



Preliminary Stormwater Site Plan

PREPARED FOR:

Tacoma School District No. 10
P.O. Box 1357
Tacoma, WA 98401-1357

PROJECT:

Bryant Montessori School
717 S Grant Avenue
Tacoma, WA 98405
2220043.10

PREPARED BY:

Amelia Davison, EIT
Project Engineer

REVIEWED BY:

Todd Sawin, PE, DBIA, LEEP AP
Principal

DATE:

August 2022

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I hereby state that this [Preliminary Stormwater Site Plan](#) for [Bryant Montessori School](#) has been prepared by me or under my supervision and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that [the City of Tacoma](#) does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1.0 Project Overview

This preliminary report accompanies the civil drawings being submitted to the City of Tacoma for the Conditional Use Permit (CUP) for the Bryant Montessori School project. The scope of the project includes the demolition of the existing school building and removal of existing portables, utility and stormwater improvements, hardscape improvements, and street improvements along three sides of the project site: S Grant Avenue, S 8th Street, and S Ainsworth Avenue. A Site Development Permit will be required for grading of the site and construction of stormwater facilities and will be submitted at a later date. A Work Order permit will be required for improvements within the public right-of-way, including connections to the existing sanitary sewer and storm systems. A building permit will also be required for building-related improvements.

The project site address is 717 S Grant Avenue. The site is bordered to the north by an alley, to the east by S Ainsworth Avenue, to the south by S 8th Street, and to the west by S Grant Avenue. Refer to Appendix E for a Vicinity Map. The site consists of four parcels: Parcel 2007320010 that is 2.36 acres, Parcels 2006330080 and 2006330070 that are 0.04 acre each, and Parcel 2006320080 that is 0.14 acre. These parcels total to 2.58 acres. The project site is located in Section 5, Township 20 N, Range 03 E in Tacoma, Pierce County, Washington.

The Bryant Montessori School project site is located in the Thea Foss Waterway water basin and drains east in an enclosed pipe network to Thea Foss Waterway. Refer to Appendix B for a map of the City of Tacoma Watersheds. There are no critical areas on or adjacent to the project site.

2.0 Existing Conditions Summary

The project parcels total approximately 2.58 acres and are located on the east side of S Grant Avenue, north of S 8th Street and west of S Ainsworth Avenue. The project site consists of the Bryant Montessori School building, an asphalt playground, and a play field. Residential property is located around the entire perimeter of the site.

Topographic relief across the site is approximately 9 feet and the site generally slopes from northwest to southeast. All runoff generated on the existing project site ultimately discharges to an existing stormwater manhole at the intersection of S Ainsworth Avenue and S 7th Street. Refer to Section 3.0 for the downstream analysis performed on this project site.

There are no known historical problems such as flooding or erosion on the project site, with no known areas of ponding on the site. Refer to Appendix B for a Flood Insurance Rate Map. Existing onsite utilities include natural gas, power, telecommunications, sanitary sewer, storm sewer, and water lines.

There are no critical areas on or adjacent to the project site. No known groundwater wells or septic systems are located onsite or within 100 feet of the site. There are no known Superfund areas in the vicinity of the project. There is no known basin plan for the area. The site is not located in a wellhead projection area, as defined by the Tacoma-Pierce County Health Department, the Environmental Protection Agency, or the City of Tacoma.

Geotechnical exploration of the site has yet to be provided but will be conducted and integrated into the Bryant Montessori design before final design submittal. Site information from the National Resources Conservation Service (NRCS) was collected in lieu of formal geotechnical exploration. The project subsurface is defined as Urban Land - Alderwood Complex at zero to 12 percent slopes. A majority of the site slopes at zero to five percent, with a small portion in the northeastern corner at a slope of up to 12 percent. See Appendix C for collected NRCS Soil Survey information.

3.0 Offsite Analysis

3.1 Qualitative Analysis

3.2 Study Area Definition and Maps

Proposed onsite project improvements include the new Bryant Montessori School building, concrete sidewalks, stairs, walls, covered play area, asphalt paving, synthetic turf playfield, two areas with play surfacing, and parking for school employees at the northeastern corner of the site.

Proposed offsite improvements include road widening along S Ainsworth Avenue for a drop-off lane; new sidewalk, curb, and gutter along S 8th Street and S Ainsworth Avenue; grind and overlay at the intersections of S 8th Street with S Grant Avenue and S Ainsworth Avenue; back-in angle parking along S 8th Street; storm sewer, sanitary sewer, and water utility improvements; stormwater treatment improvements; and associated street pavement replacement, as required for offsite utility improvements or damaged existing concrete panels.

The project is located within the North Thea Foss Watershed basin. Refer to Appendix B for a map of the City of Tacoma Watersheds.

3.3 Resource Review

The following resources were reviewed to discover any existing or potential problems in the study area:

1. Soils Information: Information collected from the online NRCS Soil Survey website is included in Appendix C. This information indicates that soils consist of an Urban Land – Alderwood Complex that varies in slope from zero to 5 percent across the majority of the site, with a small portion of the site sloping up to 15 percent. A geotechnical report will be provided with the Site Development Permit submittal.
2. Drainage system in public right-of-way: The City of Tacoma has indicated that there have been no reported problems in the existing storm drainage systems located downstream of the project site.
3. City of Tacoma maps were reviewed that show information for the existing sanitary and storm sewers, contours, easements, and streets. The maps assisted in onsite and offsite mapping of existing utilities and topographic conditions of the study area.
4. As-built construction drawings for the existing school site were consulted to determine locations of the existing utilities.
5. The topographic survey for the project site serves as the background for the design of the project.

