23,146

TDA	New Impervious (acre)	New Impervious (Pervious, acre)	New Impervious (Upgraded Impervious, acre)	Replaced Impervious (acre)
1	0.0046	0.0046	0.0000	0.0047
2	0.0712	0.0114	0.0598	0.0768
3	**0.4395**	**0.1133**	**0.3262**	**0.3418**
4	0.0464	0.0356	0.0108	0.0770
5	0.0217	0.0217	0.0000	0.0311
Project Totals	0.5834	0.1866	0.3968	0.5314

Add 5% contingency

Receiving Water Body	TDA	New + Replaced Impervious (SF)	New Impervious (SF)	New Impervious, Landscape to Pavement (SF)	New Impervious, Gravel to Pavement (SF)	Replaced Impervious (SF)
Puget Sound	1	426	210	210	0	216
Brewery Creek	2	6,768	3,256	520	2,736	3,512
Brewery Creek (East)	3	35,733	20,100	5,181	14,919	15,632
Japanese Gulch Creek	4	5,643	2,122	1,630	492	3,521
Edgewater Creek	5	2,416	994	994	0	1,422
	Project Totals	50,986	26,683	8,534	18,148	24,303

TDA	New Impervious (acre)	New Impervious (Pervious, acre)	New Impervious (Upgraded Impervious, acre)	Replaced Impervious (acre)
1	0.0048	0.0048	0.0000	0.0050
2	0.0747	0.0119	0.0628	0.0806
3	0.4614	0.1189	0.3425	0.3589
4	0.0487	0.0374	0.0113	0.0808
5	0.0228	0.0228	0.0000	0.0326


ENTIRE PROJECT
Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?
Yes
No
Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.
Minimum Requirement #2 applies.
Next Question
Does the Project add 5,000 square feet or more of new hard surfaces?
OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
OR
Convert 2.5 acres or more of native vegetation to pasture?
Yes
No
All Minimum Requirements apply to the new hard surfaces and the converted vegetation areas.
Next Question
Is this a road related project?
No
Yes
Does the Project add 5,000 square feet or more of new hard surfaces?
Yes
No
Do the new hard surfaces add 50% or more to the existing hard surfaces within the Site?
No
No additional requirements.
No
Is the total of new plus replaced hard surfaces 5,000 square feet or more,
AND
does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:
existing Project Site improvements (for commercial or industrial projects) OR
existing Site improvements (for all other projects)
Yes
All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.
Yes
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State of Washington
Flow Chart for Determining Requirements for Redevelopment
Revised March 2019
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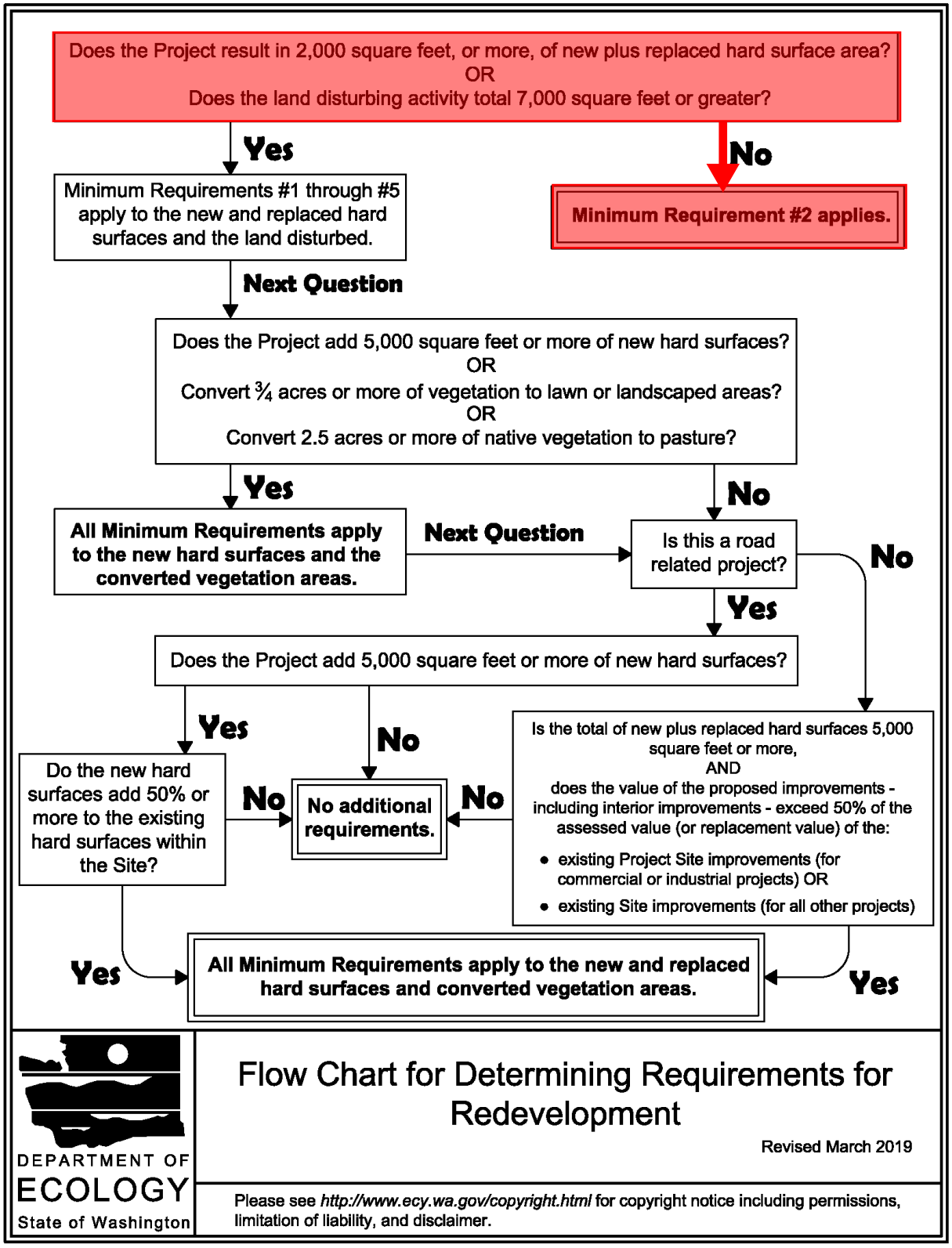
TDA 1


Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
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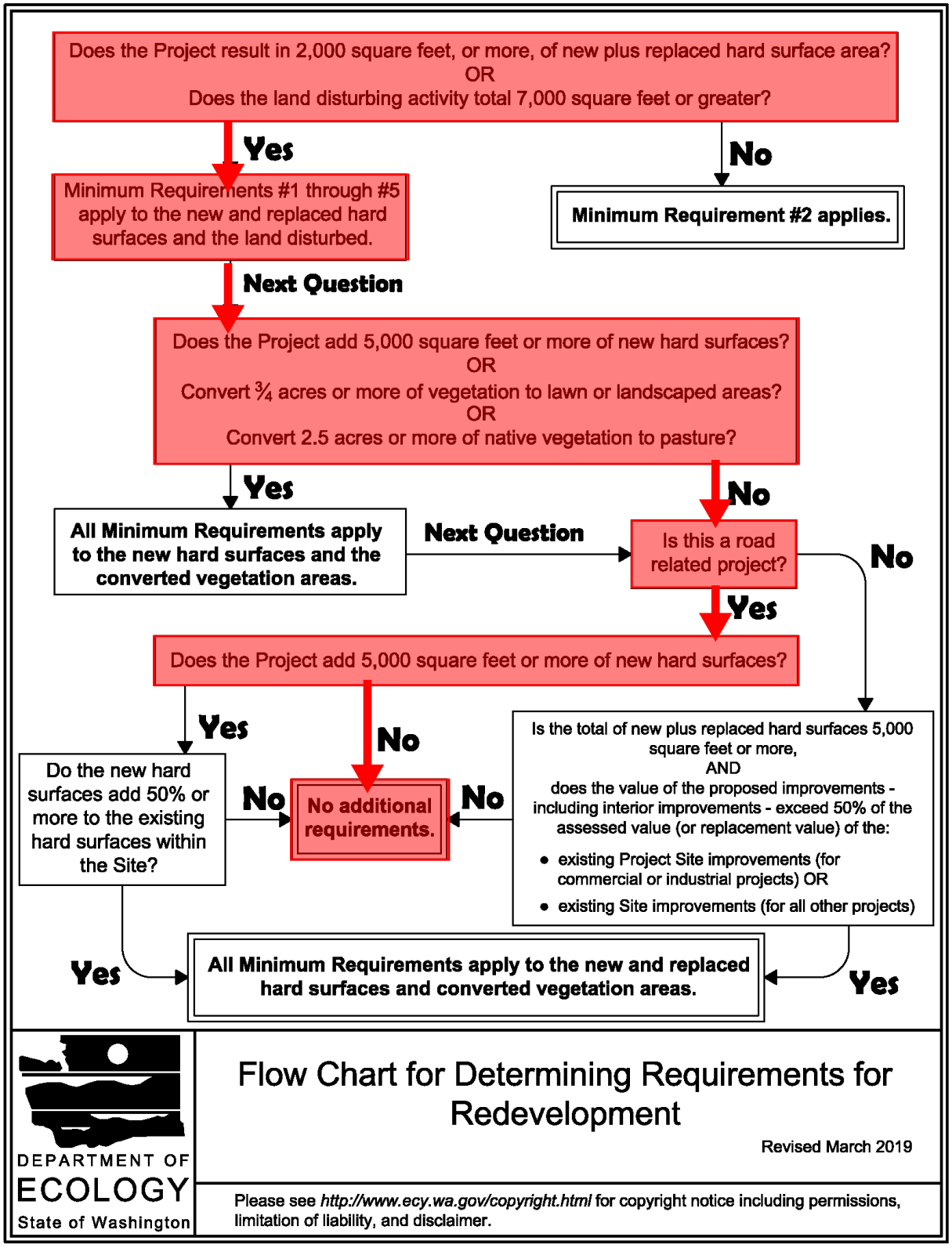
TDA 2


Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
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Yes
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Minimum Requirement #2 applies.
Next Question
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OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
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AND
does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:
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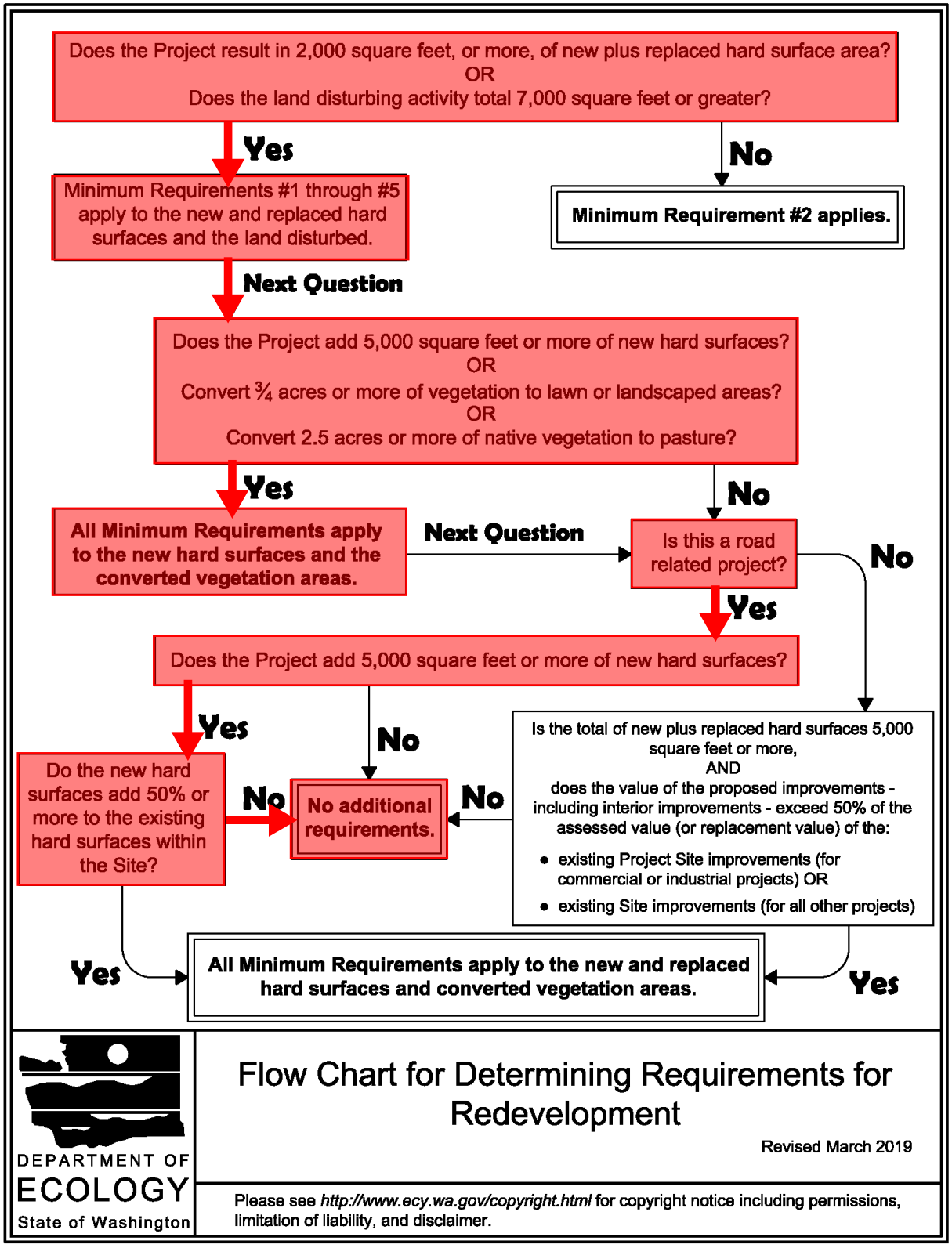
TDA 3


Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?
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Minimum Requirement #2 applies.
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existing Project Site improvements (for commercial or industrial projects) OR
existing Site improvements (for all other projects)
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Flow Chart for Determining Requirements for Redevelopment
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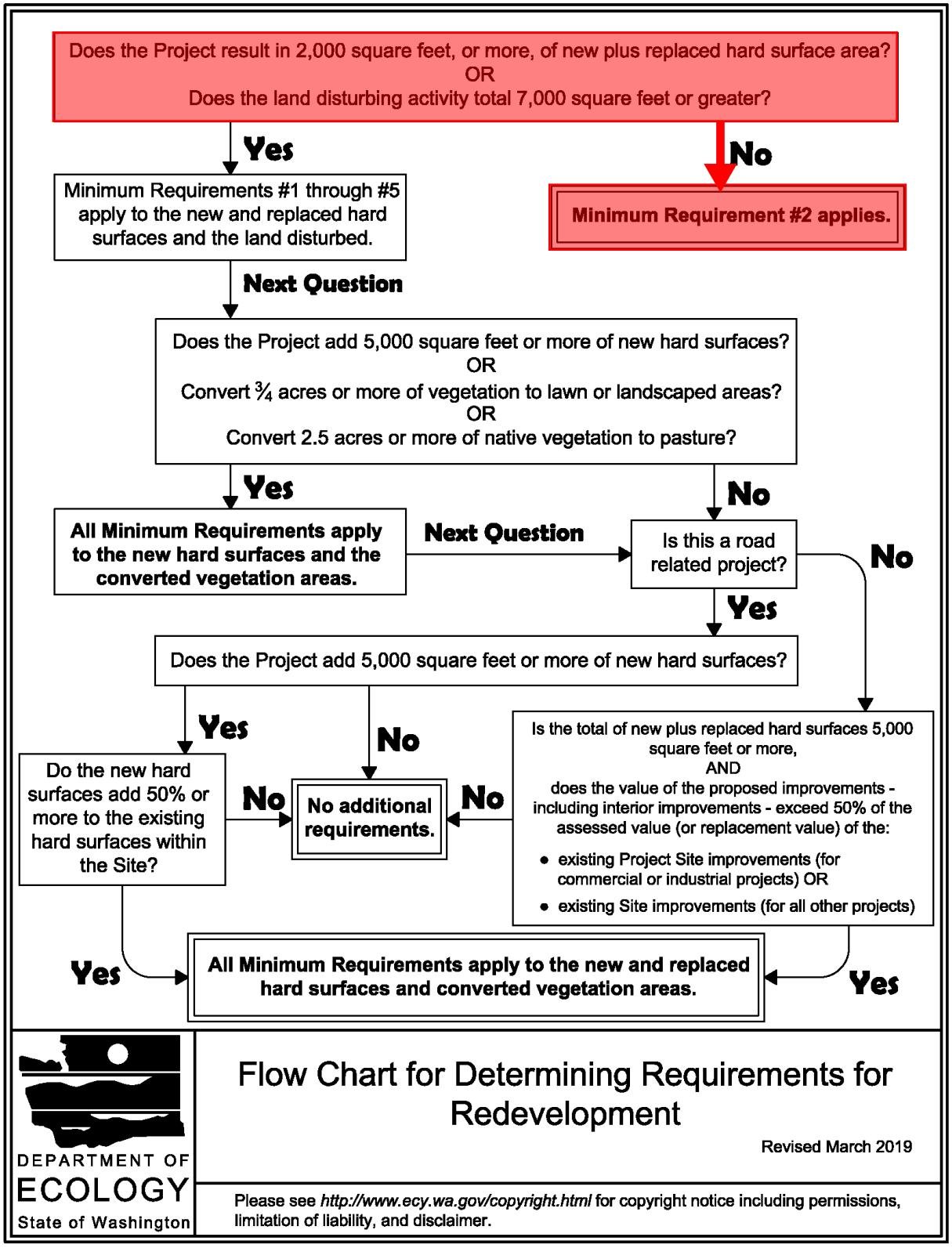
TDA 4


Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?
Yes
No
Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.
Minimum Requirement #2 applies.
Next Question
Does the Project add 5,000 square feet or more of new hard surfaces?
OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
OR
Convert 2.5 acres or more of native vegetation to pasture?
Yes
No
All Minimum Requirements apply to the new hard surfaces and the converted vegetation areas.
Next Question
Is this a road related project?
No
Yes
Does the Project add 5,000 square feet or more of new hard surfaces?
Yes
No
Do the new hard surfaces add 50% or more to the existing hard surfaces within the Site?
No
No additional requirements.
No
Is the total of new plus replaced hard surfaces 5,000 square feet or more,
AND
does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:
existing Project Site improvements (for commercial or industrial projects) OR
existing Site improvements (for all other projects)
Yes
All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.
Yes
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State of Washington
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Revised March 2019
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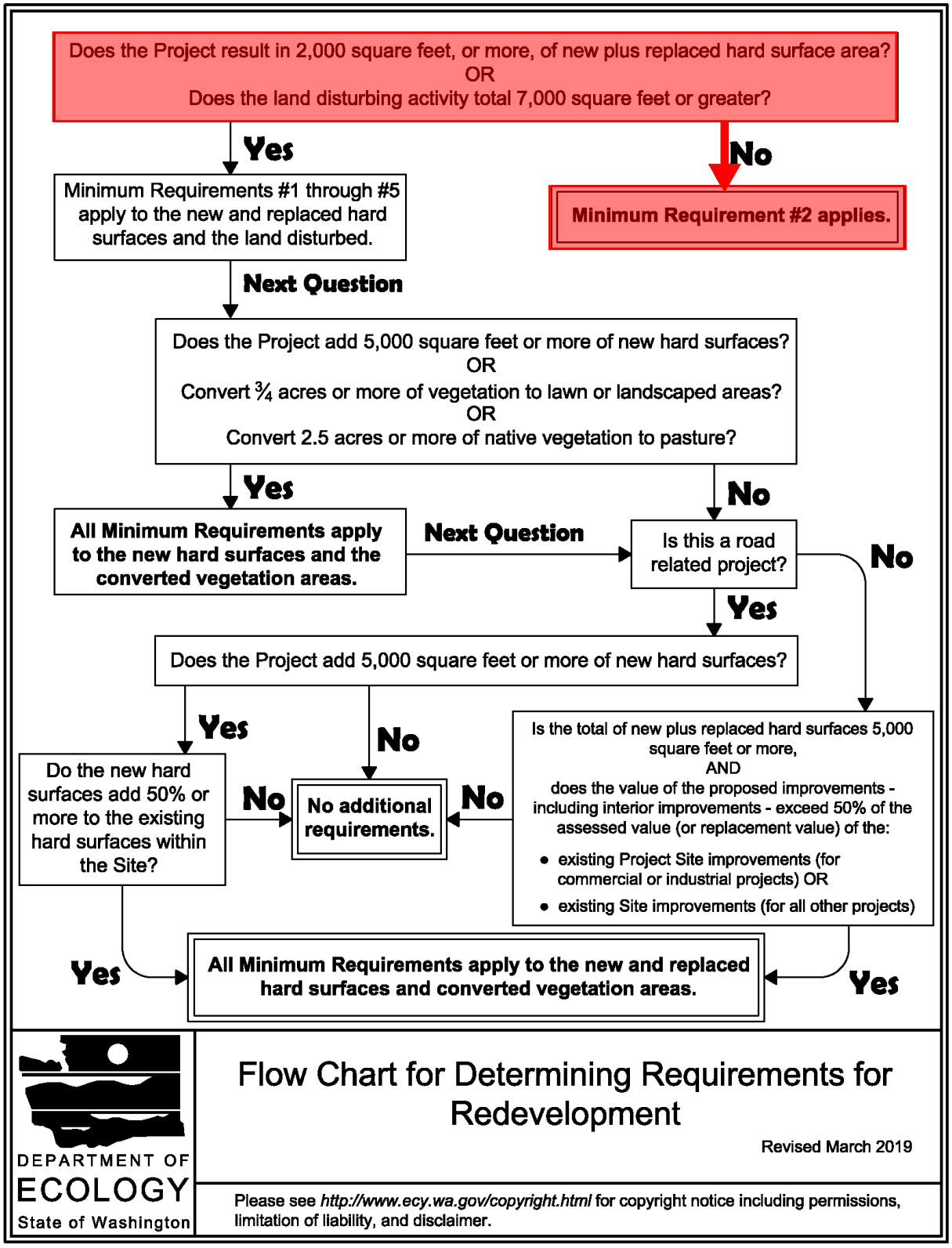
TDA 5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State of Washington
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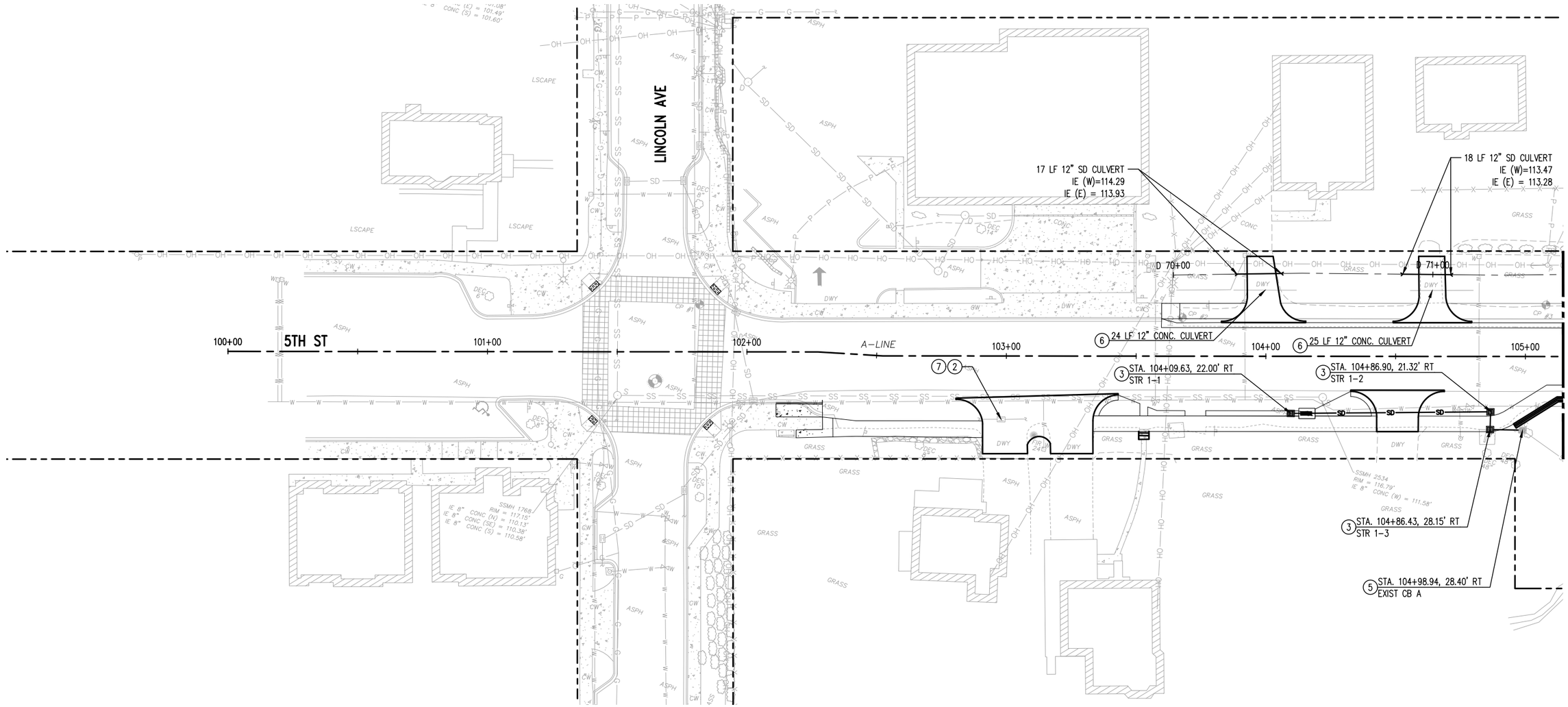
April 2022

APPENDIX D STORMWATER SITE PLANS

S4 T28N R4E W.M.



LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
- CB TYPE 1
- UNDERDRAIN CLEANOUT, SEE DD03

NOTES

1. STATION & OFFSETS ARE TO CENTER OF DRAINAGE STRUCTURE. SEE DD1 FOR TYPE 2 CATCH BASIN.
2. STORM AND CULVERT PIPE MATERIAL SHALL BE POLYVINYL CHLORIDE PIPE (PVC), LINED CORRUGATED POLYETHYLENE (LCPE), SMOOTH WALL POLYETHELYNE (SWPE), HIGH DENSITY POLYETHYLENE (HDPE), OR DUCTILE IRON FOR AREAS WHERE EXISTING IMPROVEMENTS PROHIBIT REQUIRED COVER ON OTHER PIPE MATERIALS. ALL PIPES SHALL BE CONSISTENT WITH WSDOT STANDARD SPECIFICATION 7-04 UNLESS OTHERWISE NOTED. PIPE BEDDING PER WSDOT STANDARD SPECIFICATION 9-03.
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3. CATCH BASIN TYPE 1 PER WSDOT STD PLAN B-5.20-03
4. CATCH BASIN TYPE 2 PER WSDOT STD PLAN B-10.20-02
5. CONNECTION TO DRAINAGE STRUCTURE
6. ABANDON IN PLACE
7. RECTANGULAR SOLID METAL COVER PER WSDOT B-30.20-04
8. MODULAR WETLAND SYSTEM. SEE DD02 SHEETS FOR DETAILS
9. REMOVE STORM DRAIN PIPE. SEE SITE PREPARATION PLANS.

N

0 10 20 40
1 inch = 20 feet

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DRAINAGE PLAN

DR01

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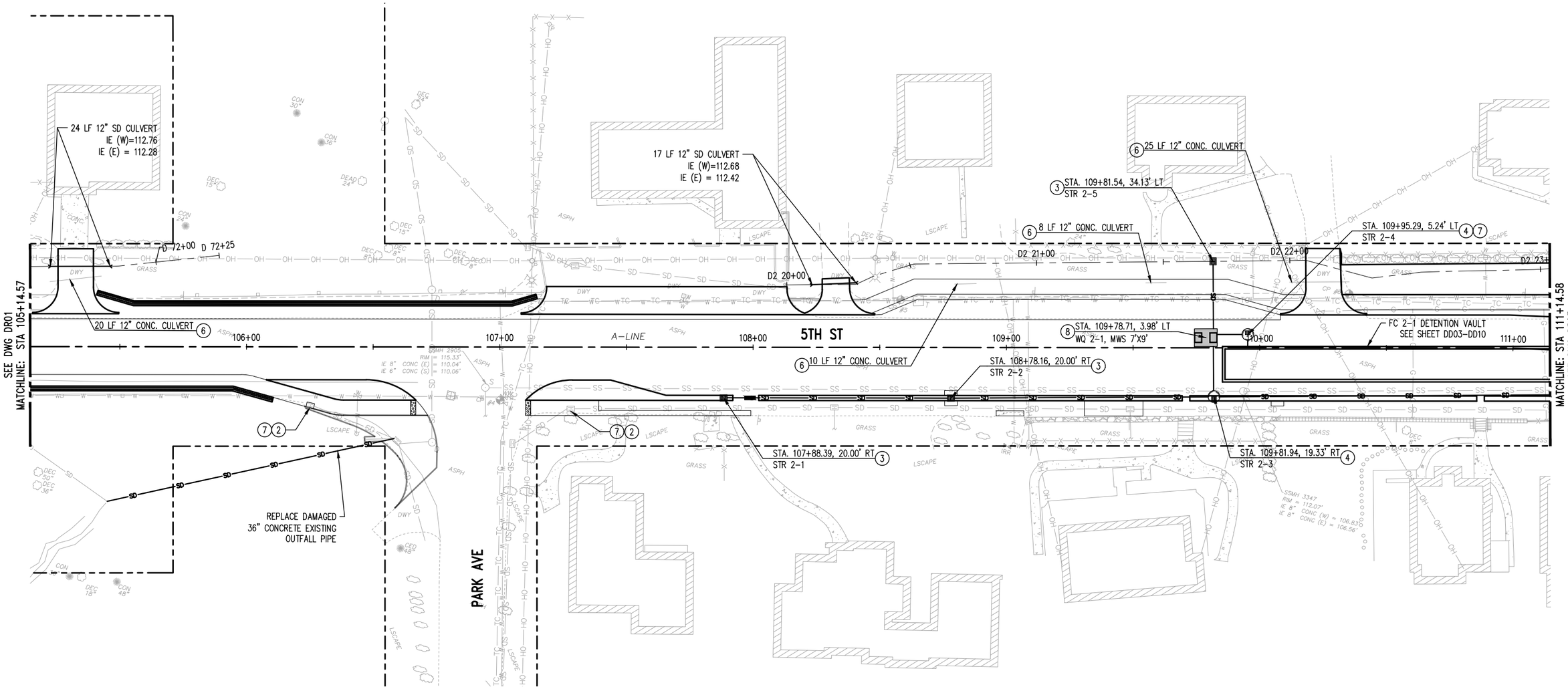

LEGEND

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N

0 10 20 40
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DRAINAGE PLAN

DR02

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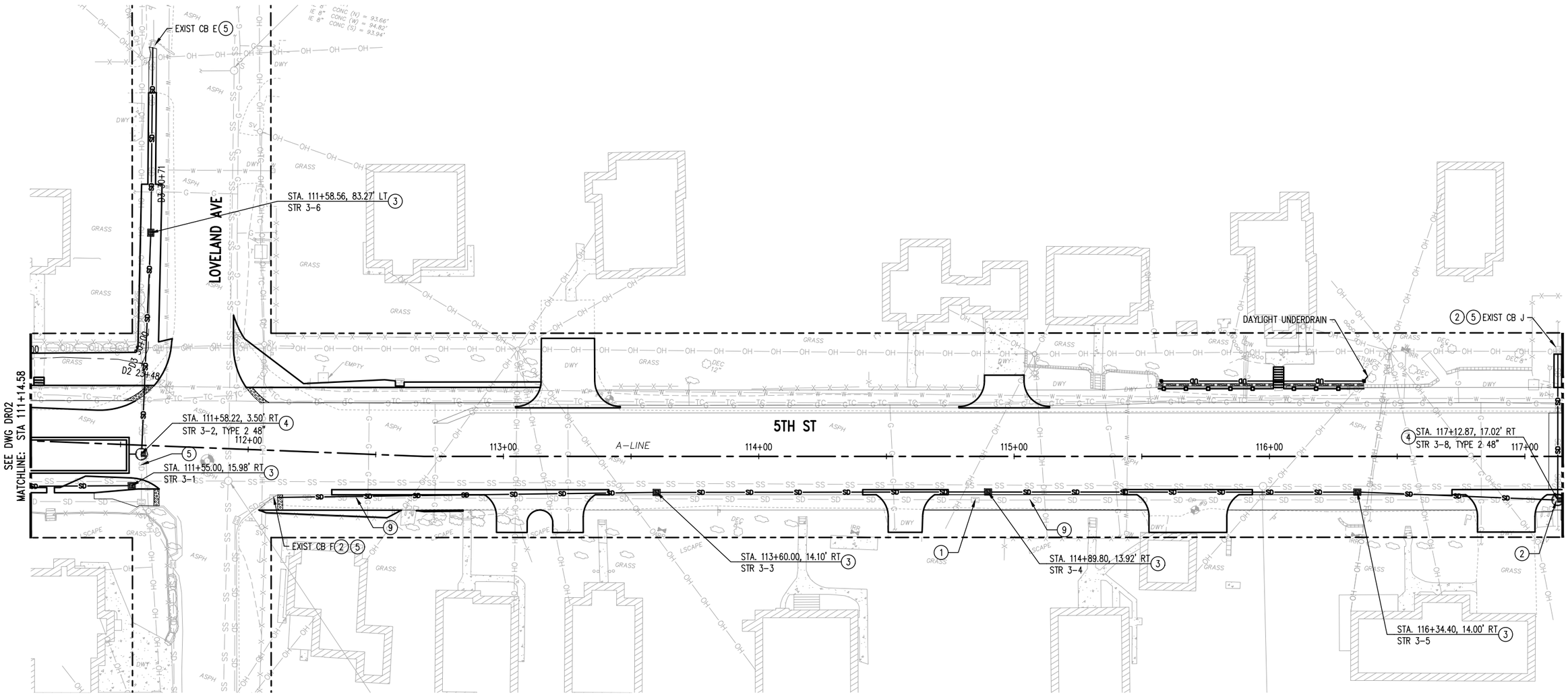

LEGEND

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N

0 10 20 40
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DR03

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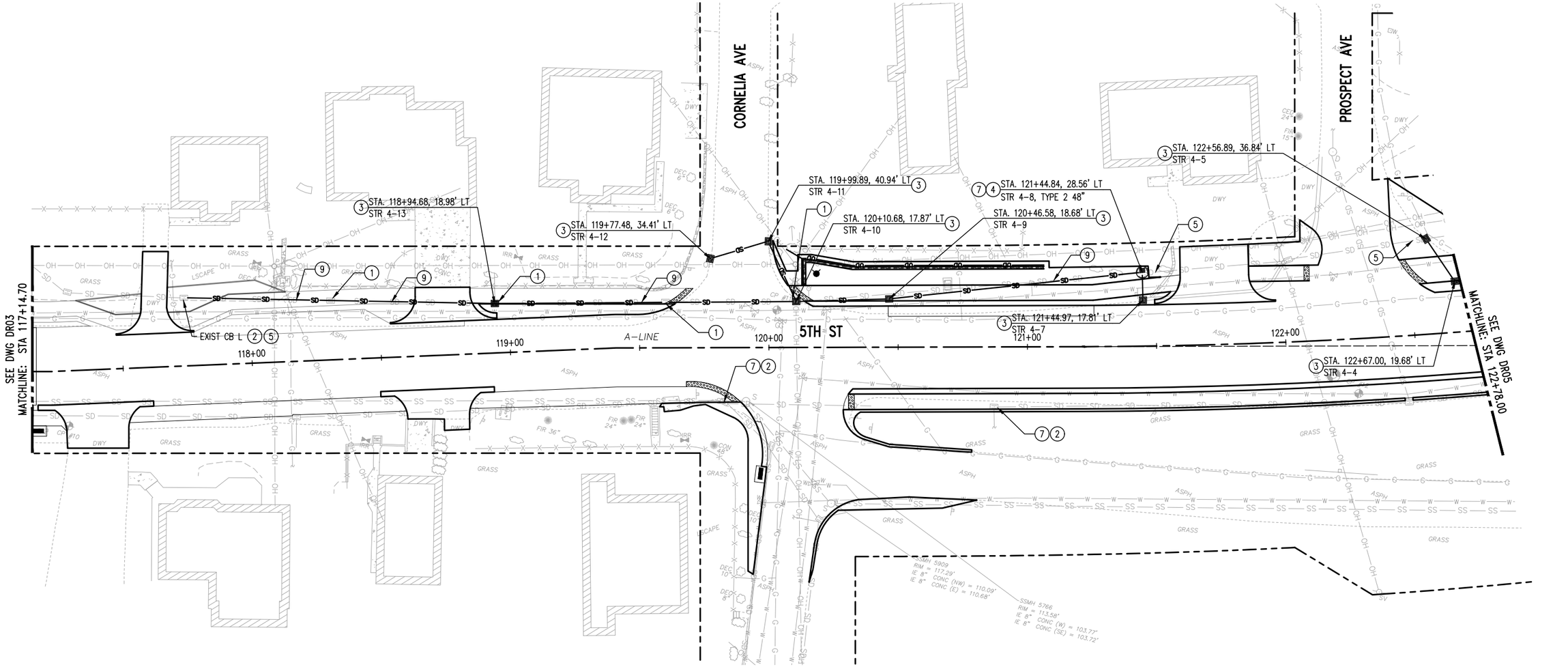

LEGEND

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- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
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- UNDERDRAIN CLEANOUT, SEE DD03

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N

0 10 20 40
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DRAINAGE PLAN

DR04

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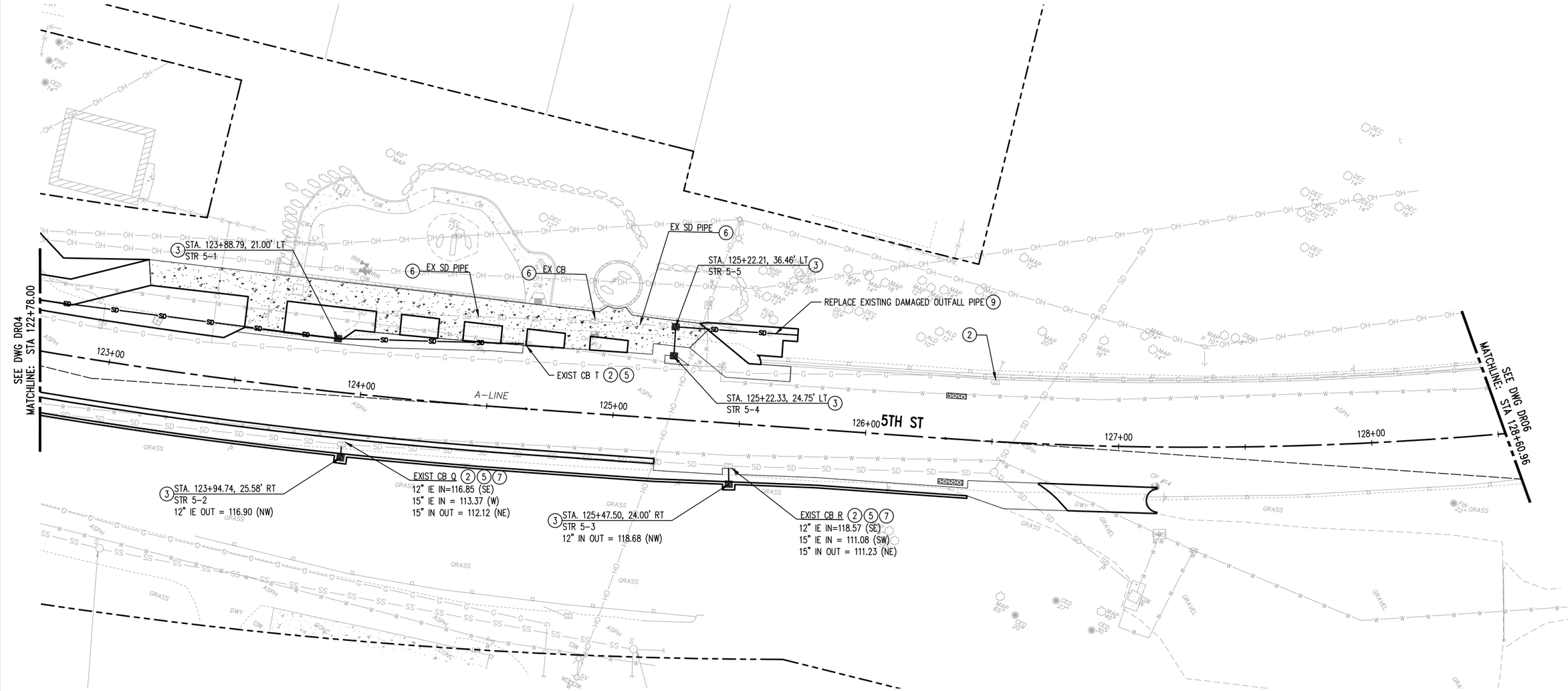

LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
- CB TYPE 1
- UNDERDRAIN CLEANOUT, SEE DD03

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8. MODULAR WETLAND SYSTEM. SEE DD02 SHEETS FOR DETAILS
9. REMOVE STORM DRAIN PIPE. SEE SITE PREPARATION PLANS.

N

0 10 20 40
1 inch = 20 feet

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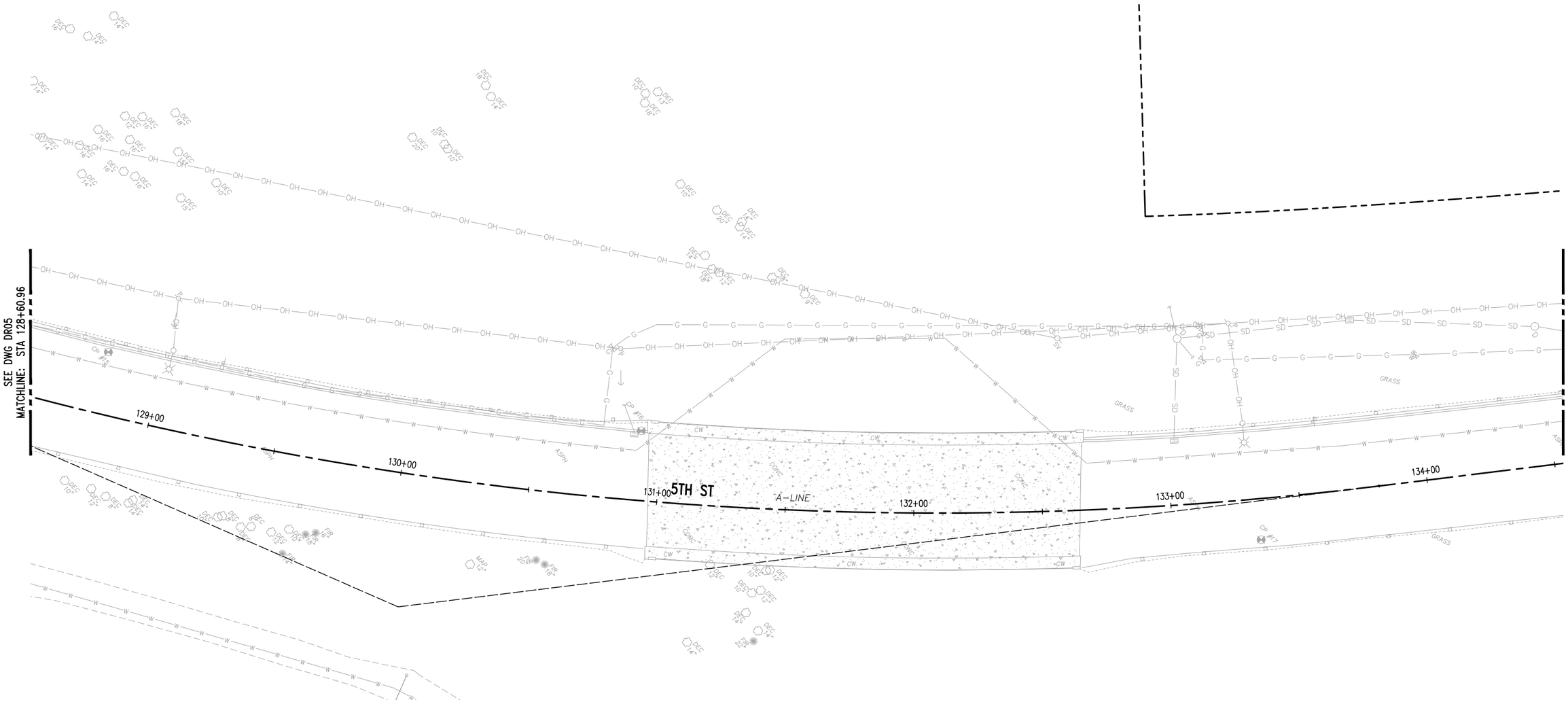

LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
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- UNDERDRAIN CLEANOUT, SEE DD03

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N

0 10 20 40
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DR06

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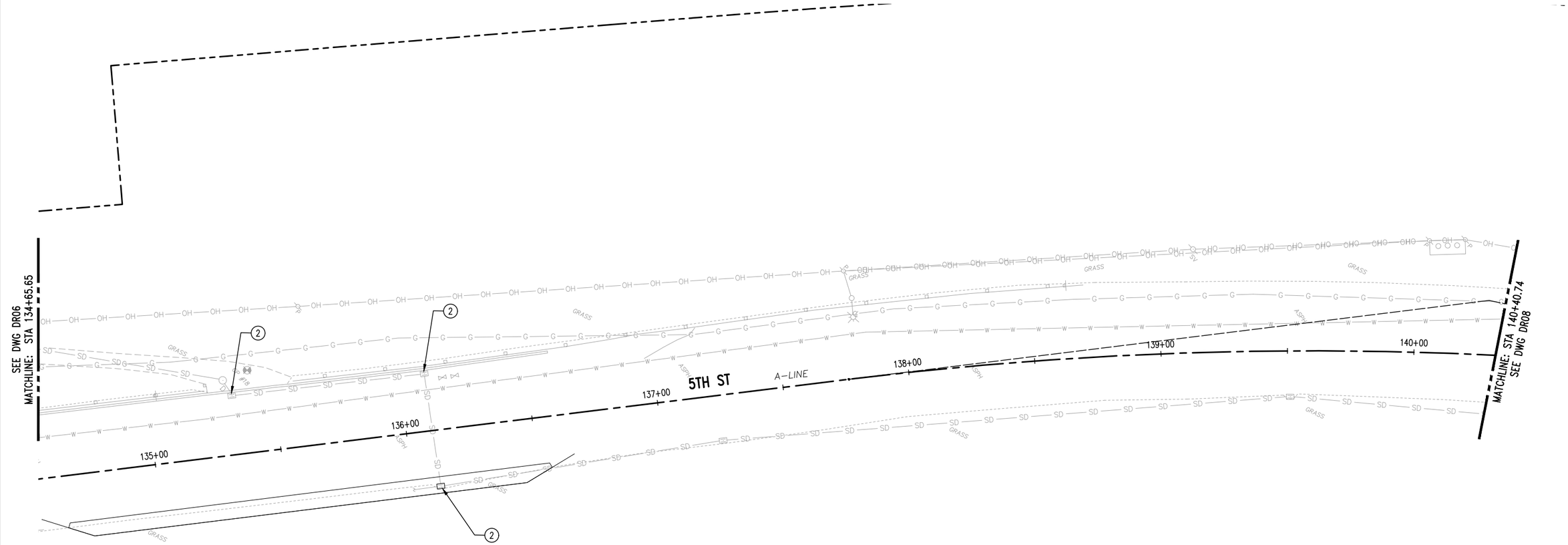

LEGEND

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- UD — 6" UNDERDRAIN PIPE
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N

0 10 20 40
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DRAINAGE PLAN

DR07

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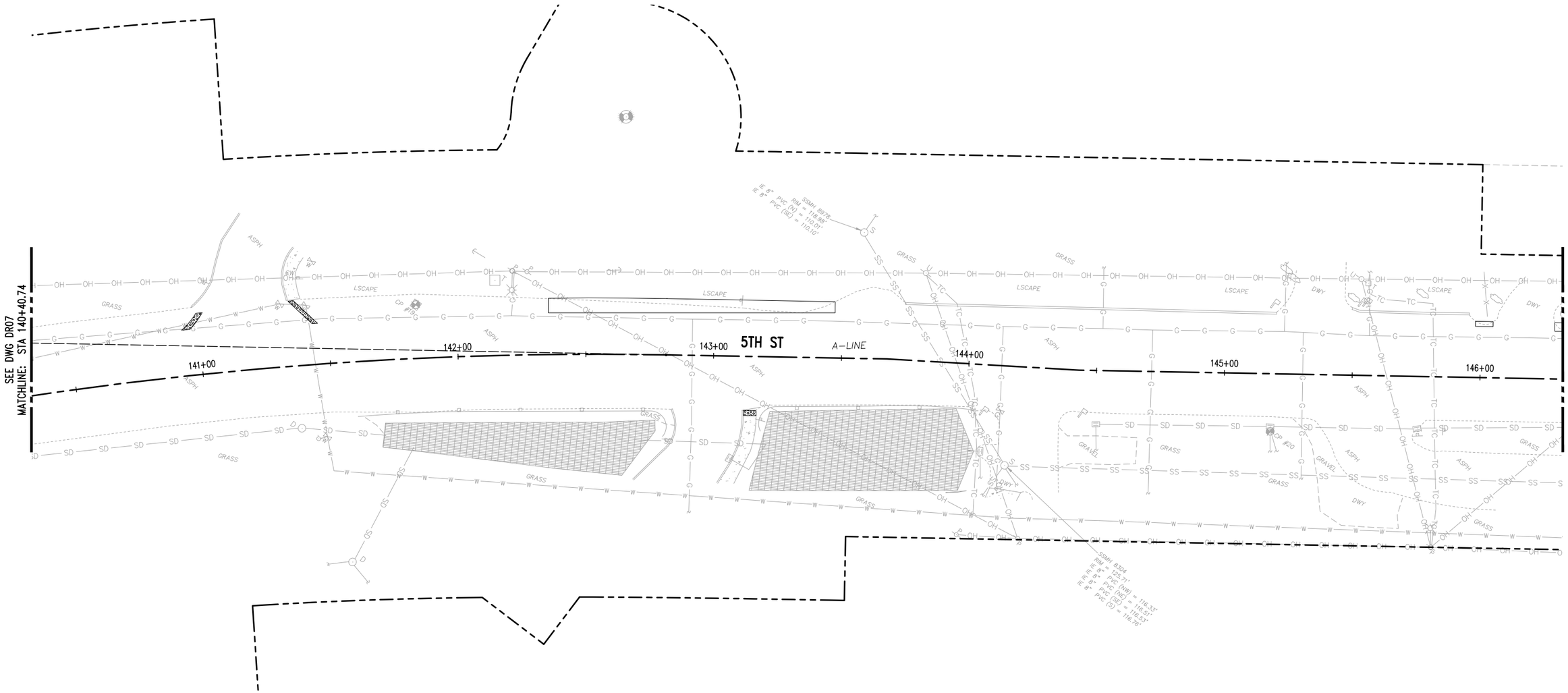

LEGEND

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J O B No. : 2000722

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S C A L E: 1" = 20'

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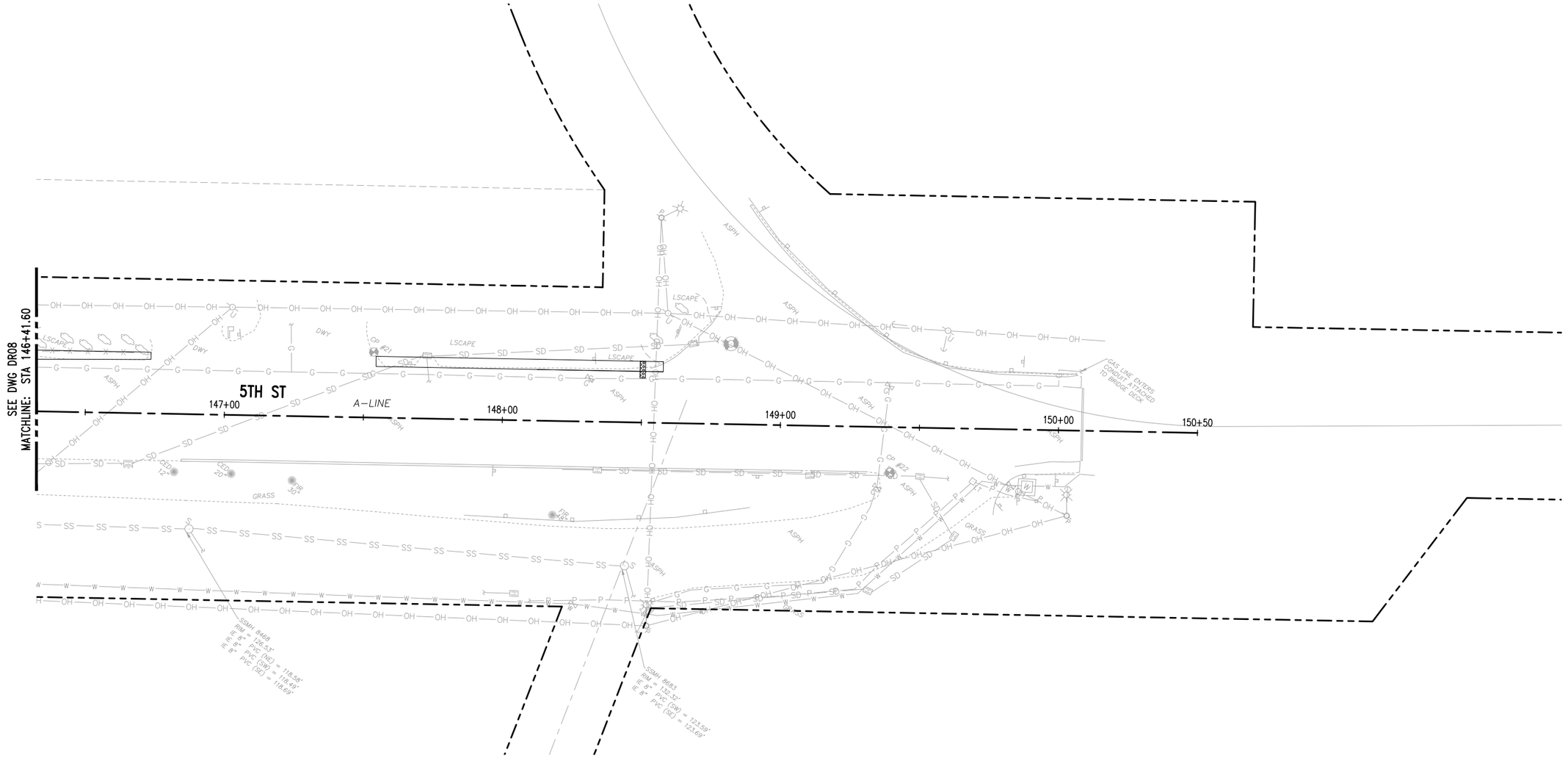
SHT. 45 OF 124

DRAINAGE PLAN

DR08

C:\Temp\AcPublish_24320\W5TH - DR.dwg
christineh
Oct 27, 2022 - 1:43pm

S34 T29N R4E W.M.



LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
- CB TYPE 1
- UNDERDRAIN CLEANOUT, SEE DD03

NOTES

1. STATION & OFFSETS ARE TO CENTER OF DRAINAGE STRUCTURE. SEE DD1 FOR TYPE 2 CATCH BASIN.
2. STORM AND CULVERT PIPE MATERIAL SHALL BE POLYVINYL CHLORIDE PIPE (PVC), LINED CORRUGATED POLYETHYLENE (LCPE), SMOOTH WALL POLYETHELYNE (SWPE), HIGH DENSITY POLYETHYLENE (HDPE), OR DUCTILE IRON FOR AREAS WHERE EXISTING IMPROVEMENTS PROHIBIT REQUIRED COVER ON OTHER PIPE MATERIALS. ALL PIPES SHALL BE CONSISTENT WITH WSDOT STANDARD SPECIFICATION 7-04 UNLESS OTHERWISE NOTED. PIPE BEDDING PER WSDOT STANDARD SPECIFICATION 9-03.
3. EXISTING OUTFALL PIPE LOCATION NOT INCLUDED IN SURVEY. OUTFALL LOCATION SHOWN IS A PLACEHOLDER THAT WILL BE UPDATED ONCE EXISTING PIPE LOCATION IS DETERMINED.

CONSTRUCTION NOTES

1. REMOVE DRAINAGE STRUCTURE
2. ADJUST CATCH BASIN
3. CATCH BASIN TYPE 1 PER WSDOT STD PLAN B-5.20-03
4. CATCH BASIN TYPE 2 PER WSDOT STD PLAN B-10.20-02
5. CONNECTION TO DRAINAGE STRUCTURE
6. ABANDON IN PLACE
7. RECTANGULAR SOLID METAL COVER PER WSDOT B-30.20-04
8. MODULAR WETLAND SYSTEM. SEE DD02 SHEETS FOR DETAILS
9. REMOVE STORM DRAIN PIPE. SEE SITE PREPARATION PLANS.

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
J O B No. :2000722

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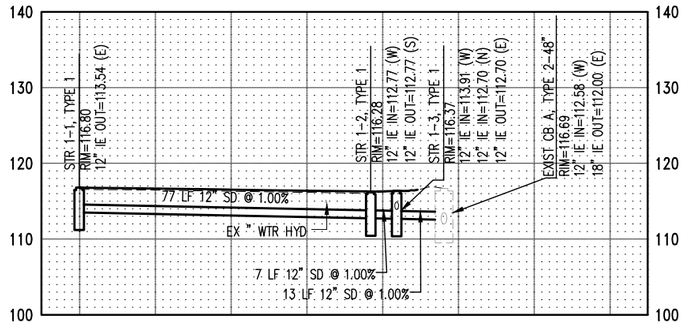
DRAINAGE PLAN

SHT. 46 OF 124

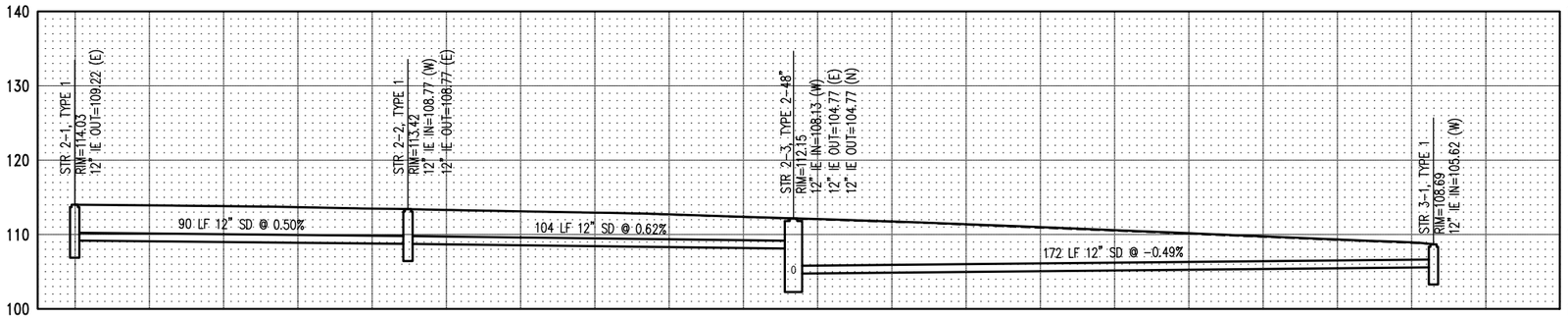
DR09

C:\Temp\AcPublish_24320\W5TH - DR.dwg
christineh
Oct 27, 2022 - 1:43pm



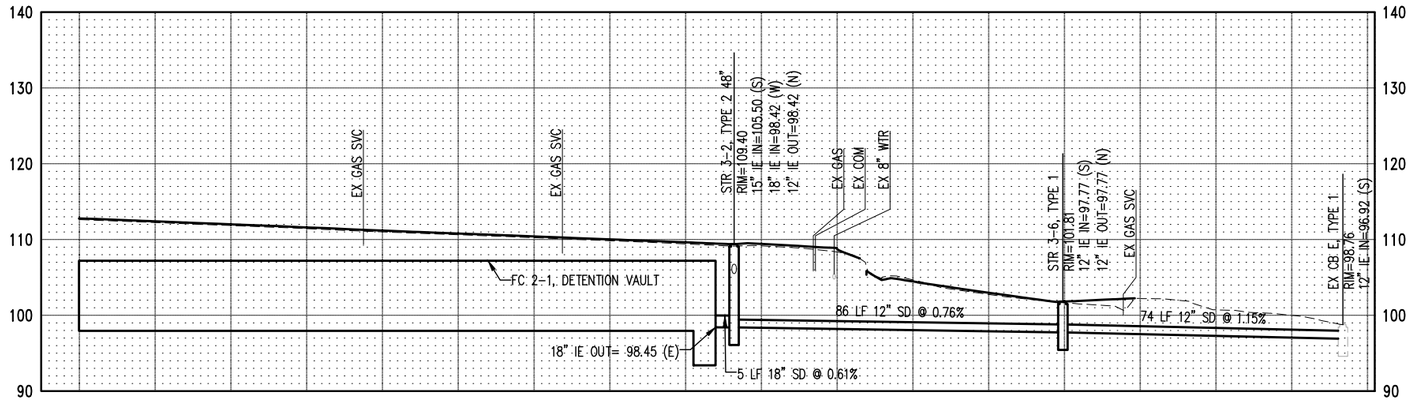
STR 1-1 TO EX CB A

STA 104+86 TO STA 105+22, SEE SHEET DR01



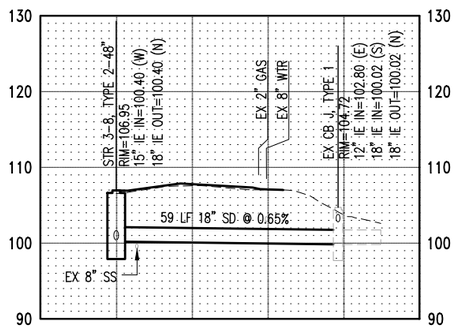
STR 2-1 TO STR 3-1

STA 108+75 TO STA 111+54, SEE SHEET DR02-DR03



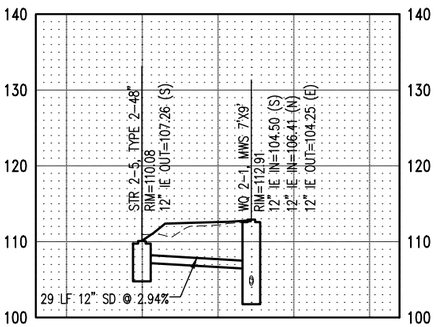
FC 2-1 TO EX CB E

STA 110+20 TO STA 1110+60, SEE SHEET DR02-DR03



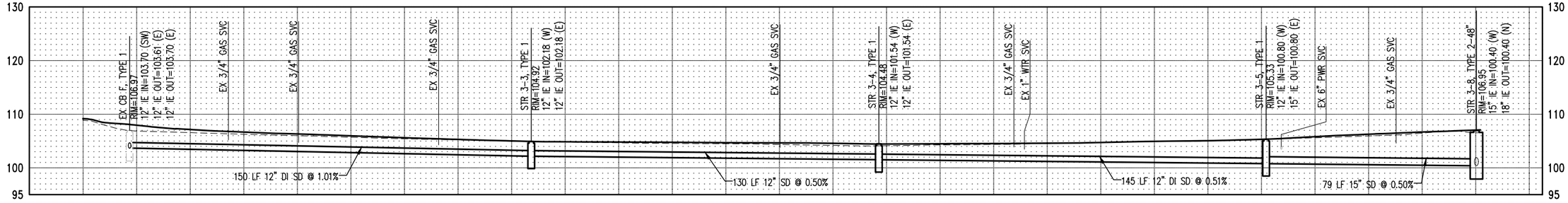
STR 3-8 TO EX CB J

STA 117+10 TO STA 117+13, SEE SHEET DR03



STR 2-5 TO WQ 2-1

STA 109+84 TO STA 109+84, SEE SHEET DR02



EX CB F TO STR 3-8

STA 112+00 TO STA 117+13, SEE SHEET DR03

NOTES:
1. EXISTING UTILITIES ARE SHOWN AT APPROXIMATE LOCATIONS USING BEST AVAILABLE INFORMATION. CONTRACTOR TO CONFIRM ACTUAL UTILITY LOCATIONS.

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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CHECKED BY: JMM | APPROVED BY: JGM
DATE: 08/2022
JOB No. :2000722
SCALE: 1" = 20'

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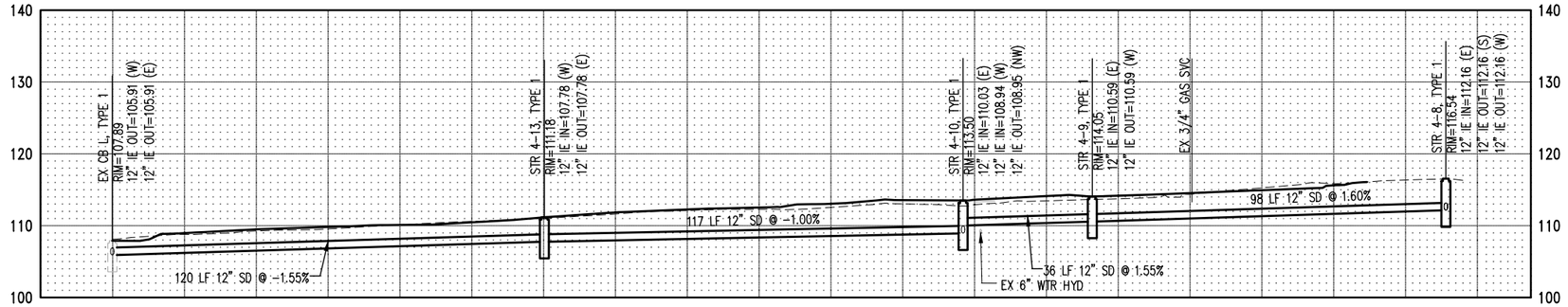
SHT. 47 OF 124

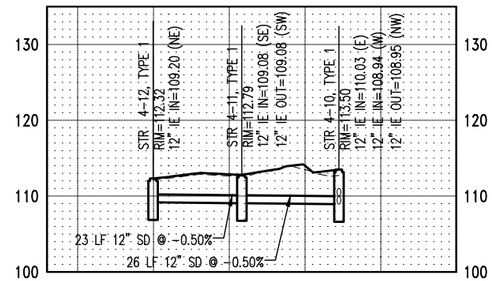
DRAINAGE PROFILES

DP01



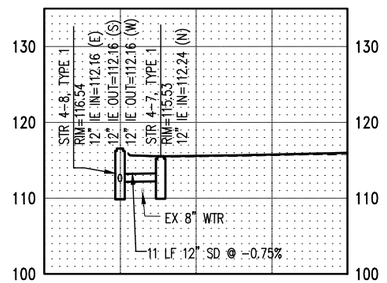
EX CB L TO STR 4-8

STA 117+90 TO STA 121+45, SEE SHEET DR04



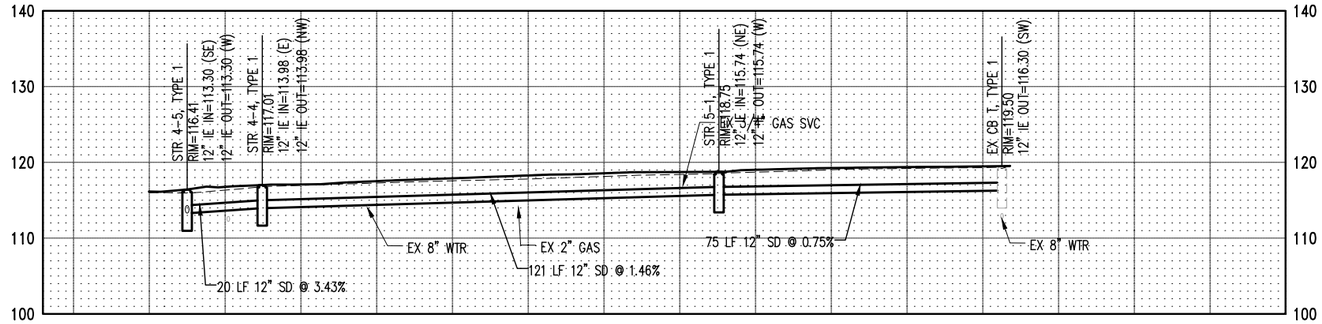
STR 4-12 TO STR 4-10

STA 119+78 TO STA 120+11, SEE SHEET DR04



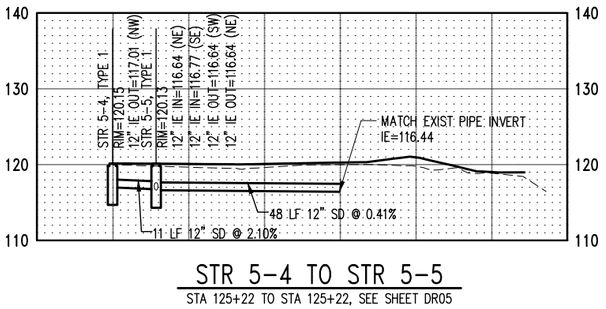
STR 4-8 TO STR 4-7

STA 121+45 TO STA 121+45, SEE SHEET DR04



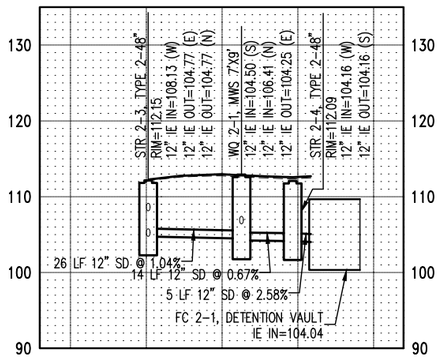
STR 4-5 TO EX CB T

STA 122+30 TO STA 124+60, SEE SHEET DR04–DR05



STR 5-4 TO STR 5-5

STA 125+22 TO STA 125+22, SEE SHEET DR05



STR 2-3 TO FC 2-1

STA 110+07 TO STA 110+21, SEE SHEET DR02

NOTES:
1. EXISTING UTILITIES ARE SHOWN AT APPROXIMATE LOCATIONS USING BEST AVAILABLE INFORMATION. CONTRACTOR TO CONFIRM ACTUAL UTILITY LOCATIONS.

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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CHECKED BY: JMM | APPROVED BY: JGM
DATE: 08/2022
JOB No.: 2000722
SCALE: 1" = 20'

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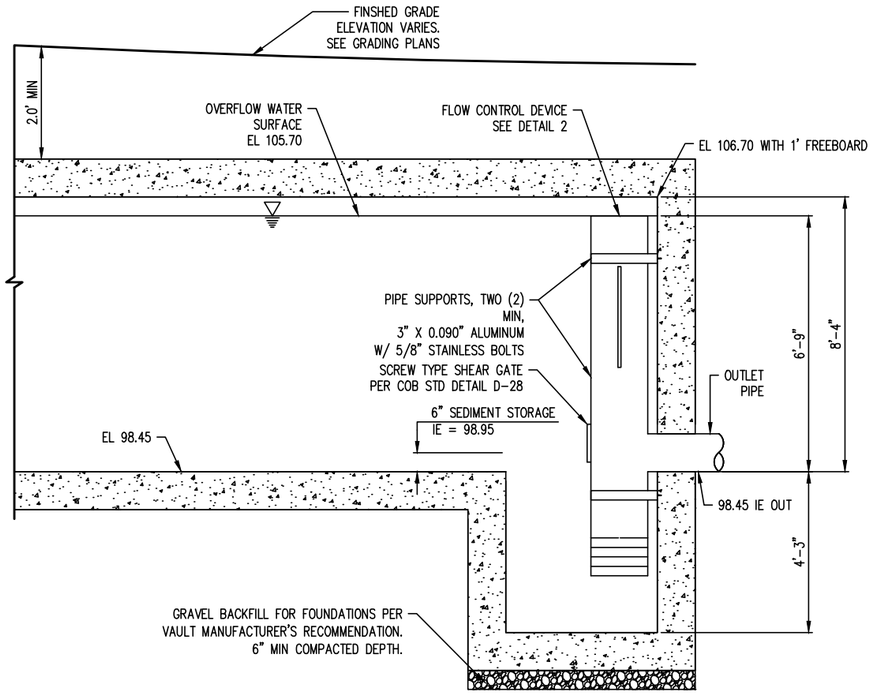
SHT. 48 OF 124

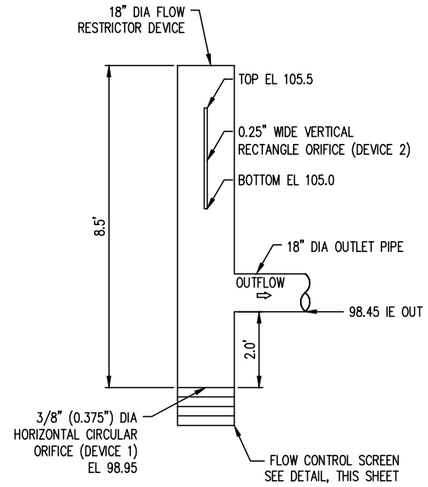
DRAINAGE PROFILES

DP02

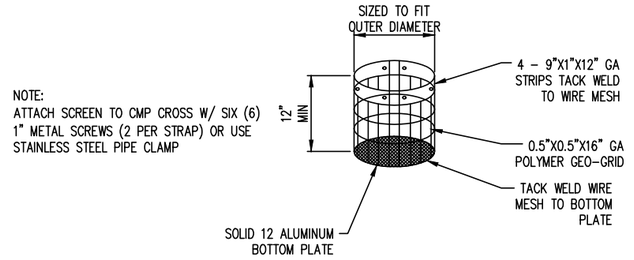


DETENTION VAULT – OUTLET DETAIL
NTS

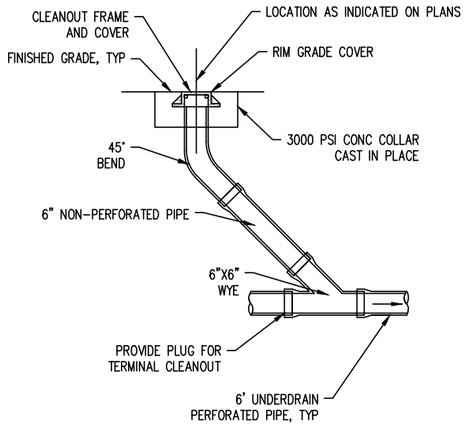
DETENTION VAULT		
DESCRIPTION	VALUES	WATER SURFACE ELEVATION IN VAULT
BASIN AREA COLLECTED	0.717 AC	–
FLOW CONTROL LIVE STORAGE DEPTH	6.75 FT	105.70
FLOW CONTROL LIVE STORAGE VOLUME	15,438 CF	–
AREA AT MAX ELEVATION	1.992 SF	–
2 YEAR DISCHARGE RATE	0.007 CFS	–
50 YEAR DISCHARGE RATE	0.292 CFS	–
100 YEAR DISCHARGE RATE	0.336 CFS	–



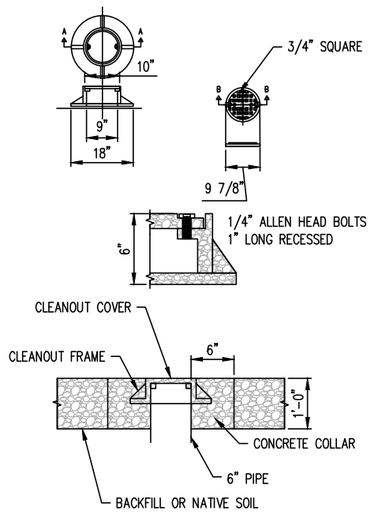
DETENTION VAULT – OUTLET DETAIL
NTS



FLOW CONTROL SCREEN
NTS



UNDERDRAIN CLEANOUT DETAIL
NTS



CLEANOUT TO GRADE
NTS

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
J O B No. :2000722
S C A L E: 1" = 20'

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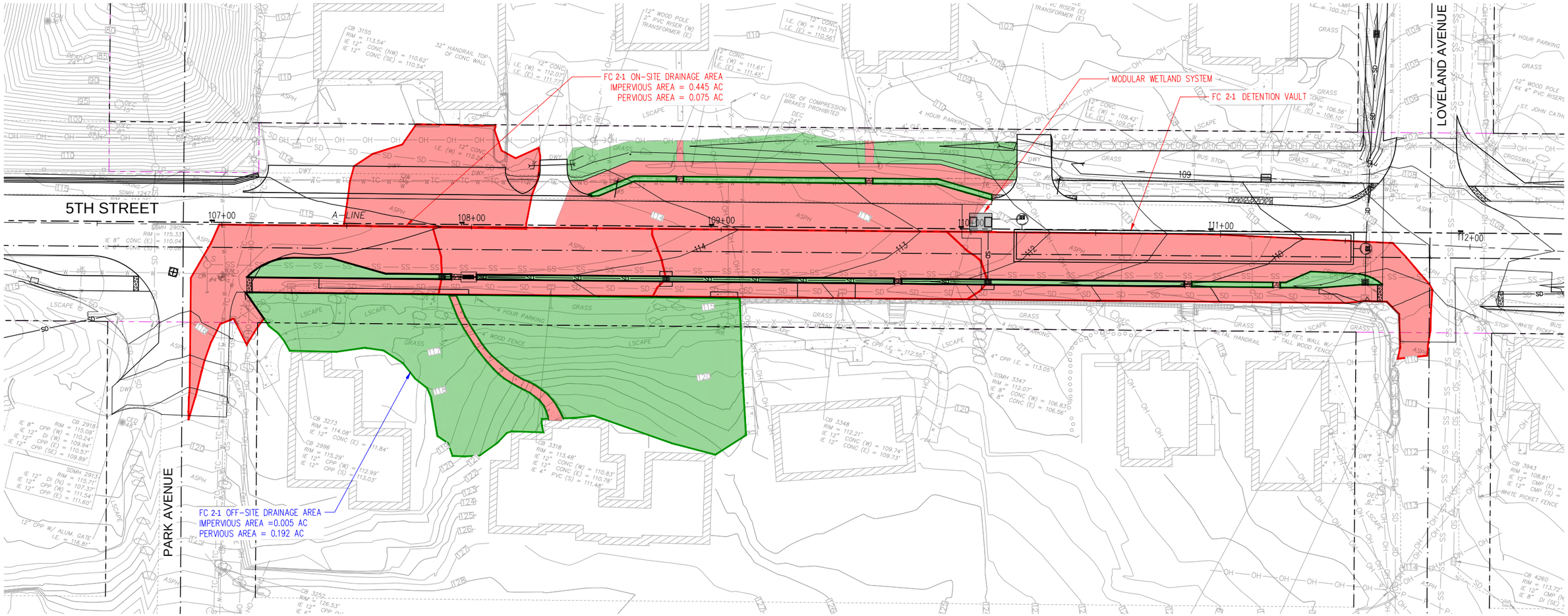
SHT. 52 OF 124

DRAINAGE DETAILS

DD01

April 2022

APPENDIX E MGS FLOOD (FLOW CONTROL)



FC 2-1 DRAINAGE AREAS	
SUBBASIN DESCRIPTION	AREA (ACRE)
ON-SITE IMPERVIOUS AREA	0.445
ON-SITE PERVIOUS AREA	0.075
OFF-SITE IMPERVIOUS AREA	0.005
OFF-SITE PERVIOUS AREA	0.192

LEGEND

IMPERVIOUS AREA

PERVIOUS AREA

N

0 10' 20' 40'

1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
JOB No. :2000722

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SHT. OF 124

DETENTION VAULT DRAINAGE AREA

Oct 26, 2022 - 2:17pm chrisfineh Z:\2000001-2009999\2000722 Mukilteo 5th St Bicycle & Pedestrian\Engineer\CAD\FC-01_Area.dwg

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.58
Program License Number: 200410007
Project Simulation Performed on: 10/27/2022 10:20 AM
Report Generation Date: 10/27/2022 10:20 AM

Input File Name: mukilteo 5th TDA 3 vault.fld
Project Name: Mukilteo 5th
Analysis Title: TDA 3 Vault
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 15
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)	0.717	0.717
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	0.717	0.717

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------
-------Area (Acres) --------
C, Forest, Flat 0.717

Subbasin Total 0.717

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Subbasin 1 ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.267
ROADS/FLAT	0.450
Subbasin Total	0.717

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

----------SCENARIO: PREDEVELOPED
Number of Links: 0

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

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: New Structure Lnk1
Link Type: Structure
Downstream Link: None

Prismatic Pond Option Used
Pond Floor Elevation (ft) : 98.95
Riser Crest Elevation (ft) : 105.70
Max Pond Elevation (ft) : 106.70
Storage Depth (ft) : 6.75
Pond Bottom Length (ft) : 166.0
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) : 1992.
Area at Riser Crest El (sq-ft) : 1,992.
(acres) : 0.046
Volume at Riser Crest (cu-ft) : 13,446.
(ac-ft) : 0.309
Area at Max Elevation (sq-ft) : 1992.
(acres) : 0.046
Vol at Max Elevation (cu-ft) : 15,438.
(ac-ft) : 0.354

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 : 105.70 ft

Hydraulic Structure Geometry

Number of Devices: 2

---Device Number 1 ---
Device Type : Circular Orifice
Control Elevation (ft) : 98.95
Diameter (in) : 0.38
Orientation : Horizontal
Elbow : No

--- Device Number 2 ---
Device Type : Vertical Rectangular Orifice
Control Elevation (ft) : 105.00
Length (in) : 0.25
Height (in) : 6.00
Orientation : Vertical
Elbow : No

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

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** Subbasin: Subbasin 1 **********

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

Tr (yrs)	Flood Peak (cfs)
2-Year	0.196
5-Year	0.253
10-Year	0.303
25-Year	0.423
50-Year	0.496
100-Year	0.627
200-Year	0.643
500-Year	0.662

********** Link: New Structure Lnk1 ********** Link Inflow Frequency Stats

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

Tr (yrs)	Flood Peak (cfs)
2-Year	0.196
5-Year	0.253
10-Year	0.303
25-Year	0.423
50-Year	0.496
100-Year	0.627
200-Year	0.643
500-Year	0.662

********** Link: New Structure Lnk1 ********** Link WSEL Stats

WSEL Frequency Data(ft)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	100.837
1.11-Year	101.069
1.25-Year	101.365
2.00-Year	102.298
3.33-Year	102.921
5-Year	103.630
10-Year	104.846
25-Year	105.363
50-Year	105.499
100-Year	105.571

************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: Subbasin 1	123.675
Total:	123.675

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Subbasin 1	32.651
Link: New Structure Lnk1	0.000
Total:	32.651

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.783 ac-ft/year, Post Developed: 0.207 ac-ft/year

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

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

Number of Links: 0

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

Number of Links: 1

********** Link: New Structure Lnk1 **********

Basic Wet Pond Volume (91% Exceedance): 2273. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 3410. cu-ft

2-Year Discharge Rate : 0.007 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.07 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.04 cfs

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 255.01
Inflow Volume Including PPT-Evap (ac-ft): 255.01
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): 254.96
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 Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Link: New Structure Lnk1

***** 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	1.522E-02	2-Year	6.866E-03
5-Year	2.415E-02	5-Year	8.118E-03
10-Year	3.121E-02	10-Year	9.112E-03
25-Year	4.057E-02	25-Year	2.172E-02
50-Year	4.475E-02	50-Year	2.918E-02
100-Year	5.105E-02	100-Year	3.363E-02
200-Year	7.042E-02	200-Year	3.775E-02
500-Year	9.645E-02	500-Year	4.319E-02

** 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%):	-24.9%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	-24.9%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-52.6%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

April 2022

APPENDIX F MGS FLOOD (WATER QUALITY)

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.58
Program License Number: 200410007
Project Simulation Performed on: 10/31/2022 4:30 PM
Report Generation Date: 10/31/2022 4:32 PM

Input File Name: TDA 3 Final Concept.fld
Project Name: Mukilteo 5th St
Analysis Title: TDA 3 WQ
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected

Full Period of Record Available used for Routing

Climatic Region Number: 15
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)	0.717	0.717
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	0.717	0.717

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Existing ----------
-------Area (Acres) --------
C, Forest, Flat 0.717

Subbasin Total 0.717

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Proposed ----------

	-------Area (Acres) --------
C, Lawn, Flat	0.267
ROADS/FLAT	0.450
Subbasin Total	0.717

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

----------SCENARIO: PREDEVELOPED
Number of Links: 0

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

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: MWS Vault
Link Type: Copy
Downstream Link: None

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

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** **Subbasin: Proposed** **********

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

Tr (yrs)	Flood Peak (cfs)
2-Year	0.196
5-Year	0.253
10-Year	0.303
25-Year	0.423
50-Year	0.496
100-Year	0.627

200-Year	0.643
500-Year	0.662

********** Link: MWS Vault ********** Link Outflow 1
Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.196
5-Year	0.253
10-Year	0.303
25-Year	0.423
50-Year	0.496
100-Year	0.627
200-Year	0.643
500-Year	0.662

*************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: Existing	123.675
Total:	123.675

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: Proposed		32.651
Link:	MWS Vault	0.000
Total:		32.651

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 0.783 ac-ft/year, Post Developed: 0.207 ac-ft/year

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

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

Number of Links: 0

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

Number of Links: 1

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

Basic Wet Pond Volume (91% Exceedance): 2273. cu-ft
Computed Large Wet Pond Volume, 1.5*Basic Volume: 3410. cu-ft

2-Year Discharge Rate : 0.196 cfs

15-Minute Timestep, Water Quality Treatment Design Discharge
On-line Design Discharge Rate (91% Exceedance): 0.07 cfs
Off-line Design Discharge Rate (91% Exceedance): 0.04 cfs

WQ DESIGN FLOW RATE FOR MWS 2-1

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 255.01
Inflow Volume Including PPT-Evap (ac-ft): 255.01
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): 255.01
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 Subbasin: Existing

Scenario Postdeveloped Compliance Link: MWS 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	1.522E-02	2-Year	0.196
5-Year	2.415E-02	5-Year	0.253
10-Year	3.121E-02	10-Year	0.303
25-Year	4.057E-02	25-Year	0.423
50-Year	4.475E-02	50-Year	0.496
100-Year	5.105E-02	100-Year	0.627
200-Year	7.042E-02	200-Year	0.643
500-Year	9.645E-02	500-Year	0.662

** 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%):	554.6%	FAIL
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	2288.2%	FAIL
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	99999.0%	FAIL
Percent Excursion from Q2 to Q50 (Must be less than 50%):	100.0%	FAIL

FLOW DURATION DESIGN CRITERIA: FAIL

April 2022

APPENDIX G GEOTECHNICAL REPORT

GEOTECHNICAL REPORT
MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

HWA Project No. 2020-144-21

Prepared for
KPFF, Inc & City of MUKILTEO

November 4, 2022

HWA GeoSciences Inc.
DBE/MWBE

Geotechnical Engineering
Pavement Engineering
Geoenvironmental
Hydrogeology
Inspection & Testing

HWA GeoSciences Inc.
DBE/MWBE

November 4, 2022
HWA Project No. 2020-144-21

KPFF Inc.
1601 Fifth Avenue, Suite 1600
Seattle, Washington 98101

Attention: John McMillan, P.E., PMP

Subject: **GEOTECHNICAL REPORT**
Mukiltoe 5th Street
Bicycle and Pedestrian Improvements
Mukilteo, Washington

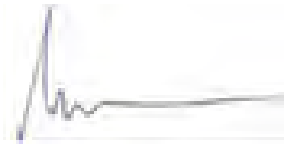
Mr. McMillan:

In accordance with your request, HWA GeoSciences Inc. (HWA) completed a geotechnical engineering investigation in support of the 5th Steet Bicycle and Pedestrian Improvements project in Mukilteo, Washington. This report presents the results of our field explorations and laboratory testing along with our recommendations pertaining to infiltration feasibility, earthwork, and luminaire & signal pole foundations. The attached report summarizes the results of our study and presents our conclusions and recommendations.

We appreciate the opportunity to provide geotechnical engineering services on this project. If you have any questions regarding this report or require additional information or services, please contact the undersigned at your convenience.

Sincerely,

HWA GEOSCIENCES INC.



Bryan Hawkins, P.E.
Senior Geotechnical Engineer

Ali Sirjani, P.E.
Geotechnical Engineer

Enclosure: Geotechnical Report

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Appendix B: Laboratory Investigation

GEOTECHNICAL REPORT
MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

1. INTRODUCTION

1.1 GENERAL

This report summarizes the results of a geotechnical engineering investigation performed by HWA GeoSciences Inc. (HWA) for the 5th Steet Bicycle and Pedestrian Improvements project in Mukilteo, Washington. The approximate location of the project site is shown on the Site and Vicinity Map, Figure 1, and on the Site and Exploration Plans, Figures 2A through 2K. Our field work investigation consisted of logging the drilling of six boreholes to evaluate subsurface soil and groundwater conditions. Laboratory tests were conducted on select soil samples obtained from the boreholes to determine relevant engineering properties of the subsurface soils. Engineering analyses were performed to develop the recommendations presented in this report.

1.2 PROJECT UNDERSTANDING

The project alignment is located along 5th Street and West Mukilteo Boulevard, from Lincoln Avenue to the Everett city limit, as shown on Figure 1, Site & Vicinity Map. Within the boundaries of the project, 5th Street and West Mukilteo Boulevard consists of an asphalt-paved, two lane (one travel lane in each direction) collector arterial running east-west. No curb, gutter or sidewalk currently exists on either side of the roadway. Asphalt or gravel shoulders exist on both sides of the alignment. We understand this project includes roadway widening to add bicycle lanes; new curb, gutter, and sidewalk; new planters and medians; stormwater drainage upgrades; and new luminaires.

2. FIELD INVESTIGATION AND LABORATORY TESTING

2.1 FIELD EXPLORATIONS

A geotechnical engineer from HWA logged the drilling of 6 machine-drilled geotechnical borings, designated BH-1 through BH-6, to assess subsurface conditions along the alignment. The locations of the explorations are shown on the Site and Exploration Plans, Figures 2A through 2K. The borings were drilled by Geologic Dill Partners of Bellevue, Washington on February 1, 2022, under subcontract to HWA, using a limited access Bobcat track-mounted drill rig equipped with hollow-stem augers. The boring depths varied from approximately 16 to 21.5 feet below ground surface (bgs).

In each boring, Standard Penetration Test (SPT) sampling was performed using a 2-inch outside diameter split-spoon sampler driven by a 140-pound hammer raised using a rope and cathead system. During the SPT, samples were obtained by driving the sampler 18 inches into the soil with the hammer free-falling 30 inches. The numbers of blows required for each 6 inches of penetration were recorded. The Standard Penetration Resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides an indication of relative density of granular soils and the relative consistency of cohesive soils; both indicators of soil strength.

A geotechnical engineer from HWA logged the explorations and recorded all pertinent information. Soil samples obtained from the borings were classified in the field and representative portions were sealed in plastic bags. Pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence was recorded. These soil samples were then taken to our Bothell, Washington, laboratory for further examination and testing.

The stratigraphic contacts shown on the individual exploration logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The soil and groundwater conditions depicted are only for the specific date and location reported and, therefore, are not necessarily representative of other locations and times. A legend of the terms and symbols used on the exploration logs is presented in Appendix A, Figure A-1. Summary logs of the explorations are presented in Figures A-2 through A-7.

2.2 LABORATORY TESTING

Representative soil samples obtained from the drilled boreholes were taken to the HWA laboratory for further examination and testing. Laboratory tests, as described below, were conducted on selected soil samples to characterize relevant engineering properties of the on-site soils.

Moisture Content of Soil: The moisture content (percent by dry mass) of selected soil samples was determined in accordance with ASTM D 2216. The results are shown at the sampled intervals on the appropriate exploration logs in Appendix A and on the laboratory test reports presented in Appendix B

Particle Size Analysis of Soils: Selected samples were tested to determine the particle size distribution of material in accordance with ASTM D6913/D7928. The results are summarized on the attached Particle-Size Analysis of Soils reports, Figures B-1 through B-6, Appendix B, which also provide information regarding the classification of the samples and the moisture content at the time of testing.

3. SITE CONDITIONS

3.1 GENERAL GEOLOGIC CONDITIONS

The project alignment is located within the Puget Lowland. The Puget Lowland has repeatedly been occupied by a portion of the continental glaciers that developed during the ice ages of the Quaternary period. During at least four periods, portions of the ice sheet advanced south from British Columbia into the lowlands of Western Washington. The southern extent of these glacial advances was near Olympia, Washington. Each major advance included numerous local advances and retreats, and each advance and retreat resulted in its own sequence of erosion and deposition of glacial lacustrine, outwash, till, and drift deposits. Between and following these glacial advances, sediments from the Olympic and Cascade Mountains accumulated in the Puget Lowland.

Specific geologic information along the project alignment was obtained from the 1:24,000-scale *Preliminary Surficial Geologic Map of the Mukilteo and Everett Quadrangles* (Smith, 1976). According to the geologic mapping, the project vicinity is underlain by combination of Quaternary Vashon Till and Whidbey Formation deposits. It is important to note that the Geologic Unit boundaries presented by geologic mapping are inferred from limited surface observations and topography and may not match the soil conditions encountered in the geotechnical explorations in the area. As indicated by the units presented on our boring logs, the Geologic Units presented by geologic mapping are inconsistent with the surface and subsurface conditions encountered in our explorations. Further discussions of geologic and subsurface conditions encountered are presented below.

3.2 SUBSURFACE SOIL CONDITIONS

The soils encountered in our soil borings consist of near surface topsoil and fill soils; weathered and unweathered advance outwash; and Whidbey formation deposits. Further descriptions of soils encountered in our explorations are presented below in order of deposition, beginning with the most recently deposited. The exploration logs in Appendix A provide more detailed description of subsurface conditions observed at specific locations and depths.

Topsoil: Loose topsoil was encountered at ground surface in in borings BH-1 and BH-3. This material was brown to dark brown and consisted of gravelly, silty to very silty, sand with abundant organics/rootlets. The topsoil layer extended from ground surface to a depth of approximately 2.5 feet below ground surface (bgs).

Fill: Fill was encountered in boring BH-4 from the ground surface to depth of about 7.5 feet bgs. The fill consisted of medium dense, slightly silty sand, with varying amounts of gravel. We expect that the fill was placed during construction of West Mukilteo Boulevard at the location of BH-4.

Weathered Advance Outwash: Weathered advance outwash soils consisting of medium dense, slightly silty to silty sand with varying amount of gravel were encountered from surface or below topsoil at the locations all borings except BH-4. Weathered advance outwash ranged in thickness from 2.5 feet to about 17.5 feet.

Advance Outwash: Advance outwash soils were encountered below fill soils at the location of boring BH-4 and below weathered advance outwash at the locations of borings BH-1 through BH-3. These borings were terminated in advance outwash, which generally consisted of dense to very dense, olive gray, clean to slightly silty, sand with varying amounts of gravel. Advance outwash soils were deposited by streams issuing from the glacial front as the ice sheet advanced. They have been overridden and densified by the weight of glacial ice and are typically dense to very dense.

Whidbey Formation: Thin to medium-bedded hard clays and silts were encountered below weathered advance outwash deposits at the locations of BH-5 and BH-6. This soil unit was not fully penetrated in our borings but explored thicknesses ranged from 12 feet in BH-5 to 19 feet in BH-6. These fine-grained deposits, known as the Whidbey formation, are interpreted as being deposited within an alluvial floodplain environment during the last interglacial period. Consequently, these deposits were covered by glacial deposits and were overridden during the last glaciation. This soil unit exhibits low permeability except at locations where it is highly jointed or contains sand lenses.

3.3 GROUNDWATER CONDITIONS

Groundwater seepage was encountered in borings BH-2 through BH-5 at the time of drilling, which occurred on February 1, 2022. In boring BH-2, seepage was encountered at a depth of about 5 feet within the weathered advance outwash and the soils below, to the termination depth of 16.5 feet, were wet. In boring BH-3, seepage was encountered at a depth of about 7.5 feet at the contact between weathered advance outwash and advance outwash and soils were wet to the termination depth of 16.5 feet. In boring BH-4, seepage was encountered at a depth of about 14.5 feet in the last sample for this boring. In boring BH-5, seepage was encountered at a depth of about 5 feet within the weathered advance outwash and the water was perched above the Whidbey formation deposit encountered at 10 feet.

We anticipate groundwater levels vary with rainfall and that levels are highest during the wet winter months.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 GENERAL

The following is a summary of our conclusions and geotechnical recommendations based on the results of our investigations, laboratory testing and analyses. Further discussion is presented in subsequent report sections.

- Near surface soils encountered in the explorations primarily consist of medium dense to very dense, slightly silty to silty sand with gravel (outwash or fill) and are generally suitable for support of the proposed shallow bearing improvements (pavement, sidewalk, curb, gutter, and median) provided the recommendations presented in this report are incorporated into design and construction. In some locations, topsoil/organic-rich soils will need to be excavated to reach soils suitable for supporting these structures.

- The subsurface soils will provide adequate lateral resistance for the proposed luminaire foundations and WSDOT Standard Plan foundations can be utilized for design and construction.

- Use of infiltration for stormwater design is not recommended for the project given the presence of glacially-consolidated soils and nearby steep slopes.

- We anticipate that much of the native outwash soils, consisting of relatively clean sand and gravel, will be suitable for reuse as trench backfill. Sufficient sampling and testing will need to be performed during construction to develop adequate grain-size distribution and compaction criteria.

4.2 LUMINAIRE FOUNDATIONS

We understand that new luminaires will be constructed as part of the proposed improvements for this project. We anticipate that WSDOT Standard Plans for construction of luminaire and signal pole foundations will be applicable. Table 17-2 of the *WSDOT Geotechnical Design Manual* (WSDOT, 2021), provides allowable lateral bearing pressures based on Standard Penetration Test (SPT) Resistance N-values (blows/foot). Based on the results of the drilled borings, we recommend using an allowable lateral bearing pressure of 1,500 psf for design of luminaire foundations along the project corridor.

Drilled shaft luminaire and signal pole foundations can be constructed using conventional methods using flighted augers. It is likely that cobbles and boulders could be present. Per the Unified Soil Classification System (USCS), cobbles are defined as a rock with a dimension between 3 and 12 inches; boulders are defined as rock with a minimum dimension of 12 inches. The contractor should be prepared to encounter cobbles and boulders during drilling of shafts.

The contractor should also be prepared to control groundwater, perched water, and/or surface water entering and collecting inside the drilled shaft excavation. The contractor should be prepared to prevent caving of the drilled shaft sidewalls using temporary casing. The concrete should be placed using a tremie pipe from the bottom of the shaft if water inside the drilled shaft excavation is over a depth of 6 inches.

A qualified geotechnical engineer should observe shaft excavation and concrete placement. This will also provide the opportunity to confirm conditions assumed in the design and provide corrective recommendations as necessary to adapt to conditions observed during construction.