3.4 Field Inspection

The existing site slopes southeast. Several existing catch basins, connected to an existing onsite pipe storm system, are located in existing asphalt and grass, which collect runoff generated throughout the site. Runoff from the building roof, portables, and covered play area is directed to downspouts that connect to these existing catch basins. One catch basin found along the eastern edge of the site, within the landing of the existing ramp, collects runoff from the majority of the site and discharges east to S Ainsworth Avenue through an existing storm pipe. Runoff generated onsite and west of the existing building sheet flows west to S Grant Avenue before flowing south along the existing roadway to S 8th Street.

3.5 Drainage System Description

Based on site observations, school resources, as-built information, and the site survey, it appears that runoff generated onsite discharges in two separate locations.

One catch basin along the eastern edge of the site collects runoff from areas northeast of the existing school building and discharges it east to an existing piped conveyance system within the S Ainsworth Avenue right-of-way. Areas conveyed to this catch basin include the covered play and open play areas, roof runoff from the school building and portables, and paved areas around the structures. From the catch basin within S Ainsworth Avenue, runoff is conveyed south towards S 8th Street.

All other runoff generated west or south of the existing school building or from any existing roof downspouts is discharged towards the nearest roadway. Catch basins line S 8th Street, and both S Grant Avenue and S Ainsworth Avenue slope towards this street. Runoff that sheet flows into the roadways surrounding Bryant Montessori flows south towards and then east along S 8th Street. All runoff generated onsite combines at the intersection of S Ainsworth Avenue and S 8th Street.

3.6 Upstream Qualitative Analysis

An existing stormwater conveyance pipe runs through the project site, entering the site along S Grant Avenue and exiting at S Ainsworth Avenue. This pipe and the corresponding utility easement will be maintained throughout this redevelopment project.

3.7 Downstream Qualitative Analysis

The project site is located approximately 1.71 miles from the site's Thea Foss Waterway discharge location. The public system located east of the project site in S Ainsworth Avenue discharges south to S 8th Street and is conveyed east from this intersection through a 10-inch pipe. This pipe upsizes to a 15-inch pipe within the next block as the water travels along S 8th Street and between S Ainsworth Avenue and Cushman Avenue. At the intersection of S 8th Street and S M Street, the pipe downsizes to 14-inches, before downsizing to 10-inches within the block between S L Street and MLK Junior Way. From MLK Junior Way, the stormwater is conveyed eastbound through pipes of 10-, 12-, 15-, 18-, 24-, and 30-inches before meeting the trunk main at Market Street. After combining with the high flow capacity trunk main, the water is conveyed through 36, 42-, 54-, and 60-inch pipes before discharging into Thea Foss Waterway just south of the Fish Peddler off Dock Street.

3.8 Quantitative Analysis

A quantitative analysis will not be required for the Bryant Montessori project per Section 1.5.2 of the City of Tacoma *Stormwater Management Manual (SWMM)* as the proposed improvements will not convert over 10,000 square feet of existing pervious area to impervious area.

4.0 Permanent Stormwater Control Plan

4.1 Threshold Discharge Areas and Applicable Requirements for Treatment, Flow Control, and Wetlands, and other Critical Areas Protection

Existing and developed areas were measured for the project site to determine the performance goals and standards. Table 1 outlines the existing and developed areas for the project site, the estimated value of the project improvements, and estimated existing value of the site.

Table 1. Project Threshold Worksheet

Description ¹	Onsite
Total Project Area ^b (ft ²)	112498
Existing hard surface (ft ²)	84100
Existing vegetation area (ft ²)	28398
Total Project Area ^b (ft ²)	112498
Amount of new hard surface (ft ²)	12600
Amount of new PGHS ^c (ft ²)	4400
Amount of replaced hard surface (ft ²)	64100
Amount of replaced PGHS (ft ²)	0
Amount of new plus replaced hard surface (ft ²)	76700
Amount of new plus replaced PGHS (ft ²)	4400
Amount of existing hard surfaces converted to vegetation (ft ²)	6700
Amount of land disturbed (ft ²)	84370
Vegetation to lawn/landscaped (acres)	0
Native vegetation to pasture (acres)	0
Existing vegetation area to remain (ft ²)	10812
Existing hard surface to remain unaltered (ft ²)	0
Value of proposed improvements (\$)	20 M
Assessed value of existing site improvements (\$)	TBD
Amount to be graded/filled (cubic feet)	-1132

^a All terms are defined in the SWMM glossary.

^b The total project area in the existing condition matches the total project area in the proposed condition. Onsite and offsite areas differ between existing and proposed conditions due to proposed right-of-way adjustments.

^c Not all “amount of new PGHS” are “amount of new hard surface.” Some “amount of replaced hard surface” are “amount of new PGHS,” if the existing hard surface was not pollution generating.

4.2 Existing Site Hydrology

The existing project site consists of one threshold discharge area (TDA) conveying stormwater towards an existing stormwater conveyance system at the intersection of S Ainsworth Avenue and S 7th Street. The project site is located within the Thea Foss Waterway. The total area for the pre-developed basin is approximately 2.58 acres and includes the four onsite parcels. Project sub-basins consist of the onsite basin, which includes all onsite impervious areas

The existing project site consists of one threshold discharge area (TDA) tributary to same location within 0.25 mile downstream of the project site at the intersection of S 8th Street and MLK Junior Way. The project site is located in the watershed discharging to the Thea Foss Waterway. The total area for the pre-developed basin is approximately 2.58 acres, which includes the four onsite parcels.