4.3 STORMWATER MANAGEMENT

According to the 2019 Stormwater Management Manual for Western Washington (SWMMWW), estimation of infiltration rates using the grain size analysis method is only applicable to soils unconsolidated by glacial advance. As indicated above and on our borehole logs, the native subsurface soils encountered have been glacially consolidated, though the weathered portion of the advance outwash is less dense than the unweathered portion. Given the presence of glacially consolidated soils, steep slopes, and localized shallow perched groundwater, we do not recommend stormwater infiltration be utilized. If stormwater infiltration is to be considered, Pilot Infiltration Testing (PIT) would need to be performed in locations where infiltration is proposed.

4.4 GENERAL EARTHWORK

4.4.1 Subgrade Preparation

Subgrade preparation for pavement, sidewalks, ramps, curbs and other improvements founded near surface should begin with the removal of all topsoil, deleterious materials and vegetation to expose dense, competent native soils or adequately compacted structural fill. A smooth bucket should be used to limit disturbance. We recommend that in areas accessible to construction equipment, the exposed subgrade be proof-rolled under the observation of the geotechnical engineer using a fully-loaded dump truck to identify any areas of loose, pumping, or otherwise unsuitable soils. If such soils are encountered, they should be over-excavated as directed by the geotechnical engineer and replaced with properly compacted structural fill. In areas inaccessible to large equipment, the subgrade soils should be evaluated by the geotechnical engineer using a T-handled probe. Subgrade soils should be compacted to a dense condition prior to placement of structural fill or construction of improvements.

4.4.2 Structural Fill

Structural fill should consist of relatively clean, free-draining, granular soils free from organic matter or other deleterious materials. Such materials should be less than 4 inches in maximum

particle dimension, with less than 10 percent fines (portion passing the U.S. Standard No. 200 sieve). Imported structural fill for areas of over-excavation and for pavement base course should consist of Crushed Surfacing Base Course, as described in Section 9-03.9(3) of the WSDOT *Standard Specifications* (WSDOT, 2022). Structural fill used to raise site grades could consist of CSBC or Gravel Borrow, as specified in Section 9-03.14(1) of the *WSDOT Standard Specifications* (WSDOT, 2022). The fine-grained portion of structural fill soils should be non-plastic.

We anticipate that much of the cleaner sand and gravel outwash soils can be used for utility trench backfill. A sufficient number of samples for grain size and Proctor testing should be obtained during construction and tested to determine the compaction characteristics.

We do not recommend the reuse of native fine-grained Whidbey formation soils as structural fill due to the very high fines content and moisture sensitivity.

4.4.3 Compaction

Structural fill should be moisture conditioned and compacted to at least 95% of the maximum dry density (MDD) determined by test method ASTM D 1557 (Modified Proctor). Structural fill should be placed and compacted in loose, horizontal lifts of not more than 8 inches in thickness.

At the time of placement, the moisture content of structural fill should be at or near optimum. Achievement of proper density of a compacted fill depends on the size and type of compaction equipment, the number of passes, thickness of the layer being compacted, and soil moisture-density properties. In areas where limited space restricts the use of heavy equipment, smaller equipment can be used, but the soil must be placed in thin enough layers and at the proper moisture content to achieve the required relative compaction. Generally, loosely compacted soils result from poor construction technique and/or improper soil moisture content. Soils with high fines contents are particularly susceptible to becoming too wet and coarse-grained materials easily become too dry for proper compaction.

4.4.4 Temporary Excavations

Maintenance of safe working conditions, including temporary excavation stability is the responsibility of the contractor. All excavations should have adequate safety systems that meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW. In accordance with Part N of Washington Administrative Code (WAC) 296-155, all temporary cuts in excess of 4 feet in height must be either sloped or shored prior to entry by personnel. The fill and weathered advance outwash soils encountered classify as Type C soils per WAC 296-155 and should be sloped no steeper than 1.5H:1V (horizontal:vertical). The dense and very dense advance outwash soils encountered at depth below weathered deposits classify as Type B soils per WAC 296-155 and should be sloped no steeper than 1H:1V (horizontal:vertical). The hard Whidbey Formation soils encountered at the locations of borings BH-5 and BH-6 classify as

Type A soils per WAC 296-155 and should be sloped no steeper than 3/4H:1V (horizontal:vertical).

The contractor should monitor the stability of temporary excavations and adjust the slope inclination accordingly. The contractor should be responsible for control of ground and surface water and should employ sloping, slope protection, ditching, sumps, dewatering, and other measures, as necessary, to prevent sloughing of soils.

4.4.5 Wet Weather Earthwork

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. These recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation of unsuitable and/or softened soil should be followed promptly by placement and compaction of clean structural fill. The size and type of construction equipment used may need to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic.

- Any backfill material used in wet weather should consist of clean granular soil with less than 5 percent passing the U.S. No. 200 sieve, based on wet sieving the fraction passing the ¾-inch sieve. The fines should be non-plastic. It should be noted this is an additional restriction on the structural fill materials specified.

- The ground surface within the construction area should be graded to promote surface water run-off and to prevent ponding.

- Within the construction area, the ground surface should be sealed on completion of each shift by a smooth drum vibratory roller, or equivalent, and under no circumstances should soil be left uncompacted and exposed to moisture infiltration.

- Excavation and placement of backfill materials should be monitored by a geotechnical engineer experienced in wet weather earthwork to determine that the work is being accomplished in accordance with the project specifications and the recommendations contained herein.

- Bales of straw combined with other best management practices such as geotextile silt fences should be strategically located to control erosion and the movement of soil.

5. CONDITIONS AND LIMITATIONS

HWA prepared this draft report for KPFF Inc. and the City of Mukilteo for use in design and construction of this project. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations and may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary.

HWA recommends it be retained to review the plans and specifications to verify that HWA's recommendations have been interpreted and implemented as intended. Sufficient geotechnical monitoring, testing, and consultation should be provided during construction to confirm the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in the area at the time the report was prepared. No warranty, express or implied, is made. The scope of HWA's work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

HWA does not practice or consult in the field of safety engineering. HWA does not direct the contractor's operations and cannot be responsible for the safety of personnel other than HWA's own on the site. As such, the safety of others is the responsibility of the contractor(s). The contractor(s) should notify the owner if it is considered that any of the recommended actions presented herein are unsafe.

November 4, 2022
HWA Project No. 2020-144-21

We appreciate the opportunity to provide geotechnical services on this project. Should you have any questions or comments, or if we may be of further service, please do not hesitate to call.

Sincerely,

HWA GEOSCIENCES INC.

Ali Sirjani, P.E.
Geotechnical Engineer

Bryan K. Hawkins, P.E
Senior Geotechnical Engineer

6. REFERENCES

Smith,1976, *Preliminary Surficial Geologic Map of the Mukilteo and Everett Quadrangles*, Snohomish County, Washington, State of Washington Department of Natural Resources, Division of Geology and Earth Resources, Geologic Map GM-20.

Washington State Department of Ecology, 2019, *Stormwater Management Manual for Western Washington,* Water Quality Program, Publication Number 19-10-021, July 2019.

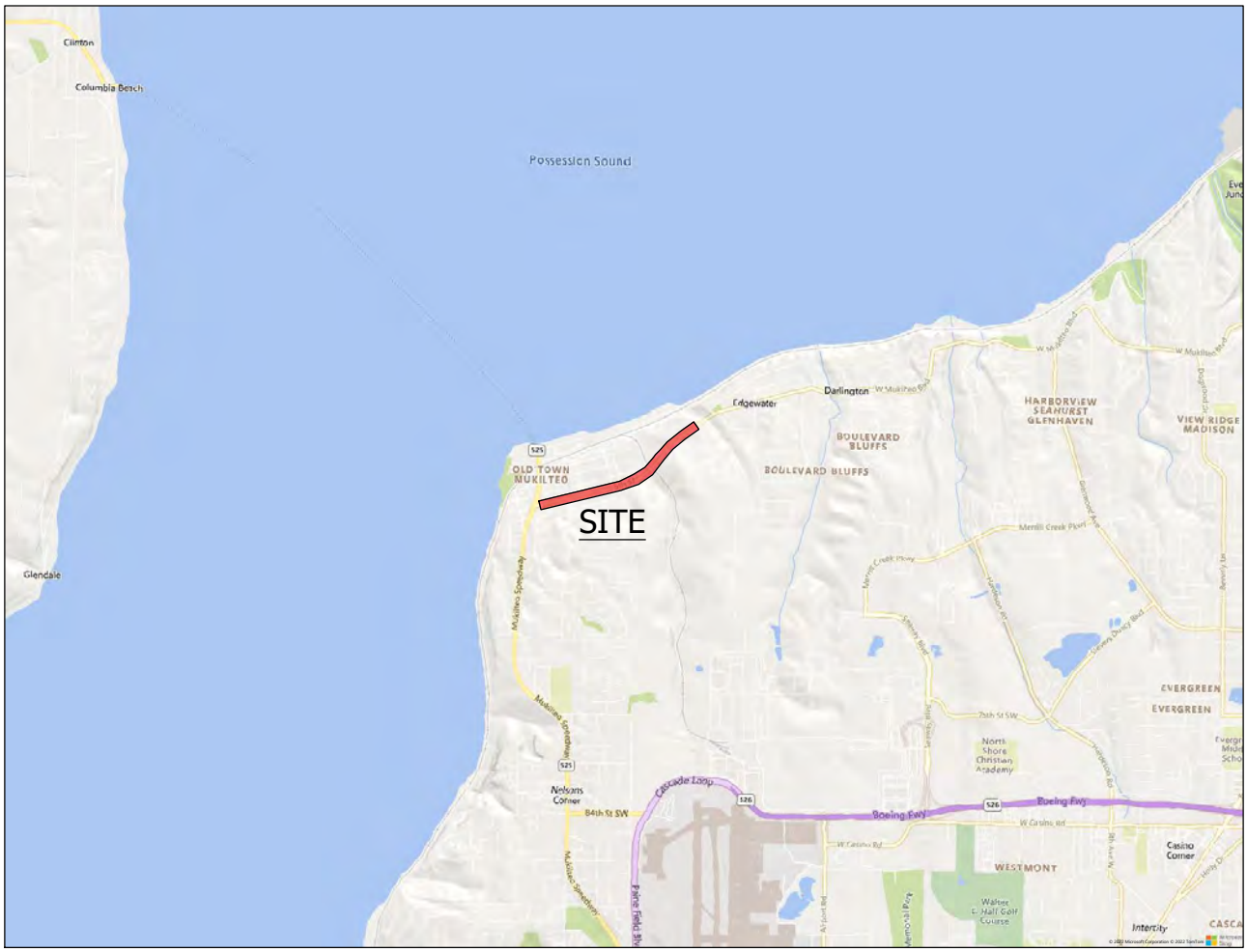
WSDOT, 2021, *Geotechnical Design Manual,* Washington State Department of Transportation M 46-03.14, June 2021.

WSDOT, 2022, *Standard Specifications for Road, Bridge and Municipal Construction,* Washington State Department of Transportation, M41-10.

SITE MAP

0 750' 1500' 2250' 3000'

SCALE: 1" = 1500'



VICINITY MAP

0 2500' 5000' 7500' 10000'

SCALE: 1" = 5000'

GEOSCIENCES INC.
DBE/MWBE

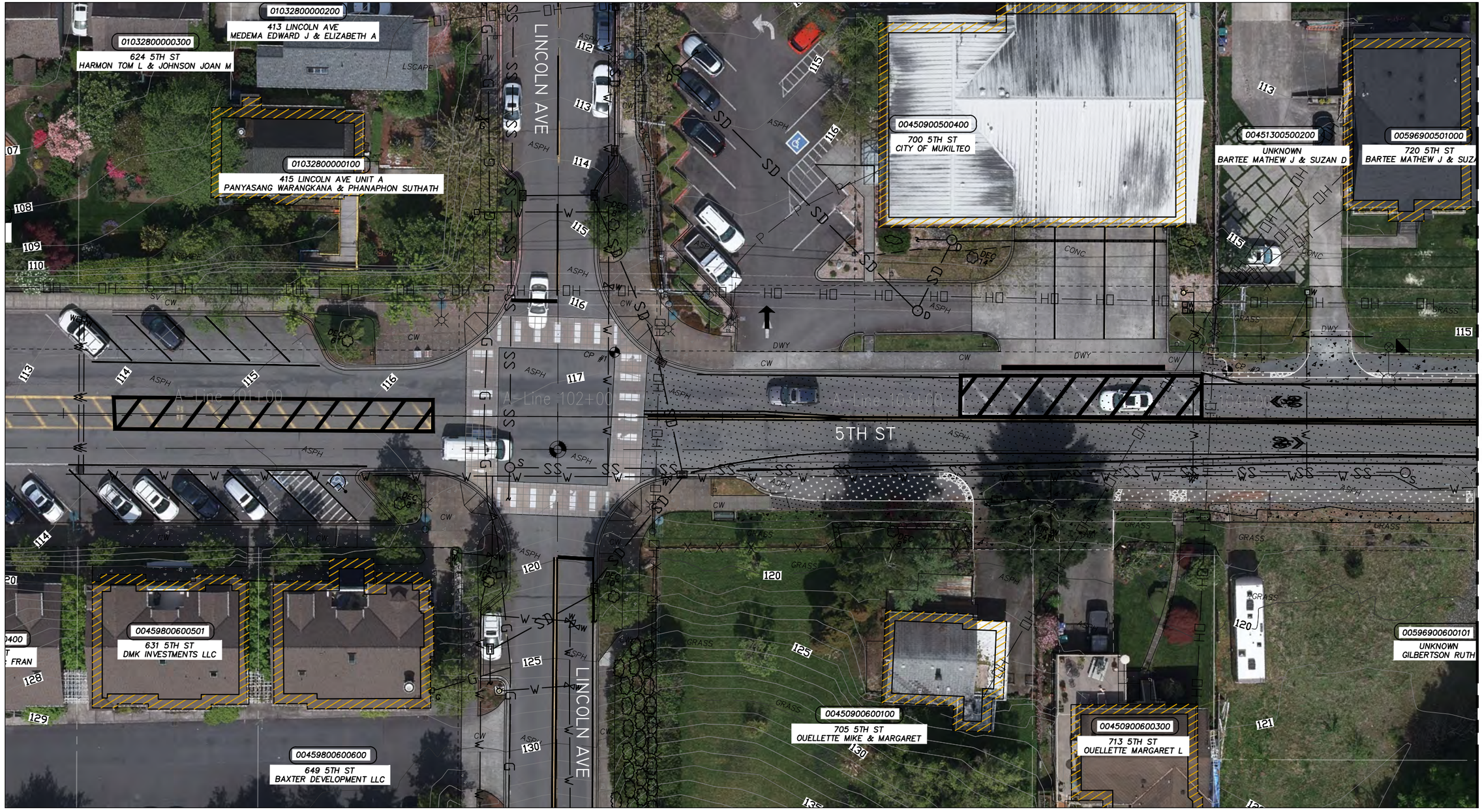
SITE AND VICINITY MAP

MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

FIGURE NO.: 1

DRAWN BY: CF
CHECK BY: AS/BKH

PROJECT # 2020-144-21



5TH STREET
Scale: 1" = 30'-0"

N

0 15 30 45 60
SCALE: 1" = 30'

GeoSciences Inc.
DBE/MWBE

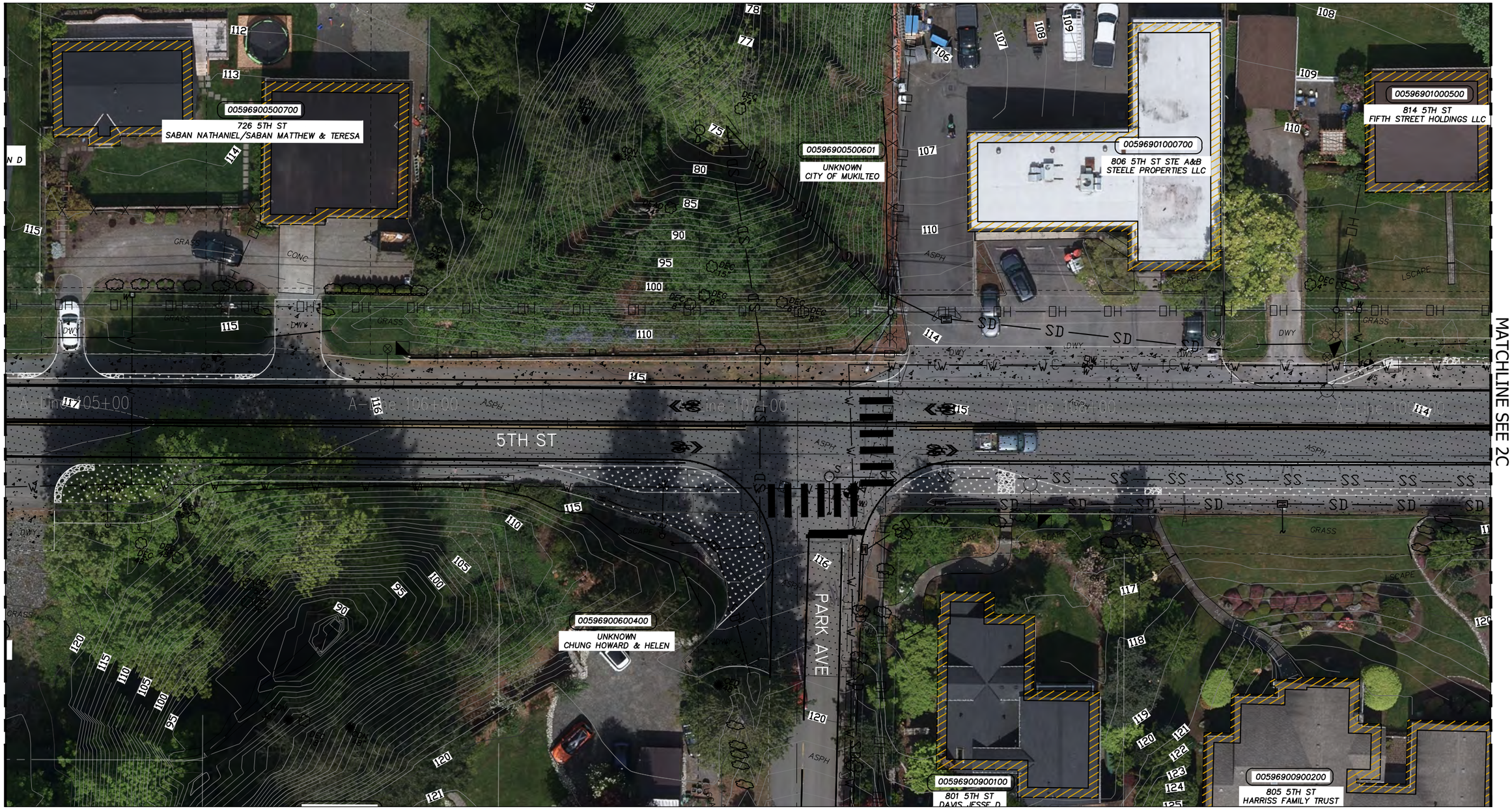
MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2A
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2A> Plotted: 3/4/2022 9:16 AM



5TH STREET
Scale: 1" = 30'-0"

N

0 15 30 45 60
SCALE: 1" = 30'

GeoSciences Inc.
DBE/MWBE

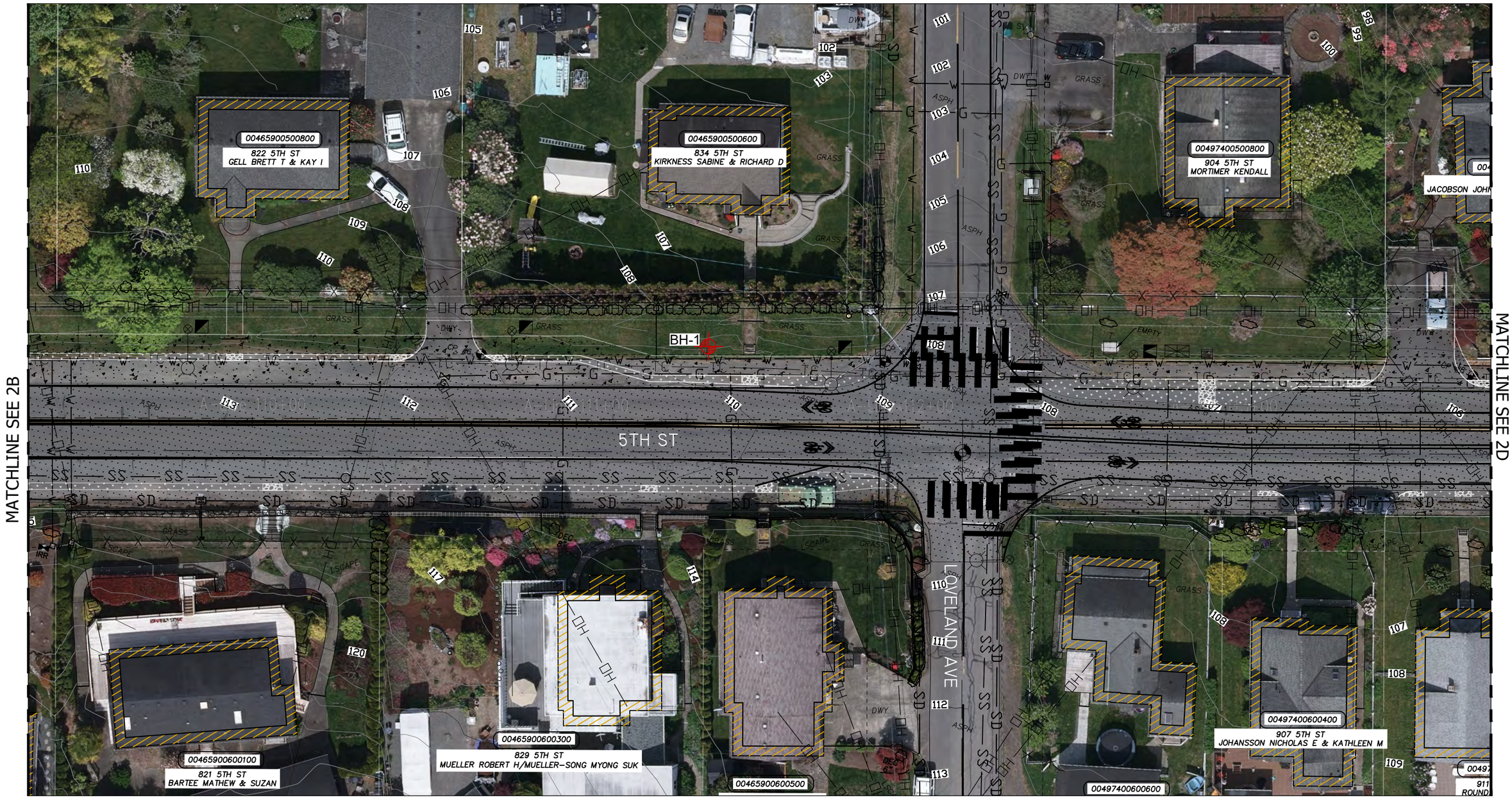
MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2B
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2B> Plotted: 3/4/2022 9:16 AM



5TH STREET
Scale: 1" = 30'-0"

EXPLORATION LEGEND

BH-1 BOREHOLE DESIGNATION AND APPROXIMATE LOCATION

N

0 15 30 45 60

SCALE: 1" = 30'

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2C
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2C> Plotted: 3/4/2022 9:16 AM

MATCHLINE SEE 2C

MATCHLINE SEE 2E

00615700201500
932 5TH ST
MAY WILLIAM & MARY JANE

00399500400700
920 5TH ST
MERCADO DEBORAH M & DENNIS L

00615700201300
926 5TH ST
JACOBSON SETH JOSEPH & KIMBERLY A

00399500400500
UNKNOWN
JACOBSON JOHN & MARILYN LIVING TRUST

00615700201800
936 5TH ST
MCGEE PATRICK J & CYNTHIA Y

00615700202100
948 5TH ST
BUI THOM V/THAI TUYET-QUAN

00615700300500
935 5TH ST
VARGAS HEATHER R

00615700300900
925 5TH ST
ROBERTS ROBERT W SR

00615700300100
947 5TH ST
OLIN DONALD

00399500500102

5TH ST

5TH STREET

Scale: 1" = 30'-0"

0 15 30 45 60

SCALE: 1" = 30'

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2D> Plotted: 3/4/2022 9:17 AM

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SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2D
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

5TH STREET
Scale: 1" = 30'-0"

EXPLORATION LEGEND

BH-2 BOREHOLE DESIGNATION AND APPROXIMATE LOCATION

N

0 15 30 45 60
SCALE: 1" = 30'

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2E
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2E> Plotted: 3/4/2022 9:17 AM

5TH STREET
Scale: 1" = 30'-0"

EXPLORATION LEGEND

BH-3 BOREHOLE DESIGNATION AND APPROXIMATE LOCATION

N

0 15 30 45 60
SCALE: 1" = 30'

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MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2F
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

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MATCHLINE SEE 2F

MATCHLINE SEE 2H

5TH STREET
Scale: 1" = 30'-0"

N

0 15 30 45 60
SCALE: 1" = 30'

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2G
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2G> Plotted: 3/4/2022 9:18 AM

5TH STREET
Scale: 1" = 30'-0"

EXPLORATION LEGEND

BH-5 ⊕ BOREHOLE DESIGNATION AND APPROXIMATE LOCATION

0 15 30 45 60
SCALE: 1" = 30'

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2H> Plotted: 3/4/2022 9:19 AM

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2H
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

5TH STREET
Scale: 1" = 30'-0"

EXPLORATION LEGEND

BH-6 BOREHOLE DESIGNATION AND APPROXIMATE LOCATION

0 15 30 45 60
SCALE: 1" = 30'

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2I> Plotted: 3/4/2022 9:19 AM

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BICYCLE AND PEDESTRIAN IMPROVEMENTS
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SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2I
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

MATCHLINE SEE 2I

MATCHLINE SEE 2K

5TH STREET/MUKILTEO BLVD

Scale: 1" = 30'-0"

0 15 30 45 60

SCALE: 1" = 30'

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2J
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2J> Plotted: 3/4/2022 9:19 AM

MUKILTEO BLVD

Scale: 1" = 30'-0"

N

0 15 30 45 60

SCALE: 1" = 30'

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MUKILTEO 5TH STREET
BICYCLE AND PEDESTRIAN IMPROVEMENTS
MUKILTEO, WASHINGTON

SITE &
EXPLORATION PLAN

DRAWN BY:	FIGURE NO.:
CF	2K
CHECK BY:	PROJECT NO.:
AS/BKH	2020-144-21

AERIAL & BASE MAP PROVIDED BY: KPFF 03.02.2022

C:\USERS\CFRY\DESKTOP\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN\2020-144-21 5TH STREET BICYCLE & PEDESTRIAN.DWG <2K> Plotted: 3/4/2022 9:20 AM

APPENDIX A

HWA FIELD EXPLORATIONS

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve		GP	Poorly-graded GRAVEL
		Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit, LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
OC	Organic Content
pH	pH of Soils
PID	Photoionization Device Reading
PP	Pocket Penetrometer (Approx. Comp. Strength, tsf)
Res.	Resistivity
SG	Specific Gravity
CD	Consolidated Drained Triaxial
CU	Consolidated Undrained Triaxial
UU	Unconsolidated Undrained Triaxial
TV	Torvane (Approx. Shear Strength, tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- Non-standard Penetration Test (3.0" OD Split Spoon with Brass Rings)
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- 3-1/4" OD Split Spoon

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation.
Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

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Bicycle and Pedestrian Improvements
Mukilteo, Washington

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2020-144-21 FIGURE: A-1

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2C

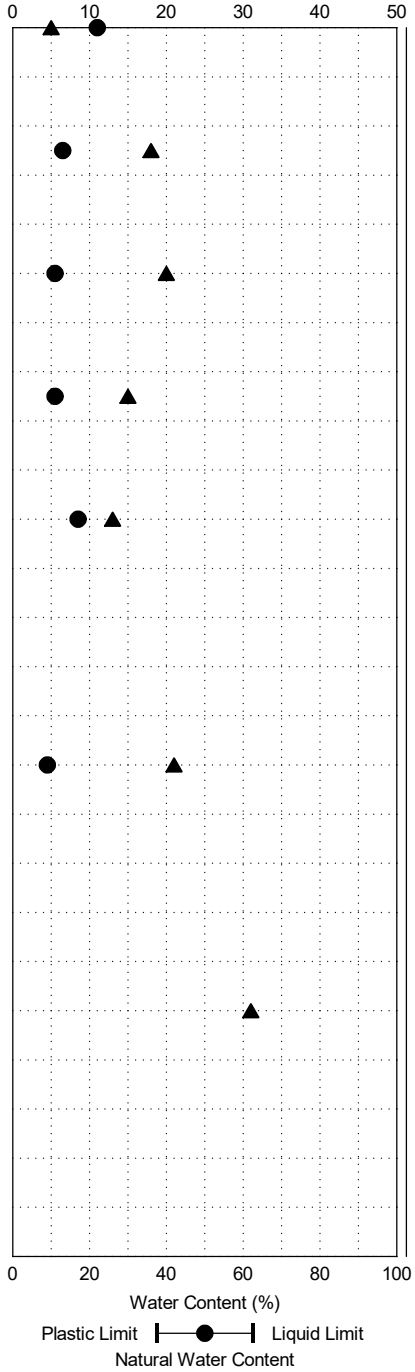
DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0		SM	Loose, dark-brown, slightly gravelly, silty SAND, moist. Rootlets observed. **(TOPSOIL)**		S-1	2-3-2	GS
		SM	Medium dense, dark olive-brown, silty, gravelly SAND, moist. Rootlets observed. **(WEATHERED ADVANCE OUTWASH)**		S-2	3-7-11	
5			Medium dense, olive-brown, silty, gravelly SAND, moist.		S-3	16-11-9	GS
			Medium dense, olive-brown, silty, gravelly, SAND, moist.		S-4	6-7-8	GS
10			Medium dense, olive-brown, slightly gravelly, silty SAND, moist. Rust mottling and silt banding observed.		S-5	5-6-7	
15			Medium dense, olive-brown, slightly gravelly, silty, SAND, moist.		S-6	8-10-11	
20		SM	Dense, olive-brown, silty SAND, moist. **(ADVANCE OUTWASH)**		S-7	8-14-17	
25			Boring terminated at 21.5 feet below ground surface. Groundwater seepage was not observed during the drilling.				

GROUNDWATER

Standard Penetration Test
(140 lb. weight, 30" drop)
▲ Blows per foot

ELEVATION (feet)



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo, Washington

BORING:
BH-1

PAGE: 1 of 1

PROJECT NO.: 2020-144-21 FIGURE: A-2

BORING-DSM 2020-144 - RESTORED FROM 3-7-22 0801.GPJ 3/16/22

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2E

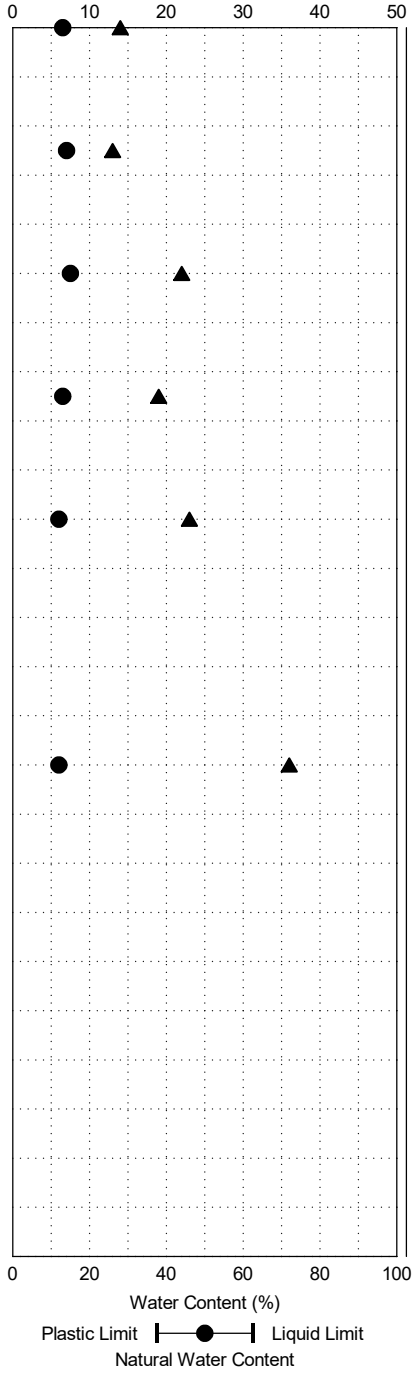
DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0		SM	Medium dense, dark olive-brown, silty, gravelly SAND, moist. Rootlets observed. **(WEATHERED ADVANCE OUTWASH)**		S-1	3-8-6	GS
			Medium dense, olive-brown, slightly gravelly, very silty, SAND, moist. Poor recovery at 2.5 feet bgs.		S-2	4-5-8	
5			Medium dense, olive-gray, slightly gravelly, silty SAND, wet.		S-3	8-10-12	GS
			Medium dense, olive-brown, silty, gravelly, SAND,wet.		S-4	7-9-10	GS
10					S-5	8-10-13	
15		SM	Dense, gravelly, silty, SAND, wet. **(ADVANCE OUTWASH)**		S-6	10-16-20	
20							
25							

Boring terminated at 16.5 feet below ground surface (bgs). Groundwater seepage was observed at 5 feet bgs during the drilling.

GROUNDWATER

Standard Penetration Test
(140 lb. weight, 30" drop)
▲ Blows per foot



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo, Washington

BORING:
BH-2

PAGE: 1 of 1

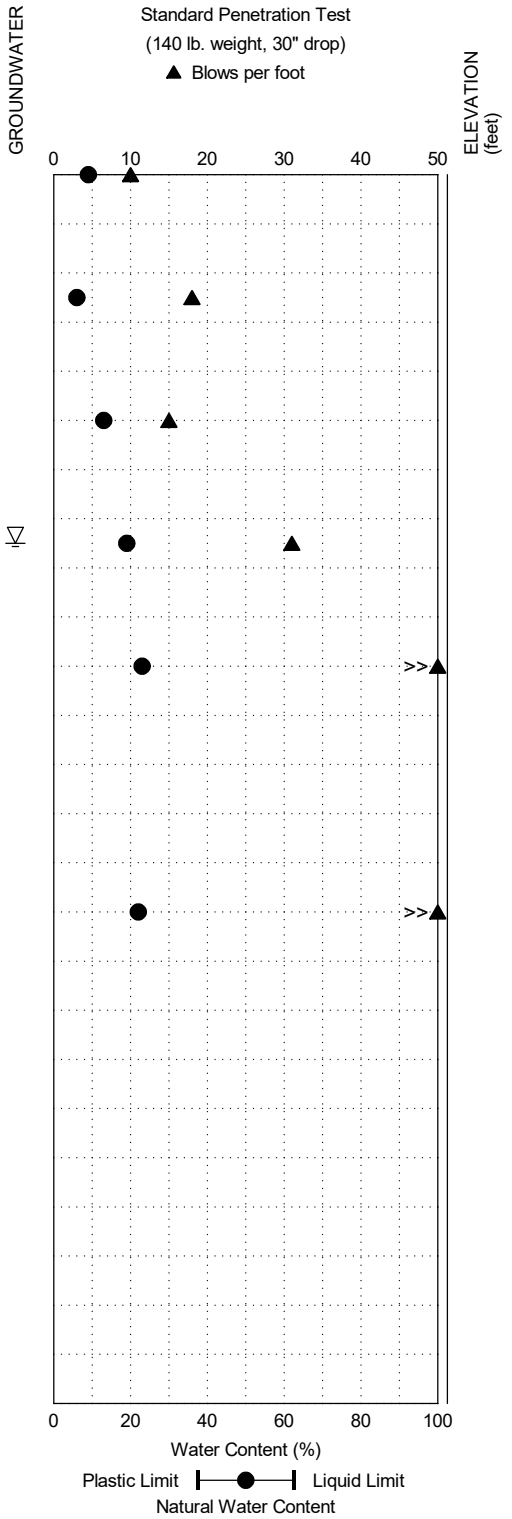
PROJECT NO.: 2020-144-21 FIGURE: A-3

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2F

DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0		SM	Loose, dark olive-brown, silty, gravelly SAND, moist. Rootlets observed. **(TOPSOIL)**		S-1	3-3-7	
		SP SM	Medium dense, olive-brown, slightly silty, gravelly SAND, moist. **(WEATHERED ADVANCE OUTWASH)**		S-2	7-8-10	GS
5		SM	Medium dense, olive-gray, slightly gravelly, very silty SAND, moist.		S-3	7-8-7	GS
		SM	Dense, olive-gray, silty SAND,wet. **(ADVANCE OUTWASH)**		S-4	4-14-17	GS
10		SP SM	Very dense, olive-gray, slightly silty, SAND, moist to wet.		S-5	18-34-35	
15					S-6	15-35-39	
20							
25							

Boring terminated at 16.5 feet below ground surface (bgs). Groundwater seepage likely from perched water was observed at 7.5 feet bgs during the drilling.



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo, Washington

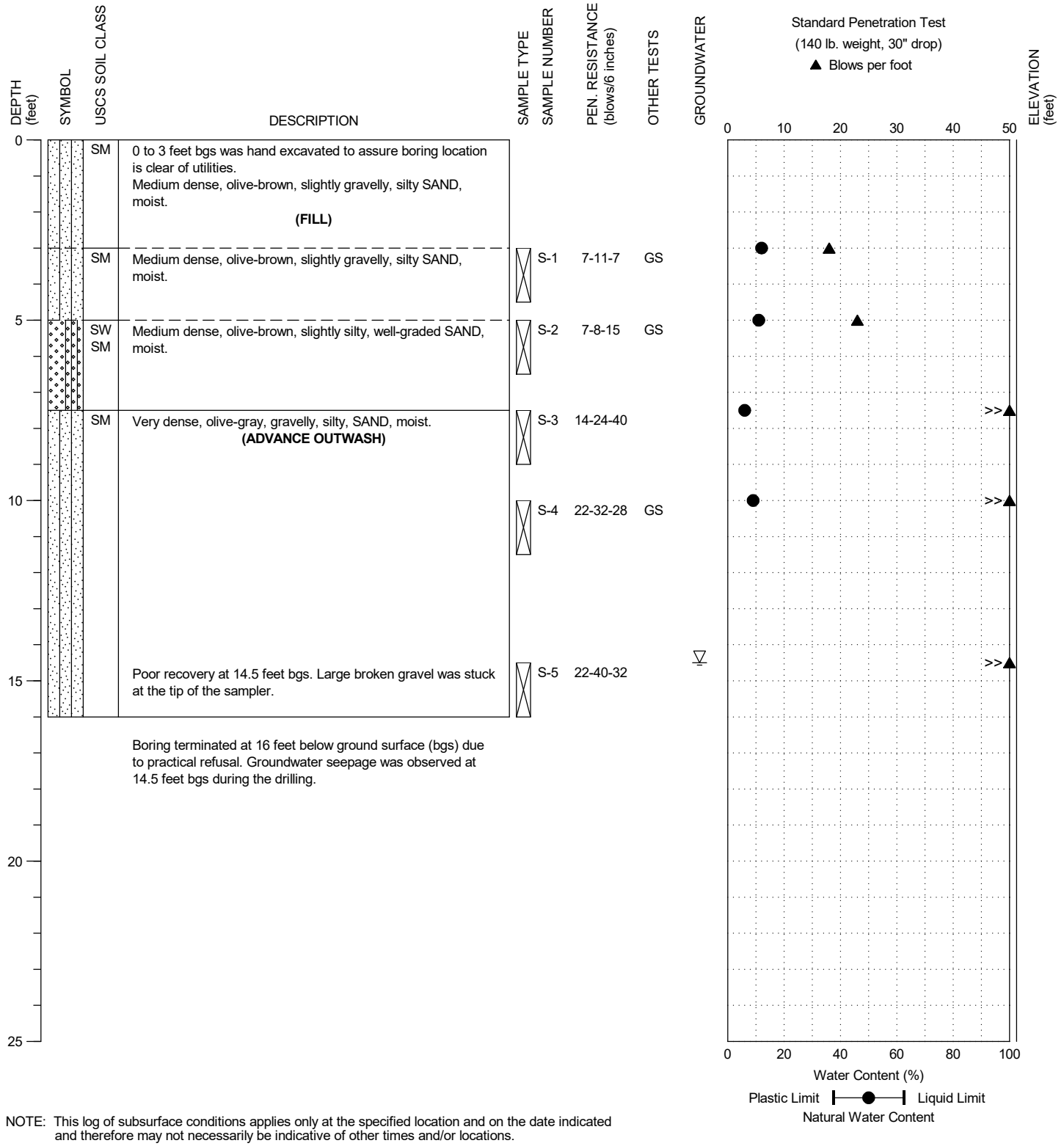
BORING:
BH-3

PAGE: 1 of 1

PROJECT NO.: 2020-144-21 FIGURE: A-4

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2H

DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo, Washington

BORING:
BH-4

PAGE: 1 of 1

PROJECT NO.: 2020-144-21 FIGURE: A-5

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2H

DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS
0		SP SM	Loose, olive-brown, slightly silty, SAND, moist. Tree root fragments observed. **(WEATHERED ADVANCE OUTWASH)**		S-1	2-3-4	
		SM	Medium dense, olive-brown, silty SAND, moist.		S-2	5-7-8	GS
5		SP SM	Medium dense, dark olive-gray, slightly silty, poorly graded SAND, wet.		S-3	5-9-8	GS
					S-4	9-11-12	
10		ML	Hard, light olive-brown, SILT, moist to dry. Rust mottling observed. **(WHIDBEY FORMATION)**		S-5	10-15-18	
15		ML	Hard, olive-gray, SILT, moist to dry.		S-6	12-18-20	
20			Becomes dark gray.		S-7	12-17-23	
25			Boring terminated at 21.5 feet below ground surface (bgs). Groundwater seepage likely from perched water was observed at 5 feet bgs during the drilling.				

GROUNDWATER ▽

Standard Penetration Test
(140 lb. weight, 30" drop)
▲ Blows per foot

ELEVATION (feet)

0 10 20 30 40 50

0 20 40 60 80 100

Water Content (%)

Plastic Limit ●—● Liquid Limit
Natural Water Content

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo 5th Street
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Mukilteo, Washington

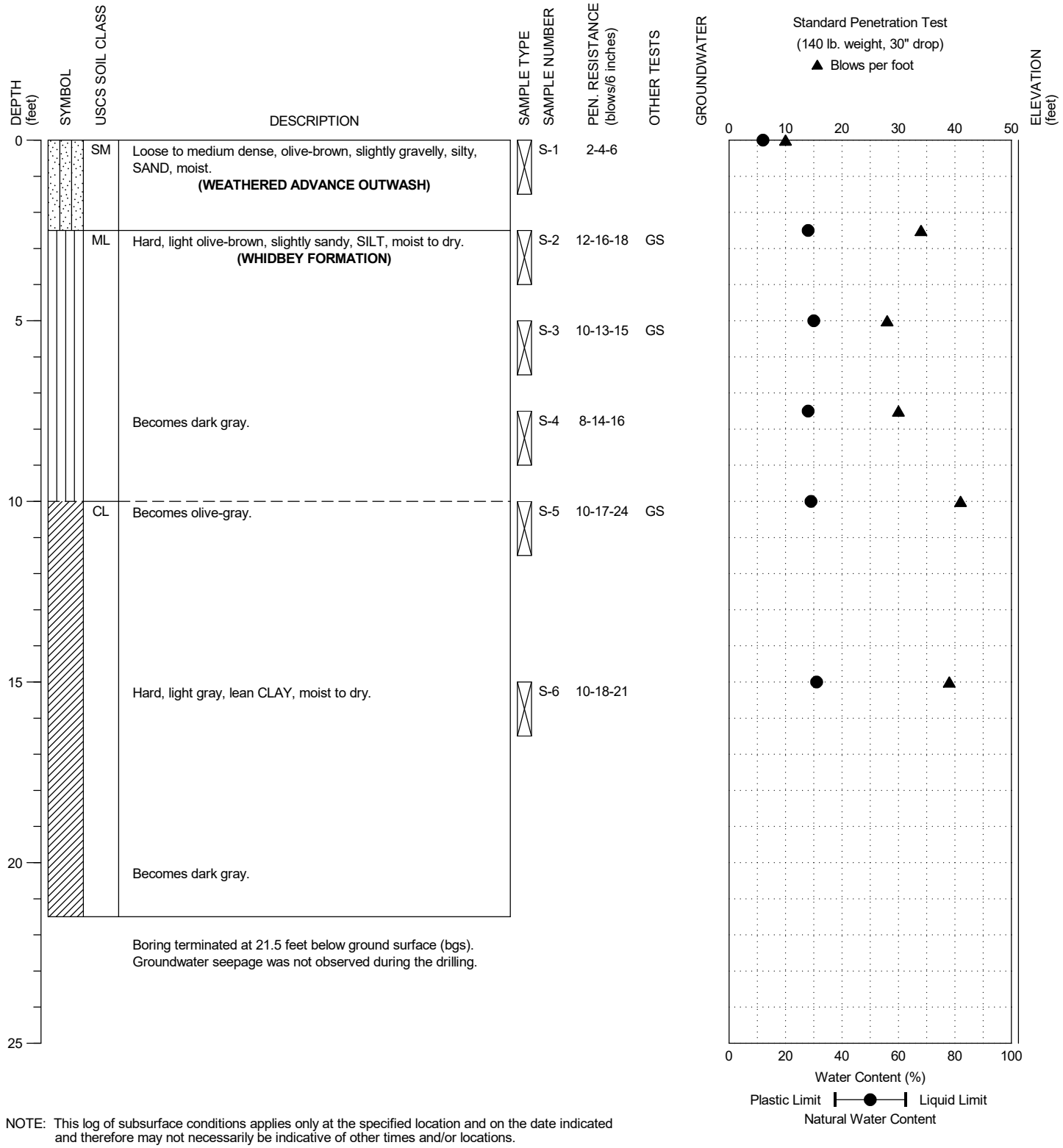
BORING:
BH-5

PAGE: 1 of 1

PROJECT NO.: 2020-144-21 FIGURE: A-6

DRILLING COMPANY: Geologic Drill Partners
DRILLING METHOD: HSA with mini-track
SAMPLING METHOD: SPT w/ Cathead
LOCATION: See Figure 2I

DATE STARTED: 2/1/2022
DATE COMPLETED: 2/1/2022
LOGGED BY: A. Sirjani



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mukilteo, Washington

BORING:
BH-6

PAGE: 1 of 1

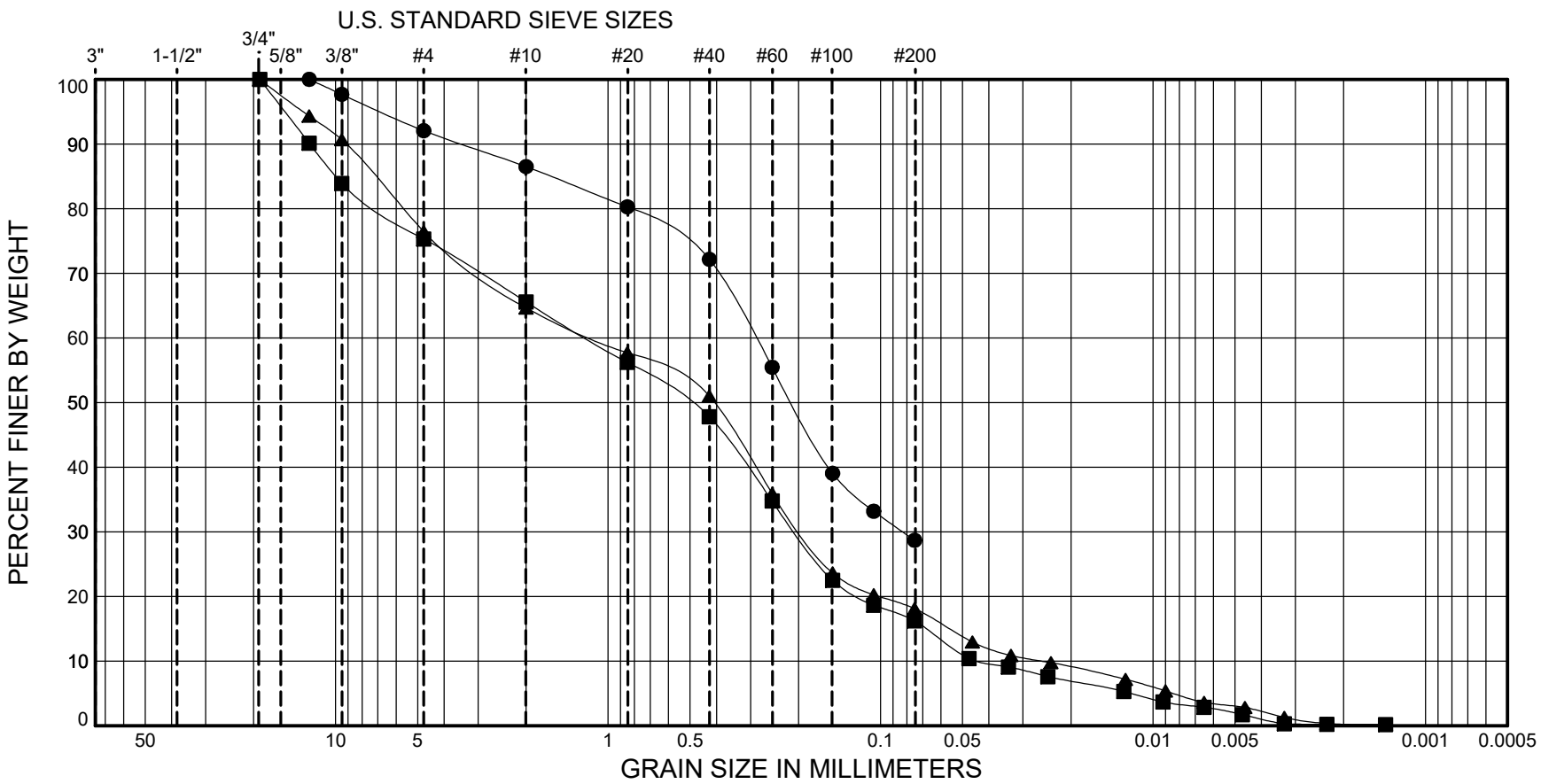
PROJECT NO.: 2020-144-21 FIGURE: A-7

BORING-DSM 2020-144 - RESTORED FROM 3-7-22 0801.GPJ 11/4/22

APPENDIX B

LABORATORY INVESTIGATION

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-1	S-1	0.0 - 1.5	(SM) Dark grayish-brown, silty SAND	22				7.9	63.4	28.7
■	BH-1	S-3	5.0 - 6.5	(SM) Olive-brown, silty SAND with gravel	11				24.7	59.1	16.2
▲	BH-1	S-4	7.5 - 9.0	(SM) Olive-brown, silty SAND with gravel	11				23.5	58.3	18.1

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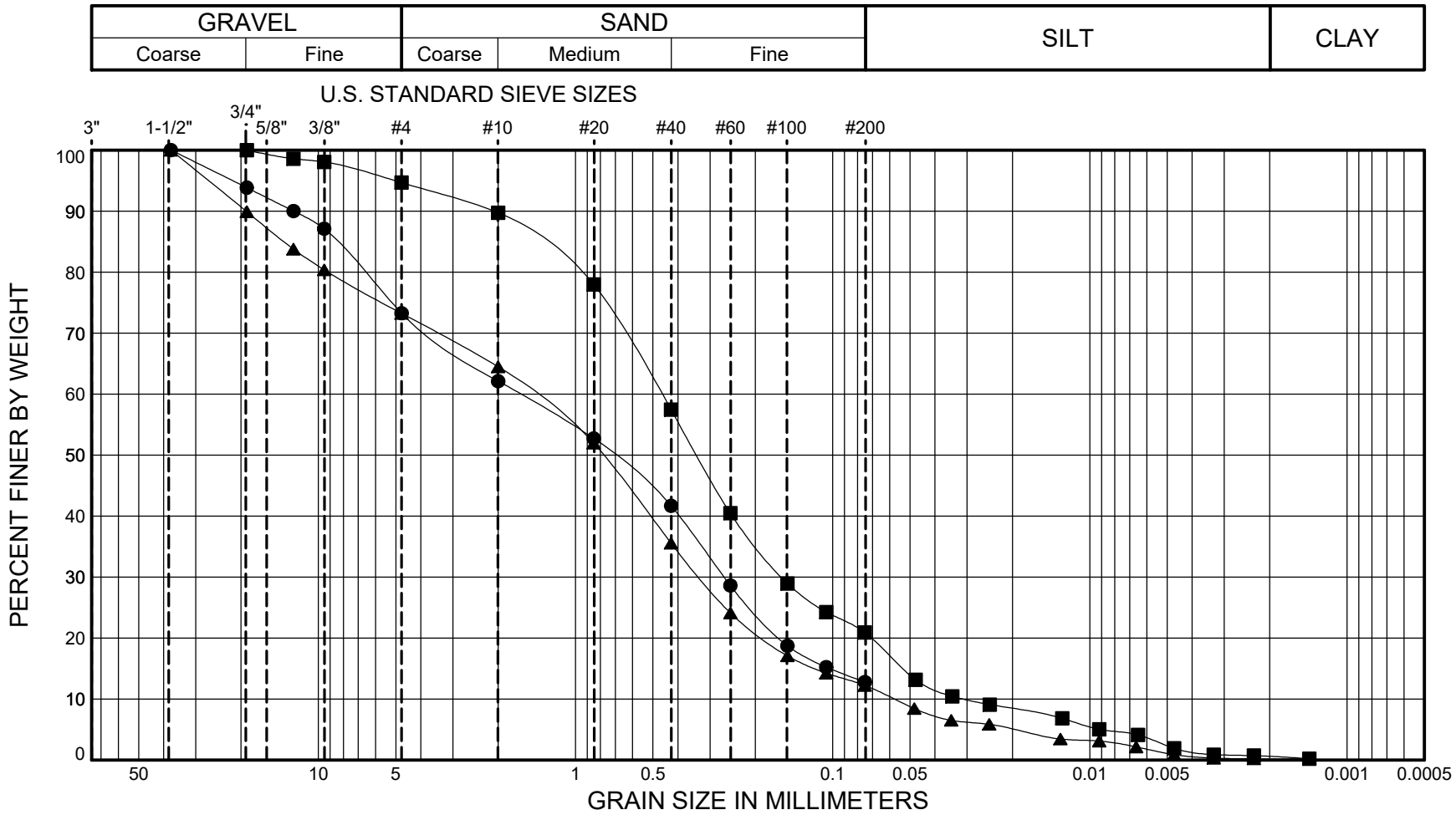
Mukilteo, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-1



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-2	S-1	0.0 - 1.5	(SM) Very dark grayish-brown, silty SAND with gravel	13				26.7	60.5	12.8
■	BH-2	S-3	5.0 - 6.5	(SM) Olive-brown, silty SAND	15				5.3	73.8	20.9
▲	BH-2	S-4	7.5 - 9.0	(SM) Light olive-brown, silty SAND with gravel	13				26.8	61.0	12.2

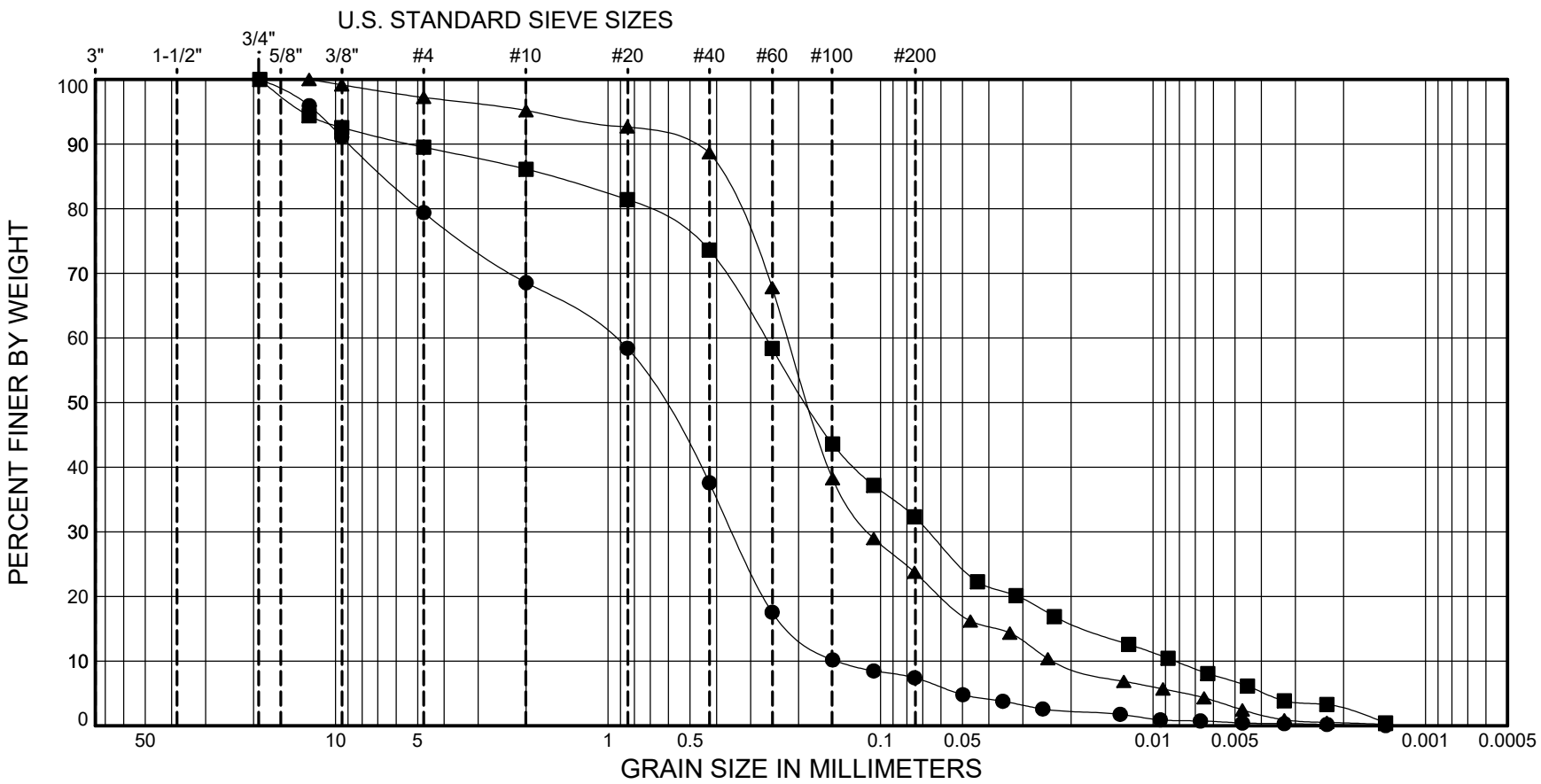
HWA GeoSciences Inc.

Mukilteo 5th Street
Bicycle and Pedestrian Improvements
Mukilteo, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-2

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-3	S-2	2.5 - 4.0	(SP-SM) Olive-brown, poorly graded SAND with silt and gravel	6				20.6	72.0	7.4
■	BH-3	S-3	5.0 - 6.5	(SM) Olive-gray, silty SAND	13				10.5	57.2	32.3
▲	BH-3	S-4	7.5 - 9.0	(SM) Olive-gray, silty SAND	19				2.8	73.5	23.7

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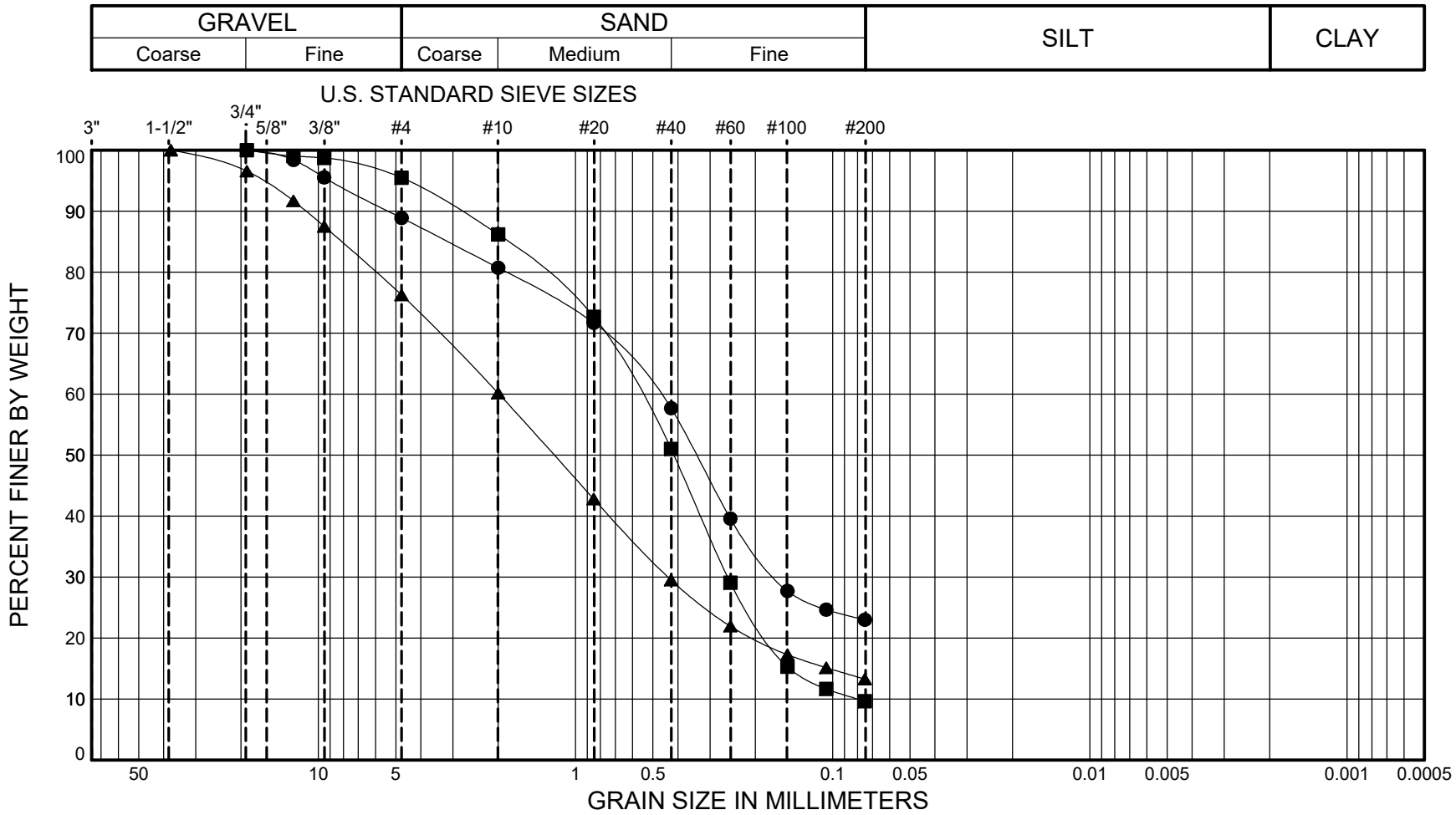
Mukilteo, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-3



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-4	S-1	3.0 - 4.5	(SM) Olive-brown, silty SAND	12				11.1	65.9	23.0
■	BH-4	S-2	5.0 - 6.5	(SW-SM) Olive-brown, well-graded SAND with silt	11				4.5	85.8	9.7
▲	BH-4	S-4	10.0 - 11.5	(SM) Dark grayish-brown, silty SAND with gravel	9				23.8	63.0	13.3

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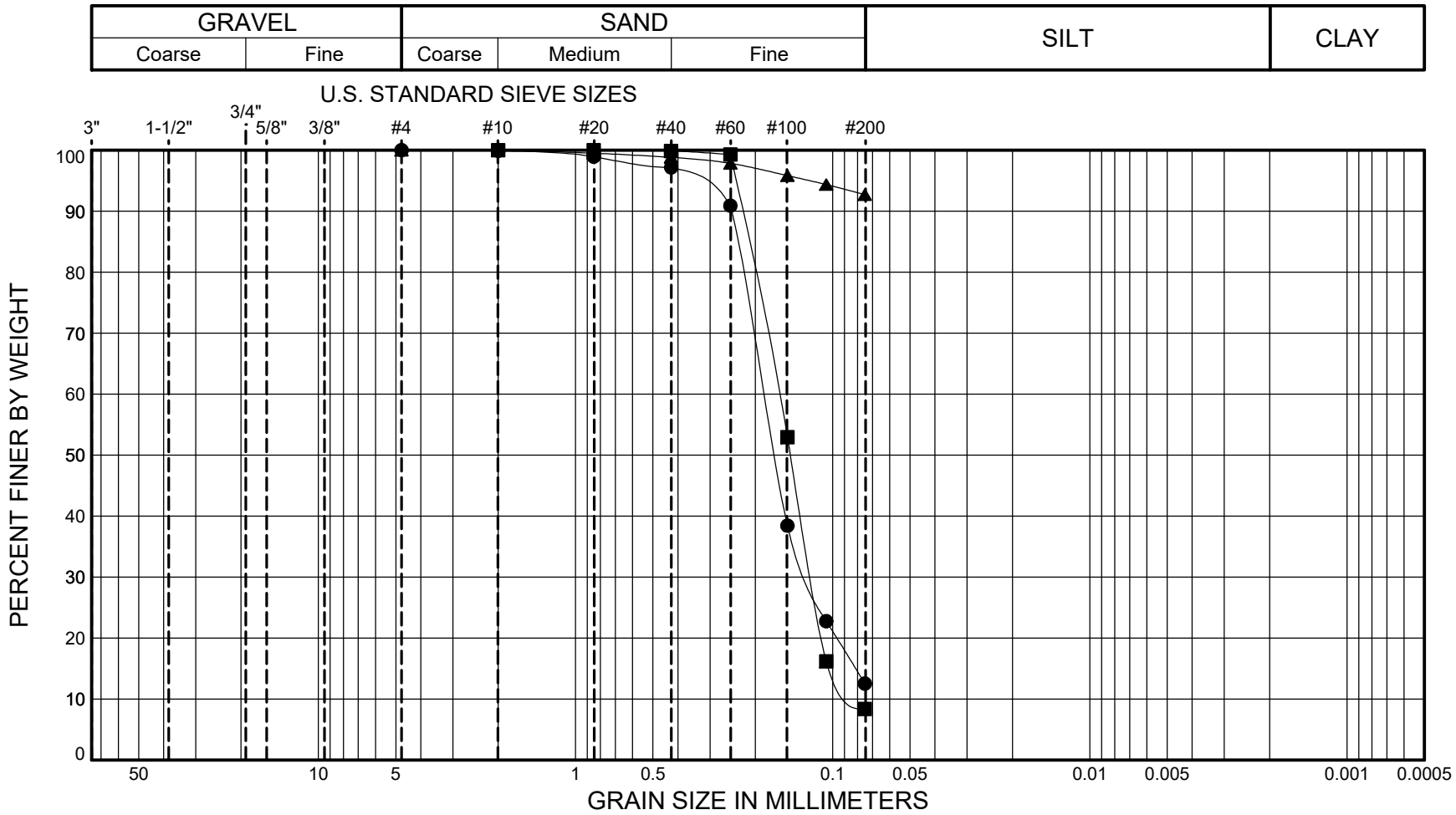
Mukilteo, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-4



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-5	S-2	2.5 - 4.0	(SM) Dark grayish-brown, silty SAND	23					87.5	12.5
■	BH-5	S-3	5.0 - 6.5	(SP-SM) Olive-brown, poorly graded SAND with silt	28					91.6	8.4
▲	BH-6	S-2	2.5 - 4.0	(ML) Olive-brown, SILT	28					7.3	92.7

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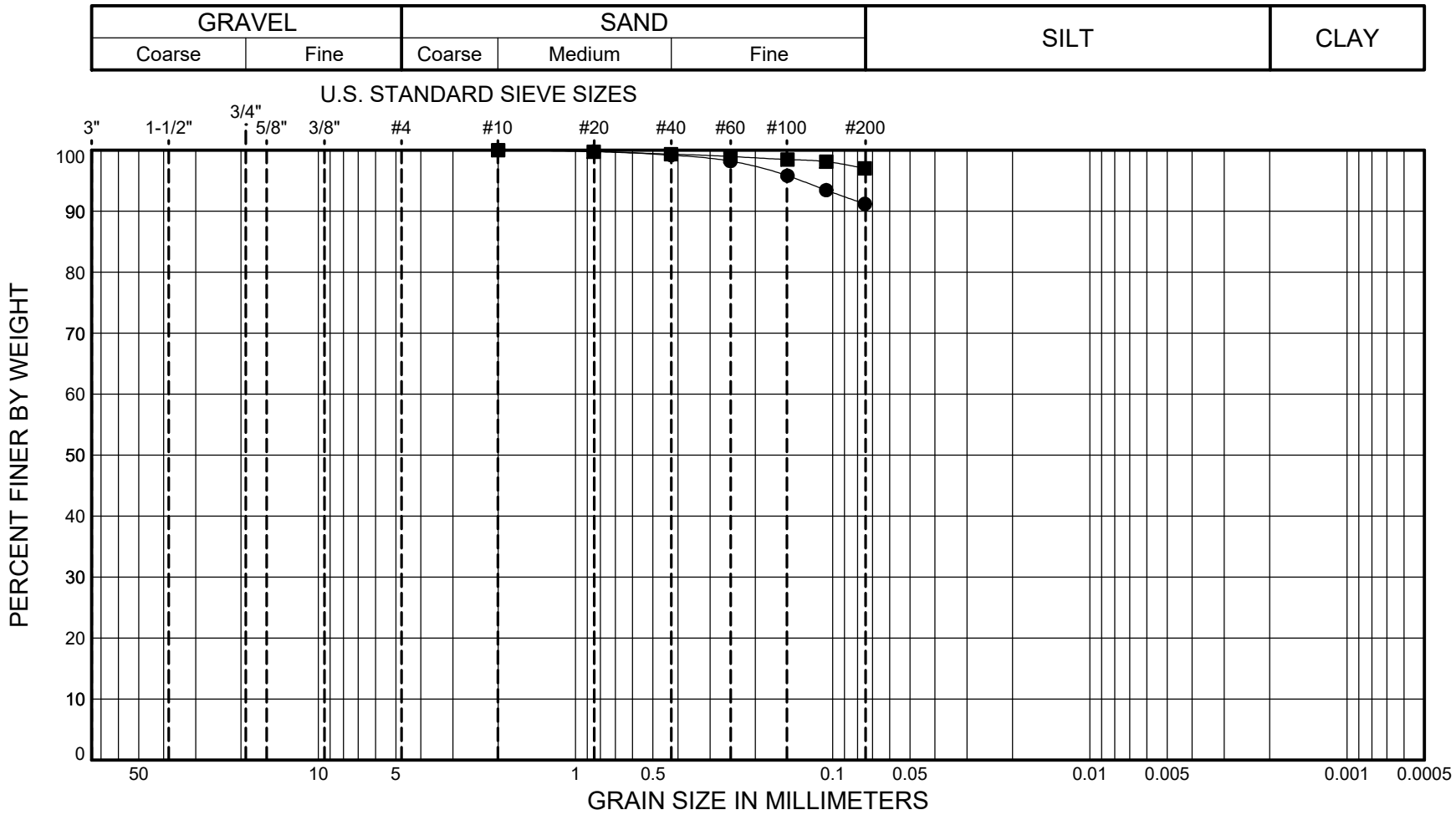
Mukilteo, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-5



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-6	S-3	5.0 - 6.5	(ML) Olive-brown, SILT	30					8.8	91.2
■	BH-6	S-5	10.0 - 11.5	(CL) Light olive-brown, lean CLAY	29					3.0	97.0

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PARTICLE-SIZE ANALYSIS
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METHOD ASTM D422

PROJECT NO.: 2020-144-21 FIGURE: B-6

April 2022

APPENDIX H PIPE SIZING CALCULATIONS

STORM SEWER DESIGN (English Units)

This spreadsheet accomplishes a storm sewer design using the rational method. Enter the data in the non-shaded areas only.
Please use one spreadsheet per stormsewer run.

Project Name:

Designed By: Enter Here
Project Office: Enter Here

m = 7.83 **n =** 0.582 **Design Storm Event =** 25-year **Pavement thickness (ft) =** 0 **Pipe Thickness (inches) =**

Location						Discharge						Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
CB T to 5-1	12464.23	12388.7	Roadway/Path	0.08	0.99	0.08	0.08	5.0	5.0	3.07	0.24	0.00	0.24	12	0.013	0.0075	3.92	3.08	VELOCITY OK	ADEQUATE PIPE CAPACITY	75	0.56	116.30	115.74	120.31	118.75	Need Pipe Thickness	Need Pipe Thickness			
5-1 to 4-4	12388.7	12256.95	Roadway/Path	0.18	0.99	0.18	0.25	5.0	5.0	3.07	0.78	0.00	0.78	12	0.013	0.0145	5.47	4.29	VELOCITY OK	ADEQUATE PIPE CAPACITY	121	1.76	115.74	113.98	118.75	117.01	Need Pipe Thickness	Need Pipe Thickness			
4-4 to 4-5	12256.95	12248.73	Roadway/Path	0.33	0.99	0.32	0.58	5.0	5.0	3.07	1.77	0.00	1.77	12	0.013	0.0340	8.36	6.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	20	0.68	113.98	113.30	117.01	115.94	Need Pipe Thickness	Need Pipe Thickness			

See WSDOT Hydraulic Manual 6-5 for explanation of columns. https://www.wsdot.wa.gov/Publications/Manuals/M23-03.htm

This spreadsheet was updated on 11/4/2019.

Notes:

Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
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For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-12.3
Please specify the largest pipe thickness of the storm sewer run being analyzed.

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Designed By: Enter Here
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Location			Discharge									Drain Design								Drain Profile						Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
4-10 to 4-11	12010.62	11999.89	Roadway/Path	0.04	0.99	0.04	0.04	5.0	5.0	3.07	0.11	0.00	0.11	12	0.013	0.0054	3.33	2.61	VELOCITY OK	ADEQUATE PIPE CAPACITY	26	0.14	109.08	108.94	112.79	113.17	Need Pipe Thickness	Need Pipe Thickness			
4-11 to 4-12	11999.89	11977.49	Roadway/Path	0.03	0.99	0.03	0.07	5.0	5.1	3.02	0.21	0.00	0.21	12	0.013	0.0100	4.54	3.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	12	0.12	109.20	109.08	112.32	112.79	Need Pipe Thickness	Need Pipe Thickness			

See WSDOT Hydraulic Manual 6-5 for explanation of columns. https://www.wsdot.wa.gov/Publications/Manuals/M23-03.htm

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Designed By: Enter Here
Project Office: Enter Here

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Location						Discharge						Drain Design									Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
4-7 to 4-8	12144.96	12144.84	Roadway/Path	0.06	0.99	0.06	0.06	5.0	5.0	3.07	0.18	0.00	0.18	12	0.013	0.0073	3.87	3.04	VELOCITY OK	ADEQUATE PIPE CAPACITY	11	0.08	112.24	112.16	115.53	116.54	Need Pipe Thickness	Need Pipe Thickness			
4-8 to 4-9	12144.84	12046.58	Roadway/Path	0.06	0.99	0.06	0.12	5.0	5.0	3.07	0.36	0.00	0.36	12	0.013	0.0160	5.74	4.50	VELOCITY OK	ADEQUATE PIPE CAPACITY	98	1.57	112.16	110.59	116.54	113.65	Need Pipe Thickness	Need Pipe Thickness			
4-9 to 4-10	12046.58	12010.62	Roadway/Path	0.15	0.99	0.15	0.27	5.0	5.0	3.07	0.81	0.00	0.81	12	0.013	0.0156	5.66	4.44	VELOCITY OK	ADEQUATE PIPE CAPACITY	36	0.56	110.59	110.03	113.65	113.17	Need Pipe Thickness	Need Pipe Thickness			
4-10 to 4-13	12010.62	11894.74	Roadway/Path	0.20	0.99	0.20	0.46	5.0	5.1	3.03	1.40	0.00	1.40	12	0.013	0.0099	4.52	3.54	VELOCITY OK	ADEQUATE PIPE CAPACITY	117	1.16	108.94	107.78	113.17	111.18	Need Pipe Thickness	Need Pipe Thickness			
4-13 to CB L	11894.74	11774.64	Roadway/Path	0.20	0.99	0.20	0.66	5.0	5.5	2.89	1.92	0.00	1.92	12	0.013	0.0156	5.66	4.44	VELOCITY OK	ADEQUATE PIPE CAPACITY	120	1.87	107.78	105.91	111.18	108.10	Need Pipe Thickness	Need Pipe Thickness			

See WSDOT Hydraulic Manual 6-5 for explanation of columns. https://www.wsdot.wa.gov/Publications/Manuals/M23-03.htm

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STORM SEWER DESIGN (English Units)

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Please use one spreadsheet per stormsewer run.

Project Name:

Designed By: Enter Here
Project Office: Enter Here

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Location						Discharge							Drain Design							Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
C1-4	10822.91	10840.64	Roadway/Path	0.01	0.99	0.01	0.01	5.0	5.0	3.07	0.02	0.00	0.02	8	0.013	0.0153	4.28	1.49	VELOCITY OK	ADEQUATE PIPE CAPACITY	17	0.26	112.68	112.42	112.63	112.37	Need Pipe Thickness	Need Pipe Thickness			

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Location						Discharge							Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
C1-3	10522.2	10840.64	Roadway/Path	0.12	0.99	0.12	0.12	5.0	5.0	3.07	0.36	0.00	0.36	12	0.013	0.0200	6.41	5.03	VELOCITY OK	ADEQUATE PIPE CAPACITY	24	0.48	112.76	112.28	112.76	112.26	Need Pipe Thickness	Need Pipe Thickness			

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Designed By: Enter Here
Project Office: Enter Here

m = 7.83 **n =** 0.582 **Design Storm Event =** 25-year **Pavement thickness (ft) =** 0 **Pipe Thickness (inches) =**

Location			Discharge										Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
C1-2	10452.74	10471.23	Roadway/Path	0.07	0.99	0.07	0.07	5.0	5.0	3.07	0.22	0.00	0.22	12	0.013	0.0106	4.66	3.66	VELOCITY OK	ADEQUATE PIPE CAPACITY	18	0.19	113.47	113.28	115.56	115.98	Need Pipe Thickness	Need Pipe Thickness			

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This spreadsheet was updated on 11/4/2019.

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Project Office: Enter Here

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Location			Discharge										Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
C1-1	10388.84	10405.97	Roadway/Path	0.02	0.99	0.02	0.02	5.0	5.0	3.07	0.06	0.00	0.06	12	0.013	0.0212	6.60	5.18	VELOCITY OK	ADEQUATE PIPE CAPACITY	17	0.36	114.29	113.93	115.31	115.77	Need Pipe Thickness	Need Pipe Thickness			

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Location						Discharge						Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
CB F to 3-3	11209.24	11360	Roadway/Path	0.05	0.99	0.05	0.05	5.0	5.0	3.07	0.15	0.00	0.15	12	0.013	0.0050	3.22	2.52	VELOCITY OK	ADEQUATE PIPE CAPACITY	151	0.76	103.61	102.85	107.01	105.09	Need Pipe Thickness	Need Pipe Thickness			
3-3 to 3-4	11360	11489.8	Roadway/Path	0.14	0.99	0.14	0.19	5.0	5.0	3.07	0.58	0.00	0.58	12	0.013	0.0048	3.13	2.46	VELOCITY OK	ADEQUATE PIPE CAPACITY	130	0.62	102.85	102.23	105.09	104.65	Need Pipe Thickness	Need Pipe Thickness			
3-4 to 3-5	11489.8	11634.4	Roadway/Path	0.29	0.99	0.29	0.48	5.0	5.0	3.07	1.46	0.00	1.46	12	0.013	0.0052	3.26	2.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	145	0.75	102.23	101.48	104.65	105.51	Need Pipe Thickness	Need Pipe Thickness			
3-5 to 3-8	11634.4	11712.87	Roadway/Path	0.46	0.99	0.46	0.93	5.0	5.7	2.83	2.64	0.00	2.64	15	0.013	0.0049	3.70	4.53	VELOCITY OK	ADEQUATE PIPE CAPACITY	79	0.39	101.48	101.09	105.51	106.54	Need Pipe Thickness	Need Pipe Thickness			
3-8 to CB J	11712.87	11712.91	Roadway/Path	1.00	0.99	0.99	1.92	5.0	5.0	3.07	5.89	0.00	5.89	18	0.013	0.0064	4.77	8.42	VELOCITY OK	ADEQUATE PIPE CAPACITY	59	0.38	100.40	100.02			Need Pipe Thickness	Need Pipe Thickness			
												0.00																		

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Project Office: Enter Here

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Location						Discharge						Drain Design								Drain Profile								Remarks
Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
3-1 to 3-2	11158.84	11158.84	Roadway/Path	0.29	0.99	0.29	0.29	5.0	5.0	3.07	0.88	0.00	0.88	12	0.013	0.0200	6.41	5.03	VELOCITY OK	ADEQUATE PIPE CAPACITY	13	0.26	105.50	105.24	108.88	109.40	Need Pipe Thickness	Need Pipe Thickness			
3-2 to 3-6	11158.84	11158.56	Roadway/Path	0.42	0.99	0.42	0.70	5.0	5.0	3.07	2.16	0.00	2.16	12	0.013	0.0076	3.94	3.09	VELOCITY OK	ADEQUATE PIPE CAPACITY	86	0.65	98.42	97.77	109.40	101.80	Need Pipe Thickness	Need Pipe Thickness			
3-6 to CB E	11158.56	11156.44	Roadway/Path	0.43	0.99	0.43	1.13	5.0	5.4	2.95	3.32	0.00	3.32	12	0.013	0.0115	4.86	3.81	VELOCITY OK	ADEQUATE PIPE CAPACITY	74	0.85	97.77	96.92	101.80	98.76	Need Pipe Thickness	Need Pipe Thickness			

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1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14	14a	15	16	17	17a	17b	18	19	20	21	22	23	24	25	26	27	24
2-5 to WQ2-1	10983.57	10983.57	Roadway/Path	0.14	0.99	0.14	0.14	5.0	5.0	3.07	0.43	0.00	0.43	12	0.013	0.0293	7.76	6.09	VELOCITY OK	ADEQUATE PIPE CAPACITY	29	0.85	107.26	106.41	110.08	112.91	Need Pipe Thickness	Need Pipe Thickness			

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1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
2-1 to 2-2	10788.35	10878.09	Roadway/Path	0.07	0.99	0.07	0.07	5.0	5.0	3.07	0.22	0.00	0.22	12	0.013	0.0050	3.21	2.52	VELOCITY OK	ADEQUATE PIPE CAPACITY	90	0.45	109.22	108.77	114.03	113.42	Need Pipe Thickness	Need Pipe Thickness			
2-2 to 2-3	10878.09	11006.95	Roadway/Path	0.13	0.99	0.12	0.20	5.0	5.0	3.07	0.60	0.00	0.60	12	0.013	0.0062	3.56	2.79	VELOCITY OK	ADEQUATE PIPE CAPACITY	104	0.64	108.77	108.13	113.42	111.79	Need Pipe Thickness	Need Pipe Thickness			
2-3 to MWS	10981.95	10981.95	Roadway/Path	0.32	0.99	0.32	0.51	5.0	5.0	3.07	1.57	0.00	1.57	12	0.013	0.0104	4.62	3.63	VELOCITY OK	ADEQUATE PIPE CAPACITY	26	0.27	104.77	104.50	112.15	112.91	Need Pipe Thickness	Need Pipe Thickness			
MWS to 2-4	10981.95	10995.29	Roadway/Path	0.45	0.99	0.45	0.96	5.0	5.1	3.04	2.91	0.00	2.91	18	0.013	0.0064	4.76	8.41	VELOCITY OK	ADEQUATE PIPE CAPACITY	14	0.09	104.25	104.16	112.35	112.09	Need Pipe Thickness	Need Pipe Thickness			
2-4 to FC2-1	10995.29	10995.29	Roadway/Path	0.45	0.99	0.45	1.40	5.0	5.1	3.02	4.24	0.00	4.24	12	0.013	0.0240	7.03	5.51	VELOCITY OK	ADEQUATE PIPE CAPACITY	5	0.12	104.16	104.04	112.09	112.19	Need Pipe Thickness	Need Pipe Thickness			
FC 2-1 to 3-2	11153.46	11158.36	Roadway/Path	0.45	0.99	0.45	1.85	5.0	5.2	3.01	5.57	0.00	5.57	18	0.013	0.0060	4.60	8.13	VELOCITY OK	ADEQUATE PIPE CAPACITY	5	0.03	98.45	98.42	109.50	105.50	Need Pipe Thickness	Need Pipe Thickness			

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Drain Located On	From Sta.	To Sta.	Source of Drainage	Drainage Area A (acre)	Runoff Coeff. C	CA (acre)	Sum CA (acre)	T, Across Area (minutes)	Total Tc = Col. 8a + Tc across pipe length (minutes)	Rainfall Intensity (in/hr)	Runoff (cfs)	Contrib. Inflow (cfs)	Total Flow (cfs)	Pipe Dia. (in)	Manning roughness coefficient "n"	Pipe Slope (ft/ft)	Velocity Of Flow (ft/s)	Pipe Capacity (cfs)	Pipe Velocity Check (Desirable Minimum 3 ft/sec; Desirable Maximum 10 ft/sec for Column 16)	Pipe Capacity Check (Column 13 vs. Column 17)	Pipe Length*** (ft)	Elevation Change (ft)	Upstr. Invert Elev. (ft)	Downstr. Invert Elev. (ft)	Upstr. Ground Elev. (ft)	Downstr. Ground Elev. (ft)	Upstr. Pipe Cover (ft)	Downstr. Pipe Cover (ft)	Upstr. Pipe Cover Check (ft)	Downstr. Pipe Cover Check (ft)	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*8a*	*9*	*10*	*11*	*12*	*13*	*14*	*14a*	*15*	*16*	*17*	*17a*	*17b*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*24*
1-1 TO 1-2	10409.63	10486.57	Roadway/Path	0.08	0.99	0.08	0.08	5.0	5.0	3.07	0.24	0.00	0.24	12	0.013	0.0100	4.54	3.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	77	0.77	113.54	112.77	116.80	116.28	Need Pipe Thickness	Need Pipe Thickness			
1-2 TO 1-3	10486.57	10486.43	Roadway/Path	0.13	0.99	0.13	0.20	5.0	5.0	3.07	0.63	0.00	0.63	12	0.013	0.0100	4.54	3.56	VELOCITY OK	ADEQUATE PIPE CAPACITY	7	0.07	112.77	112.70	116.28	116.37	Need Pipe Thickness	Need Pipe Thickness			
1-3 to EX A	10486.43	10498.94	Roadway/Path	0.13	0.99	0.13	0.33	5.0	5.0	3.06	1.02	0.00	1.02	12	0.013	0.0092	4.36	3.42	VELOCITY OK	ADEQUATE PIPE CAPACITY	13	0.12	112.70	112.58	116.37	116.69	Need Pipe Thickness	Need Pipe Thickness			

See WSDOT Hydraulic Manual 6-5 for explanation of columns. https://www.wsdot.wa.gov/Publications/Manuals/M23-03.htm

This spreadsheet was updated on 11/4/2019.

Notes:

Column 12 represents inflow from a storm sewer line, branch, an offsite source that flows into the trunk line being analyzed.
The conservative assumption is that the flow enters the storm sewer run at the upstream end of the run being analyzed.

For pipe cover calculation, Pipe cover = (Ground or Rim Elevation - Pipe invert elevation) - (pavement thickness) - (top of pipe thickness) - (pipe diameter).
The pipe thickness is based on the pipe diameter per WSDOT Manual Concrete for Shallow Pipe Cover Installations Fill Height Table 8-12.3
Please specify the largest pipe thickness of the storm sewer run being analyzed.

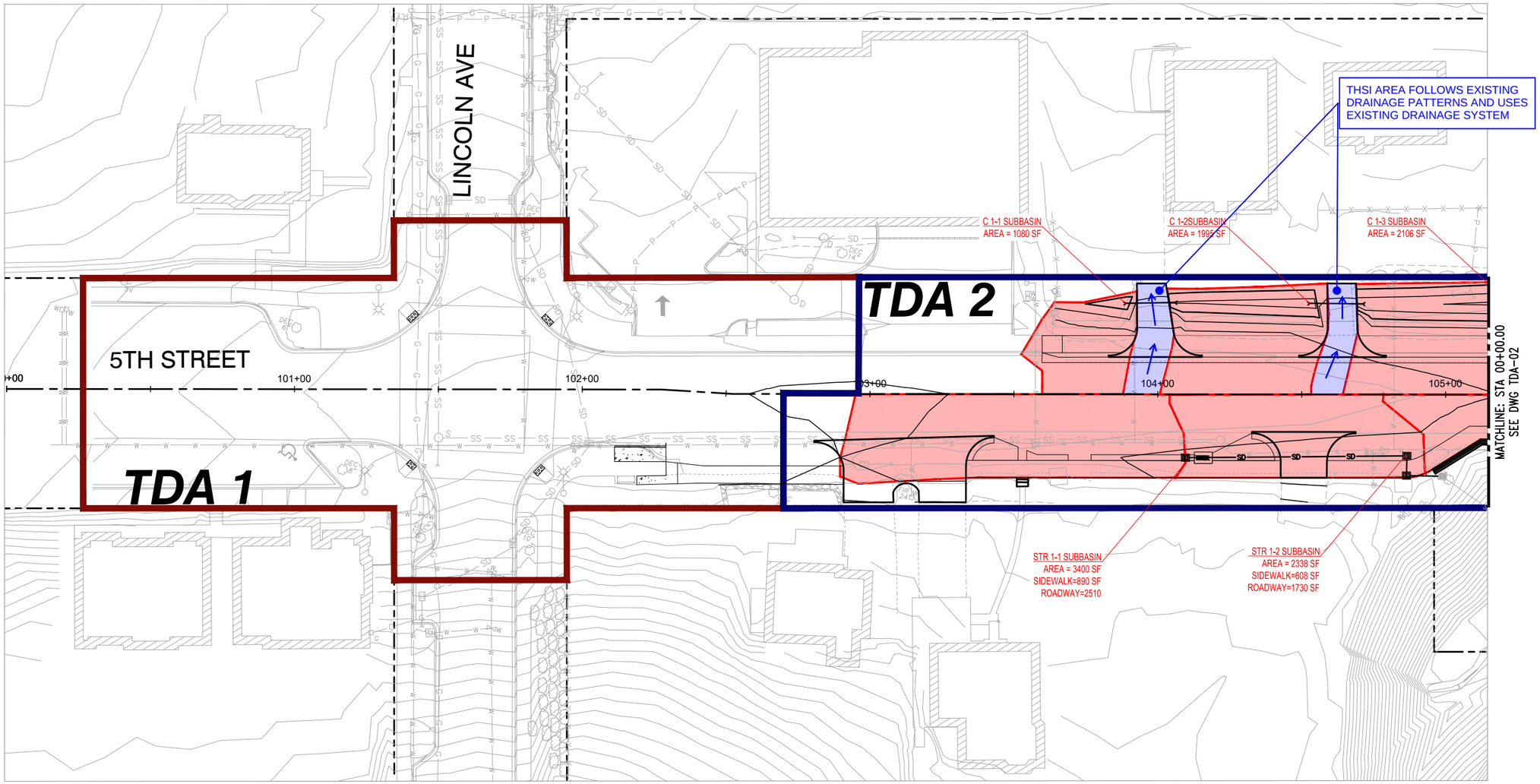
The spreadsheet will only calculate one storm sewer line at a time. Please copy the "Blank Template" and use this for calculating new storm sewer lines.
If analyzing complicated stormsewer system with multiple lateral lines to the trunk line, it is recommended that Stormshed be used to model the conveyance system. Please contact your Region Hydraulics Engineer.

WARNING: START YOUR STORMSEWER RUN ON ROW 12. DO NOT SKIP ANY ROWS IN BETWEEN. USE ONE SHEET PER STORMSEWER RUN

Please report any problems to the WSDOT HQ Hydraulics Section.

APPENDIX I INLET SPACING/SPREAD CALCULATIONS

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
J O B No. : 2000722

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

S C A L E: 1" = 20'

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MUKILTEO, WA

SHT. 02 OF 124

PROPOSED SUBBASIN MAP

TDA01

Oct 28, 2022 - 2:49pm christineh C:\Temp\AcPublish_19508\M5TH_ProposedSubbasins.dwg

S4 T28N R4E W.M.

THSI AREA FOLLOWS EXISTING DRAINAGE PATTERNS AND USES EXISTING DRAINAGE SYSTEM (TYP)

C 1-4 SUBBASIN
AREA = 2592 SF

STR 2-5 SUBBASIN
AREA = 6211 SF

TDA 3

TDA 2

SEE DWG TDA-01
MATCHLINE: STA 00+00.00

MATCHLINE: STA 00+00.00
SEE DWG TDA-03

106+00 107+00 108+00 109+00 110+00 111+00

STR 2-1 SUBBASIN
AREA = 3117 SF
SIDEWALK = 553 SF
ROADWAY = 2464 SF

STR 2-2 SUBBASIN
AREA = 2374 SF
SIDEWALK = 611 SF
ROADWAY=1763 SF

STR 2-3 SUBBASIN
AREA = 2738 SF
SIDEWALK = 734 SF
ROADWAY = 2004 SF

PARK AVE

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
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DATE 08/2022
JOB No. :2000722

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PROPOSED DITCH SUBBASIN MAP

TDA02

C:\Temp\AcPublish_19508\MSTH_ProposedSubbasins.dwg
chrisl.neh
Oct 28, 2022 - 2:40pm

S4 T28N R4E W.M.