Table 2. Existing Site Basin

	A _{Imp} (ac)	A _{Per} (ac)	Total (ac)
Existing Conditions	1.93	0.65	2.58

4.3 Developed Site Hydrology

The developed site will consist of the same TDA as existing conditions. A new onsite conveyance system will collect runoff from onsite surfaces and discharge to a new stormwater manhole located on the east side of the project site. One new StormFilter catch basin will be added to this area to capture and treat runoff generated on the proposed asphalt pavement, where it will discharge east to an existing stormwater manhole and then discharge south, similar to existing conditions, to a new StormFilter catch basin designed to treat new asphalt paving proposed along S Ainsworth Avenue.

Table 3. Developed Site Basin

	A_{Imp}(ac)	A_{Per} (ac)	Total (ac)
Developed Conditions	1.76	0.82	2.58

4.4 Performance Goals and Standards

Based on *Figure 1-5 – New Development Flowchart* in the *SWMM*, the proposed site improvements are a redevelopment because the site has greater than 35 percent existing hard surface coverage. Based on *Figure 1-6 – Redevelopment Flowchart* in the *SWMM*, Minimum Requirements 1 through 9 should be reviewed and complied with, if applicable. The applicable Minimum Requirements apply to new and replaced hard surfaces and converted vegetation areas located both onsite and offsite. Refer to Appendix B for additional information.

Based on *Table 5 – Minimum Requirement #5 Compliance List* in the *SWMM*, the project discharges into a flow control exempt waterbody; Thea Foss Waterway in the Puget Sound. The project thresholds found in Section 1.4.5.2 of the *SWMM* apply to Flow Control Exempt Waterbodies. Refer to Appendix B for additional information. Section 1.4.5.2 of the *SWMM*, *Compliance Methods - The List Approach*, lists several Best Management Practices (BMPs) for various types of surfacing found on the project site.

- Roofs:
 - For all proposed roof areas the first BMP to evaluate is Downspout Full Infiltration which is infeasible due to the low infiltration rates expected to be found onsite. Refer to the NRCS Soil Survey information included in Appendix C.
 - The second BMP to evaluate for roof areas is Downspout Dispersion which is infeasible as there is not enough flat, vegetated area found on the project site. The proposed project is a redevelopment so there is little to no native vegetation found onsite.
 - The third BMP listed for roof areas is BMP L604: Perforated Stub-Out Connections which is infeasible due to the limited amount of flat, pervious area proposed on the project site. Perforated Stub-Out Connections cannot be placed under impervious or heavily compacted areas. Perforated Stub-Out Connections cannot be placed on slopes steeper than 20 percent. The only areas where there is enough pervious area proposed on the project site is north and west of the proposed school building but these areas have steep slopes over 20 percent.
 - The fourth and final BMP listed for roofs is BMP L605: Collect and convey to the City system.
- Other Hard Surfaces:

- For all other hard surfaces found onsite the first BMP to evaluate is Concentrated Flow Dispersion which is infeasible as there is not enough flat, vegetated area found on the project site. The proposed project is a redevelopment so there is little to no native vegetation found onsite.
- The second BMP to evaluate is Sheet Flow Dispersion which is also infeasible as there is not enough flat, vegetated area found on the project site. The proposed project is a redevelopment so there is little to no native vegetation found onsite.
- The third and final BMP listed for other hard surfaces is BMP L605: Collect and convey to the City system.
- Lawn and Landscaped Areas:
 - All lawn and landscaped areas must utilize BMP L613: Post- Construction Soil Quality and Depth.

Based on *Figure 1-8 – Flow Control Flowchart* in the *SWMM*, flow control is not required for this project. The site does not discharge, directly or indirectly, into fresh water. Instead runoff discharged from the project site discharges to a publicly owned storm sewer system, which discharges directly into Thea Foss Waterway. Onsite stormwater management is required per Minimum Requirement #5. All onsite sub-basins combine at the intersection of S Ainsworth Avenue and S 8th Street, within 0.25 mile downstream; therefore, the entire project site is considered one TDA. Refer to Appendix B for additional information.

This project is not within the South Tacoma Groundwater Protection District (STGPD).

4.5 Flow Control System

Flow control is not required per *Figure 1-9* of the *SWMM* as the existing stormwater system downstream of the project site passed the required downstream qualitative analysis; refer to Section 3.4 for more information.

4.6 Water Quality Systems

The Tacoma School District policy does not allow pesticides or herbicides to be applied to landscaped areas or play fields; therefore, the pervious areas on the project site are not considered pollution generating. Runoff generated in the proposed onsite trash enclosure, a pollution generating area, shall discharge to the new sanitary side sewer via a proposed trench drain, not the stormwater conveyance system per City of Tacoma requirements.

Portions of the existing roadway, where concrete panels or asphalt pavement are being replaced as part of proposed improvements, will require treatment as the base course will be exposed. The StormFilter catch basin proposed along S Ainsworth Avenue is designed to treat these areas.

Runoff generated in the new 0.10-acre onsite parking area will be treated onsite, separate from the polluted runoff generated in the adjacent roadway. Runoff will flow to the southeast corner of this parking area, where it will enter a proposed StormFilter catch basin for treatment before combining with the rest of the onsite runoff and before discharging offsite at the project site.

Table 4 below shows the amount of pollution generating hard surface that will require treatment as part of the onsite project improvements.

5.0 Conveyance System Analysis and Design

Stormwater conveyance improvements include the construction of a new onsite conveyance and the addition of new catch basins and drainage pipes to the existing publicly owned storm sewer

system in S Ainsworth Avenue. Conveyance analysis will be provided with the Site Development Permit submittal.