LOVELAND AVE

E SUBBASIN
REA = 480 SF

STR 3-6 SUBBASIN
AREA = 5790 SF

THIS AREA GOES FOLLOWS
EXISTING DRAINAGE PATTERNS
AND USES EXISTING SYSTEM

SEE DWG TDA-02
MATCHLINE: STA 00+00.00

MATCHLINE: STA 00+00.00
SEE DWG TDA-04

112+00
113+00
114+00
115+00
116+00
117+00

TDA 3

EXIST CB F SUBBASIN
AREA = 538 SF

EXIST SUBBASIN
AREA = 1654 SF

STR 3-1SUBBASIN
AREA = 5593 SF
SIDEWALK=1236 SF
ROADWAY=4357 SF

STR 3-3 SUBBASIN
AREA = 4086 SF
SIDEWALK=1366 SF
ROADWAY=2720 SF

STR 3-4 SUBBASIN LT
AREA = 2870 SF
SIDEWALK=1044 SF
ROADWAY=1826 SF

STR 3-4 SUBBASIN RT
AREA = 3335 SF
SIDEWALK=1290 SF
ROADWAY=2045 SF

STR 3-5 SUBBASIN
AREA = 7430 SF
SIDEWALK=2220 SF
ROADWAY=5210 SF

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

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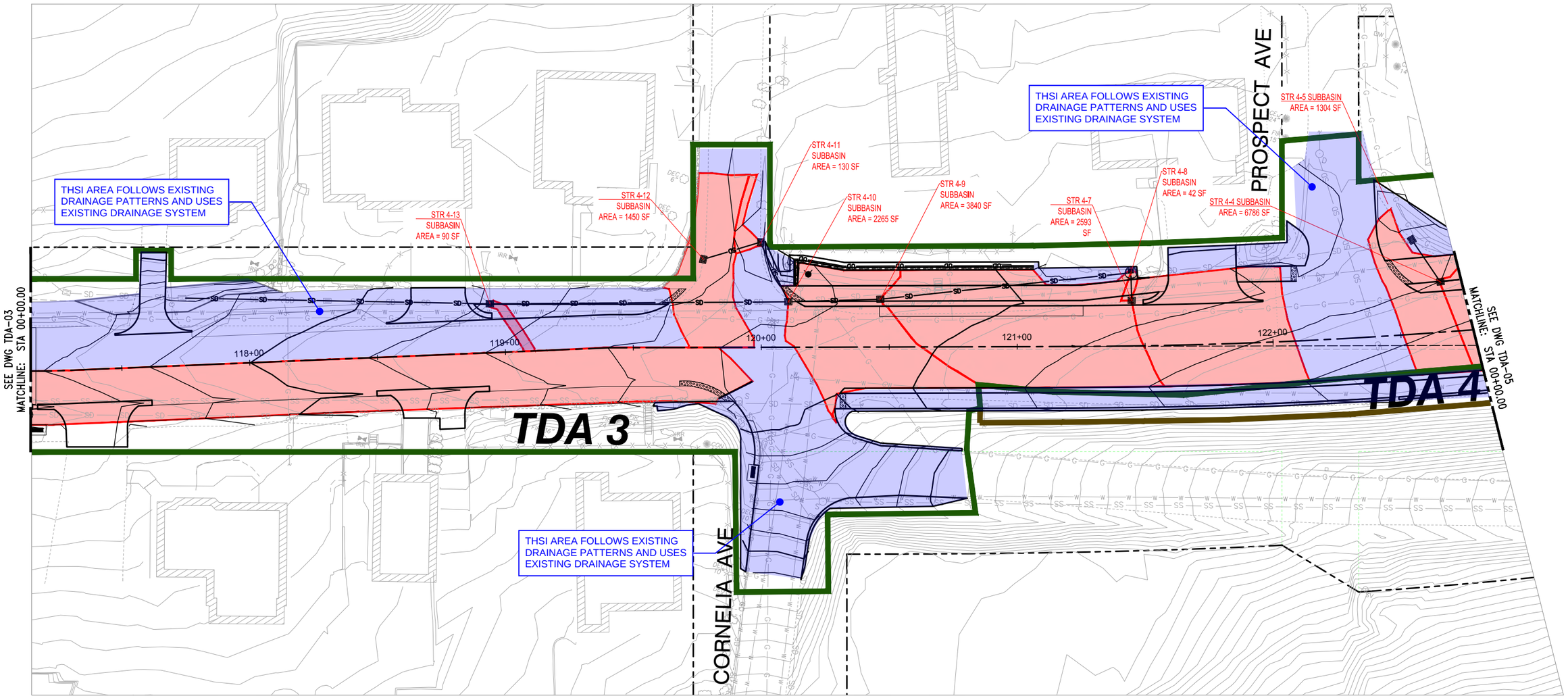
SHT. 04 OF 124

INDIVIDUAL TDA BASIN MAPS

TDA03

C:\Temp\AcPublish_19508\MSTH_ProposedSubbasins.dwg
chrisl.neh
Oct 28, 2022 - 2:40pm

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

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J O B No. :2000722

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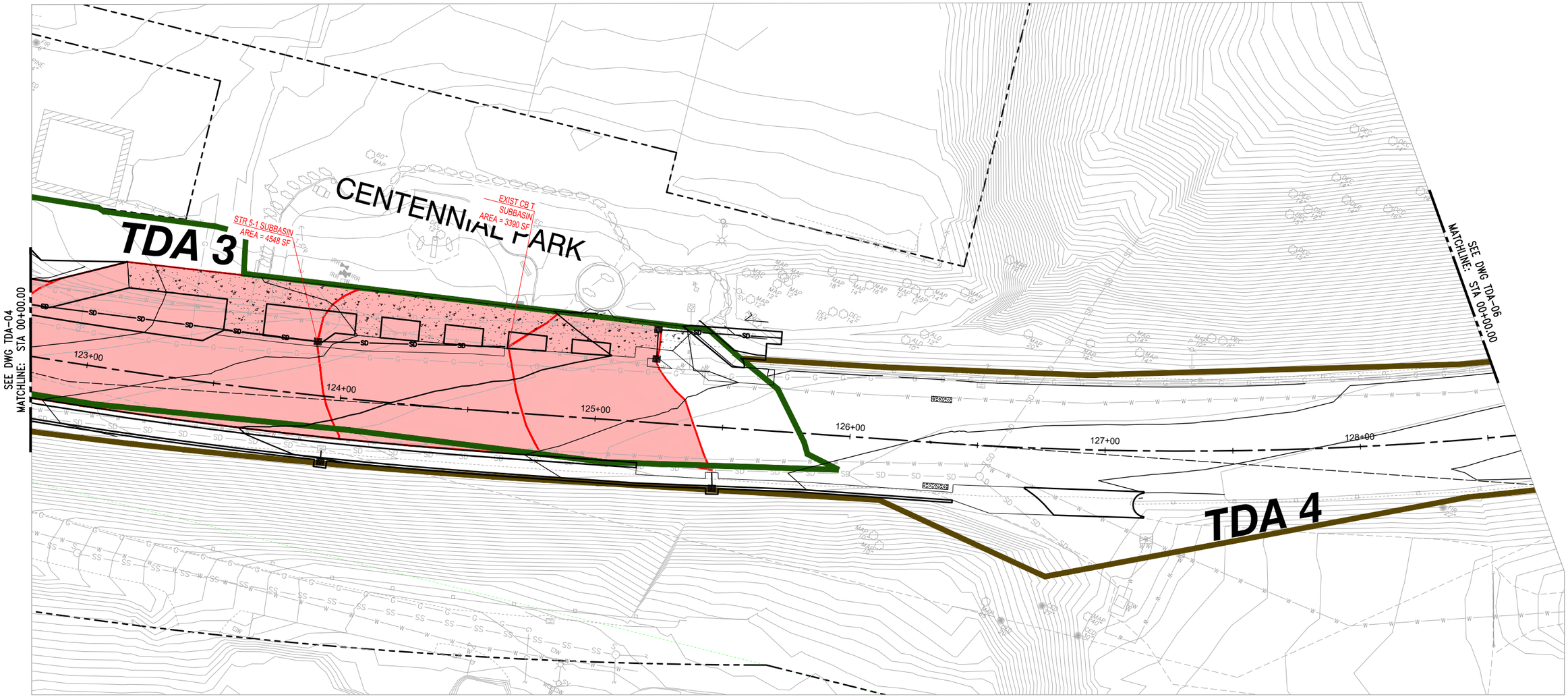
INDIVIDUAL TDA BASIN MAPS

TDA04

C:\Temp\AcPublish_19508\MSTH_ProposedSubbasins.dwg
chrisisneh
Oct 28, 2022 - 2:40pm

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

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INDIVIDUAL TDA BASIN MAPS

TDA05

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christineh
Oct 28, 2022 - 2:40pm

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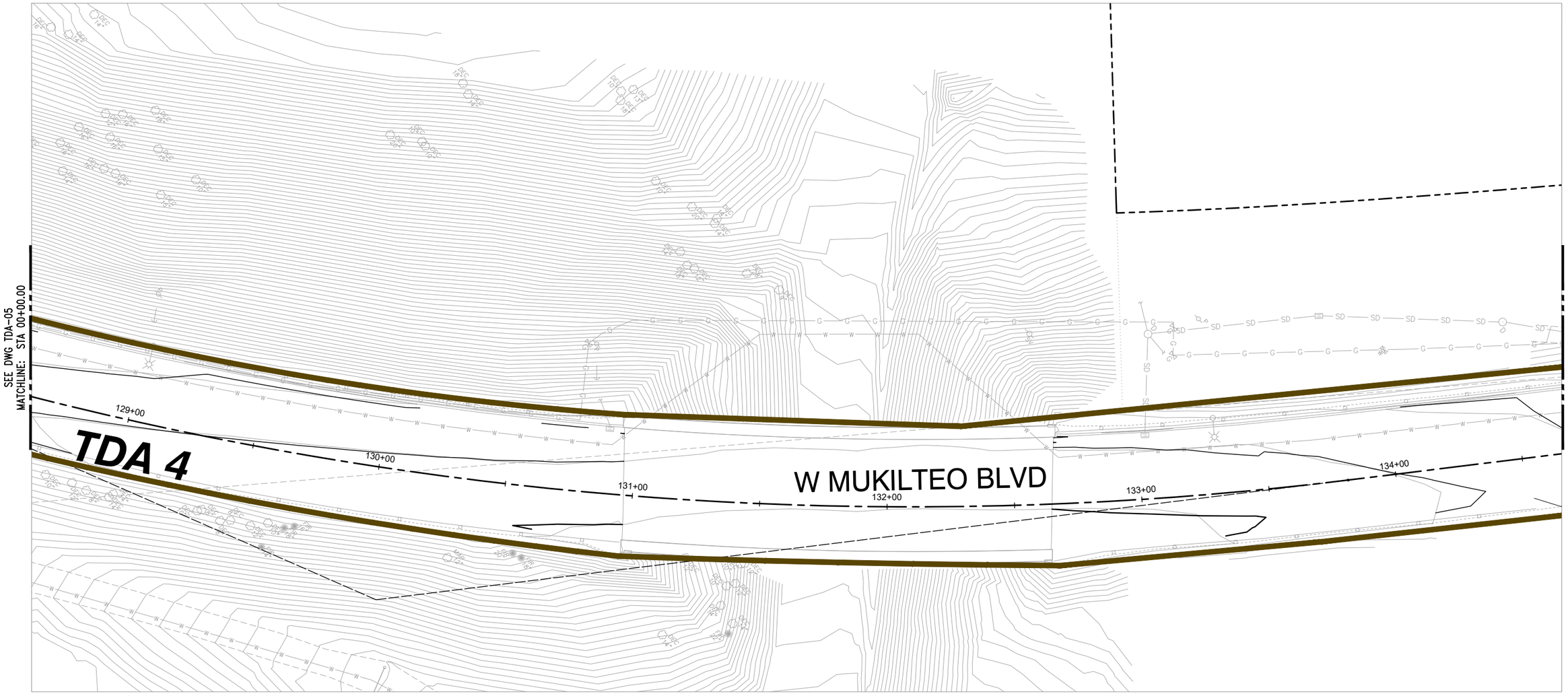

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

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INDIVIDUAL TDA BASIN MAPS

TDA06

Oct 28, 2022 - 2:40pm
chrisl.weh
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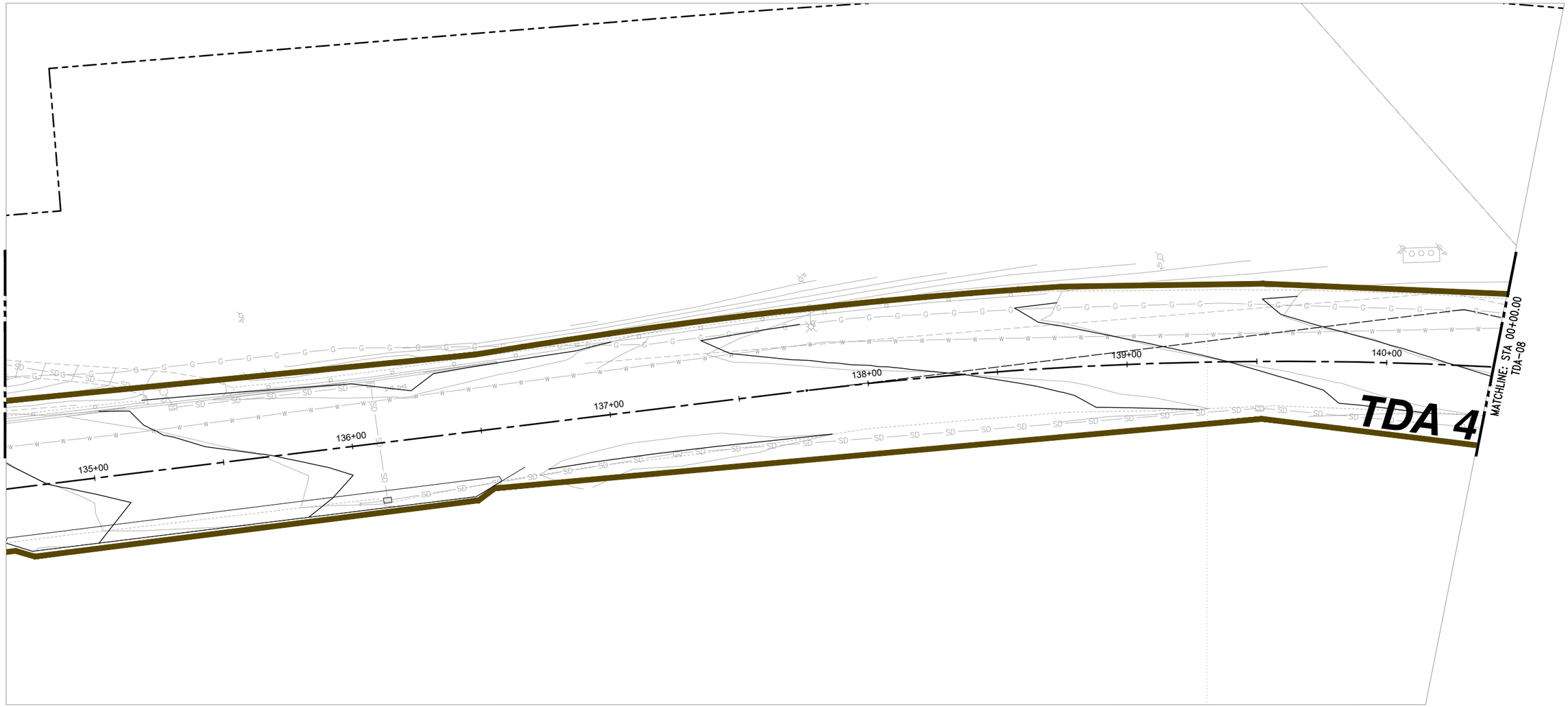
S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

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INDIVIDUAL TDA BASIN MAPS

TDA07

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chrisl.neh
Oct 28, 2022 - 2:40pm

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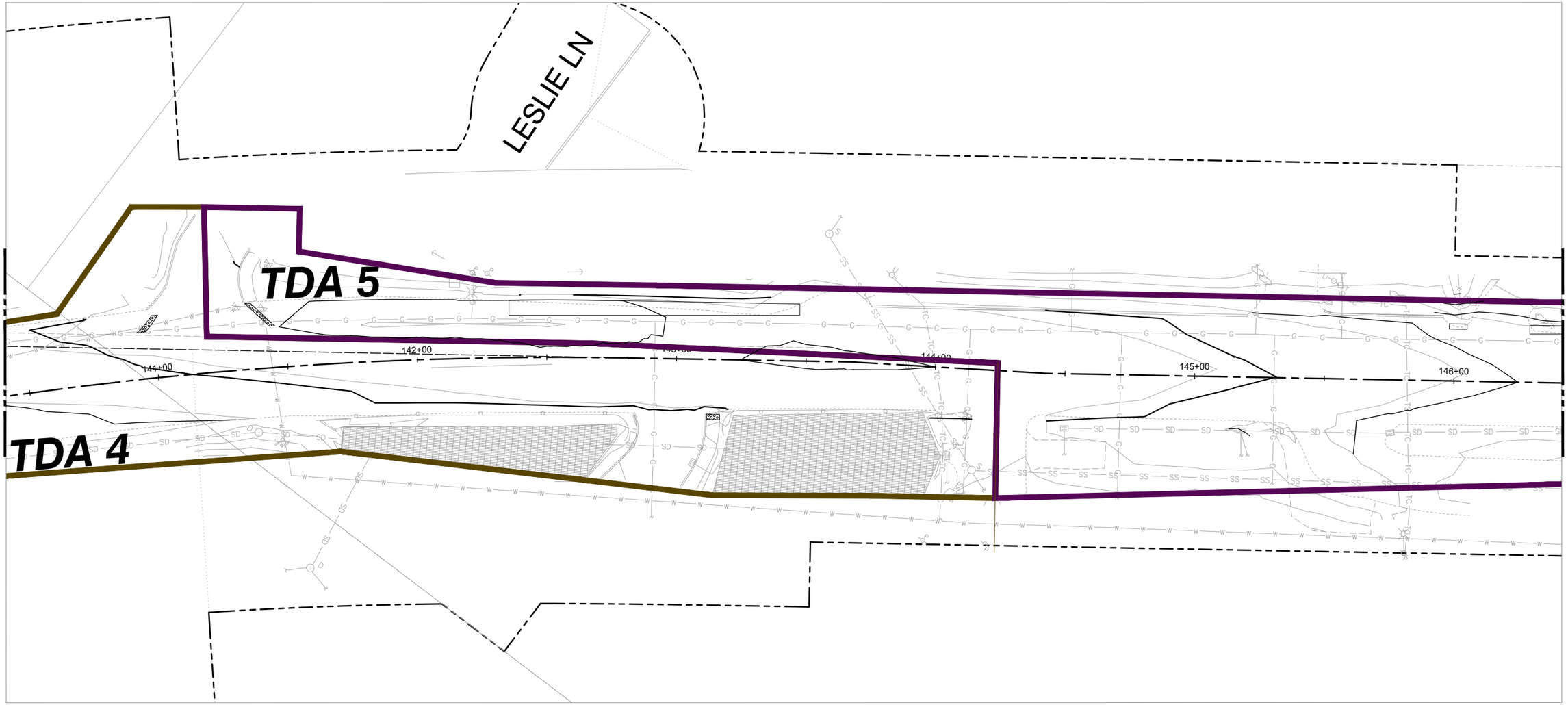

LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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CHECKED BY JMM | APPROVED BY JGM
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INDIVIDUAL TDA BASIN MAPS

TDA08

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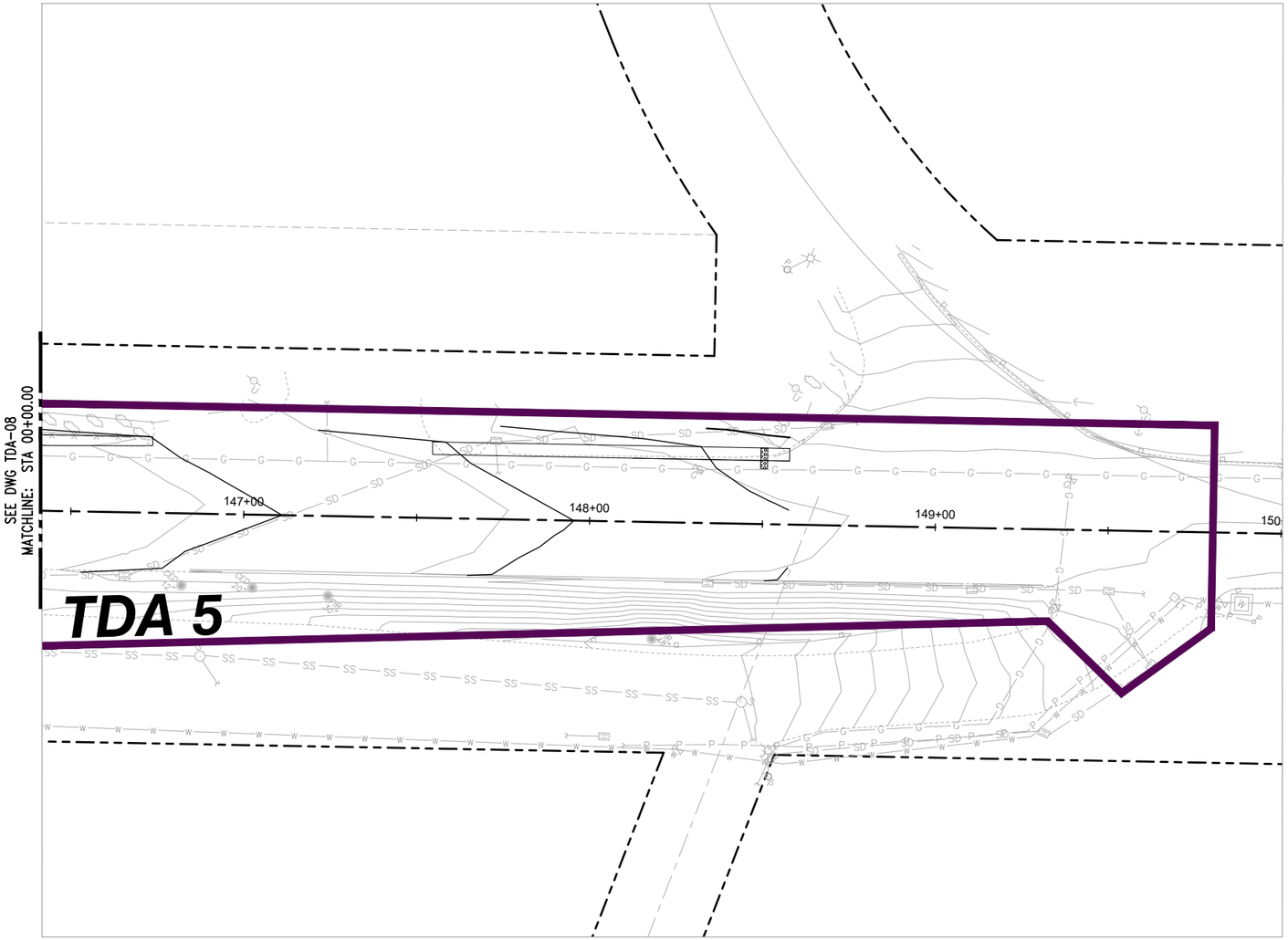
christineh
Oct 28, 2022 - 2:40pm

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- PROPOSED SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

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INDIVIDUAL TDA BASIN MAPS

TDA09

Oct 28, 2022 - 2:40pm christineh C:\Temp\AcPublish_19508\MSTH_ProposedSubbasins.dwg

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the roadway.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity to Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_i (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
STR 1-1	102+90.00 104+09.63	119.63	21.00	2,510.00	0.18	0.18	0.010	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	10.00	15.50	3.77	0.90	0.016	1.23	0.79	4.60	1.00	0.31	0.86	0.15	0.03	Zd Allowable > Zd Design		
STR1-2	104+09.63 104+86.57	76.94	21.00	1,730.00	0.12	0.15	0.007	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	9.00	14.50	3.76	0.90	0.016	1.03	0.79	4.60	1.00	0.39	0.87	0.13	0.02	Zd Allowable > Zd Design	Qbp < 0.1 CFS	

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the sidewalk.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity to Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_i (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
STR 1-1	102+90.00 104+09.63	119.63	6.00	890.00	0.06	0.06	0.010	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.55	0.61	0.016	0.95	0.94	4.60	1.00	0.42	0.97	0.06	0.00	Zd Allowable > Zd Design		
STR1-2	104+86.57	76.94	6.00	608.00	0.04	0.04	0.007	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.41	0.58	0.016	0.76	0.96	4.60	1.00	0.52	0.98	0.04	0.00	Zd Allowable > Zd Design	Qbp < 0.1 CFS	

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the roadway.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs (cfs)	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity fo Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_s (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
	106+87.81																															
STR 2-1	107+88.35	100.54	19.00	2,464.00	0.17	0.17	0.012	0.039	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	8.00	13.50	2.38	1.11	0.016	1.55	0.96	4.60	1.00	0.37	0.97	0.17	0.00	Zd Allowable > Zd Design		
STR 2-2	108+78.09	89.74	19.00	1,763.00	0.12	0.13	0.008	0.033	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	8.00	13.50	2.55	1.01	0.016	1.18	0.94	4.60	1.00	0.45	0.97	0.12	0.00	Zd Allowable > Zd Design		
STR 2-3	109+81.95	103.86	19.00	2,487.00	0.17	0.18	0.014	0.034	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	8.00	13.50	2.55	1.04	0.016	1.60	0.94	4.60	1.00	0.33	0.96	0.17	0.01	Zd Allowable > Zd Design		
STR 3-1	111+55.00	173.05	15.00	3,860.00	0.27	0.28	0.010	0.040	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	4.00	9.50	2.90	1.39	0.016	1.64	0.90	4.60	1.00	0.35	0.93	0.26	0.02	Zd Allowable > Zd Design	Qbp < 0.1 CFS	

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the sidewalk.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs (cfs)	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity fo Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_s (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
	106+87.81																															
STR 2-1		100.54		553.00	0.04	0.04	0.012	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.07	0.50	0.016	0.90	0.99	4.60	1.00	0.44	0.99	0.04	0.00	Zd Allowable > Zd Design		
	107+88.35		6.00																													
STR 2-2		89.74		611.00	0.04	0.04	0.008	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.32	0.56	0.016	0.79	0.97	4.60	1.00	0.50	0.98	0.04	0.00	Zd Allowable > Zd Design		
	108+78.09		6.00																													
STR 2-3		128.86		904.00	0.06	0.06	0.014	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.42	0.58	0.016	1.08	0.96	4.60	1.00	0.36	0.97	0.06	0.00	Zd Allowable > Zd Design		
	110+06.95		6.00																													
STR 3-1		151.89		1,066.00	0.07	0.08	0.010	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Interstate, Principal, Minor Arterial, or Divided	Enter Speed (mph) ---------->	25	Shoulder + 2 feet	4.00	2.00	4.00	2.76	0.66	0.016	1.00	0.92	4.60	1.00	0.40	0.95	0.07	0.00	Zd Allowable > Zd Design	Qbp < 0.1 CFS	
	111+58.84		6.00																													

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the roadway.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs (cfs)	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity fo Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_i (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
	112+09.24																															
STR 3-3	113+60.00	150.76	13.00	4,912.00	0.34	0.34	0.010	0.050	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	2.00	7.50	2.73	1.64	0.016	1.83	0.92	4.60	1.00	0.36	0.95	0.32	0.02	Zd Allowable > Zd Design		
STR 3-4	114+89.80	129.80	13.00	1,826.00	0.13	0.14	0.008	0.050	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	2.00	7.50	2.06	1.24	0.016	1.35	0.99	4.60	1.00	0.49	0.99	0.14	0.00	Zd Allowable > Zd Design		
STR 3-5	116+34.40	144.60	13.00	2,046.00	0.14	0.14	0.008	0.070	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	2.00	7.50	1.66	1.40	0.016	1.47	1.00	4.60	1.00	0.53	1.00	0.14	0.00	Zd Allowable > Zd Design		
EX CB H	117+12.87	78.47	13.00	1,122.00	0.08	0.08	0.014	0.069	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	11.00	2.00	7.50	1.20	1.00	0.016	1.55	1.00	4.60	1.00	0.51	1.00	0.08	0.00	Zd Allowable > Zd Design	Qbp < 0.1 CFS	

2019 INLET SPACING - CURB AND GUTTER SPREADSHEET (ENGLISH UNITS)

Fill in the data for the *grey shaded areas* only

Tc =	5.00
C =	0.99
I =	3.07
m=	7.83
n=	0.58

Project Name: 5th Street Mukilteo Pedestrian Improvements
Project #:
S.R.:
Designed By: C.Hawatmeh
Date: 10/16/2022

Note: The areas shown are to calculate spread along the sidewalk.

Structure ID	Station	Distance (ft)	Width (ft)	Area (ft2)	Δ Q cfs (cfs)	Σ Q (cfs)	Slope L (ft/ft)	Super T (ft/ft)	Grate Type HM Figure 5-11	GRATE WIDTH (ft)	GRATE LENGTH (ft)	Roadway Classification	Enter Requested Information		Allowable Spread Policy	Driving Lane Width (ft)	Shoulder Width (ft)	Allowable Zd (ft)	Calculated Z_d (ft)	Depth of Flow at Face of Curb d (inches)	Manning's n for Street and Pavement Gutter	Velocity fo Gutter Flow (ft/sec)	Ratio of Frontal Flow to Total Gutter Flow E_o	Splash-Over Velocity V_o (ft/sec)	Ratio of Frontal Flow Intercepted to Full Frontal Flow R_f	Ratio of Side Flow Intercepted to Total Side Flow R_s	Effiency of Grate E	Q_s (cfs)	Q_{bp} (cfs)	Z_d Check	Q_{bp} Check	Comments (L/R)
STR 3-3	112+09.24	150.76		1,366.00	0.10	0.10	0.010	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	3.00	0.72	0.016	1.05	0.89	4.60	1.00	0.37	0.93	0.09	0.01	Zd Allowable > Zd Design		
	113+60.00		6.00																													
STR 3-4 LT	114+89.80	129.80	6.00	1,044.00	0.07	0.08	0.008	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.92	0.70	0.016	0.93	0.90	4.60	1.00	0.43	0.94	0.07	0.00	Zd Allowable > Zd Design		
STR 3-4 RT	116+34.40	144.60	6.00	1,290.00	0.09	0.09	0.012	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	2.89	0.69	0.016	1.13	0.90	4.60	1.00	0.35	0.93	0.09	0.01	Zd Allowable > Zd Design		
STR 3-5	119+66.97	332.57	6.00	2,220.00	0.15	0.16	0.024	0.020	Standard Plan B-30.30-03 Rectangular Vaned Grate	1.67	2.00	Collector and Local Streets	Enter Speed (mph) ---------->	25	Shoulder + 1/2 Driving Lane	4.00	2.00	4.00	3.10	0.74	0.016	1.67	0.87	4.60	1.00	0.21	0.90	0.14	0.02	Zd Allowable > Zd Design	Qbp < 0.1 CFS	

April 2022

APPENDIX J DITCH CAPACITY ANALYSIS

HYDROLOGY BY RATIONAL FORMULA (English or Metric Units)

This spreadsheet calculates runoff rate and volume using the rational method. Enter the data in the grey shaded areas only.

Project Name:	**5th Street Mukilteo Pedestrian Improvements**	*SR :*		*Designed By:* Christine Hawatmeh
Project Number:	2000722			*Date:* 10/15/2022

Q = Flow (cfs or m^3/s)
L = Length of drainage basin (ft or m)
S = Average slope (ft/ft, m/m)
K = Ground cover coeeficient (ft/min or m/min)
I = Rainfall intensity (in/hr or mm/hr)

T_c = time of concentration (min)
m & n = Rainfall coefficients
K_c = Conversion factor (1 for English, 360 for Metric)
C = Runoff coefficient
A = Drainage area (acres or ha)

Description of Area	MRI	L	S	K	T_c	Rainfall Coefficients		K_c	C	I	A	Q
						m	n					
D1.1, ditch TDA 2	25-year	176	0.02	1200	1.037089946	7.83	0.582	1	0.99	7.665784449	0.088	0.667843141
D2.1, ditch TDA 3	25-year	170	0.02	1200	1.001734607	7.83	0.582	1	0.99	7.822106123	0.104	0.805364046
D2.2, ditch TDA 3	25-year	145	0.02	1200	0.854420694	7.83	0.582	1	0.99	8.580820135	0.077	0.654115919
D2.3, ditch TDA 3	25-year	50	0.02	1200	0.294627825	7.83	0.582	1	0.99	15.945731	0.018	0.284152926

Worksheet for TDA 2 - D1.1

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.035	
Channel Slope	0.015	ft/ft
Normal Depth	9.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	4.41	cfs
Flow Area	1.7	ft²
Wetted Perimeter	4.7	ft
Hydraulic Radius	4.3	in
Top Width	4.50	ft
Critical Depth	8.0	in
Critical Slope	0.028	ft/ft
Velocity	2.61	ft/s
Velocity Head	0.11	ft
Specific Energy	0.86	ft
Froude Number	0.752	
Flow Type	Subcritical	

calculated 25 yr flow = 0.67 cfs

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	9.0	in
Critical Depth	8.0	in
Channel Slope	0.015	ft/ft
Critical Slope	0.028	ft/ft

Worksheet for TDA 3 - D2.1

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.035	
Channel Slope	0.008	ft/ft
Normal Depth	5.6	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	0.92	cfs
Flow Area	0.7	ft²
Wetted Perimeter	3.0	ft
Hydraulic Radius	2.7	in
Top Width	2.80	ft
Critical Depth	4.3	in
Critical Slope	0.034	ft/ft
Velocity	1.41	ft/s
Velocity Head	0.03	ft
Specific Energy	0.50	ft
Froude Number	0.513	
Flow Type	Subcritical	

calculated 25 yr flow = 0.67 cfs

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.6	in
Critical Depth	4.3	in
Channel Slope	0.008	ft/ft
Critical Slope	0.034	ft/ft

Worksheet for TDA 3 - D2.2

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.035	
Channel Slope	0.008	ft/ft
Normal Depth	7.2	in
Left Side Slope	8.230	H:V
Right Side Slope	6.700	H:V

Results		
Discharge	4.60	cfs
Flow Area	2.7	ft²
Wetted Perimeter	9.0	ft
Hydraulic Radius	3.6	in
Top Width	8.96	ft
Critical Depth	5.7	in
Critical Slope	0.029	ft/ft
Velocity	1.71	ft/s
Velocity Head	0.05	ft
Specific Energy	0.65	ft
Froude Number	0.551	
Flow Type	Subcritical	

calculated 25 yr flow = 0.67 cfs

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.2	in
Critical Depth	5.7	in
Channel Slope	0.008	ft/ft
Critical Slope	0.029	ft/ft

Worksheet for TDA 3 - D2.3

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.035	
Channel Slope	0.063	ft/ft
Normal Depth	19.0	in
Left Side Slope	2.350	H:V
Right Side Slope	1.510	H:V

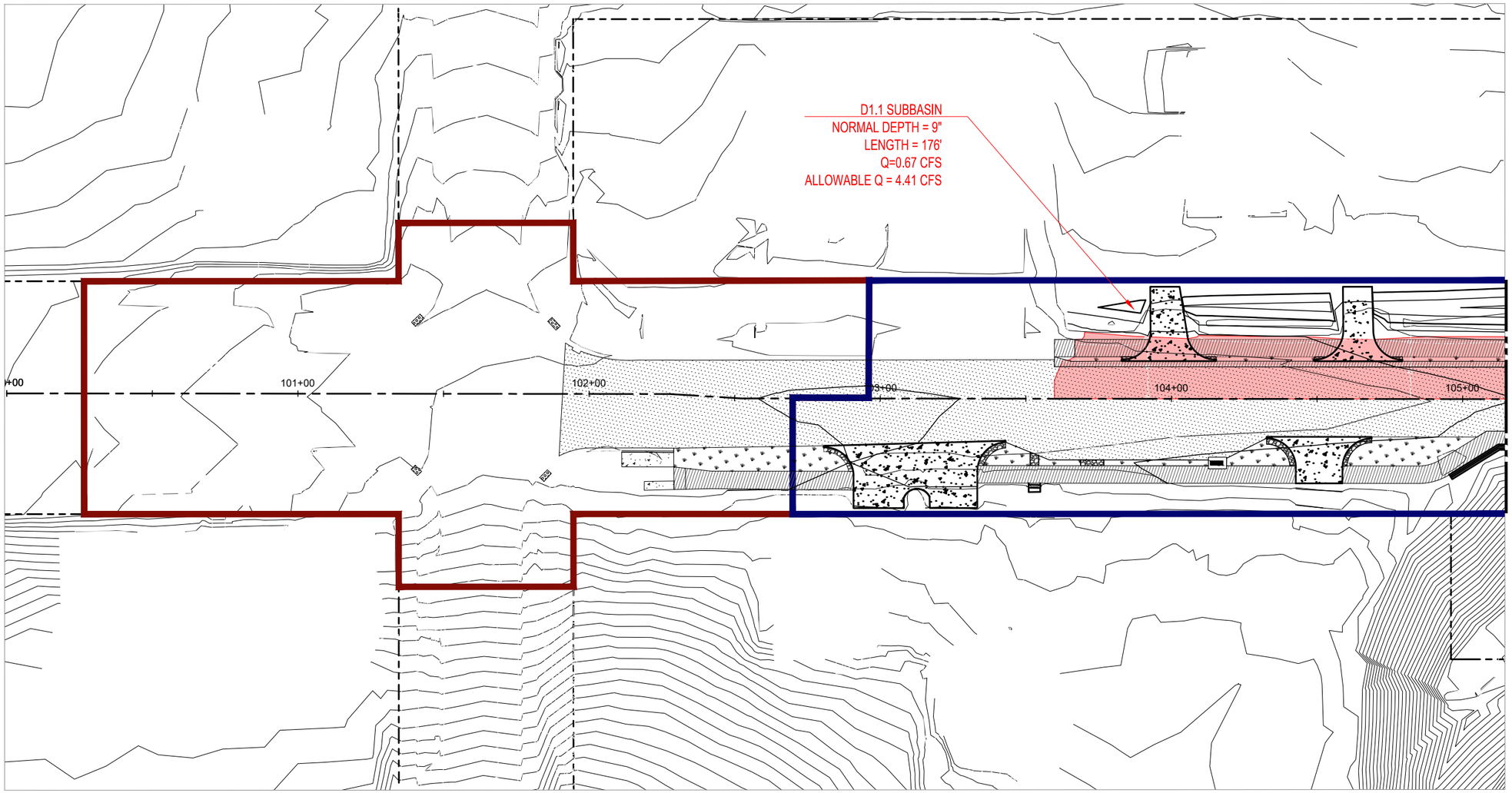
Results		
Discharge	40.65	cfs
Flow Area	4.8	ft²
Wetted Perimeter	6.9	ft
Hydraulic Radius	8.4	in
Top Width	6.11	ft
Critical Depth	23.3	in
Critical Slope	0.021	ft/ft
Velocity	8.40	ft/s
Velocity Head	1.10	ft
Specific Energy	2.68	ft
Froude Number	1.665	
Flow Type	Supercritical	

calculated 25 yr flow = 0.67 cfs

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	19.0	in
Critical Depth	23.3	in
Channel Slope	0.063	ft/ft
Critical Slope	0.021	ft/ft

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- DITCH SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
JOB No. :2000722

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

SCALE: 1" = 20'

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

CITY OF MUKILTEO

MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

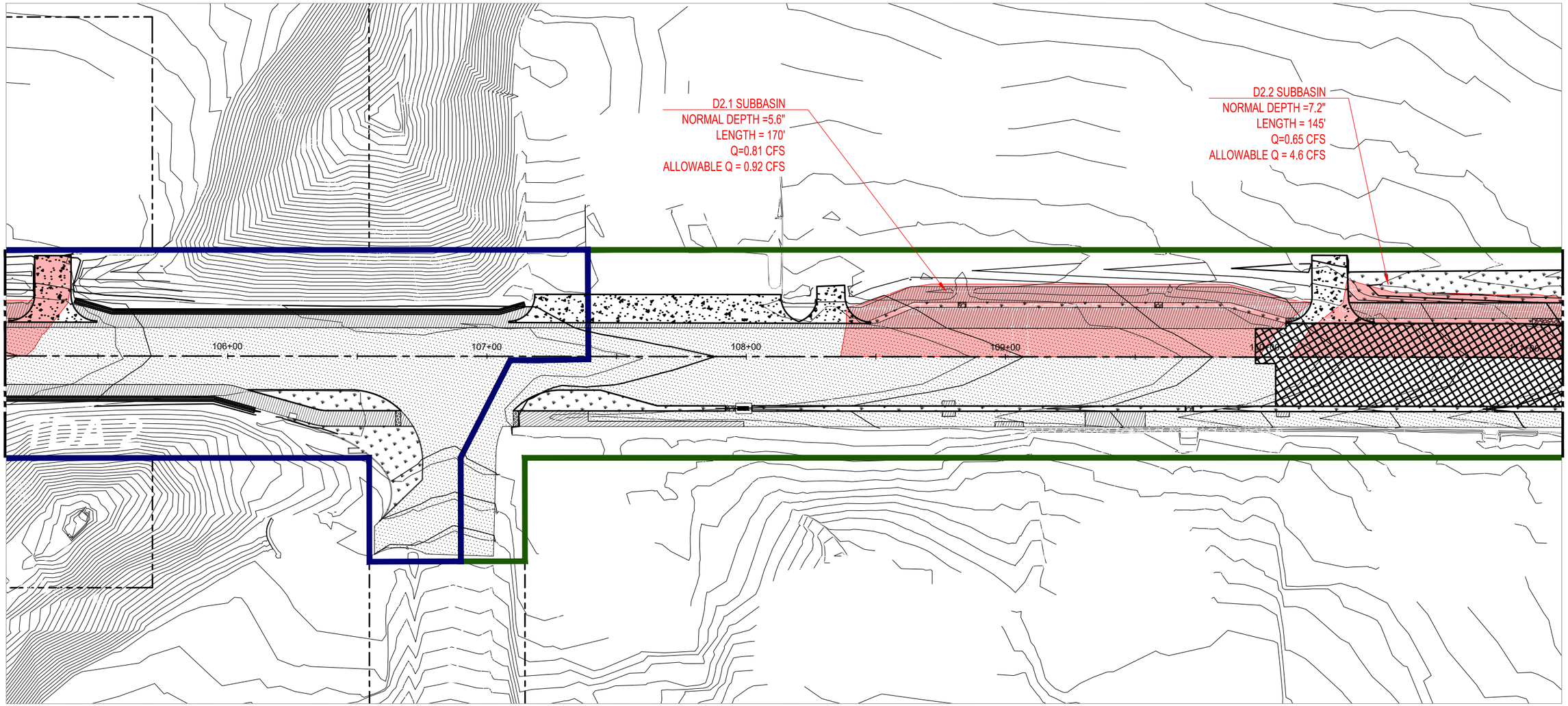
SHT. 02 OF 124

PROPOSED DITCH SUBBASIN MAP

TDA01

C:\Temp\AcPublish_19508\Individual TDA Proposed Basin Maps.dwg
chrisl.neh
Oct 28, 2022 - 2:49pm

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- DITCH SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
J O B No. :2000722

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S C A L E: 1" = 20'

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206.622.5822
www.kpff.com

CITY OF MUKILTEO

MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

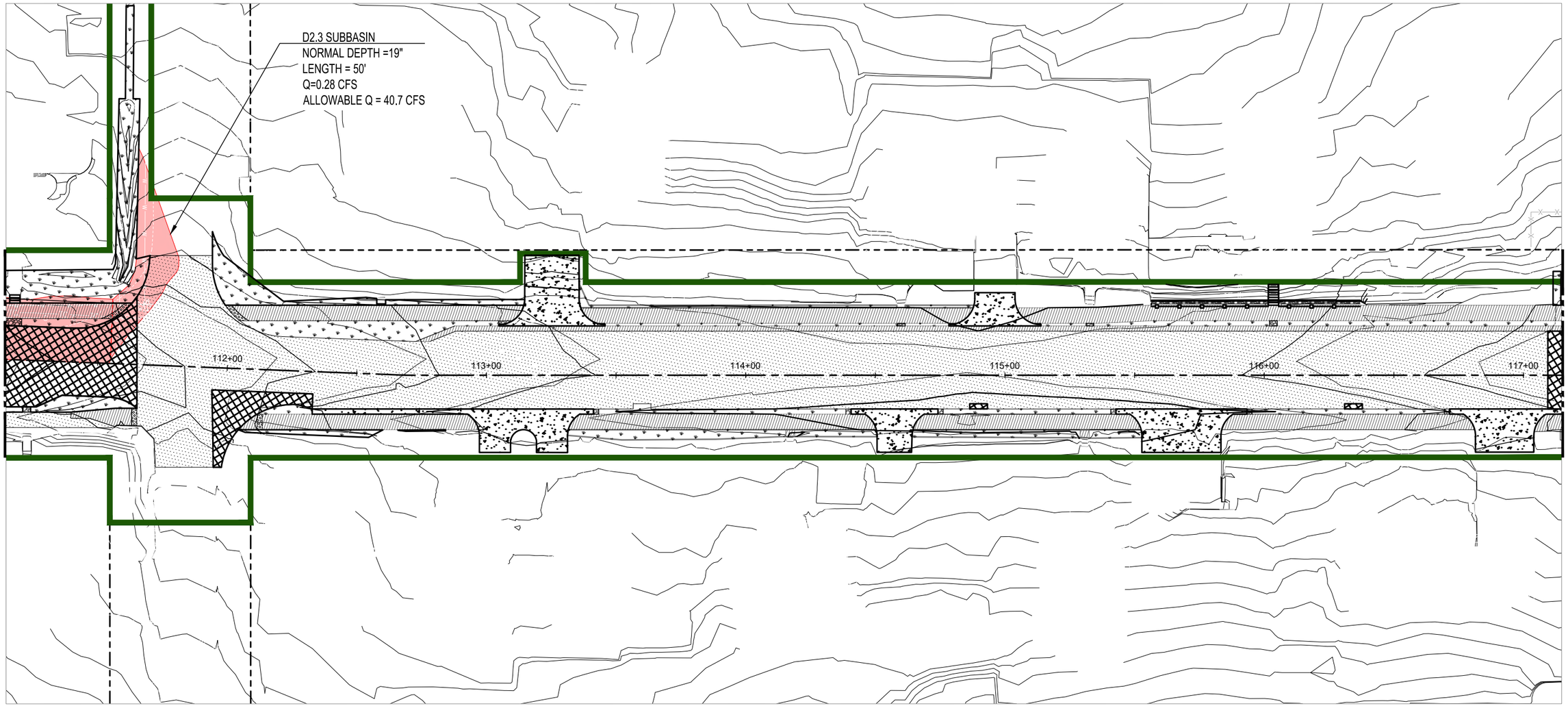
SHT. 03 OF 124

PROPOSED DITCH SUBBASIN MAP

TDA02

Oct 28, 2022 - 2:50pm chrisilineh C:\Temp\AcPublish_19508\Individual TDA Proposed Basin Maps.dwg

S4 T28N R4E W.M.



LEGEND

- TDA 1 BOUNDARY
- TDA 2 BOUNDARY
- TDA 3 BOUNDARY
- TDA 4 BOUNDARY
- TDA 5 BOUNDARY
- DITCH SUBBASIN

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
JOB No. :2000722

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

SCALE: 1" = 20'

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101
206.622.5822
www.kpff.com

CITY OF MUKILTEO

MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

SHT. 04 OF 124

INDIVIDUAL TDA BASIN MAPS

TDA03

Oct 28, 2022 - 2:59pm chrisl\neh C:\Temp\AcPublish_19508\Individual TDA Proposed Basin Maps.dwg

April 2022

APPENDIX K OPERATIONS & MAINTENANCE MANUAL

Stormwater Management Facility
Operation and Maintenance (O&M) Manual

for

5th Street Bicycle and Pedestrian Project

Located at:

Mukilteo, WA

Prepared for:

City of Mukilteo

Prepared by:

KPFF Consulting Engineers
1601 Fifth Avenue, Suite 1600
Seattle, WA 98101

Stormwater Management Facility
Operation and Maintenance (O&M) Manual

Table of Contents

Stormwater Management Facility
Operation and Maintenance (O&M) Manual

I Contact Information

Owner_____ Phone _____

Email_____

Maintenance Responsible Party: _____ Phone _____

Email_____

Emergency Contact _____

Phone _____

Email _____

City of Mukilteo, Stormwater Inspection: 425.263.6000

The above contact information shall be updated any time that the information changes. Notify the City of Mukilteo, with this information within 30 days of changes.

II Compliance with Mukilteo Municipal Code

In accordance with Mukilteo Municipal Code 13.12.210, the city shall be responsible for operation, maintaining, repairing, and replacing public stormwater facilities and the public stormwater system.

III. Maintenance

Stormwater facilities shall be maintained so that they function and as designed and intended. Maintenance shall be performed in accordance with the City's maintenance standards. A copy of the O&M plan for any stormwater facility should remain on-site. The O&M plan should be updated as needed to ensure stormwater facilities are properly functioning.

IV. Preventative Measures to Reduce Maintenance Costs

The most effective way to maintain your water quality facility is to prevent the pollutants from entering the facility in the first place. Common pollutants include sediment, trash & debris, chemicals, dog wastes, runoff from stored materials, illicit discharges into the storm drainage system (like car wash or pressure washing runoff) and many others. A thoughtful maintenance program will include measures to address these potential contaminants, and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate property owners/residents/tenants to be aware of how their actions affect water quality, and how they can help reduce maintenance costs.
- Keep properties, streets and gutters, and parking lots free of trash, debris, and lawn clippings.
- Ensure the proper handling, storage and disposal of hazardous wastes and chemicals.

- Plan landscaping care to minimize the use of chemicals and pesticides.
- Sweep paved surfaces and dispose of in the regular solid waste.
- Be aware of automobiles leaking fluids. Use absorbents such as clean cat litter to soak up leaked fluids– dispose of properly.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.
- Clean out the upstream components of the storm drainage system, including inlets, storm sewers and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.
- Close the covers on dumpsters to prevent liquids from leaking into the storm system.
- Ensure that garbage compactor units are functioning properly and are not leaking, including during pick-up and hauling procedure.
- Fleet and commercial car washing should be conducted in an area that drains to sanitary sewer, not stormwater system.

V. Safety

Never enter a confined space (outlet structure, manhole, etc.) without proper training and equipment. A confined space should never be entered without at least one additional person present.

If a toxic or flammable substance is discovered, leave the immediate area and call 911. Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to the local Fire Department immediately for response by the Hazardous Materials Unit. The emergency contact number is 911.

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop.

If any hazard is found within the facility area that poses an immediate threat to public safety, call 911 immediately.

VI. General Location and Description of Stormwater Management Facilities

The stormwater facilities were designed to meet requirements of the City of Mukilteo (City) Development Standards, amended 2019 and the Washington Department of Ecology Stormwater Management Manual for Western Washington (SWMM), 2019 (DOE).

The site will be divided into five sub-basins, TDA's 1 through 5.

Flow Control

TDA 3 runoff is collected by a conveyance system that routes flows into a detention vault under the eastbound lane of 5th Street. The vault (FC 2-1) will release runoff through a flow control structure to a conveyance system that connects to the existing conveyance system on the west side of Loveland Avenue.

Water Quality Treatment

Water quality treatment will be designed to provide enhanced treatment for the TDA 3 and will be provided by a modular wetland system that connects to the detention vault (FC 2-1).

Conveyance System

The conveyance systems collect roadway and sidewalk runoff and routes runoff to the water quality treatment facilities and flow control vaults in TDA 3. The conveyance systems in all other TDA's collect runoff and connect to the existing conveyance system.

All the stormwater facilities and most of the conveyance systems are public and will be maintained by the City.

VII. Inspecting Stormwater Management Facilities

The City of Mukilteo inspects all public owned stormwater systems.

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent best management practices. Stormwater management facilities must be periodically inspected to ensure that they function as designed. The inspection will determine the appropriate maintenance that is required for the facility.

All stormwater management facilities are required to be inspected by a qualified individual at a minimum of once per year. Inspections should occur at a minimum in the fall before the wet season begins and after large storm events.

VIII. Maintaining Stormwater Management Facilities

Stormwater management facilities must be properly maintained to ensure that they operate correctly and provide the water quality treatment for which they were designed. Routine maintenance performed on a frequently scheduled basis, can help avoid more costly rehabilitative maintenance that results when facilities are not adequately maintained. The Maintenance requirements are contained in Appendix B. These requirements should be updated to reflect changes and updates to these facilities.

Routine Work

The majority of this work consists of inspection, and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging the outlet structure flow control screen and pre-treatment chamber.

Minor Work

This work consists of a variety of isolated or small-scale maintenance and work needed to address operational problems. Most of this work can be completed by a small crew, with minor tools, and small equipment.

Major Work

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater management facilities. This work may require an engineering design with construction plans to be prepared for review and approval by the City.

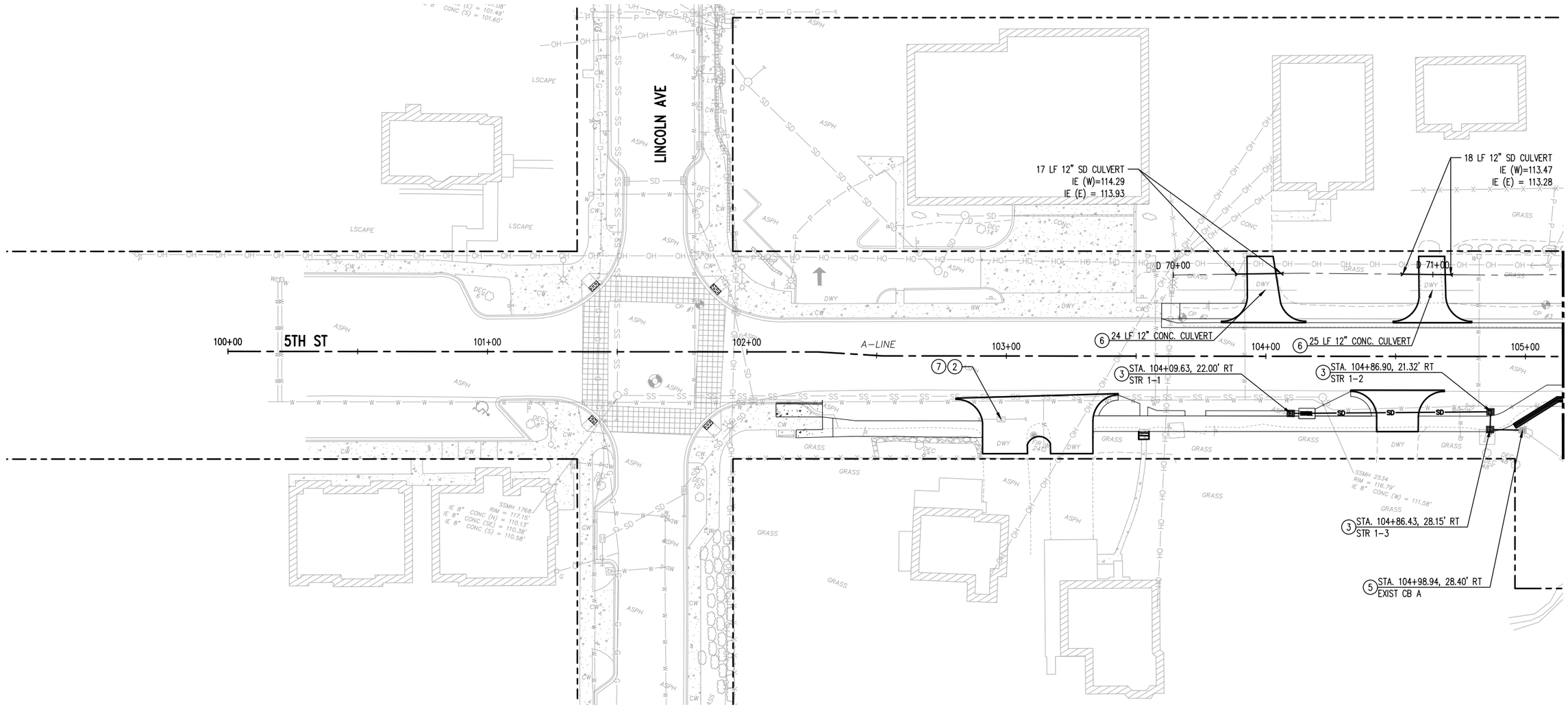
IX. Maintenance Documentation

The Stormwater Management Facility Maintenance Activity Form provides a record of maintenance activities. Maintenance Forms for each facility type are provided in Appendix B. Maintenance shall be completed by the City.

Appendix A

Stormwater Site Plan

S4 T28N R4E W.M.



LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
- CB TYPE 1
- UNDERDRAIN CLEANOUT, SEE DD03

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6. ABANDON IN PLACE
7. RECTANGULAR SOLID METAL COVER PER WSDOT B-30.20-04
8. MODULAR WETLAND SYSTEM. SEE DD02 SHEETS FOR DETAILS
9. REMOVE STORM DRAIN PIPE. SEE SITE PREPARATION PLANS.

N

0 10 20 40
1 inch = 20 feet

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DRAINAGE PLAN

DR01

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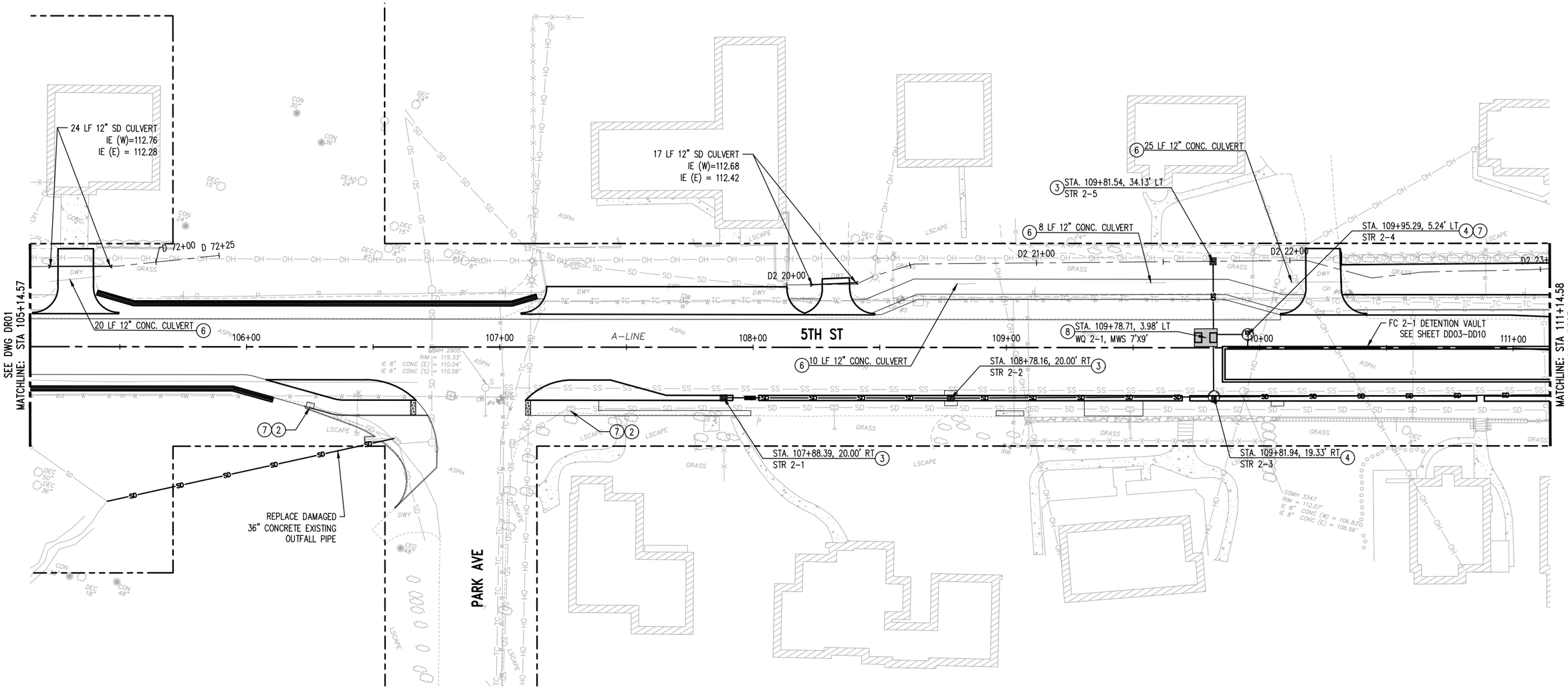

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DR02

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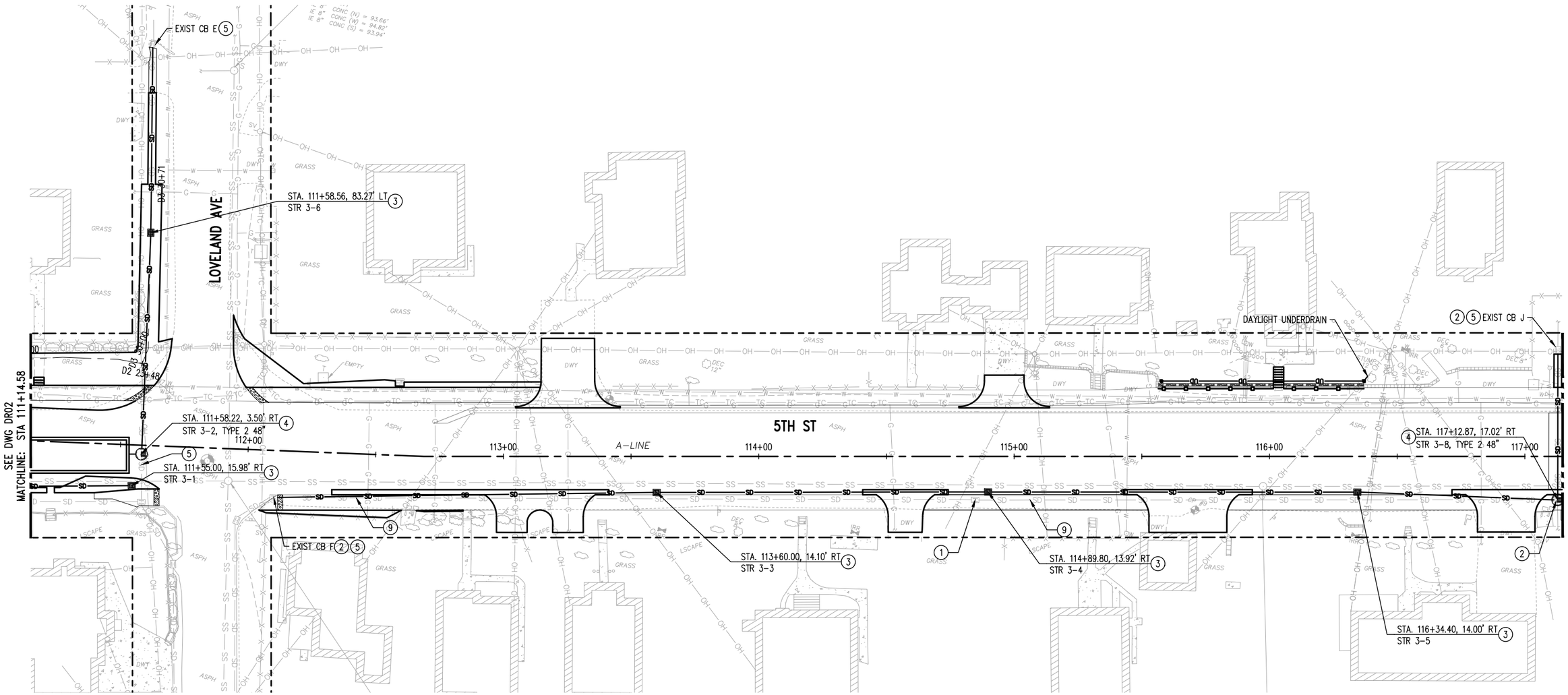

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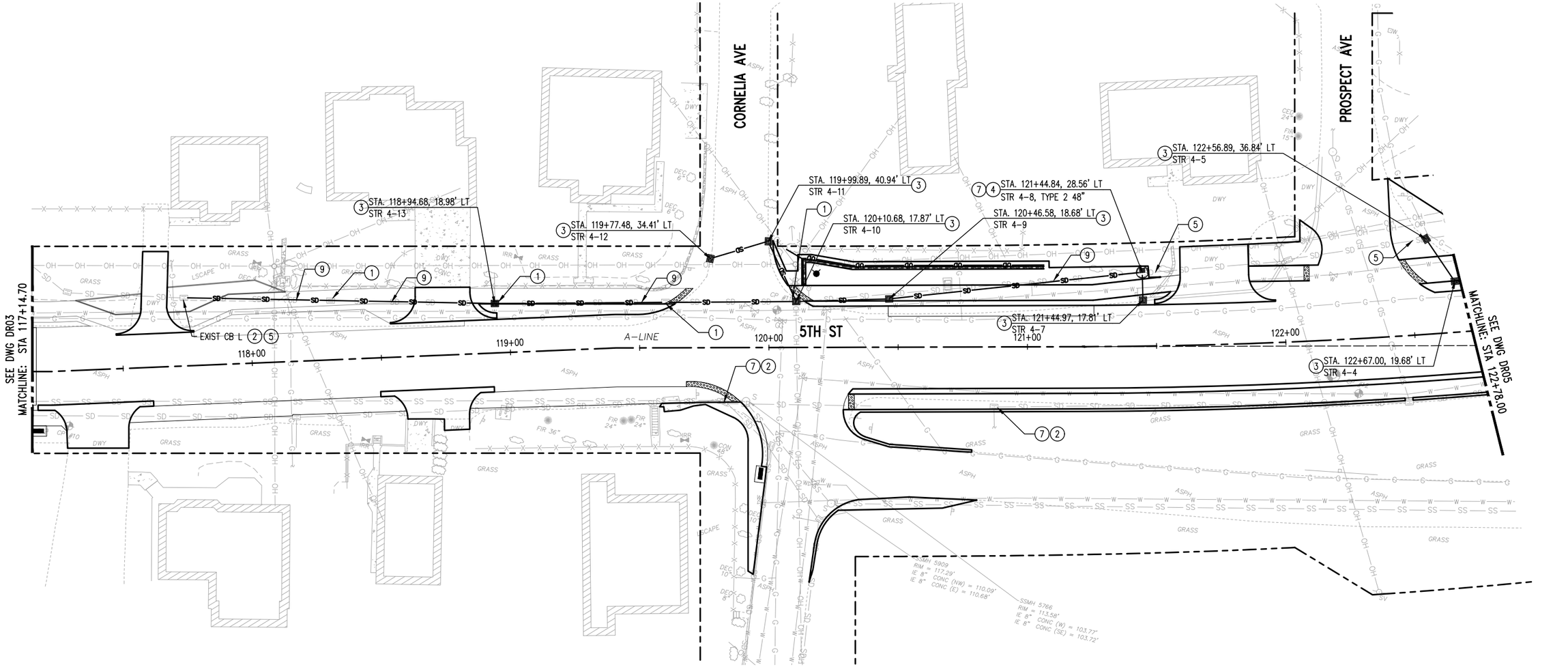

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DR04

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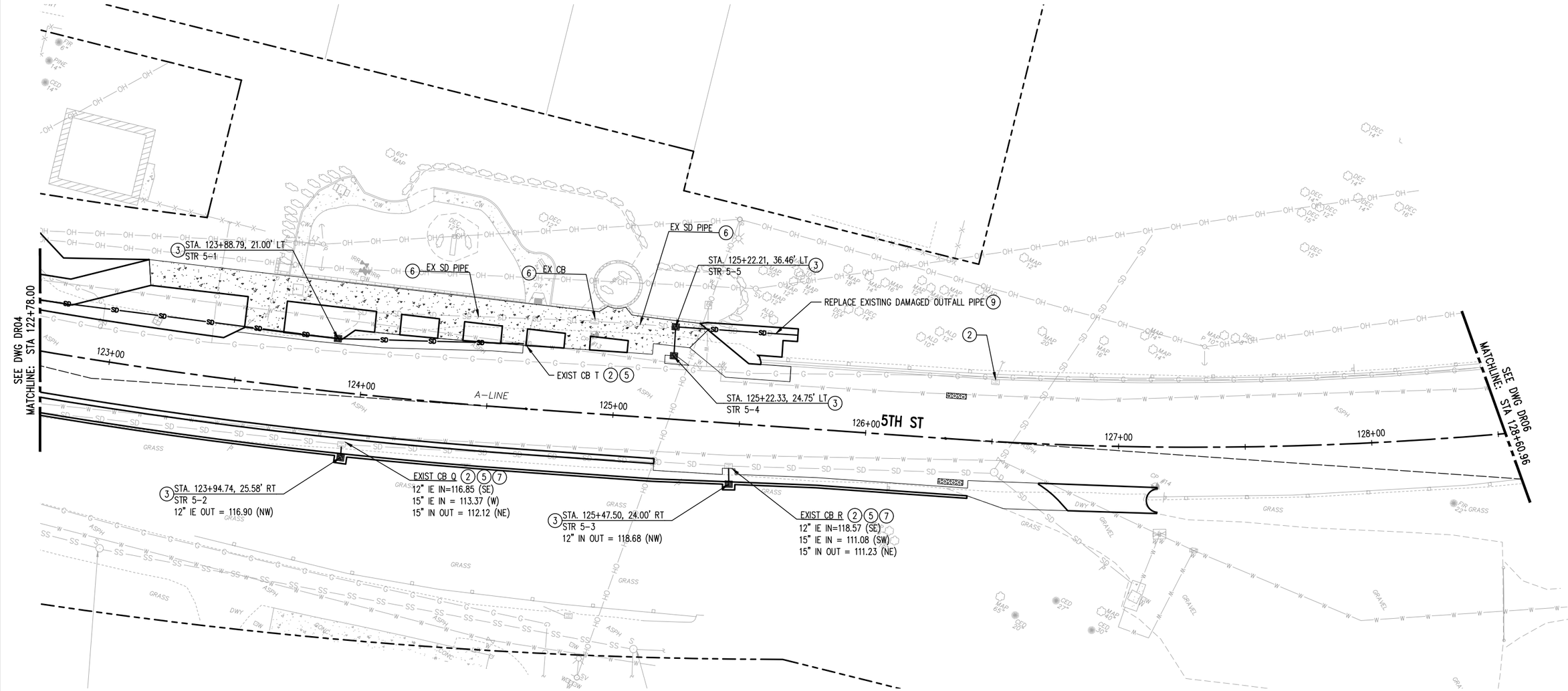

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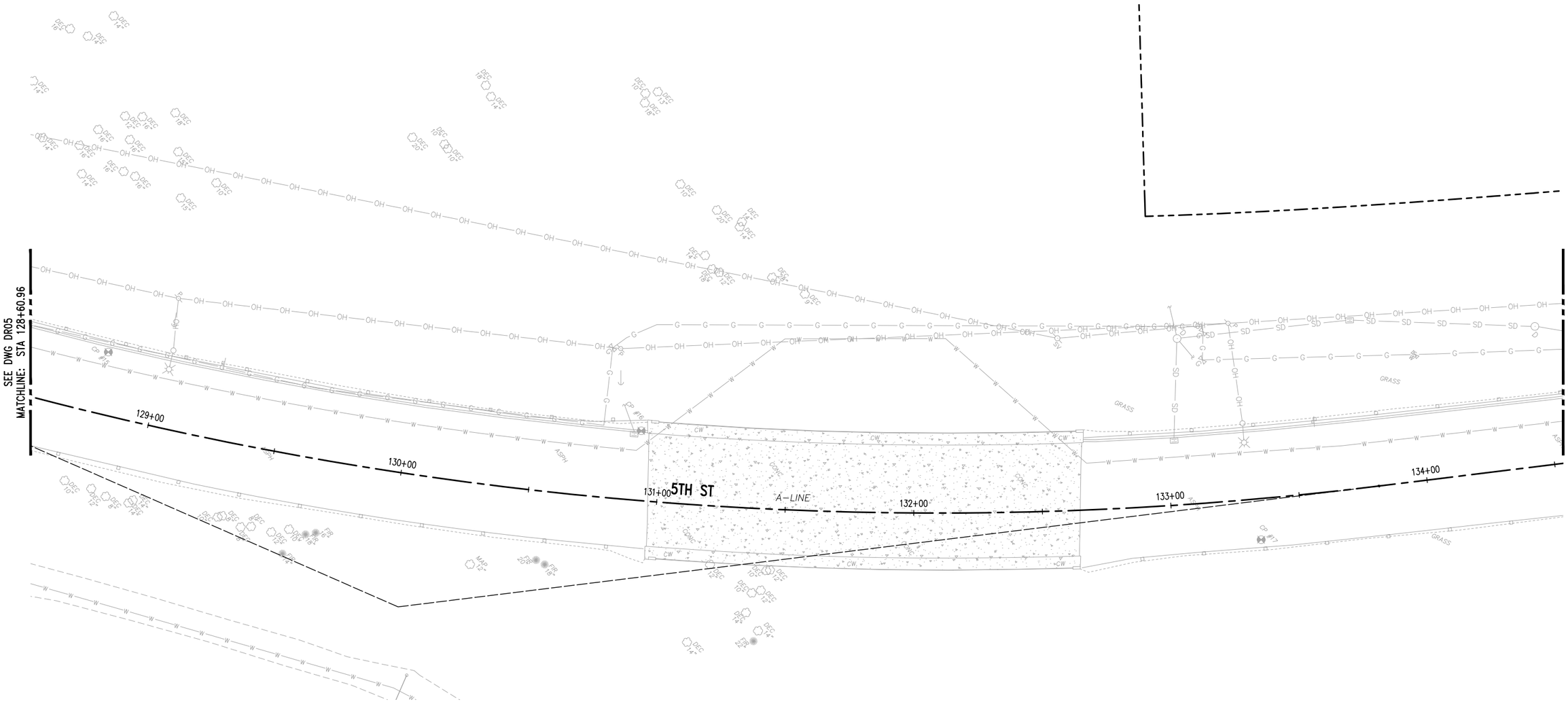

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N

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DR06

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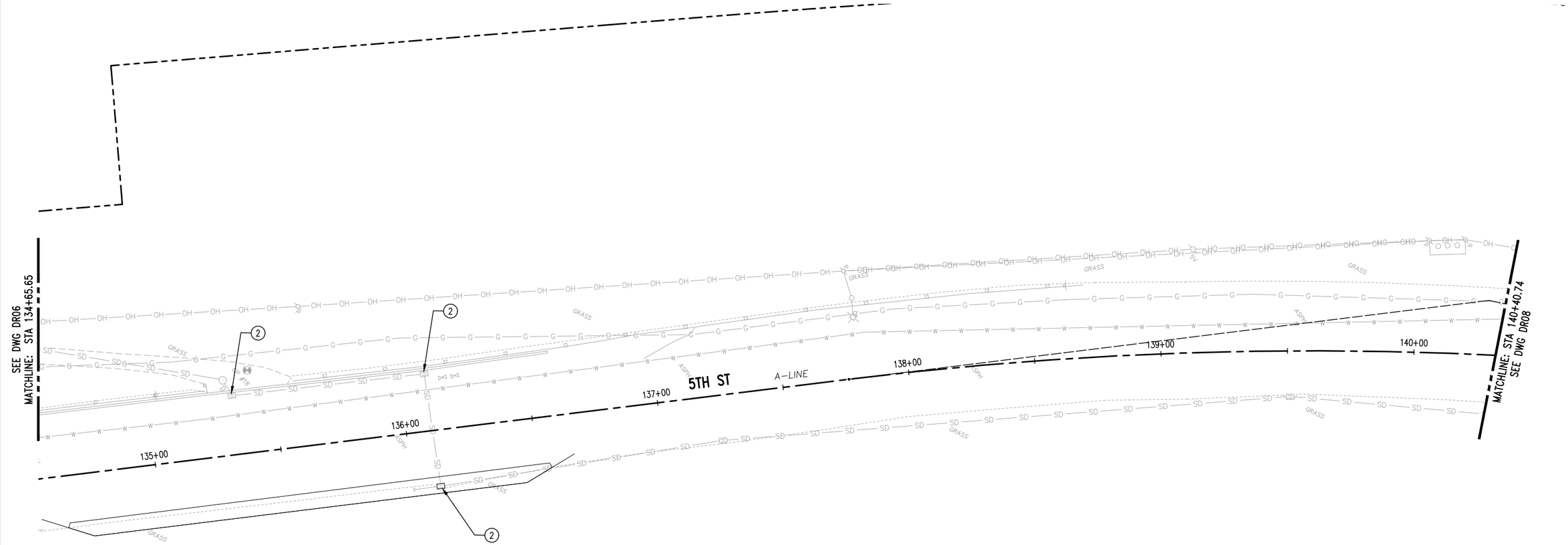

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DR07

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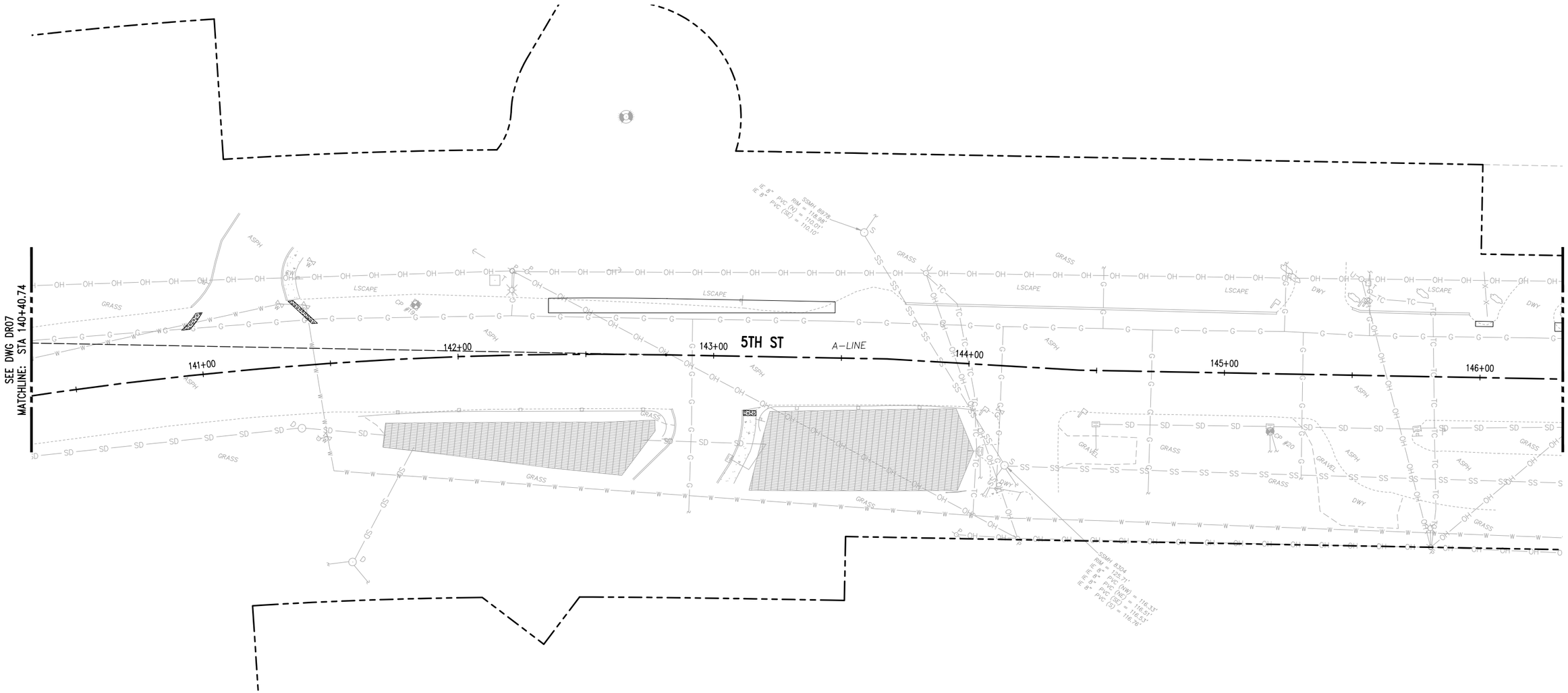

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DRAINAGE PLAN

DR08

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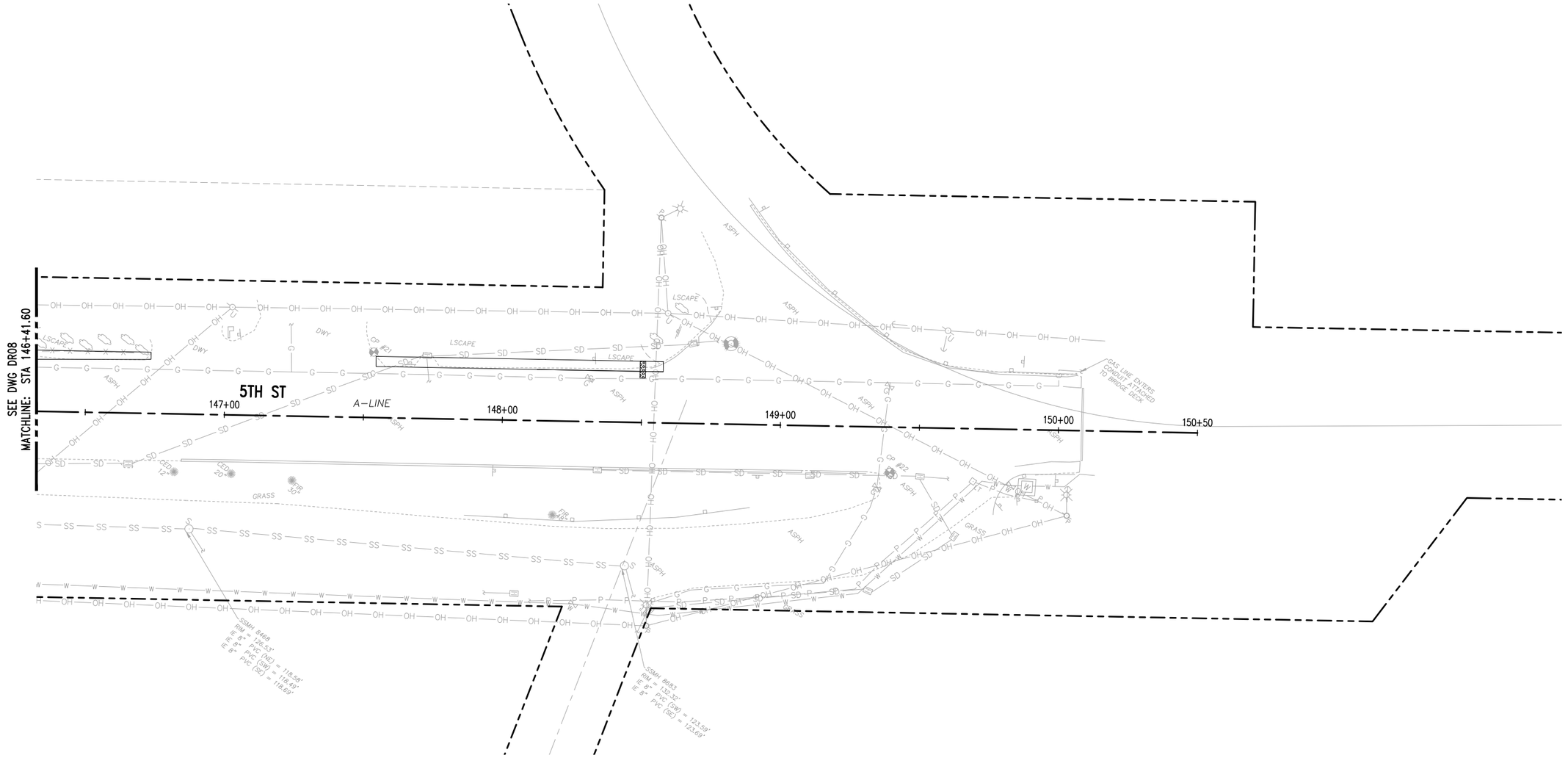
christineh
Oct 27, 2022 - 1:43pm

S34 T29N R4E W.M.



LEGEND

- SD — STORM DRAIN PIPE
- UD — 6" UNDERDRAIN PIPE
- CB TYPE 2, SIZE PER PLAN
- CB TYPE 1
- UNDERDRAIN CLEANOUT, SEE DD03

NOTES

1. STATION & OFFSETS ARE TO CENTER OF DRAINAGE STRUCTURE. SEE DD1 FOR TYPE 2 CATCH BASIN.
2. STORM AND CULVERT PIPE MATERIAL SHALL BE POLYVINYL CHLORIDE PIPE (PVC), LINED CORRUGATED POLYETHYLENE (LCPE), SMOOTH WALL POLYETHELYNE (SWPE), HIGH DENSITY POLYETHYLENE (HDPE), OR DUCTILE IRON FOR AREAS WHERE EXISTING IMPROVEMENTS PROHIBIT REQUIRED COVER ON OTHER PIPE MATERIALS. ALL PIPES SHALL BE CONSISTENT WITH WSDOT STANDARD SPECIFICATION 7-04 UNLESS OTHERWISE NOTED. PIPE BEDDING PER WSDOT STANDARD SPECIFICATION 9-03.
3. EXISTING OUTFALL PIPE LOCATION NOT INCLUDED IN SURVEY. OUTFALL LOCATION SHOWN IS A PLACEHOLDER THAT WILL BE UPDATED ONCE EXISTING PIPE LOCATION IS DETERMINED.

CONSTRUCTION NOTES

1. REMOVE DRAINAGE STRUCTURE
2. ADJUST CATCH BASIN
3. CATCH BASIN TYPE 1 PER WSDOT STD PLAN B-5.20-03
4. CATCH BASIN TYPE 2 PER WSDOT STD PLAN B-10.20-02
5. CONNECTION TO DRAINAGE STRUCTURE
6. ABANDON IN PLACE
7. RECTANGULAR SOLID METAL COVER PER WSDOT B-30.20-04
8. MODULAR WETLAND SYSTEM. SEE DD02 SHEETS FOR DETAILS
9. REMOVE STORM DRAIN PIPE. SEE SITE PREPARATION PLANS.

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 100 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY JGM
DATE 08/2022
J O B No. :2000722

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

S C A L E: 1" = 20'

kpff
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Seattle, WA 98101
206.622.5822
www.kpff.com

CITY OF MUKILTEO

MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

DRAINAGE PLAN

SHT. 46 OF 124

DR09

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Oct 27, 2022 - 1:43pm

Appendix B Maintenance Standards

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Maintenance standards are from the 2019 Stormwater Management Manual for Western Washington, Department of Ecology.

Detention Vault

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 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 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	**Defect**	**Conditions When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
Catch Basins	See Table V-A.5	See Table V-A.5	See Table V-A.5

Control Structure / Flow Restrictor

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
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.
Manhole	See "Wet Vault”	See "Wet Vault”	See "Wet Vault”
Catch Basin	See Table V-A.5	See Table V-A.5	See Table V-A.5

Catch Basins and Manholes

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 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.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	**Defect**	**Conditions When Maintenance is Needed**	**Results Expected When Maintenance is performed**
	Contamination and Pollution	See "Detention Ponds"	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	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 inletting capacity.	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.

Conveyance Pipes and Ditches

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment and 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 personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where 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.

Underdrains (Perforated Pipes)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Preventative	Blocking, obstructions	Debris or trash limiting flow into perforated pipe system or outfall of BMP is plugged or otherwise nonfunctioning.	Outfall of BMP is receiving designed flows from perforated pipe connection.
Inflow	Inflow impeded	Inflow into the perforated pipe is partially or fully blocked or altered to prevent flow from getting into the pipe.	Inflow to the perforated pipe is unimpeded.
Pipe Trench Area	Surface compacted	Ground surface over the perforated pipe trench is compacted or covered with impermeable material.	Ground surface over the perforated pipe is not compacted and free of any impervious cover.
Outflow	Outflow impeded	Outflow from the perforated pipe into the public drainage system is blocked.	Outflow to the public drainage system is unimpeded.
Outfall Area	Erosion or landslides	Existence of the perforated pipe is causing or exasperating erosion or landslides.	Perforated pipe system is sealed off and an alternative BMP is implemented.
Inspection	Frequency	Annually and prior to and following significant storms.	Perforated pipe system is operating as designed.

Modular Wetland System

Table V-A.15: Maintenance Standards - Manufactured Media Filters

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.

Table V-A.15: Maintenance Standards - Manufactured Media Filters

Maintenance Component	**Defect**	**Condition When Maintenance is Needed**	**Results Expected When Maintenance is Performed**
		cracks.	
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

April 2022

APPENDIX L STORMWATER POLLUTION PREVENTION PLAN

Construction Stormwater General Permit (CSWGP)

Stormwater Pollution Prevention Plan (SWPPP)

for

Mukilteo 5th Street

Prepared for:

Department of Ecology

Northwest Region Office, Shoreline

Permittee / Owner	Developer	Operator / Contractor
City of Mukilteo	N/A	TBD

Mukilteo, WA

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Eric Mendel, PE	KPFF Consulting Engineers	(206) 622-5822

SWPPP Preparation Date

06 / 22 / 2022

Project Construction Dates

Activity / Phase	Start Date	End Date
Pedestrian & Bicycle Facility Improvements	TBD	TBD

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List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

Project Information (1.0)

Project/Site Name: Mukilteo 5th Street
Street/Location: Located on 5th Street between Licoln Ave. and Mukilteo Ln.
City: Mukilteo State: WA Zip code: 98275
Subdivision: N/A
Receiving waterbody: Puget Sound

The project proposes to improve access modes along 5th St/Mukilteo Blvd by adding bicycle and pedestrian facilities

Existing Conditions (1.1)

Total acreage: 8.1 acre

Disturbed acreage: 1.0 acre

Existing structures: Catch basins, storm drains

Landscape topography: 0-17% slopes

Drainage patterns: Runoff is collected by existing catch basins or ditches and storm drains along 5th Street/ Mukilteo Boulevard.

Existing Vegetation: Trees, grass

Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): Landslide hazard areas

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: There are no known or suspected containants associated with the site.

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
N/A			

Proposed Construction Activities (1.2)

Description of site development (example: subdivision):
Site development shall consist of widening and paving of 5th street. This will include replacement of existing sidewalks, asphalt, utilities and various drainage aspects as well as installing new various aspects like a drainage detention vault and a retaining wall.

Description of construction activities (example: site preparation, demolition, excavation):
Construction activities include site preparation, applying temporary erosion control measures, installing new drainage, grading, paving, and installation of a retaining wall.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
The proposed flow patterns will maintain existing flow paths.The runoff is collected by a system of existing and proposed catch basins and ditches and conveyed via storm pipes.The water quality treatment volume, treated first with the modular wetland system, will be conveyed to the detention vault. Existing outfall locations will be maintained as shown on the TDA Overview Plan in Appendix A.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
Final Stabilization includes paving and landscaping disturbed areas.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
No contaminated soils or groundwater are anticipated during construction.

Construction Stormwater Best Management Practices (BMPs) (2.0)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

The 13 Elements (2.1)

In order to protect adjacent properties and reduce the area of soil exposed to construction, the limits of construction and trees that are to be preserved within the construction area will be clearly marked before land-disturbing activities begin. The following BMPs will be applied for marking clearing limits:

1. Marking of Sawcut Limits
2. Silt Fence

The location of sawcut and silt fence limits will be marked in the TESC Plans (See Appendix A)

List and describe BMPs: Silt Fence (C233)

Installation Schedules: First Order of Work

Inspection and Maintenance plan: As Needed

Responsible Staff: TBD

Element 2: Establish Construction Access (2.1.2)

The existing paved roadway will be used for construction access. No additional BMPs are needed.

List and describe BMPs: N/A

Element 3: Control Flow Rates (2.1.3)

Construction activities may result in increased flow rates downstream of the project. Straw wattles will be provided along the downstream boundary of disturbed areas to control flow rates.

Will you construct stormwater retention and/or detention facilities?

☐ Yes ☒ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

☐ Yes ☒ No

List and describe BMPs: Straw Wattles (C235)

Installation Schedules: First Order of Work

Inspection and Maintenance plan: As Needed

Responsible Staff: TBD

Element 4: Install Sediment Controls (2.1.4)

Construction activities may result in increased sediment discharges from the site. To counter this, Straw Wattles and Silt Fences will be installed. Straw Wattles and Silt Fences will be placed alongside the downstream boundary of the project area as well as downstream of construction activities to prevent sediment from leaving the project site.

List and describe BMPs: Straw Wattles (C235)

Silt Fence (C233)

Installation Schedules: First Order of Work

Inspection and Maintenance plan: As Needed

Responsible Staff: TBD

Element 5: Stabilize Soils (2.1.5)

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: TBD End date: TBD

Will you construct during the wet season?

☒ Yes ☐ No

List and describe BMPs: Plastic Covering (C123)

Installation Schedules: During Construction

Inspection and Maintenance plan: As Needed

Responsible Staff: TBD

Element 6: Protect Slopes (2.1.6)

There are no steep slopes within working limits. Existing slopes are not susceptible to erosion so no BMP is proposed for slope protection.

Will steep slopes be present at the site during construction?

☐ Yes ☒ No

List and describe BMPs: N/A

Element 7: Protect Drain Inlets (2.1.7)

All catch basins made operable during construction and within 500 feet downstream of the project site shall be protected to prevent unfiltered water from entering the stormwater conveyance system. Grate inlets will be protected using catch basin filters.

List and describe BMPs: Storm Drain Inlet Protection (C220)

Installation Schedules: First Order of Work

Inspection and Maintenance plan: Inspected weekly at a minimum and daily during storm events. Clean and replace inlet protection devices when sediment has filled one-third of the available storage or as specified by the manufacturer.

Responsible Staff: TBD

Element 8: Stabilize Channels and Outlets (2.1.8)

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

There will not be significant increases to runoff at outfalls during the proposed construction activities or disturbance to any outfalls. Outfall protection and channel stabilization are not needed.

List and describe BMPs: N/A

Element 9: Control Pollutants (2.1.9)

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (and source, if applicable)
Petrochemicals from construction equipment
Waste materials and demolition debris

Demolished roadway elements and cleared and grubbed materials will be removed from the site by truck.

Extreme care shall be taken to ensure that no petroleum products, hydraulic fluid, sediments, chemicals, or any other toxic materials are allowed to enter or leach into waters of the State.

List and describe BMPs: Spill Prevention and Control Measures

Installation Schedules: During Construction

Inspection and Maintenance plan: N/A

Responsible Staff: TBD

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

☒ Yes ☐ No

Vehicles, construction equipment, and/or petroleum project storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment with a capacity of 110% of the combined capacity of the contents within the secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.

- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.

- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Will wheel wash or tire bath system BMPs be used during construction?

☐ Yes ☒ No

Will pH-modifying sources be present on-site?

☒ Yes ☐ No

Table 3 – pH-Modifying Sources

	None
	Bulk cement
	Cement kiln dust
	Fly ash
	Other cementitious materials
X	New concrete washing or curing waters
X	Waste streams generated from concrete grinding and sawing
	Exposed aggregate processes
	Dewatering concrete vaults
X	Concrete pumping and mixer washout waters
	Recycled concrete
	Other (i.e. calcium lignosulfate) [please describe]

List and describe BMPs: Sawcutting and Surfacing Pollution Prevention (C152)

Installation Schedules: During Construction

Inspection and Maintenance plan: As Needed

Responsible Staff: TBD

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

Element 10: Control Dewatering (2.1.10)

Utility trench dewatering if required will be collected in a portable tank then treated and tested on-site before being discharged into receiving waters.

Table 4 – Dewatering BMPs

	Infiltration
	Transport off-site in a vehicle (vacuum truck for legal disposal)
X	Ecology-approved on-site chemical treatment or other suitable treatment technologies
	Sanitary or combined sewer discharge with local sewer district approval (last resort)
	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs: TBD

Element 11: Maintain BMPs (2.1.11)

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

Element 12: Manage the Project (2.1.12)

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

X	Design the project to fit the existing topography, soils, and drainage patterns
X	Emphasize erosion control rather than sediment control
X	Minimize the extent and duration of the area exposed
X	Keep runoff velocities low
X	Retain sediment on-site
X	Thoroughly monitor site and maintain all ESC measures
X	Schedule major earthwork during the dry season
	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
TBD	TBD	TBD	TBD

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
[Insert construction activity]	[Insert BMP]	[MM/DD/YYYY]	[Insert Season]

Element 13: Protect Low Impact Development (LID) BMPs (2.1.13)

N/A

There are no existing LID BMPs on the project

Pollution Prevention Team (3.0)

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	[Insert Name]	[Insert Number]
Resident Engineer		
Emergency Ecology Contact		
Emergency Permittee/ Owner Contact		
Non-Emergency Owner Contact		
Monitoring Personnel		
Ecology Regional Office	[Insert Regional Office]	[Insert General Number]

Monitoring and Sampling Requirements (4.0)

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

Site Inspection (4.1)

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

Stormwater Quality Sampling (4.2)

Turbidity Sampling (4.2.1)

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

X	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours. https://www.ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue
    - Central Region (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490
    - Eastern Region (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
    - Northwest Region (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000
    - Southwest Region (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

pH Sampling (4.2.2)

pH monitoring is required for “Significant concrete work” (i.e. greater than 1000 cubic yards poured concrete or recycled concrete over the life of the project).The use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH: N/A

Table 8 – pH Sampling Method

	pH meter
	pH test kit
	Wide range pH indicator paper

Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies (5.0)

303(d) Listed Waterbodies (5.1)

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

☐ Yes ☒ No

Reporting and Record Keeping (6.0)

Record Keeping (6.1)

Site Log Book (6.1.1)

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

Records Retention (6.1.2)

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

Updating the SWPPP (6.1.3)

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

Reporting (6.2)

Discharge Monitoring Reports (6.2.1)

Cumulative soil disturbance is less than one (1) acre; therefore, Discharge Monitoring Reports (DMRs) will not be submitted to Ecology because water quality sampling is not being conducted at the site.

Notification of Noncompliance (6.2.2)

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- Central Region at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- Eastern Region at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- Southwest Region at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number

3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

Appendix A

Site Plans

TDA OVERVIEW

TDA	RECEIVING WATER BODY
1	POSESSION SOUND
2	BREWERY CREEK
3	BREWERY CREEK (EAST)
4	JAPANESE GULCH
5	EDGEWATER CREEK

0 200' 400' 800'

1 inch = 400' feet

Project Title: 5TH STREET PEDESTRIAN IMPROVEMENTS	Drawing Title: TDA OVERVIEW MAP	ASI/RFI/CSK Number
Client: CITY OF MUKILTEO	kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206.622.5822 www.kpff.com	Drawing Reference / Scale
		Date / Drawn/Ck'd By: CHA

Apr 11, 2022 - 3:42pm chrisllineh Z:\2000001-2009999\2000722 Mukilteo 5th St Bicycle & Pedestrian\Engineer\CAD\TDA Overview.dwg

EROSION AND SEDIMENT CONTROL NOTES

1. APPROVAL OF THIS EROSION/SEDIMENT CONTROL (ESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESGIN (E.G. SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES).
2. THE IMPLEMENTATION OF THIS ESC PLAN AND CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC BMPS IS THE RESPONSIBILITY OF THE APPLICANT UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND VEGETATION/LANDSCAPING IS ESTABLISHED.
3. CLEARLY FLAG THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THE SITE PREP PLAN IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED BY THE APPLICANT FOR THE DURATION OF CONSTRUCTION.
4. CONSTRUCT THE ESC BMPS SHOWN ON THIS PLAN IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT ENTER THE DRAINAGE SYSTEM, ROADWAYS, OR VIOLATE APPLICABLE WATER STANDARDS.
5. THE ESC BMPS SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, UPGRADE THESE ESC BMPS AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DO NOT LEAVE THE SITE.
6. THE APPLICANT SHALL INSPECT THE ESC BMPS DAILY AND MAINTAIN THEM AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING.
7. INSPECT AND MAINTAIN THE ESC BMPS ON INACTIVE SITE A MINIMUM OF ONCE A MONTH OR WITHIN THE 48 HOURS FOLLOWING A MAJOR STORM EVENT (I.E. 24-HOUR STORM EVENT WITH A 10-YR OR GREATER RECURRANCE INTERVAL).
8. AT NO TIME SHALL THE SEDIMENT EXCEED 60-PERCENT OF THE SUMP DEPTH OR HAVE LESS THAN 6-INCHES OF CLEARANCE FROM SEDIMENT SURFACE TO THE INVERT OF THE LOWEST PIPE. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT LADEN WATER INTO THE DOWNSTREAM SYSTEM.
9. CLEARED AND EXPOSED SLOPES SHALL BE STABILIZED AND COVERED BY A PLASTIC COVERING IF LEFT EXPOSED FOR MORE THAN 7 DAYS DURING THE DRY SEASON (MAY 1 – SEPTEMBER 30) OR MORE THAN 2 DAYS DURING THE WET SEASON (OCTOBER 1 – APRIL 30).