6.0 Discussion of Minimum Requirements

6.1 Minimum Requirements

6.1.1 MR 1 – Preparation of Stormwater Site Plan

A Stormwater Site Plan is required for Environmental Services review. This report provides the Stormwater Site Plan narrative, exhibits, figures, and calculations. Engineering plans are provided in the form of temporary erosion and sedimentation control plans, site plans, and grading and drainage plans.

6.1.2 MR 2 – Construction Stormwater Pollution Prevention

The proposed project is required to provide a Construction Stormwater Pollution Prevention Plan (SWPPP), including a narrative and Erosion Control Plans. The Construction SWPPP complies with the 12 Elements identified in the *SWMM*. The Construction SWPPP is discussed in Section 8.0 and will be provided with the Site Development Permit submittal.

6.1.3 MR 3 – Source Control of Pollution

The proposed project is required to provide source control of pollution. Design of source control systems will be included in the final Bryant Montessori School project design, alongside the Construction SWPPP that will be provided with that final design submittal.

6.1.4 MR 4 – Preserving Drainage Patterns and Outfalls

The project site currently consists of one TDA and is located in the watershed of the Thea Foss Waterway.

Under existing conditions, runoff from the existing project site and adjacent rights-of-way is collected and discharged, with no flow control or water quality treatment, to publically owned storm sewers in either the S Ainsworth Avenue or S 8th Street rights-of-way. All runoff generated in these areas is tributary to a publically owned storm sewer manhole at the intersection of S Ainsworth Avenue and S 8th Street; this is less than 0.25 mile from the project site.

Proposed storm improvements include a new onsite stormwater conveyance system, one onsite and one offsite StormFilter catch basin, and new collection and conveyance stormwater systems within the S Ainsworth Avenue right-of-way. Flow control is not required; refer to Section 4.5 of this report. Refer to Section 4.6 of this report for a description of the proposed water quality facilities. All runoff generated onsite or on the adjacent rights-of-way will remain tributary to the same publically owned storm sewer manhole at the intersection of S Ainsworth Avenue and S 8th Street. Project improvements will not cause a significant adverse impact to the downstream receiving waters and downgradient properties, refer to Section 3.3 of this report for a discussion of the downstream analysis for the project improvements.

6.1.5 MR 5 – Onsite Stormwater Management

This project will meet the Flow Control Exempt Waterbodies list of BMPs for all onsite runoff. Refer to Section 4.4 for more information.

6.1.6 MR 6 – Stormwater Treatment

Basic Water Quality treatment will be provided by two StormFilter catch basins proposed both onsite and offsite. All new and replaced pollution generating surfaces require treatment. This does not include surfaces replaced as part of proposed utility improvements or pavement maintenance that does not expose the existing base course, per Section 1.2.2 of the *SWMM*. The proposed trash enclosure shall discharge to the sanitary sewer system, rather than the storm drainage sewer system, per City of Tacoma requirements.

6.1.7 MR 7 – Flow Control

Flow control is not required for the proposed project improvements; see Section 4.5 of this report and *Figure 1-8 – Flow Control Flowchart* of the *SWMM* in Appendix B.

6.1.8 MR 8 – Wetlands Protection

There are no known wetlands in the project vicinity; therefore, wetland protection measures are not required.

6.1.9 MR 9 – Operation and Maintenance

The operations and maintenance requirements are discussed in Section 7.0. An Operations and Maintenance Manual will be included with the Site Development Permit submittal.

7.0 Operations and Maintenance

Operations and maintenance will be the responsibility of the project owner. All drainage facilities shall be maintained and operated in compliance with City of Tacoma maintenance standards. The Operations and Maintenance Manual for privately maintained drainage facilities will be provided with the Site Development Permit submittal.

8.0 Construction Stormwater Pollution Prevention Plan

The proposed development shall comply with the requirements of the *SWMM*. The temporary erosion and sedimentation control plans include BMPs that are intended to prevent sediment-laden runoff from leaving the site or adversely affecting critical water resources during construction. A separate Construction SWPPP will be prepared for this project and included in the Site Development Permit submittal.

9.0 Special Reports and Studies

Preliminary geotechnical research was conducted utilizing the online NRCS Web Soil Survey. See Appendix C for the collected information.

10.0 Conclusion

This project has been designed to meet the requirements of the City of Tacoma *Stormwater Management Manual (SWMM)*. It was determined from the requirements in the *SWMM* that:

- The Low Impact Development Performance Standard will be met.
- Water quality treatment is required and will be provided.
- Flow control is not required.

- The storm drainage conveyance systems will be designed at adequate size and slope to effectively convey the 25-year, 24-hour design storm

This analysis is based on data and records either supplied to or obtained by AHBL. These documents are referenced within the text of the analysis. The analysis has been prepared using procedures and practices within the standard accepted practices of the industry. We conclude that this project, as proposed, will not create any new problems within the existing downstream drainage system. This project will not noticeably aggravate any existing downstream problems due to either water quality or quantity.

AHBL, Inc.