NOT FOR CONSTRUCTION - 60 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY RJL
DATE 04/2022
JOB No. :2000722

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SCALE: 1" = 20'

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SHT. 1 OF 10

EROSION AND SEDIMENT CONTROL NOTES

ECN01

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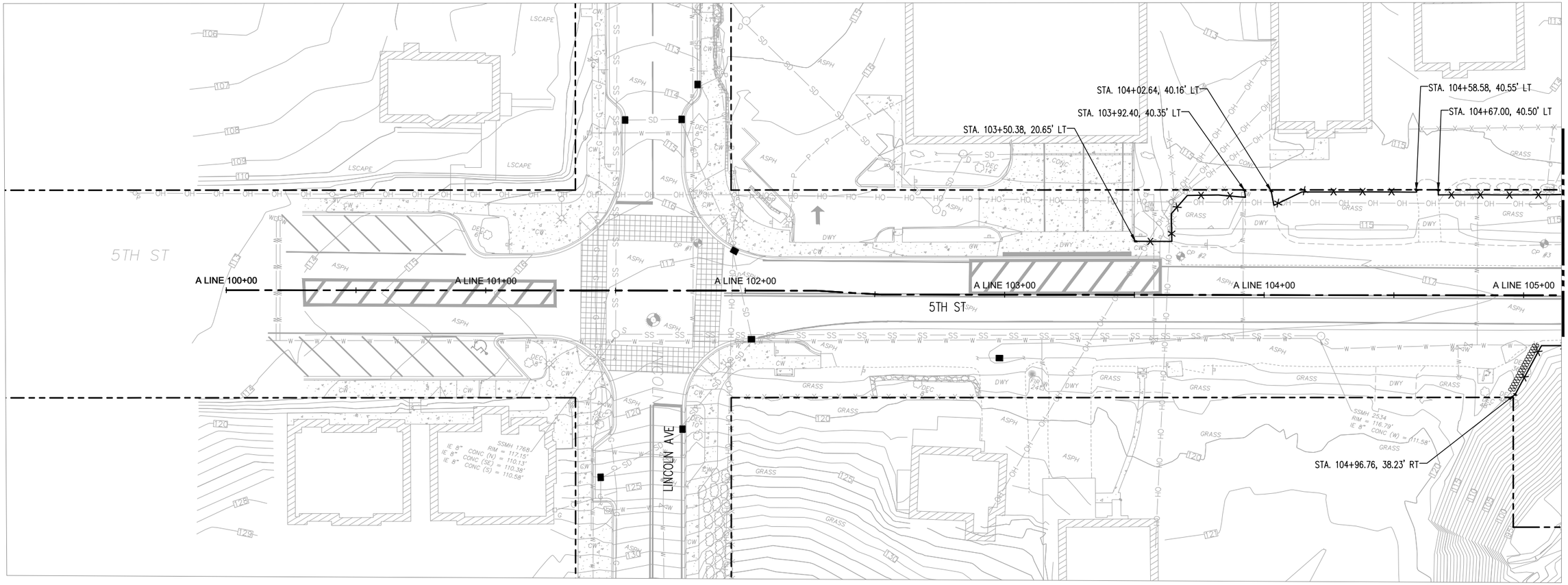

LEGEND

- RIGHT-OF-WAY
- SILT FENCE
- STRAW WATTLES
- INLET PROTECTION

GENERAL NOTES

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N

0 10 20 40
1 inch = 20 feet

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EC01

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michaelv
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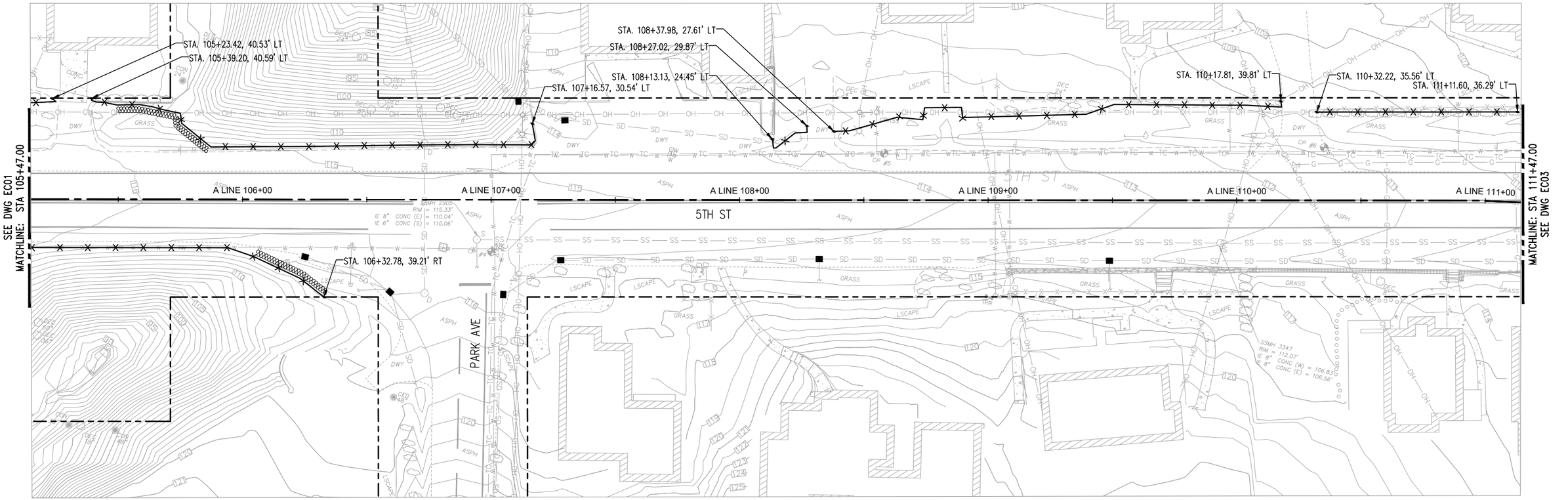

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EROSION AND SEDIMENT CONTROL PLAN

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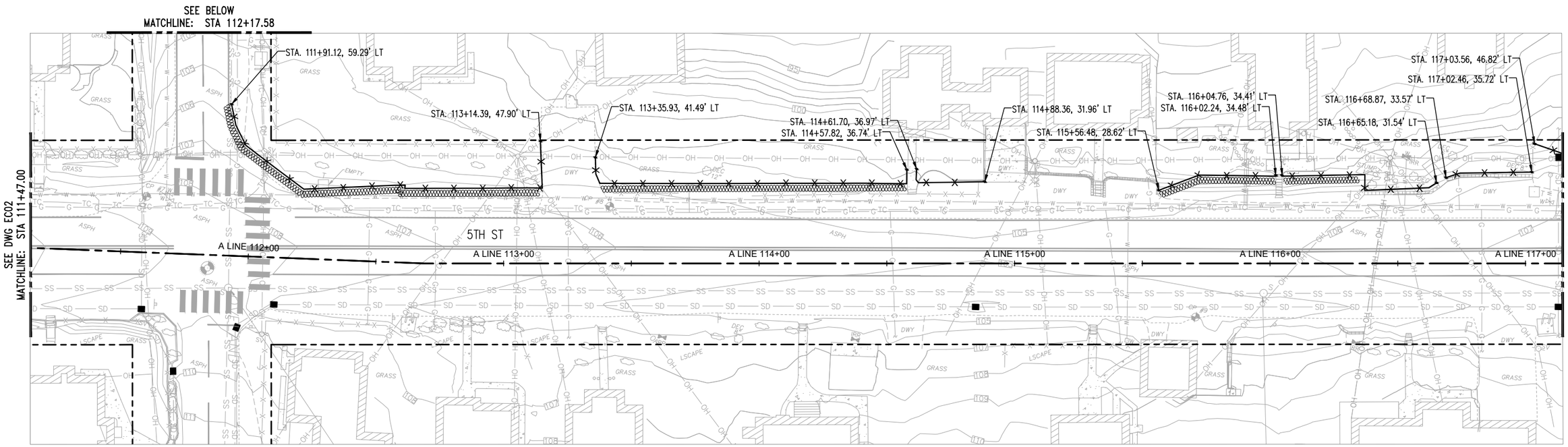

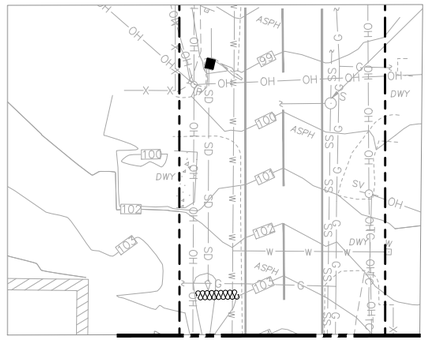

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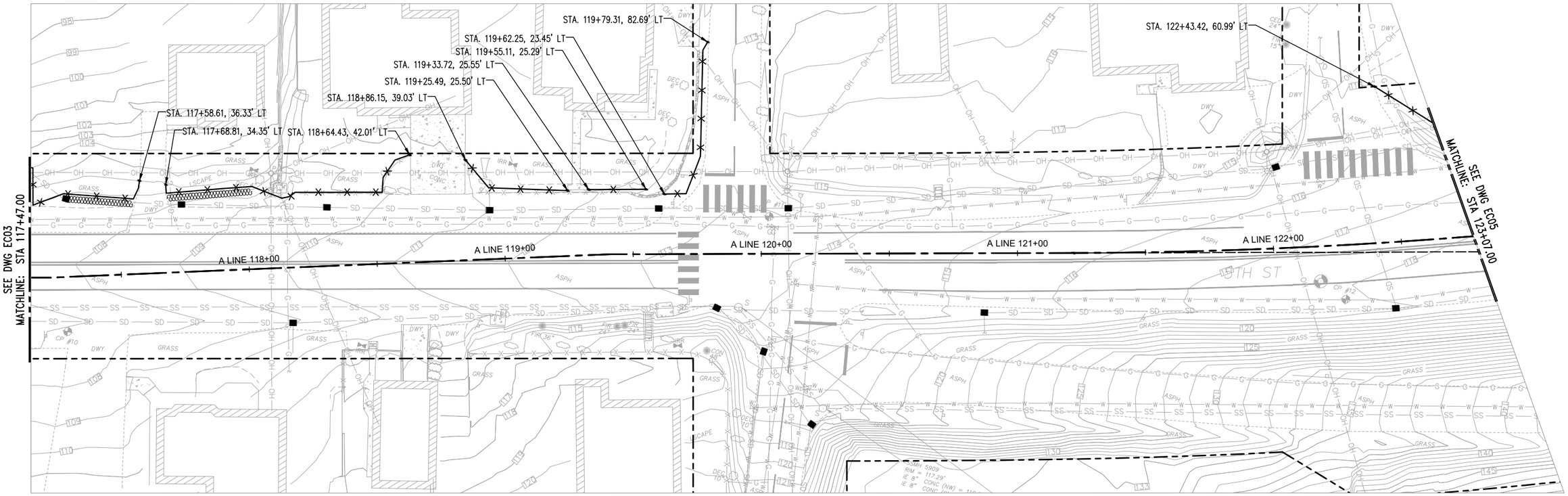

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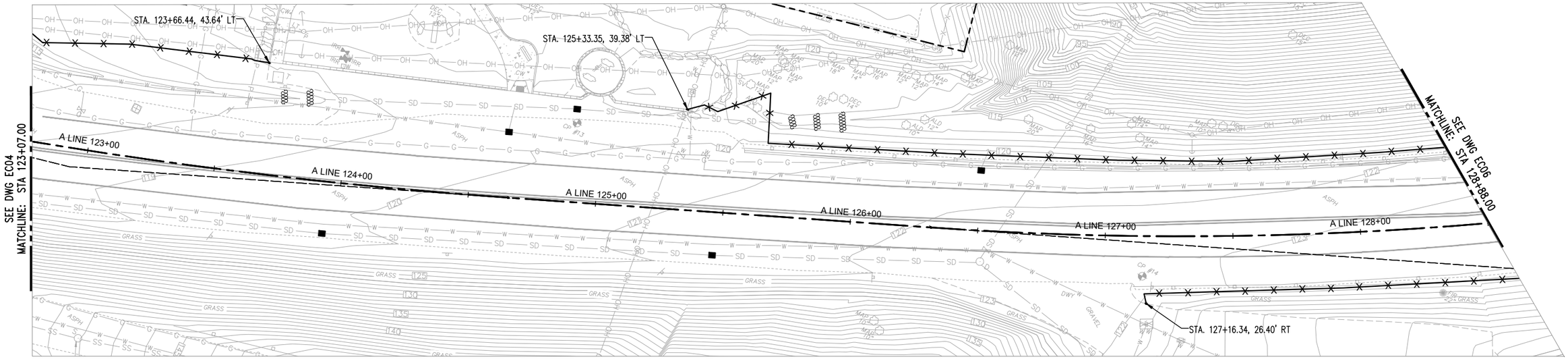

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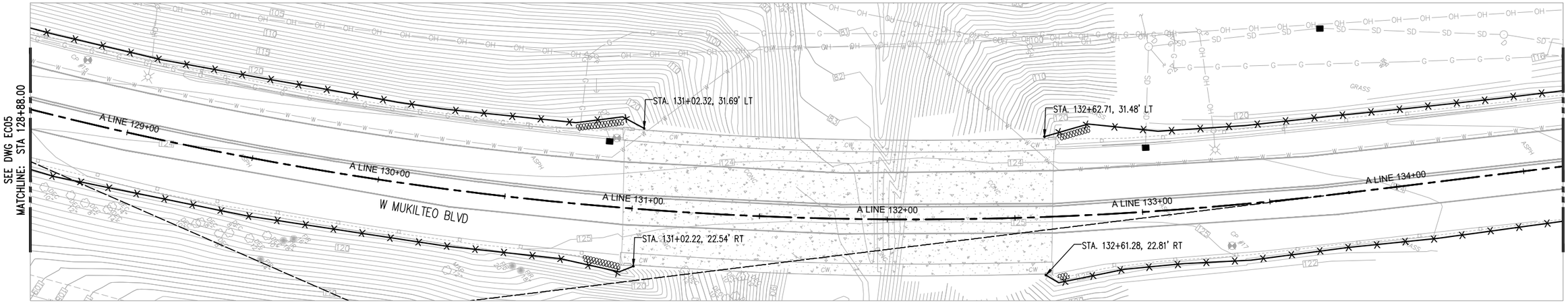

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EROSION AND SEDIMENT CONTROL PLAN

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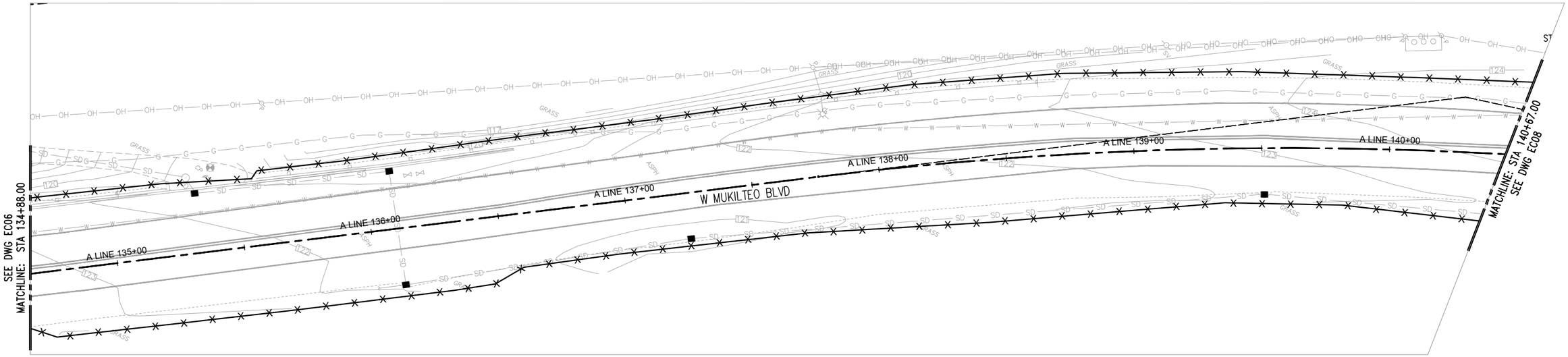

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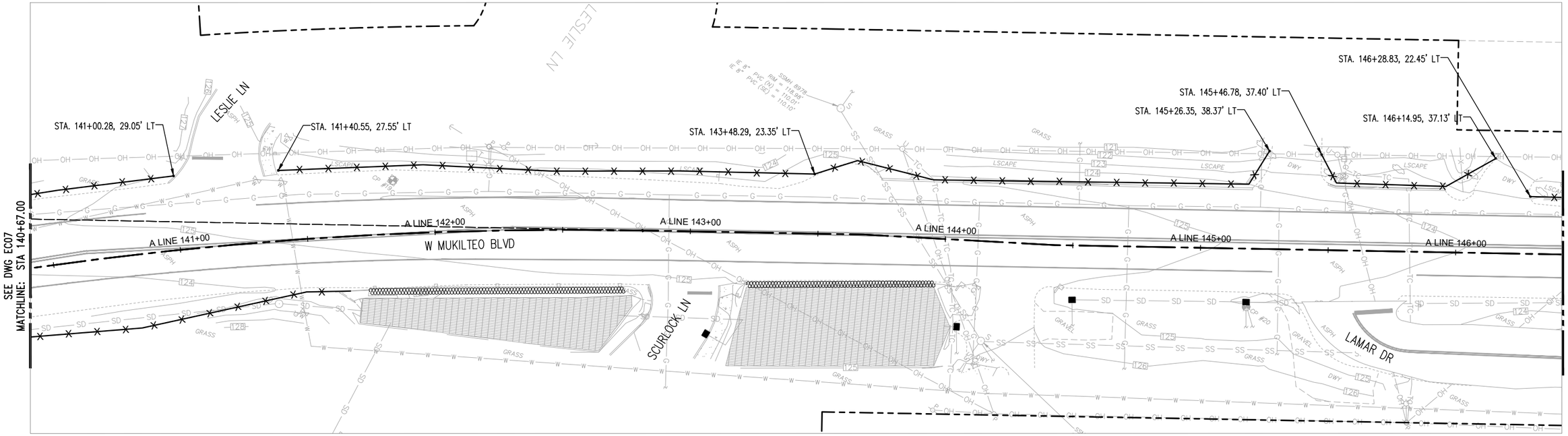
EROSION AND SEDIMENT CONTROL PLAN

EC07

S34 T29N R4E W.M.



LEGEND

- RIGHT-OF-WAY
- SILT FENCE
- STRAW WATTLES
- INLET PROTECTION

GENERAL NOTES

1. PROTECT OPEN SLOPES WITH PLASTIC COVERING CONFORMING TO BMP C123 PER SWMMWW
2. INLET PROTECTION MUST CONFORM TO BMP C220 PER SWMMWW
3. SILT FENCE MUST CONFORM TO BMP C233 PER SWMMWW
4. WATTLES MUST CONFORM TO BMP C235 PER SWMMWW

N

0 10 20 40
1 inch = 20 feet

NOT FOR CONSTRUCTION - 60 PERCENT

NO.	DATE	BY	CHD.	APPR.	REVISION

DRAWN BY MRV | DESIGNED BY TCG
CHECKED BY JMM | APPROVED BY RJL
DATE 04/2022
JOB No. :2000722

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SCALE: 1" = 20'

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CITY OF MUKILTEO

MUKILTEO 5TH ST BICYCLE & PEDESTRIAN
MUKILTEO, WA

SHT. 9 OF 10

EROSION AND SEDIMENT CONTROL PLAN

EC08

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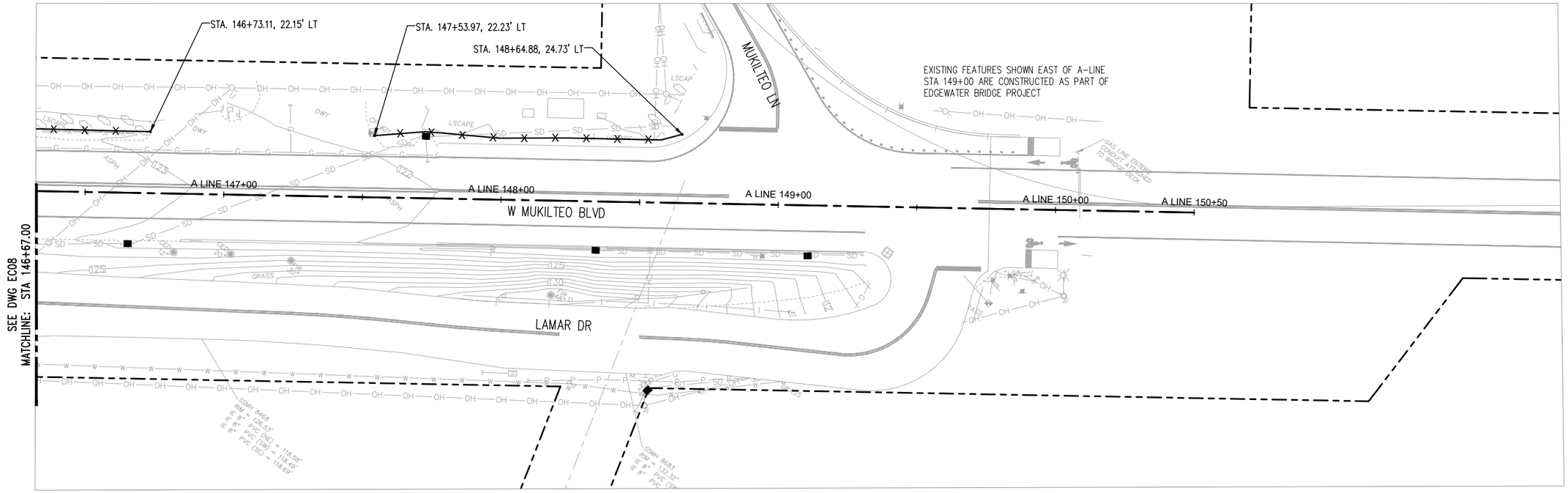
michaelv
Jul 14, 2022 - 9:19am

S34 T29N R4E W.M.



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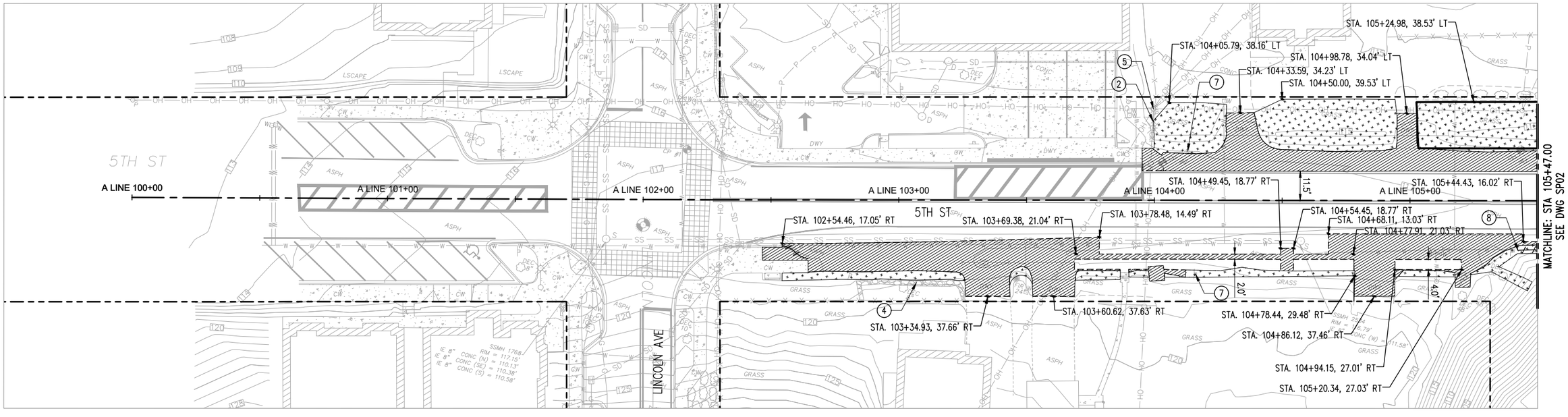
EROSION AND SEDIMENT CONTROL PLAN

EC09

S4 T28N R4E W.M.



LEGEND

- RIGHT-OF-WAY
- SAWCUT
- REMOVE CURB OR CURB AND GUTTER
- REMOVE STRUCTURE OR OBSTRUCTION NOTED
- ROADWAY EXCAVATION INCL. HAUL
- CLEARING AND GRUBBING

CONSTRUCTION NOTES

1. REMOVE FENCE
2. REMOVE LUMINAIRE
3. REMOVE CEMENT CONCRETE STAIRS
4. PROTECT EX. WALL
5. PROTECT EX. POWER POLE
6. PROTECT EX. FENCE
7. REMOVE EX. SIGN
8. REMOVE GUARDRAIL

GENERAL NOTES

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2. TREE REMOVAL IS INCLUDED IN CLEARING AND GRUBBING
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5. EXISTING OVERHEAD UTILITY WIRES EXIST WITHIN THE PROJECT CORRIDOR
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SITE PREPARATION PLAN

SP01

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tmg
Apr 11, 2022 - 6:52pm

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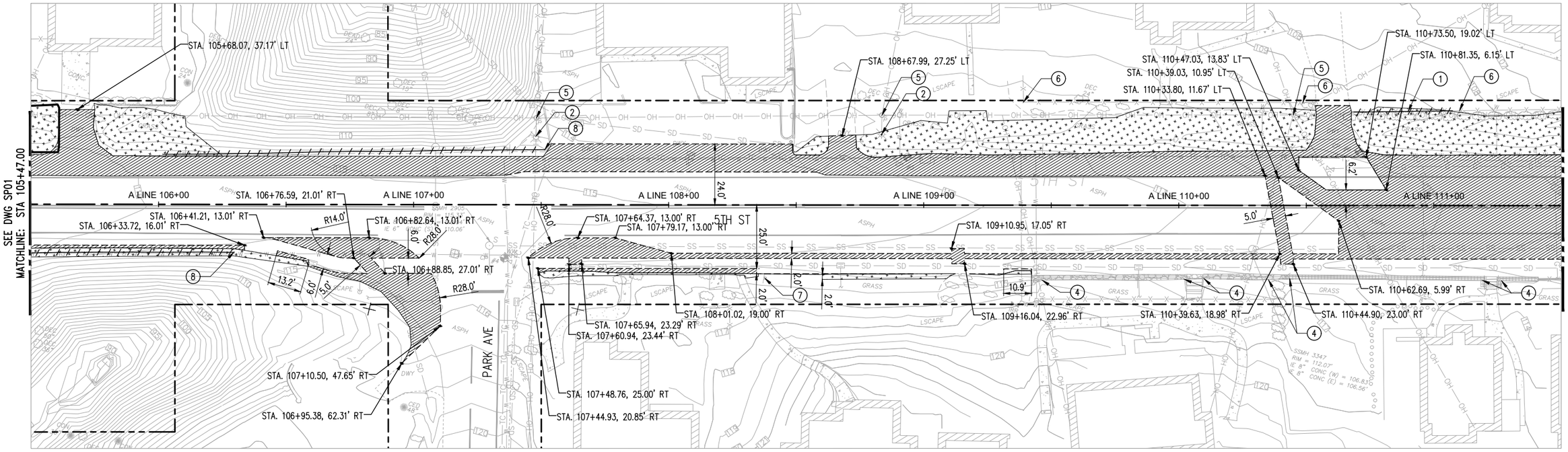

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SP02

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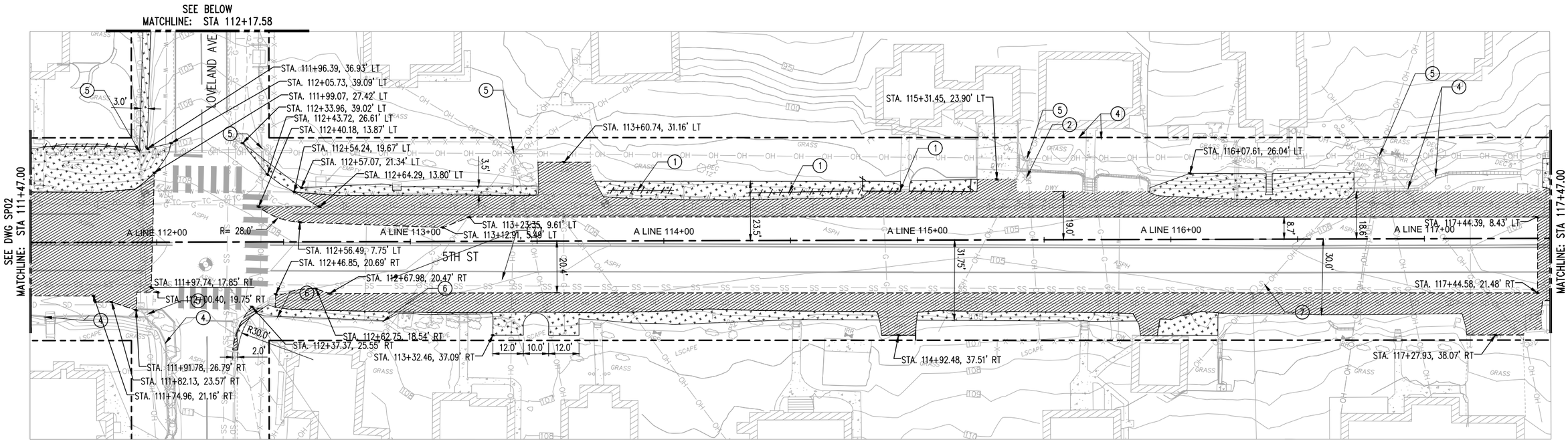

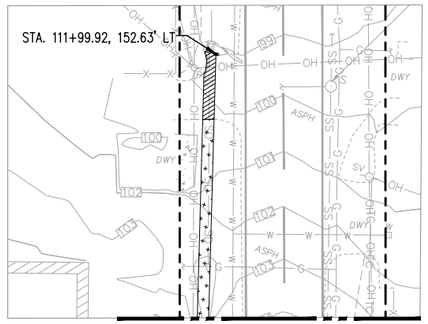

MATCHLINE: STA 112+17.58
SEE ABOVE

LEGEND

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- SAWCUT
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- CLEARING AND GRUBBING

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SITE PREPARATION PLAN

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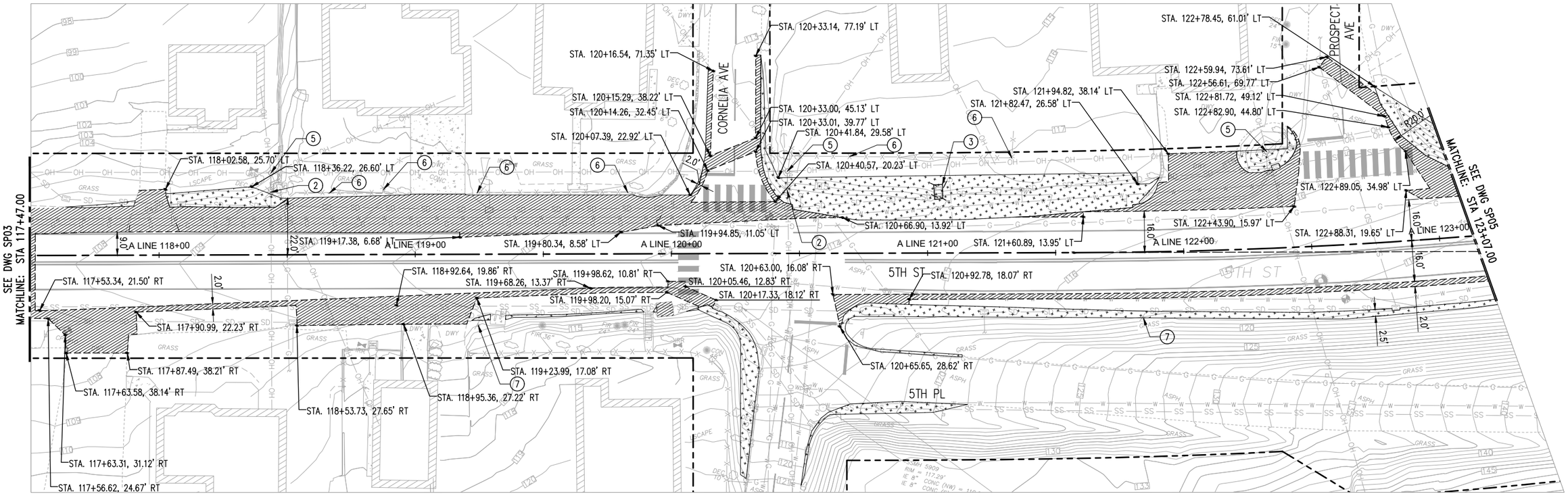

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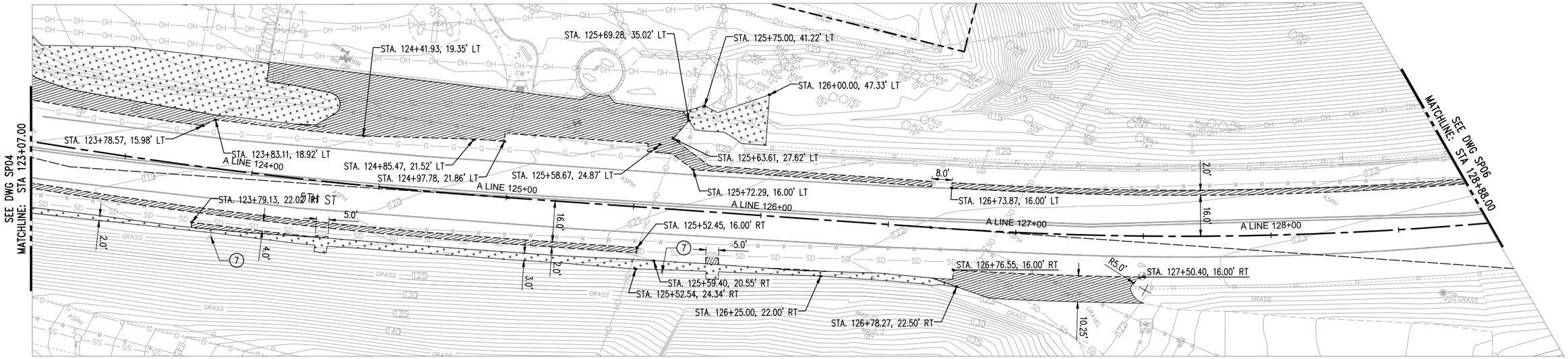

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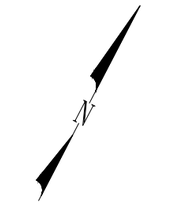

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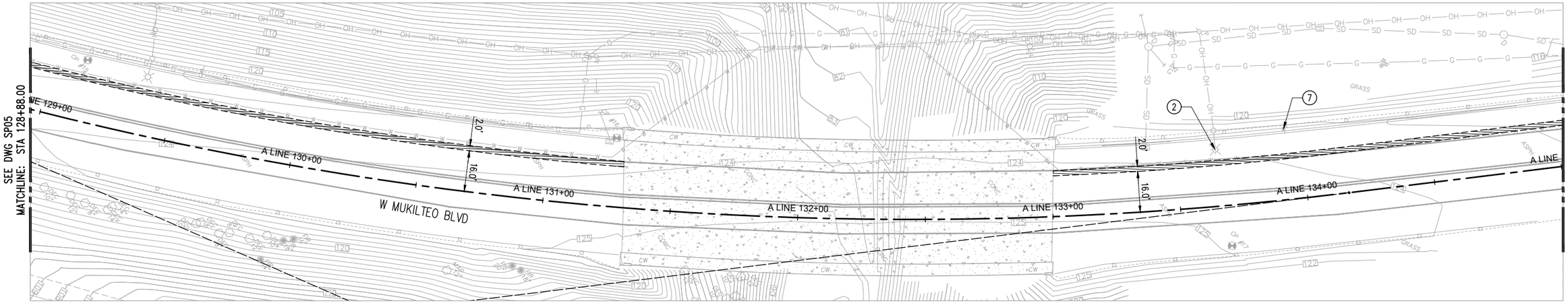

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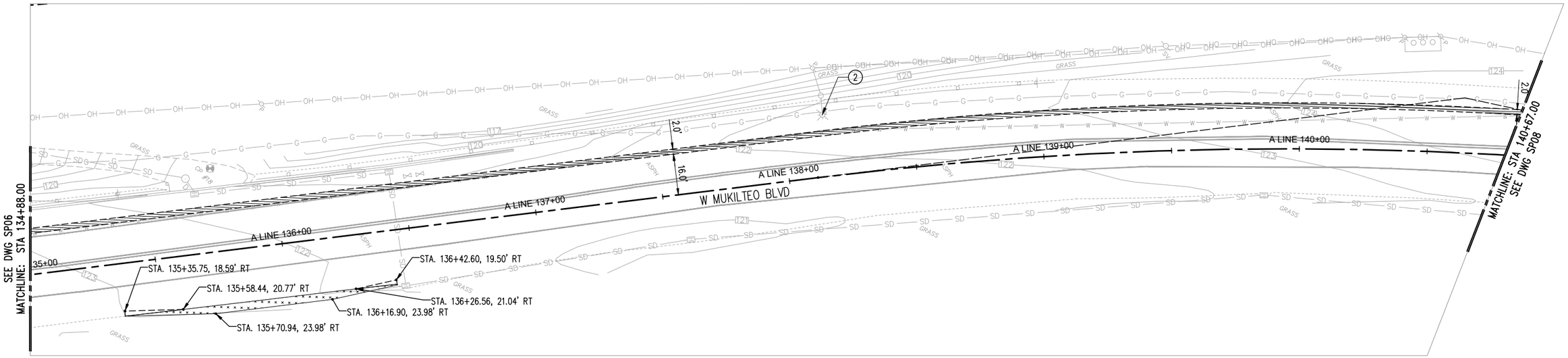

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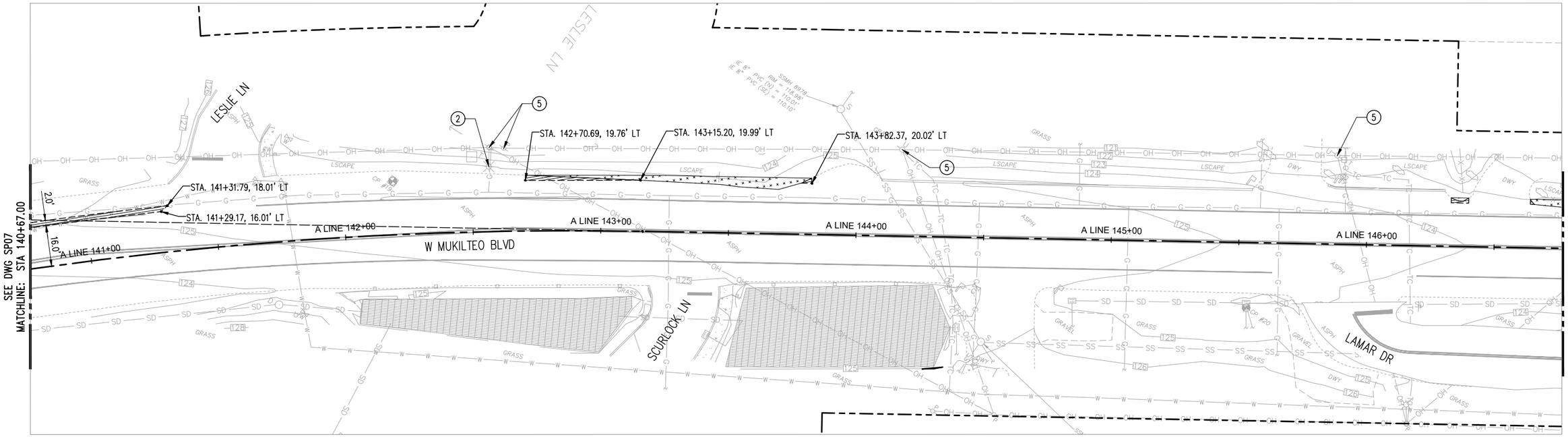

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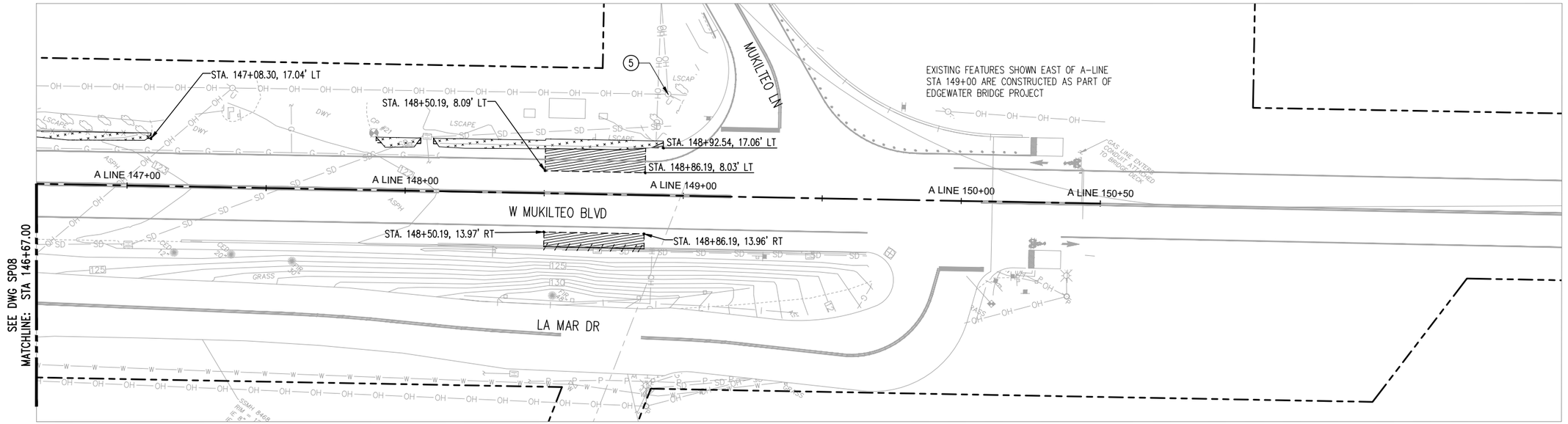

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SP09

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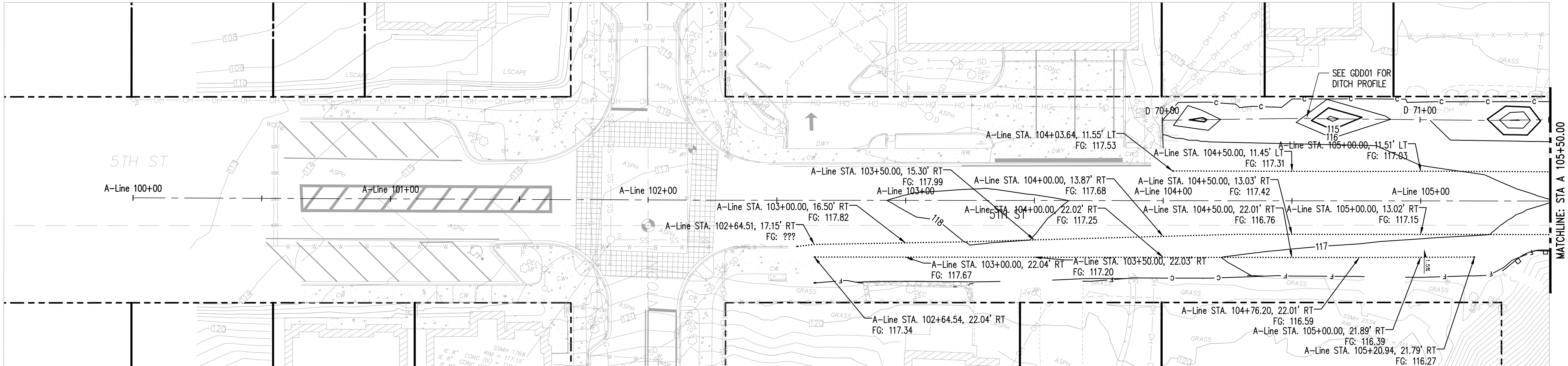

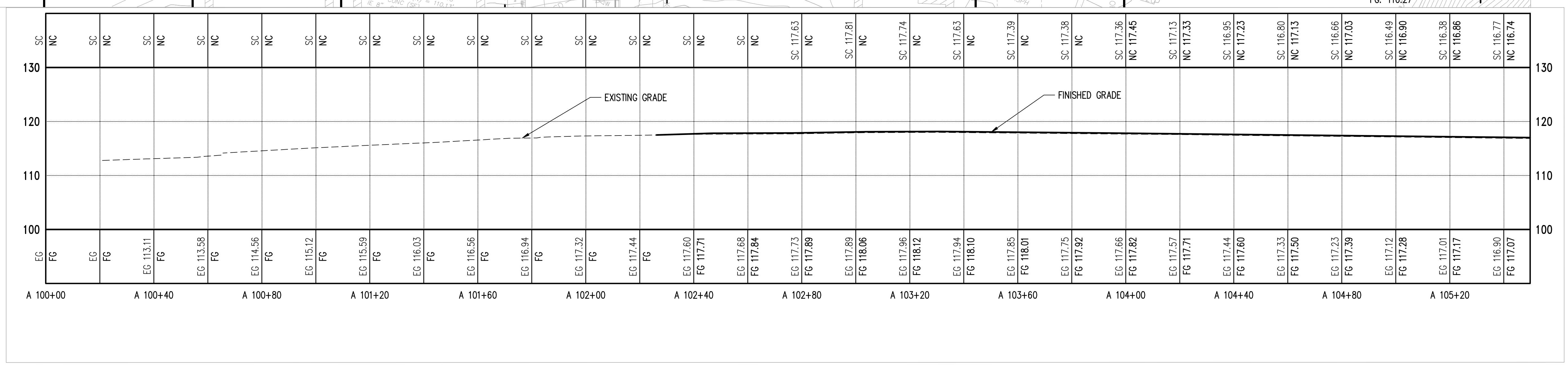

LEGEND

.... GRADE BREAK LINE (GB)

NOTES

1. SEE PAVING PLANS FOR PAVING LIMITS

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0 10 20 40
1 inch = 20 feet

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GD01

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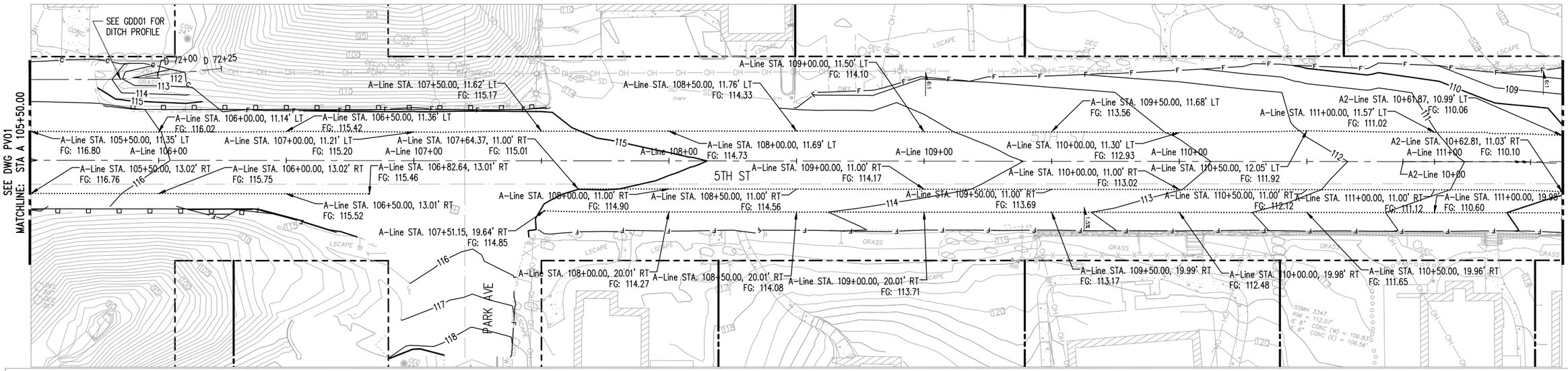

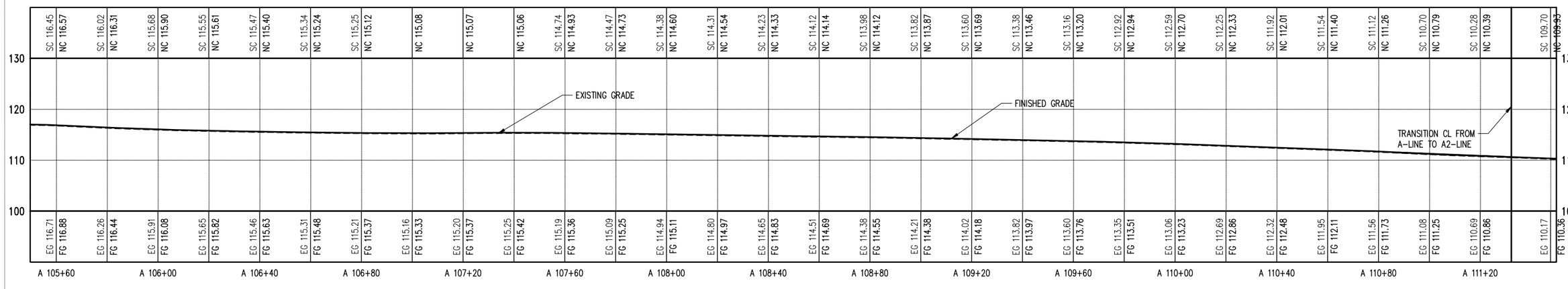

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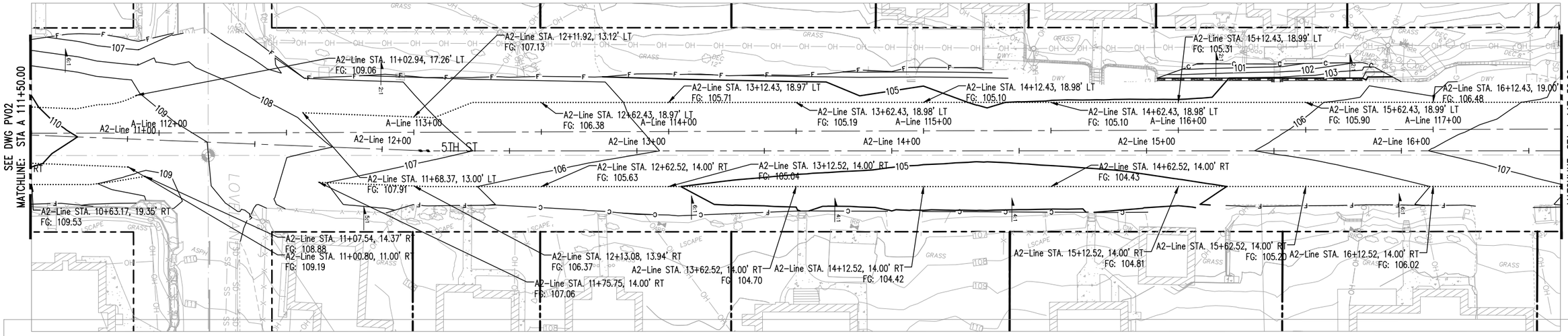

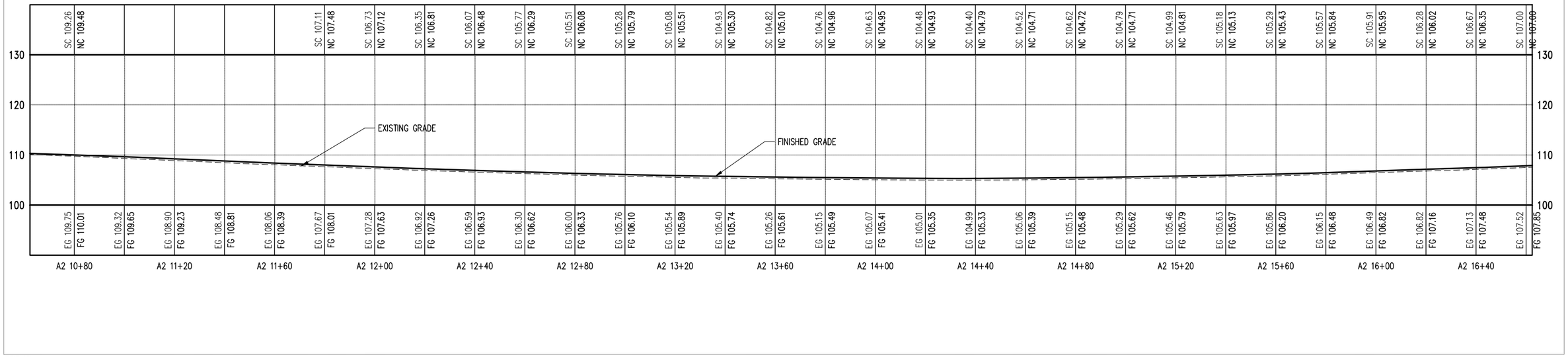

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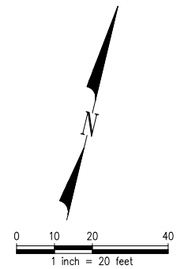