Amelia Davison, EIT
Project Engineer

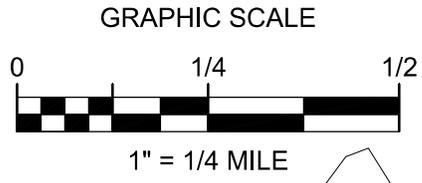
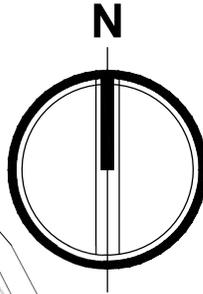
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August 2022

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Appendix A

Qualitative Downstream Analysis



- NTB 1 - NORTH TACOMA BASIN 1
- NTB 2 - NORTH TACOMA BASIN 2
- STFWB - SOUTH THEA FOSS WATERWAY BASIN
- NTFWB 1 - NORTH THEA FOSS WATERWAY BASIN 1
- NTFWB 2 - NORTH THEA FOSS WATERWAY BASIN 2
- NTFWB 3 - NORTH THEA FOSS WATERWAY BASIN 3
- NTFWB 4 - NORTH THEA FOSS WATERWAY BASIN 4
- NTFWB 5 - NORTH THEA FOSS WATERWAY BASIN 5
- NTFWB 6 - NORTH THEA FOSS WATERWAY BASIN 6
- NTFWB 7 - NORTH THEA FOSS WATERWAY BASIN 7

NTB 1

Bryant Montessori School

DIVIDING LINE
BETWEEN NORTH
TACOMA AND THEA
FOSS WATERWAY
WATERSHEDS

NTB 2

Discharge
Enters Trunk
Main Waterline

NTFWB 1

NTFWB 2

NTFWB 3

NTFWB 4

NTFWB 5

NTFWB 6

NTFWB 7

STFWB

1/4 MILE DOWNSTREAM
FROM MLK JR WAY



2215 North 30th Street,
Suite 300,
Tacoma, WA 98403
253.383.2422 TEL
253.383.2572 FAX

TACOMA LINKS TO OPPORTUNITY

BASIN MAP

JOB NO:
2160917.10
DATE: 10/26/2017

EX-1

3.3 Downstream Qualitative Analysis

The project site is located about 1.71 miles from the site's Foss Waterway discharge location. The public system runs west to east underneath our site and discharges to the east to the intersection of S Ainsworth Ave and S 7th St through an 8-inch pipe. Here the pipe upsizes to 10-inches and the discharge flows south to the intersection of S Ainsworth Ave and S 8th St. At the intersection the pipe diameter increases to 15-inches and the discharge is conveyed east to S M St. At S M St. the pipe decreases to 14-inches and the discharge continues east until S L St. where the pipe decreases again to a diameter of 10-inches. The discharge continues east until the intersection of Martin Luther King Jr Way over a ¼ mile from the site.

Site to first ¼ miles offsite

Direction	Street Names	Pipe Length	Pipe Diameter	Pipe Slope
Southbound on S Ainsworth	From site to S 8 th St	354 Feet	10 Inches	0.361
Eastbound on S 8 th St	Between S Ainsworth Ave And S Cushman Ave	246 Feet	15 Inches	1.461
Eastbound on S 8 th St	To S Cushman Ave	115 Feet	15 Inches	1.693
Eastbound on S 8 th St	S Cushman Ave to S Sheridan Ave	358 Feet	15 Inches	1.271
Eastbound on S 8 th St	Between S Sheridan Ave and S M St	180 Feet	15 Inches	0.782

Eastbound on S 8 th St	To S M St	183 Feet	15 Inches	0.836
Southbound on S M St	Across S 8 th St	21 Feet	14 Inches	0.973
Eastbound on S 8 th St	S M St to S L St	365 Feet	14 Inches	0.55
Eastbound on S 8 th St	Between S L St and MLK Way	31 Feet	14 Inches	0.96
Southeast on S 8 th St	Between S L St and MLK Way	23 Feet	10 Inches	2.87
Eastbound on S 8 th St	To MLK Way	282 Feet	10 Inches	3.231

MLK Way to Trunk Main

Direction	Street Names	Pipe Length	Pipe Diameter	Slope
Eastbound on S 8 th St	MLK Way to S J St	387 Feet	10 Inches	4.623
Eastbound on S 8 th St	S J St to Neighbors Park	190 Feet	12 Inches	0.972

Eastbound on S 8 th St	Neighbors Park to S I St	173 Feet	12 Inches	0.971
Eastbound on S 8 th St	S I St to Yakima Ave	323 Feet	10 Inches	6.529
Eastbound on S 8 th St	Between S I St and S G St	181 Feet	12 Inches	1.058
Eastbound on S 8 th St	To S G St	237 Feet	10 Inches	4.117
Eastbound on S 8 th St	Between S G St and Tacoma Ave S	36 Feet	10 Inches	4.109
Eastbound on S 8 th St	To Tacoma Ave S	306 Feet	10 Inches	7.895
Southbound on Tacoma Ave S	S 8 th St to S 9 th St	376 Feet	15 Inches	2.913
Eastbound on S 9 th St	Tacoma Ave S to Court E	222 Feet	18 Inches	6.947
Eastbound on S 9 th St	Court E to Fawcett Ave	157 Feet	18 Inches	9.52
Eastbound on S 9 th St	Fawcett Ave to Court D	187 Feet	18 Inches	11.371

Eastbound on S 9 th St	Court D to Market St	170Feet	18 Inches	12.926
Southbound on Market St	Between S 9 th St and S 11 th St	427.Feet	24 Inches	2.465
Southbound on Market St	To S 11 th St	322 Feet	24 Inches	2.073
Southeast on Market St	Across the intersection of S 11 th St and Market St	63 Feet	30 Inches	10.051

Trunk Main to final Discharge

Direction	Street Names	Pipe Length	Pipe Diameter	Slope
Southbound on Market St	Between S 11 th St and S 13 th St	372 Feet	36 Inches	1.359
Southbound on Market St	To S 13 th St	331 Feet	36 Inches	2.099
Southbound on Market St	Across S 13 th St	58 Feet	36 Inches	1.825
Southbound on Market St	Between S 13 th St and S 15 th St	343 Feet	42 Inches	1.296
Southbound on Market St	To S 15 th St	367 Feet	42 Inches	2.648

Eastbound on S 15 th St	Market St to Court C	176 Feet	36 Inches	11.631
Eastbound on S 15 th St	Court C to Broadway	183 Feet	36 Inches	12.795
Eastbound on S 15 th St	Between Broadway and Commerce St	111 Feet	36 Inches	11.643
Eastbound on S 15 th St	To Commerce St	35 Feet	36 Inches	10.094
Eastbound on S 15 th St	Commerce St to Pacific Ave	166 Feet	36 Inches	7.62
Eastbound on S 15 th St	Between Pacific Ave and A St	129 Feet	36 Inches	5.674
Eastbound on S 15 th St	Between Pacific Ave and A St	50 Feet	36 Inches	10.048
Northeast on S 15 th St	Between Pacific Ave and A St	45 Feet	36 Inches	16.914
Eastbound on Court A	Between Pacific Ave and A St	133 Feet	52 Inches	10.602
Eastbound below of E 15 th St	To S Hood St	85 Feet	52 Inches	0.694

Eastbound on E 15 th St	Between S Hood St and 705	18 Feet	43 Inches	1.394
Eastbound on E 15 th St	705 to Dock St	199 Feet	60 Inches	5.97
Eastbound on E 15 th St	Between Dock St and Discharge	65 Feet	60 Inches	0.785
Eastbound	Between Dock St and Discharge	86 Feet	60 Inches	1.08
Eastbound	Discharge into Foss Waterway	180 Feet	60 Inches	1.006

Total Pipe Length= 9047 Feet=1.71 Miles

Appendix B

Exhibits

- B-1.....Vicinity Map
- B-2.....City of Tacoma Watershed
- B-3.....FEMA Flood Insurance Rate Map
- B-4.....New Development and Redevelopment Flowcharts (Figures 1-5 and 1-6)
- B-5.....Minimum Requirement #5 Flowchart (Table 6)
- B-6.....Flow Control Flowchart (Figure 1-8)

CITY OF TACOMA WATERSHEDS (2020)