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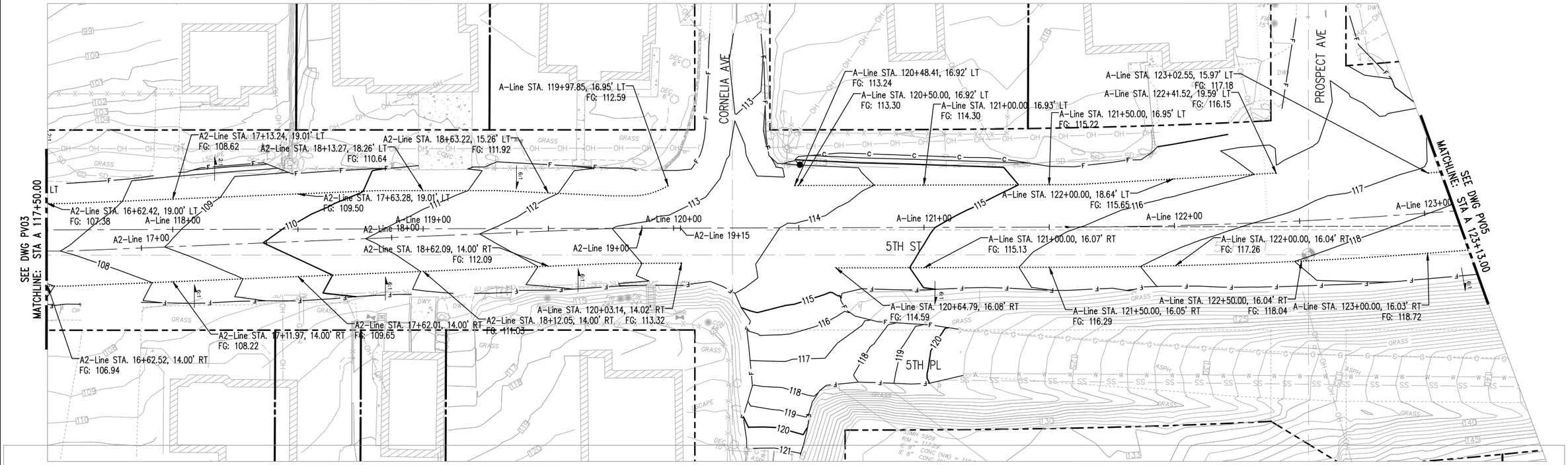

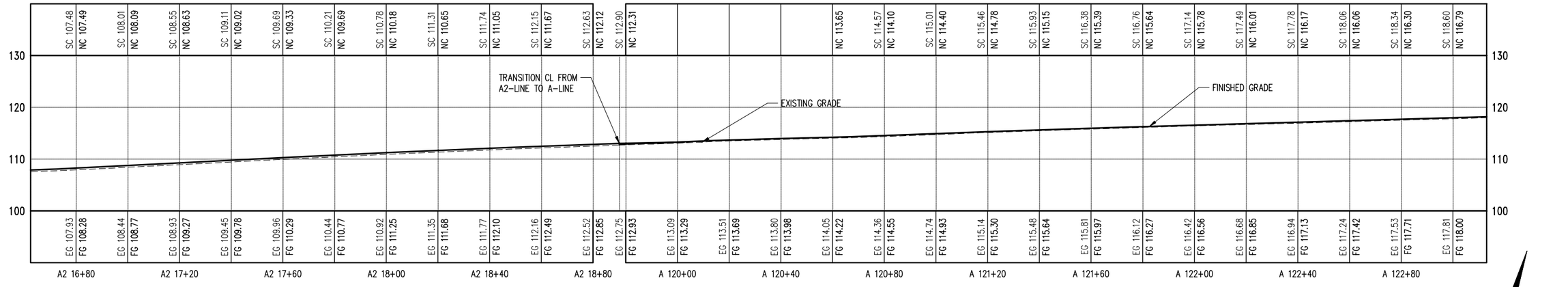

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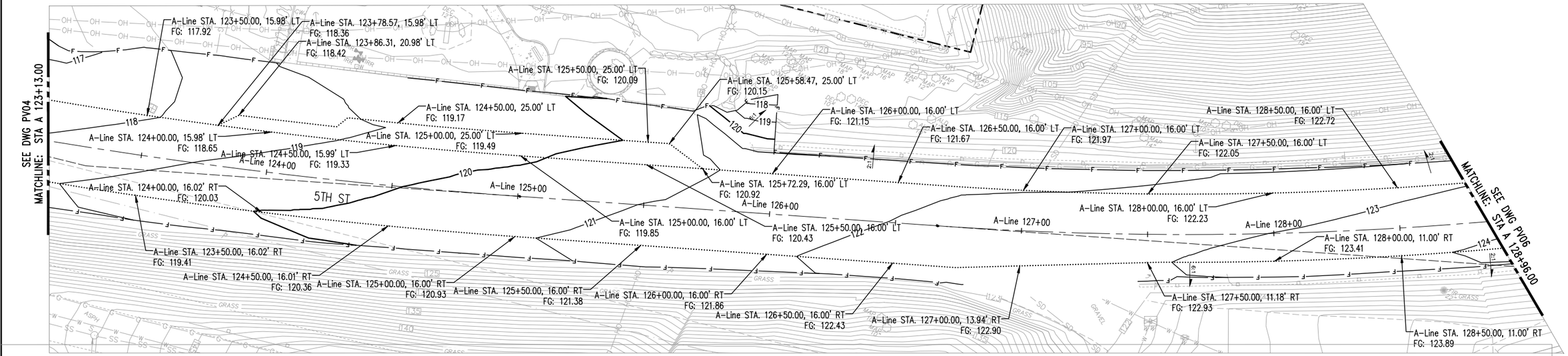

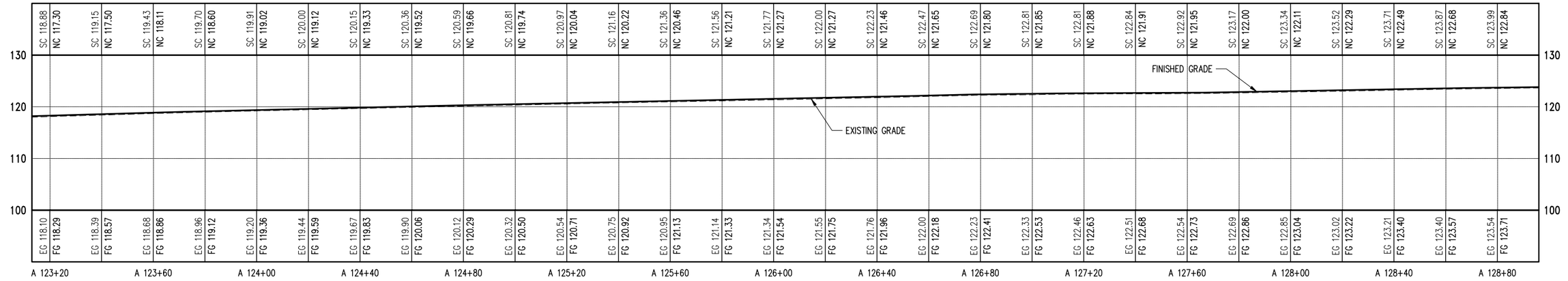

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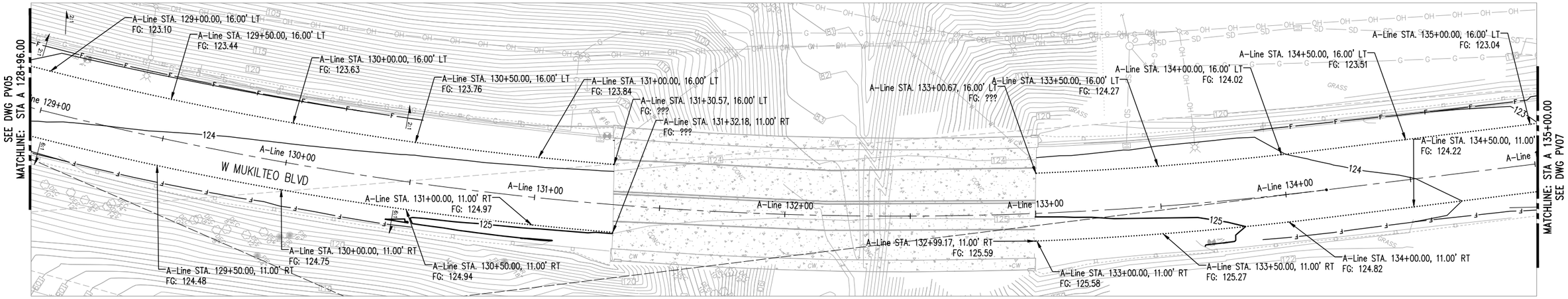

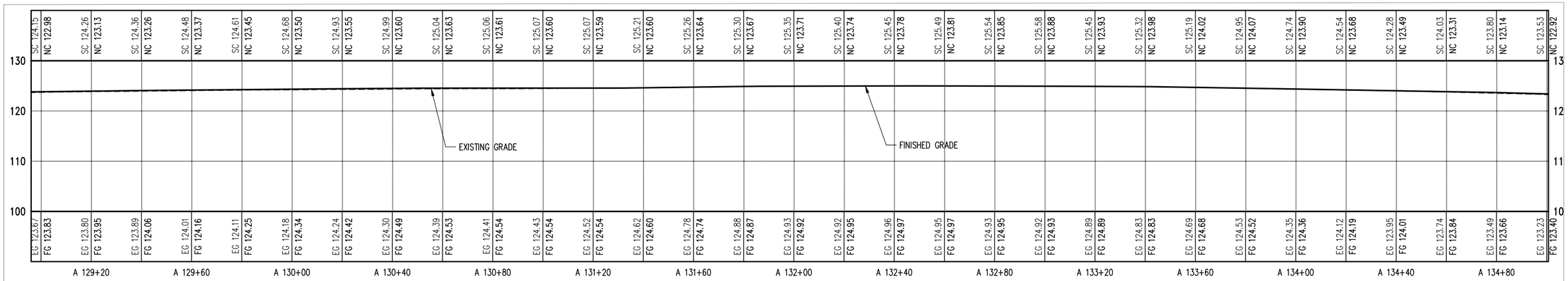

LEGEND

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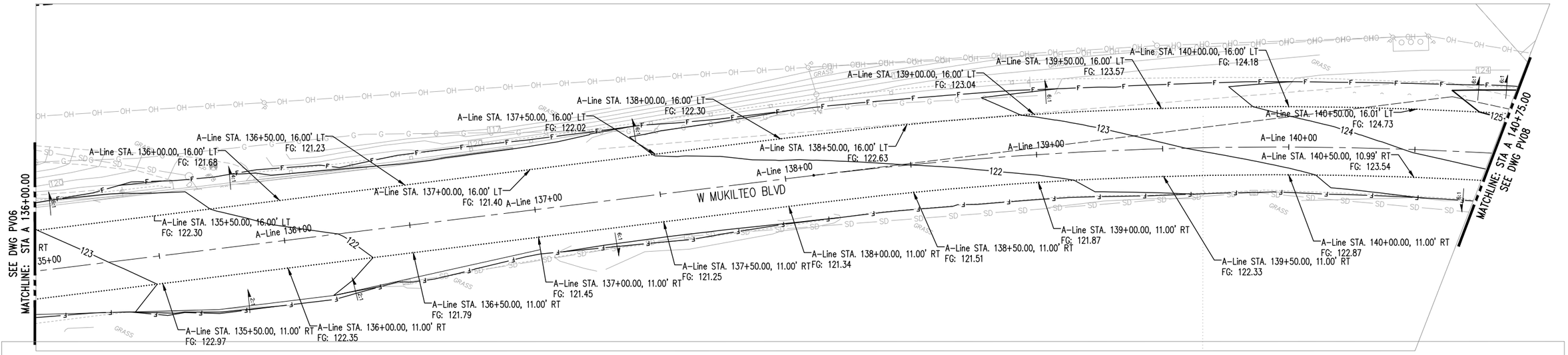

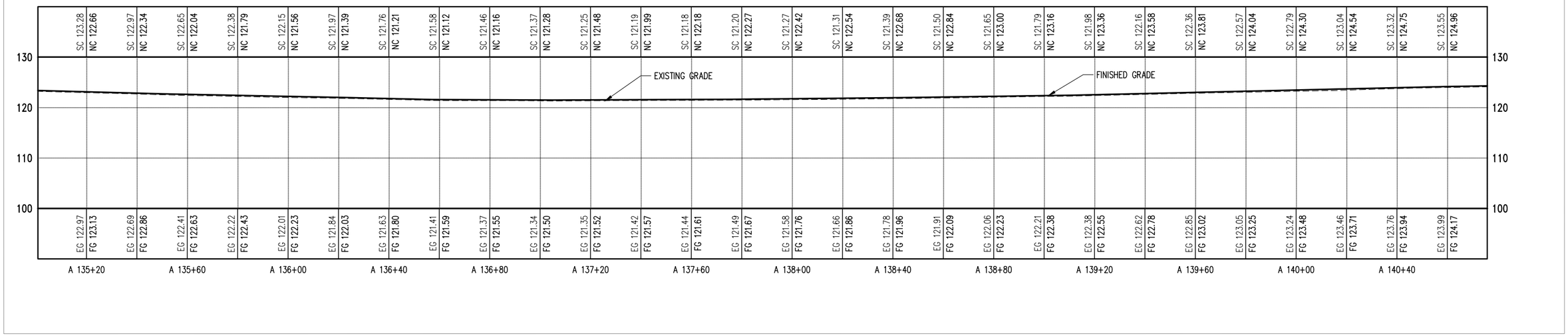

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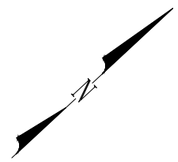

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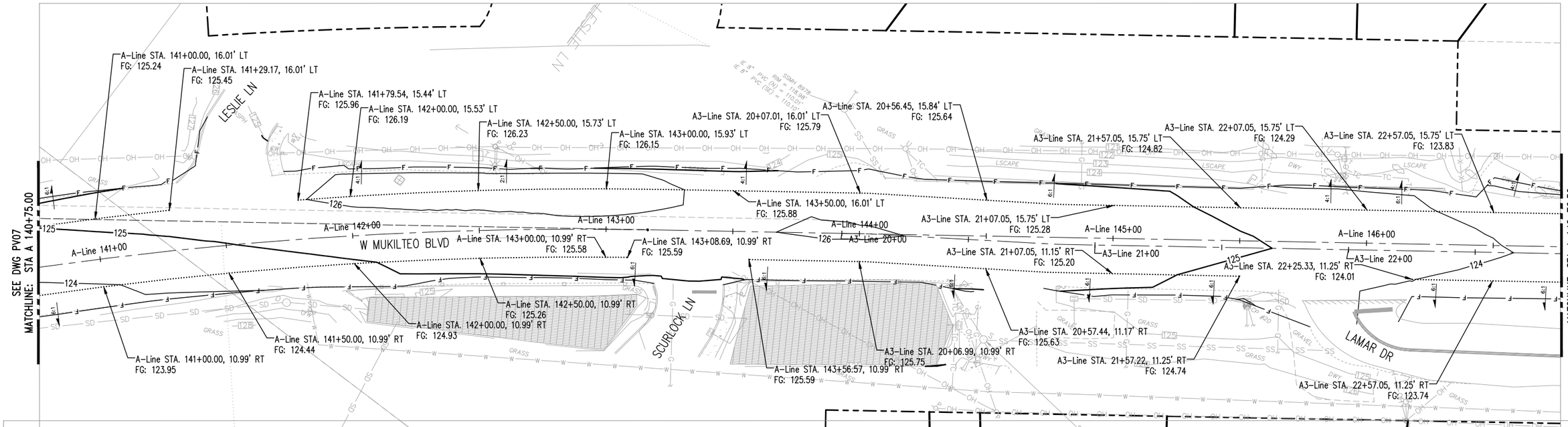
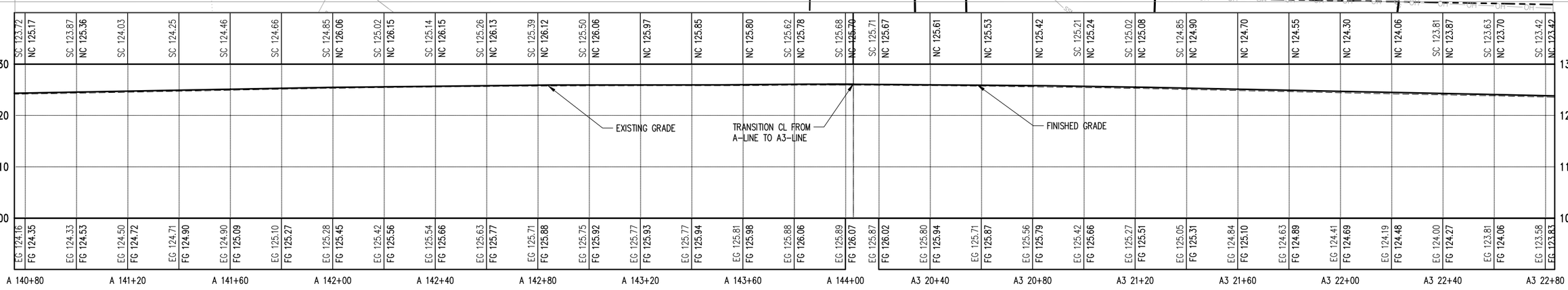
S3 T29N R4E





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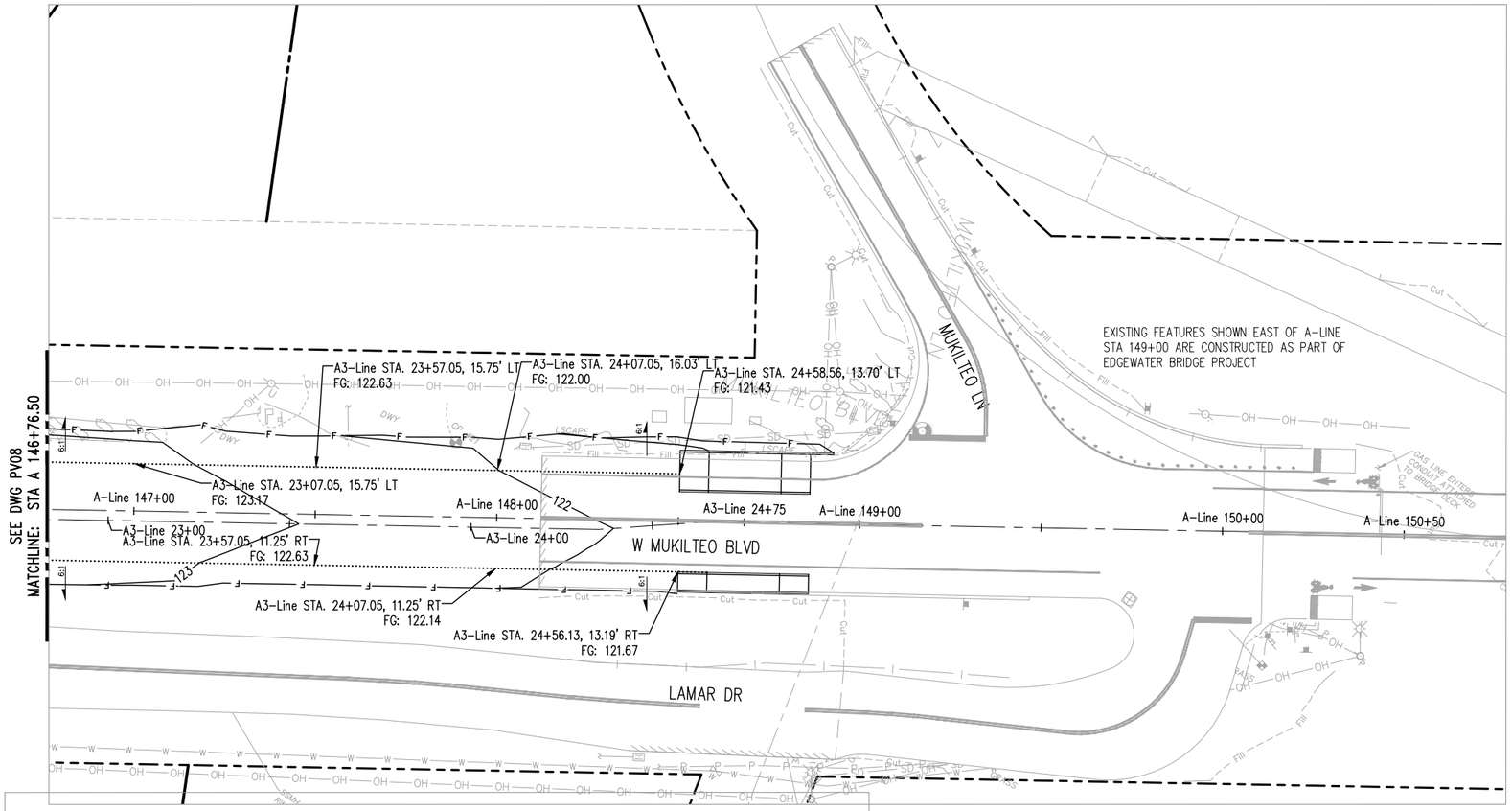

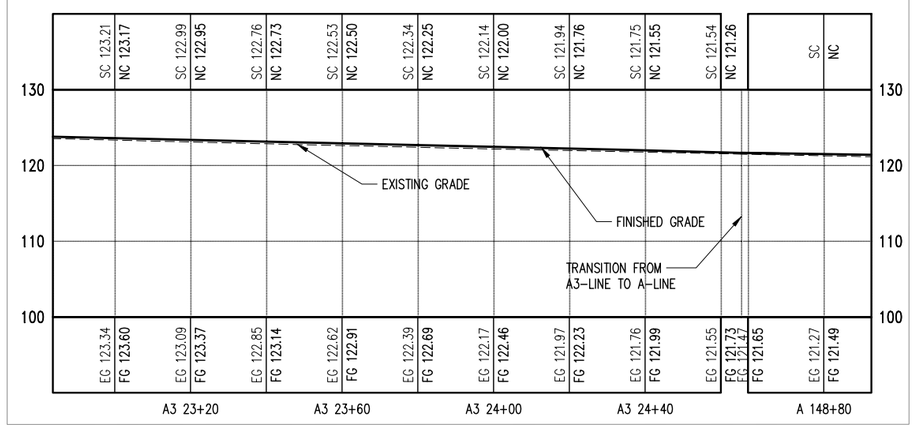

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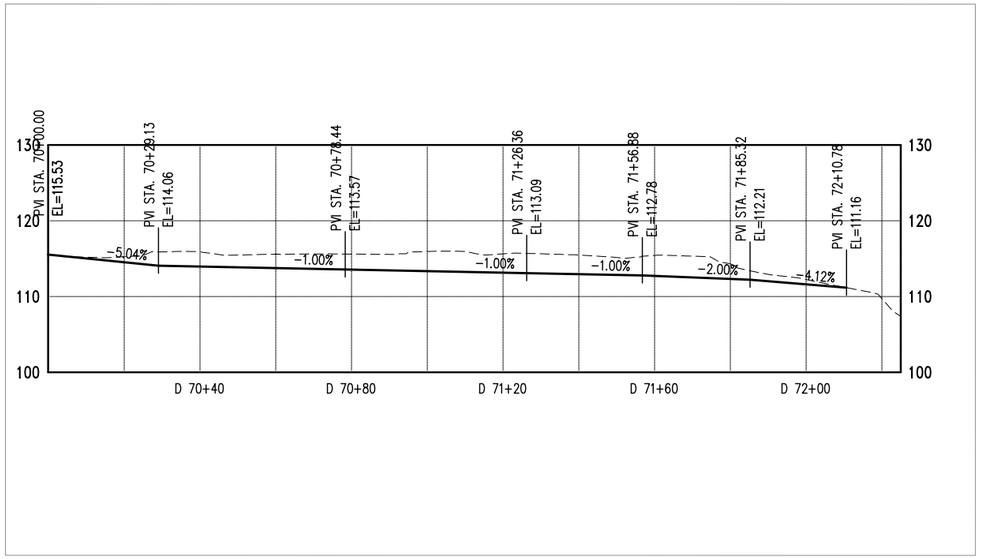

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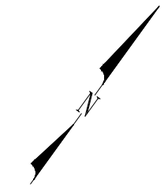

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Appendix B

BMP Specifications

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.

3. Provide a minimum of 8-inch overlap at the seams.
4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C124: Sodding

Purpose

The purpose of sodding is to establish turf for immediate erosion protection and to stabilize drainage paths where concentrated overland flow will occur.

thickness is 2 feet.

- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.

- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.11 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-3.10: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

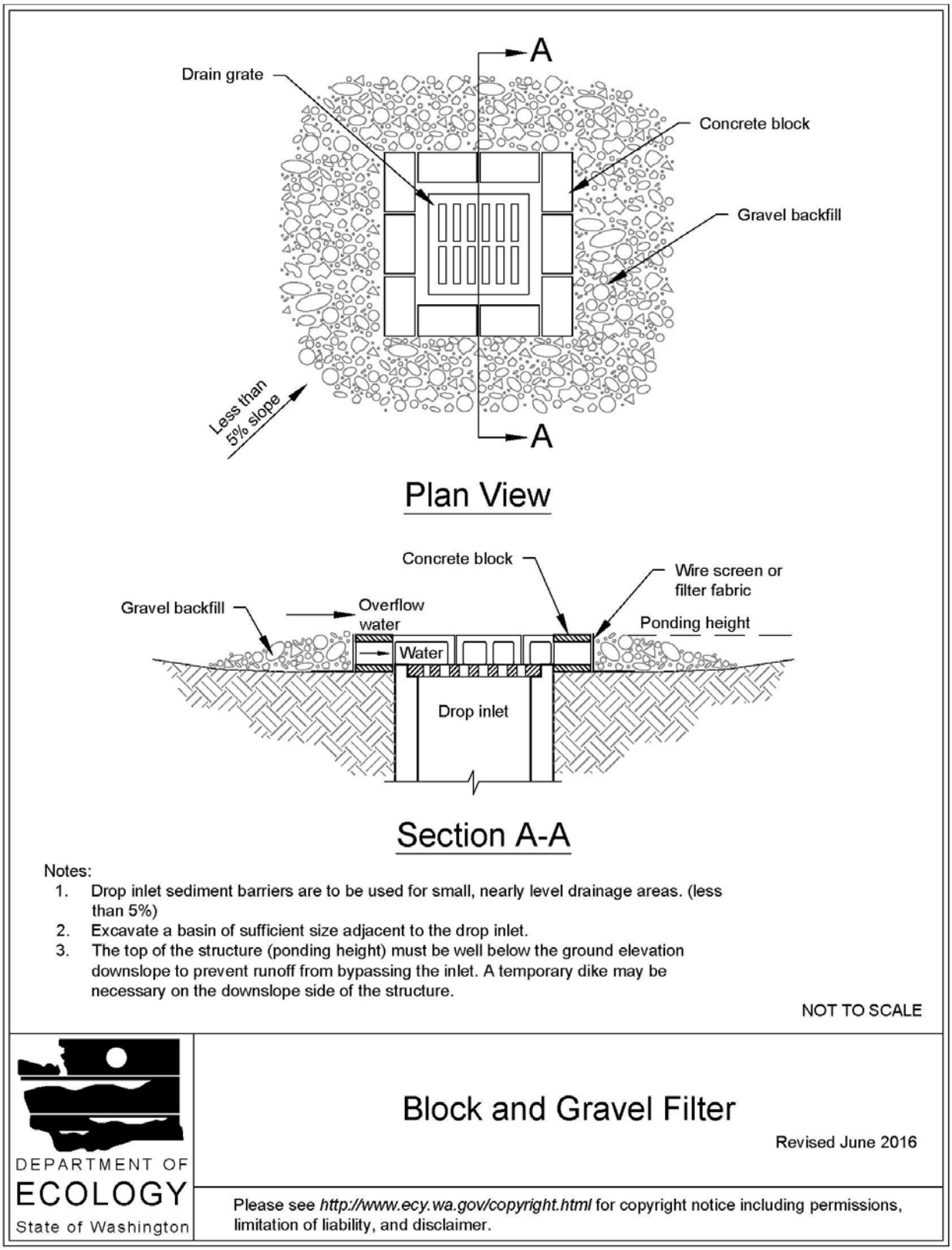
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
    - Provide a slope of 3H:1V on the upstream side of the berm.
    - Provide a slope of 2H:1V on the downstream side of the berm.
    - Provide a 1-foot wide level stone area between the gravel berm and the inlet.
    - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: Block and Gravel Filter



Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

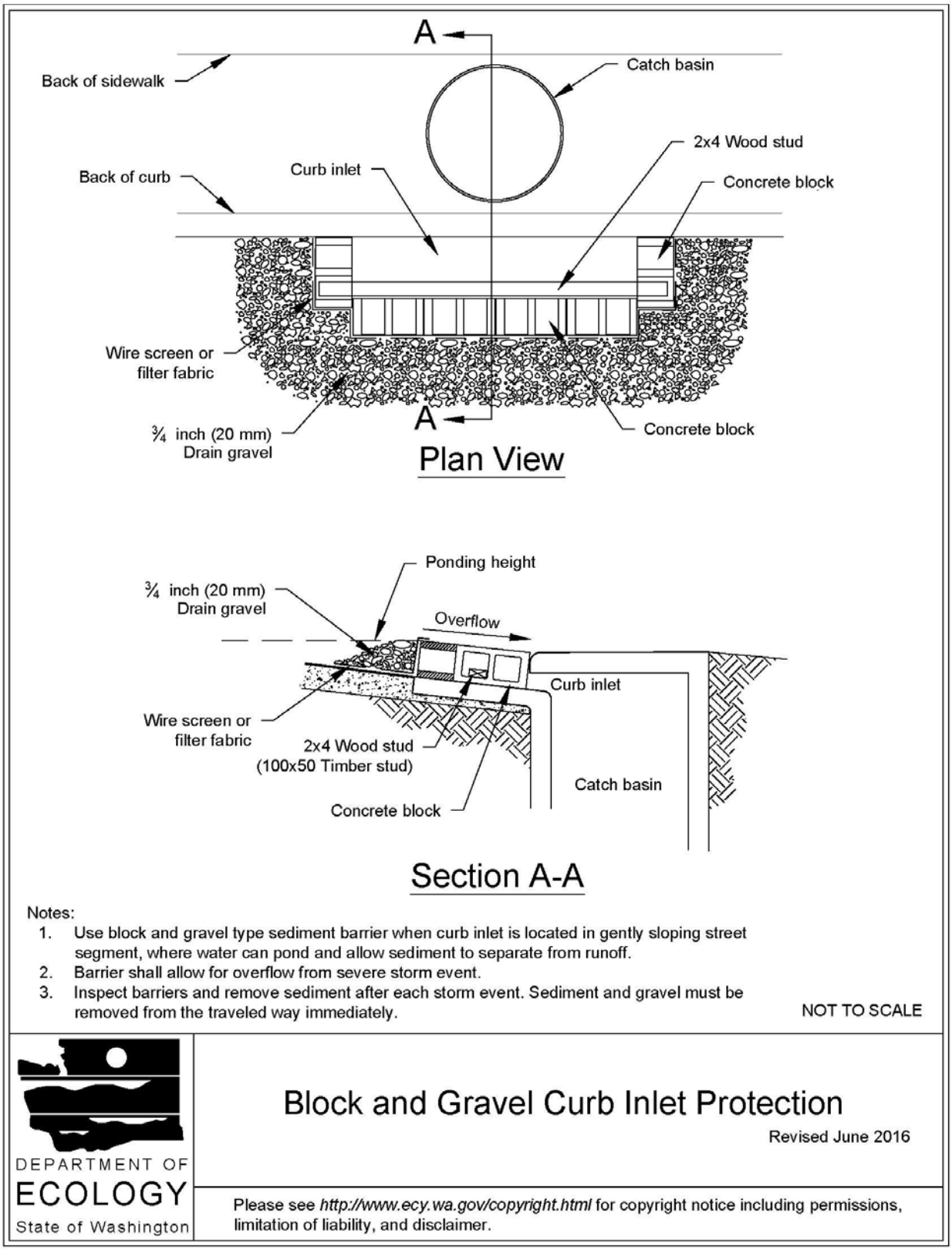
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure II-3.18: Block and Gravel Curb Inlet Protection



Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Block and Gravel Curb Inlet Protection

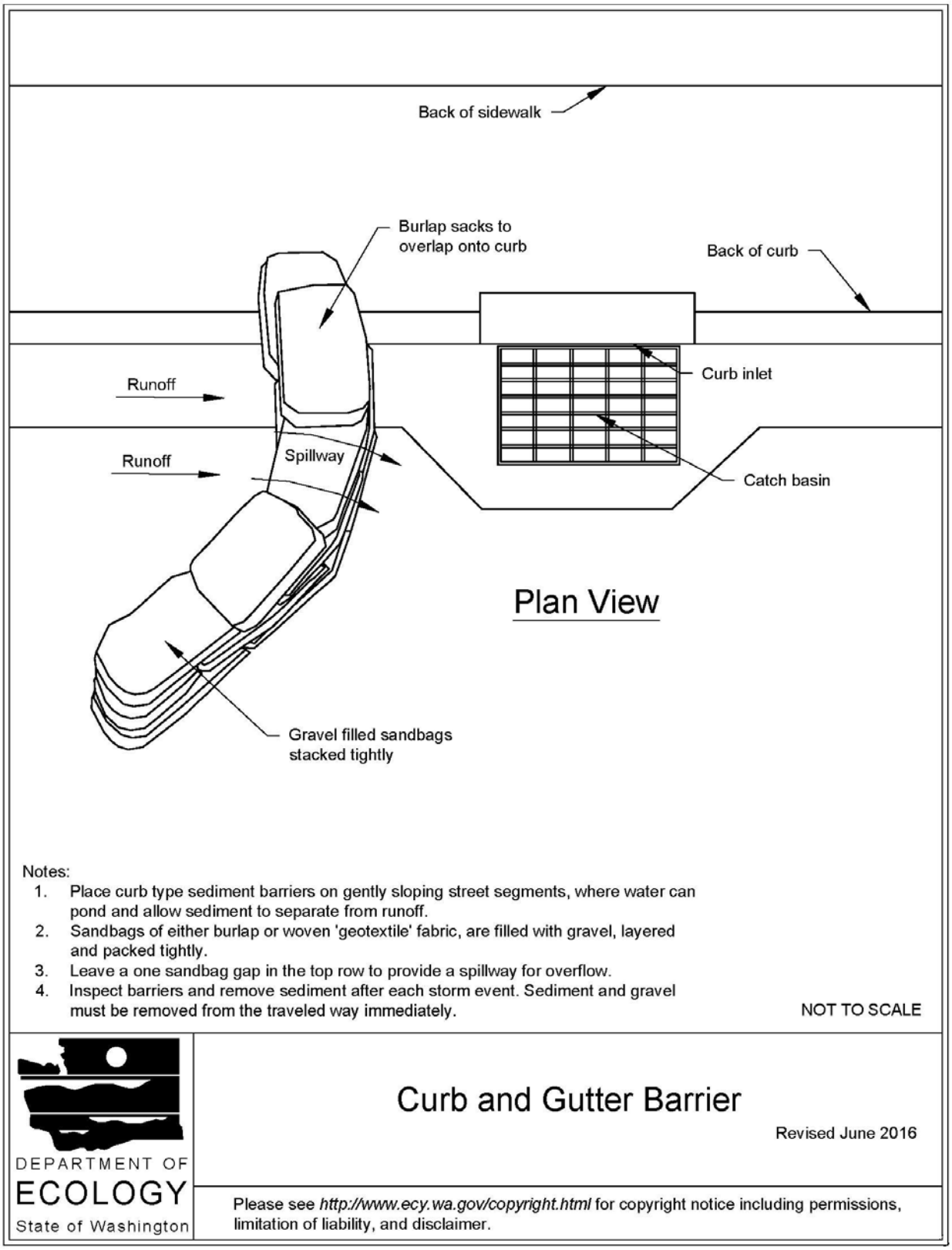
Revised June 2016

Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-3.19: Curb and Gutter Barrier



Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C231: Brush Barrier

Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Brush barriers may be used downslope of disturbed areas that are less than one-quarter acre.
- Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be directed to a sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment trapping BMP, is when the area draining to the barrier is small.
- Brush barriers should only be installed on contours.

Design and Installation Specifications

- Height: 2 feet (minimum) to 5 feet (maximum).
- Width: 5 feet at base (minimum) to 15 feet (maximum).
- Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.

BMP C233: Silt Fence

Purpose

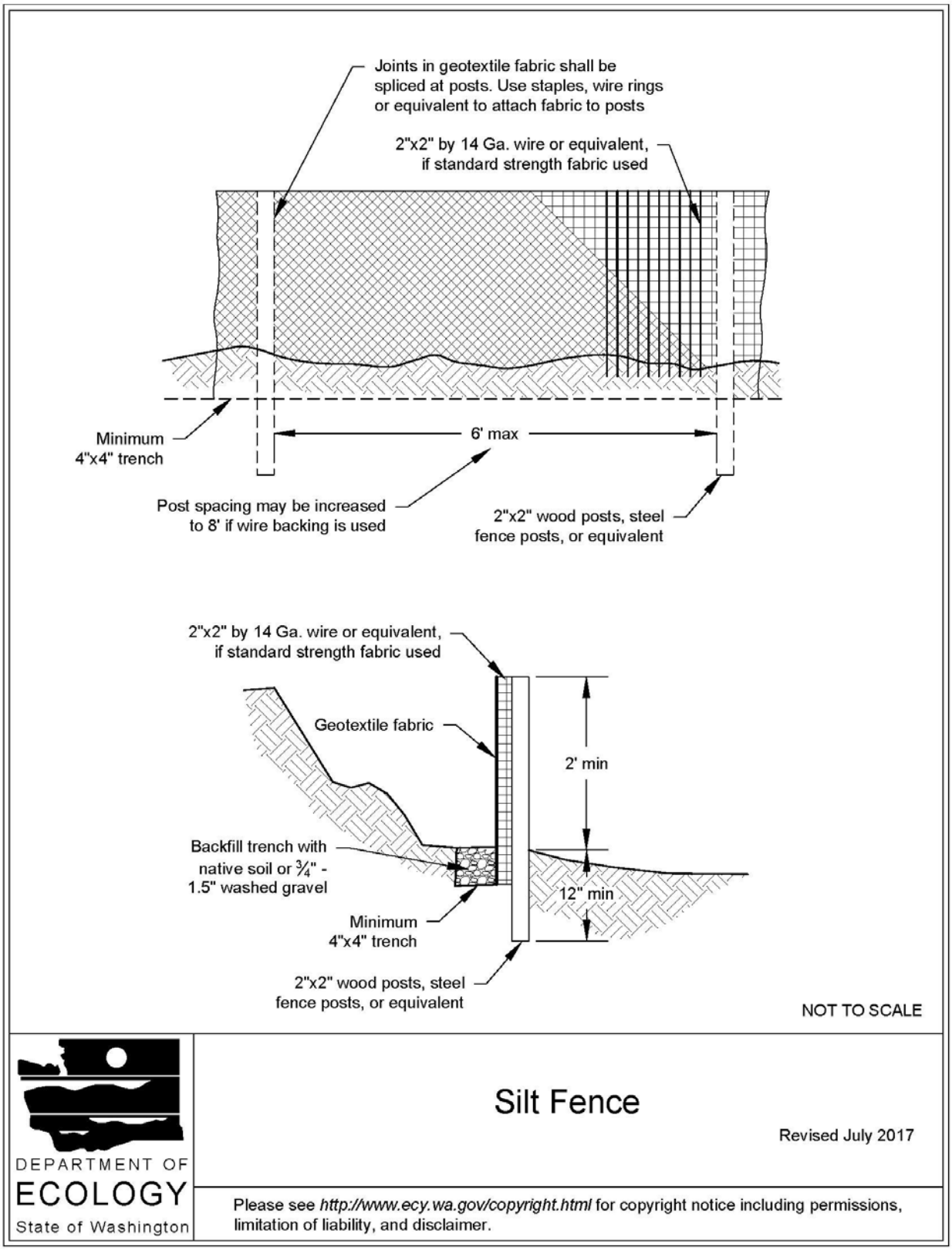
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure II-3.22: Silt Fence



Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table II-3.11: Geotextile Fabric Standards for Silt Fence):

Table II-3.11: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure II-3.22: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:

    1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
    2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.

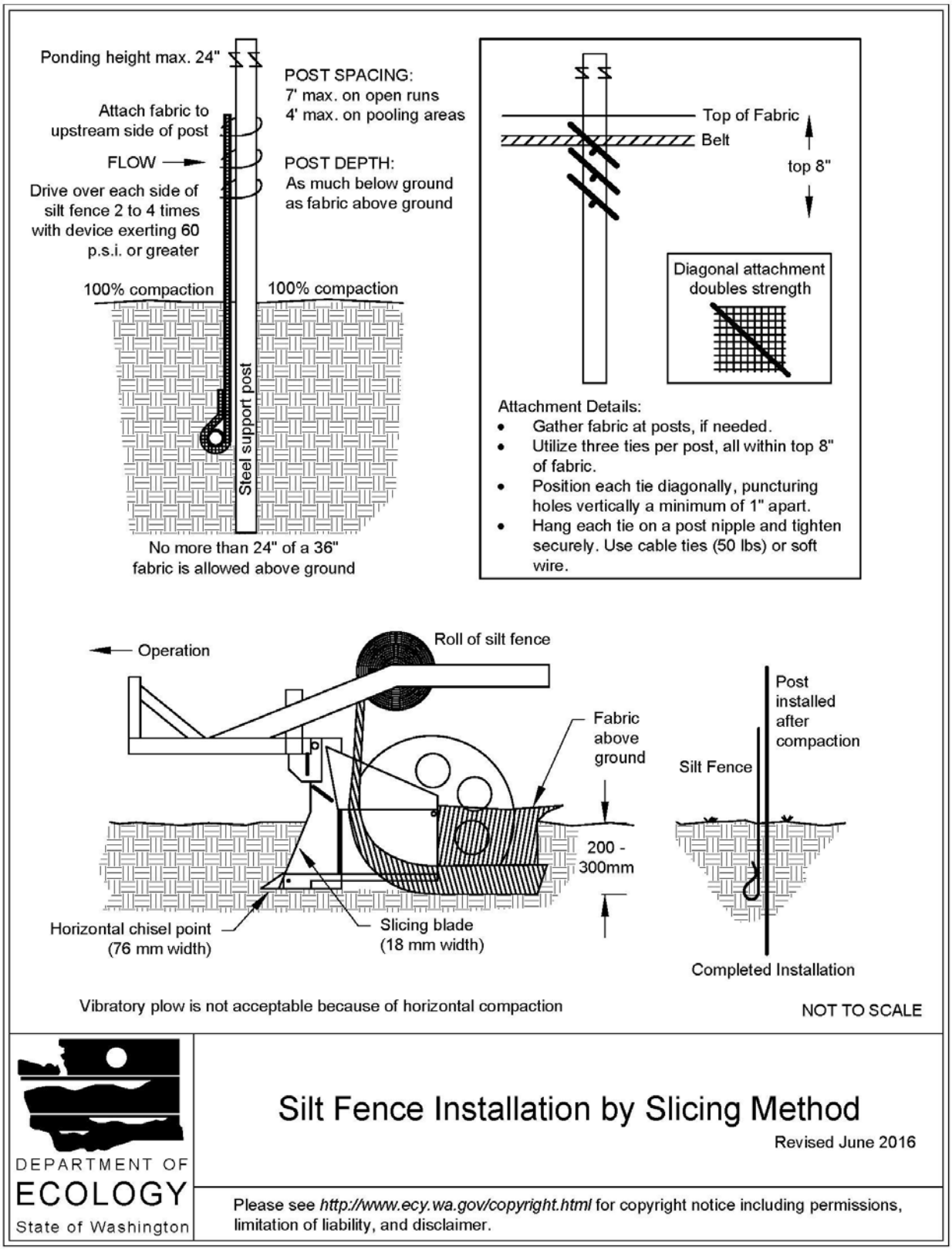
3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
9. Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:
    - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
    - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.
11. Locate silt fences on contour as much as possible, except at the ends of the fence,

where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
    - Check dams shall be approximately 1-foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
    - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Refer to Figure II-3.23: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:
    1. The base of both end posts must be at least 2- to 4-inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    2. Install posts 3- to 4-feet apart in critical retention areas and 6- to 7-feet apart in standard applications.
    3. Install posts 24-inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
    4. Install posts with the nipples facing away from the geotextile fabric.
    5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8-inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    6. Wrap approximately 6-inches of the geotextile fabric around the end posts and secure with 3 ties.
    7. No more than 24-inches of a 36-inch geotextile fabric is allowed above ground level.
    8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure II-3.23: Silt Fence Installation by Slicing Method



Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

BMP C234: Vegetated Strip

Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to BMP C241: Sediment Pond (Temporary) or other sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a vegetated strip, rather than by a sediment trapping BMP, is when the following criteria are met (see Table II-3.12: Contributing Drainage Area for Vegetated Strips):

Table II-3.12: Contributing Drainage Area for Vegetated Strips

Average Contributing Area Slope	Average Contributing Area Percent Slope	Max Contributing area Flowpath Length
1.5H : 1V or flatter	67% or flatter	100 feet
2H : 1V or flatter	50% or flatter	115 feet
4H : 1V or flatter	25% or flatter	150 feet
6H : 1V or flatter	16.7% or flatter	200 feet
10H : 1V or flatter	10% or flatter	250 feet

Design and Installation Specifications

- The vegetated strip shall consist of a continuous strip of dense vegetation with topsoil for a minimum of a 25-foot length along the flowpath. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the vegetated strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the vegetated strip, stormwater runoff controls must be installed to reduce the flows entering the vegetated strip, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

Conditions of Use

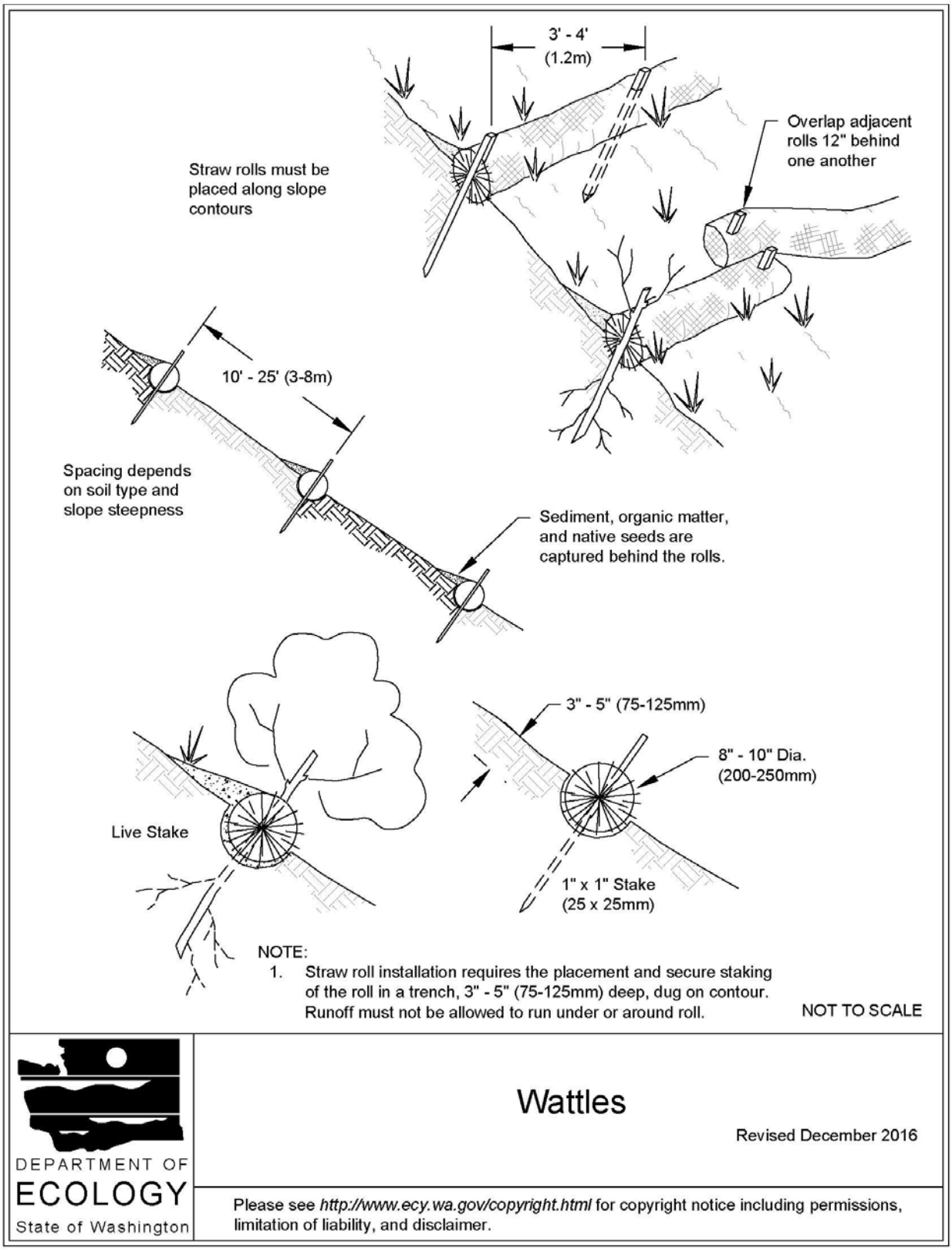
- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles:
    - In disturbed areas that require immediate erosion protection.
    - On exposed soils during the period of short construction delays, or over winter months.
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.

- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- See Figure II-3.24: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3- to 5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-3.24: Wattles



Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C236: Vegetative Filtration

Purpose

Vegetative filtration as a BMP is used in conjunction with detention storage in the form of portable tanks or BMP C241: Sediment Pond (Temporary), BMP C206: Level Spreader, and a pumping system with surface intake. Vegetative filtration improves turbidity levels of stormwater discharges by filtering runoff through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every five acres of disturbed soil use one acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, ground water table height, and other site conditions.
- Wetlands shall not be used for vegetative filtration.
- Do not use this BMP in areas with a high ground water table, or in areas that will have a high seasonal ground water table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated filtration area if standing water or erosion results.

Appendix C

Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____