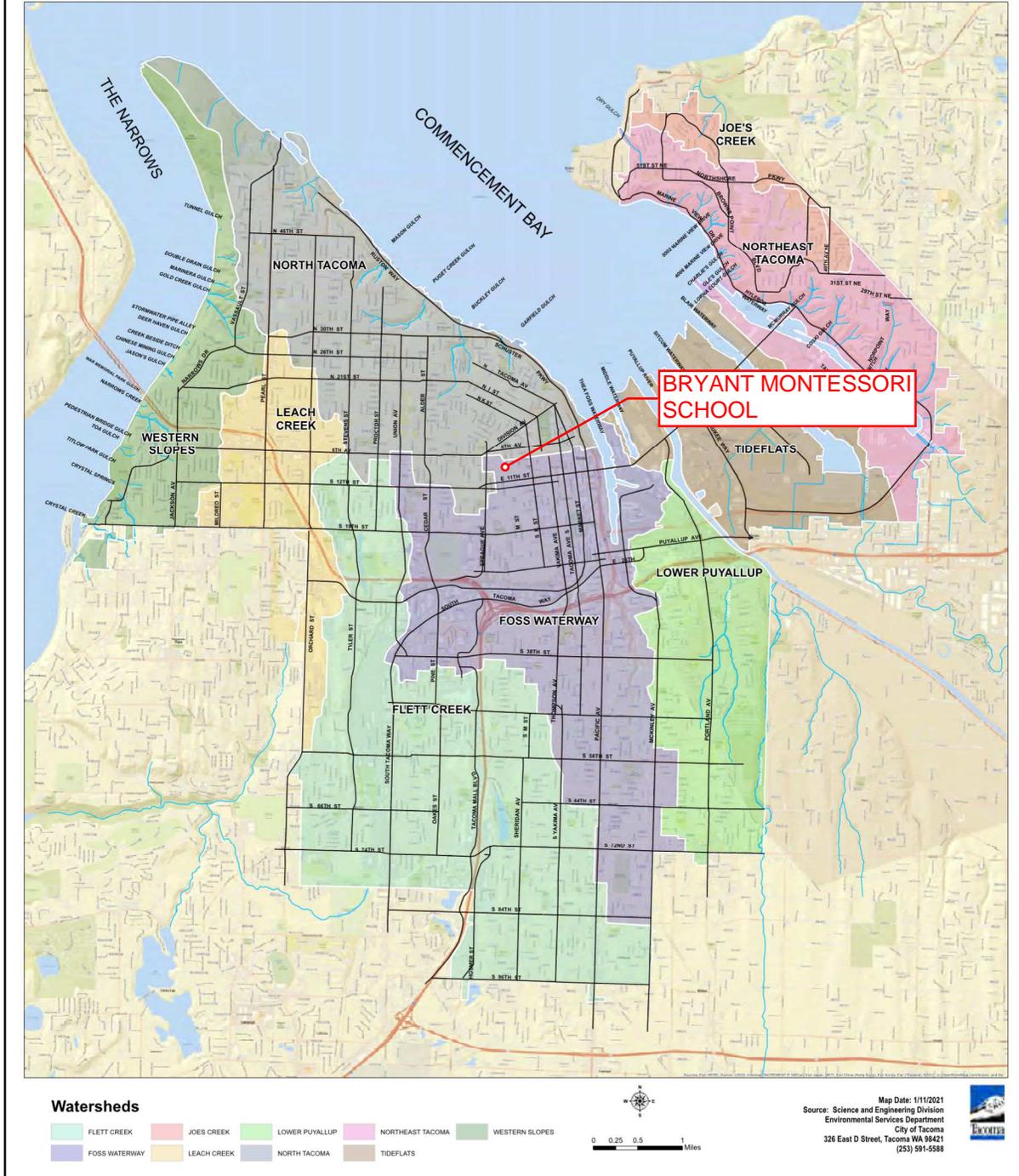


Figure P - 1: City of Tacoma Watersheds

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be used for construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0 North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10. The horizontal datum was NAD 83 GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the preparation of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services
 NOAA, NNGS12
 National Geodetic Survey
 SSMC-3, #5202
 1315 East-West Highway
 Silver Spring, Maryland 20910-3282
 (301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (941) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Pierce County GIS, WA DNR, WSDOT-USFWS, Washington State Department of Ecology, and Puget Sound Regional Council. This information was compiled at scales of 1:100 to 1:24,000 during the time period 1996-2012.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of projected topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

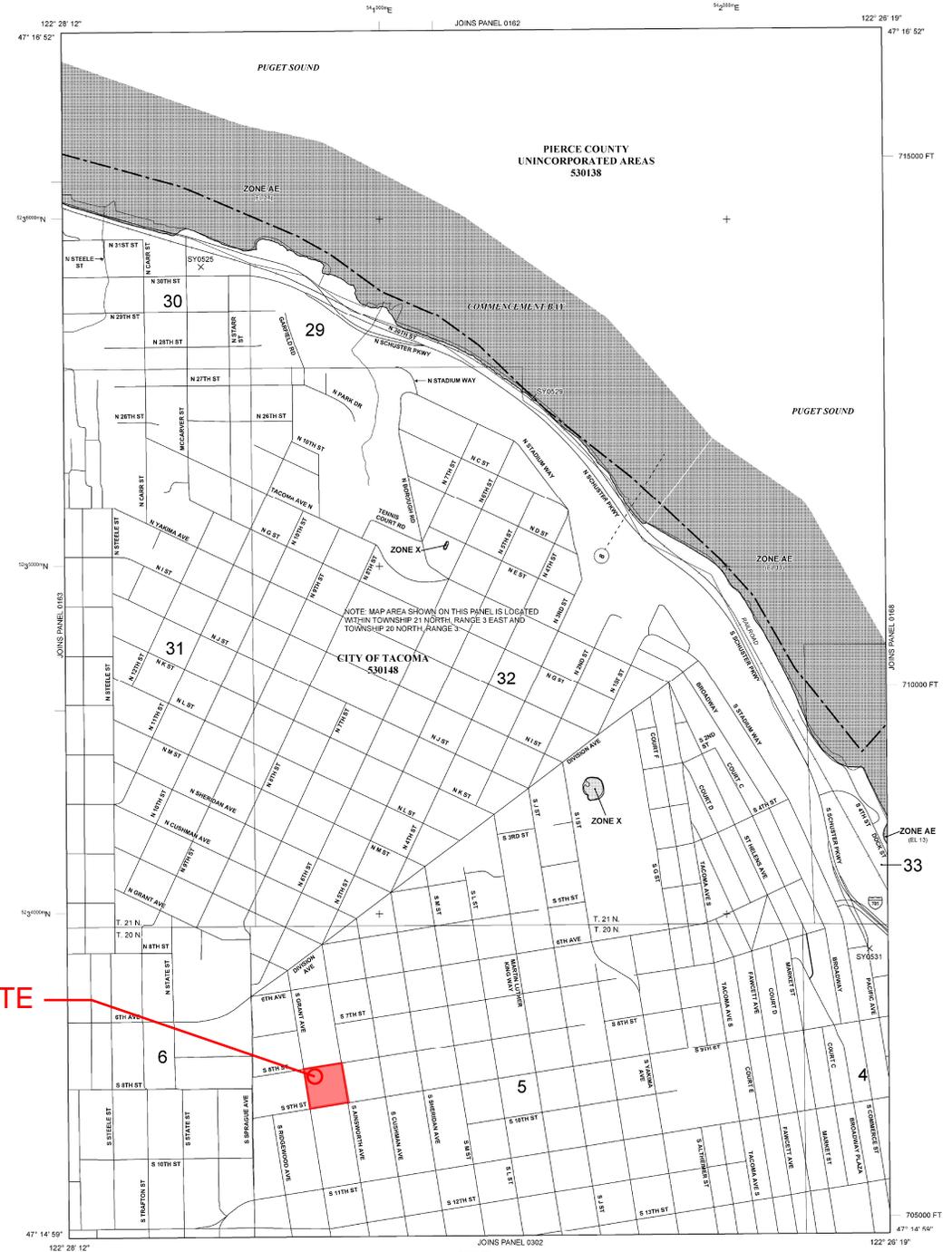
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or disannexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://map.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA-MAP (1-877-335-2627) or visit the FEMA website at <http://www.fema.gov/businessinfo>.

SITE



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHA) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equalled or exceeded in any given year. The area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, AR, AV, and VE. The base flood elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A
 No Base Flood Elevations determined.

ZONE AE
 Base Flood Elevations determined.

ZONE AH
 Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO
 Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined; for areas of sheet flow, velocities also determined.

ZONE AR
 Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently destroyed. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE AVS
 Area to be protected from 1% annual chance flood by a federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V
 Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE
 Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X
 Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with change areas less than 1 square mile; and areas protected by levees from the 1% annual chance flood.

OTHER AREAS

ZONE X
 Areas determined to be outside the 0.2% annual chance floodplain. Areas in which flood hazards are undetermined, but possible.

ZONE D
 COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- Base Flood Elevation (in feet and value, elevation in feet)
- Base Flood Elevation (in feet and value, elevation in feet)
- Base Flood Elevation (value uniform within zone, elevation in feet)

*Referenced to the North American Vertical Datum of 1988

(A) Cross section line
(B) Transvers line
(C) Culvert

91616
 Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
 45° 02' 08" 92° 02' 12"
 98° 11' N
 1000-meter Universal Transverse Mercator grid value, zone 10
 DMS10 X
 River Mile
 M 1.5

MAP REPOSITORIES
 Refer to Map Repositories list on Map Index

COPYRIGHT DATE OF COUNTY/STATE FLOOD INSURANCE RATE MAP
 Pierce County
 March 7, 2017

EFFECTIVE DATES OF REVISIONS TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if Flood Insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-438-6620.

MAP SCALE 1" = 500'
 250 0 250 500 1000
 FEET
 150 0 150 300
 METERS

NFP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0164E

FIRM
FLOOD INSURANCE RATE MAP
PIERCE COUNTY,
WASHINGTON
AND INCORPORATED AREAS

PANEL 164 OF 1375
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:
 COMMUNITY NUMBER PANEL SUBAREA
 PIERCE COUNTY 530138 0164 E
 TACOMA, CITY OF 530148 0164 E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

FEDERAL EMERGENCY MANAGEMENT AGENCY

MAP NUMBER
53053C0164E

EFFECTIVE DATE
MARCH 7, 2017

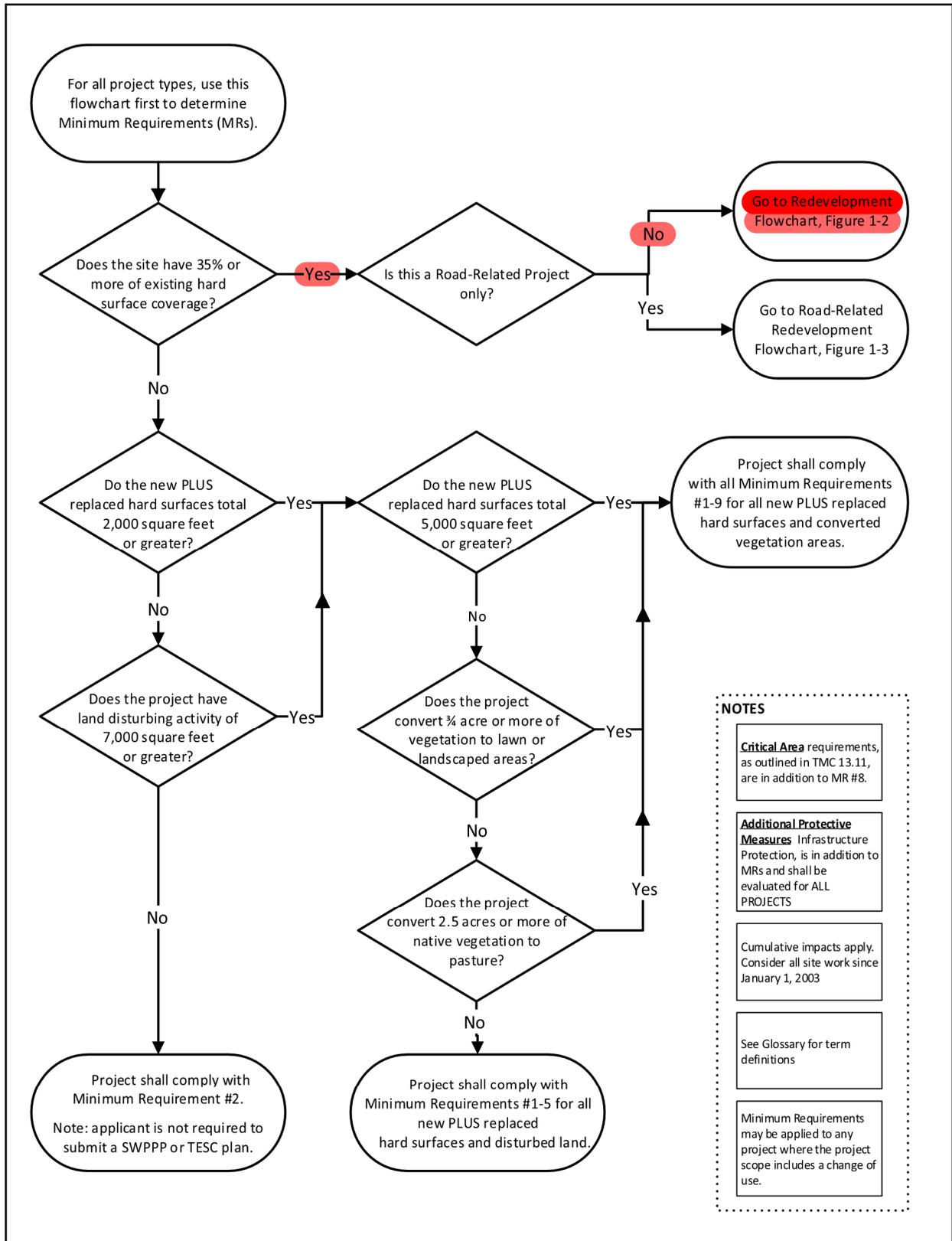


Figure 1 - 1: All Projects and New Development Flowchart

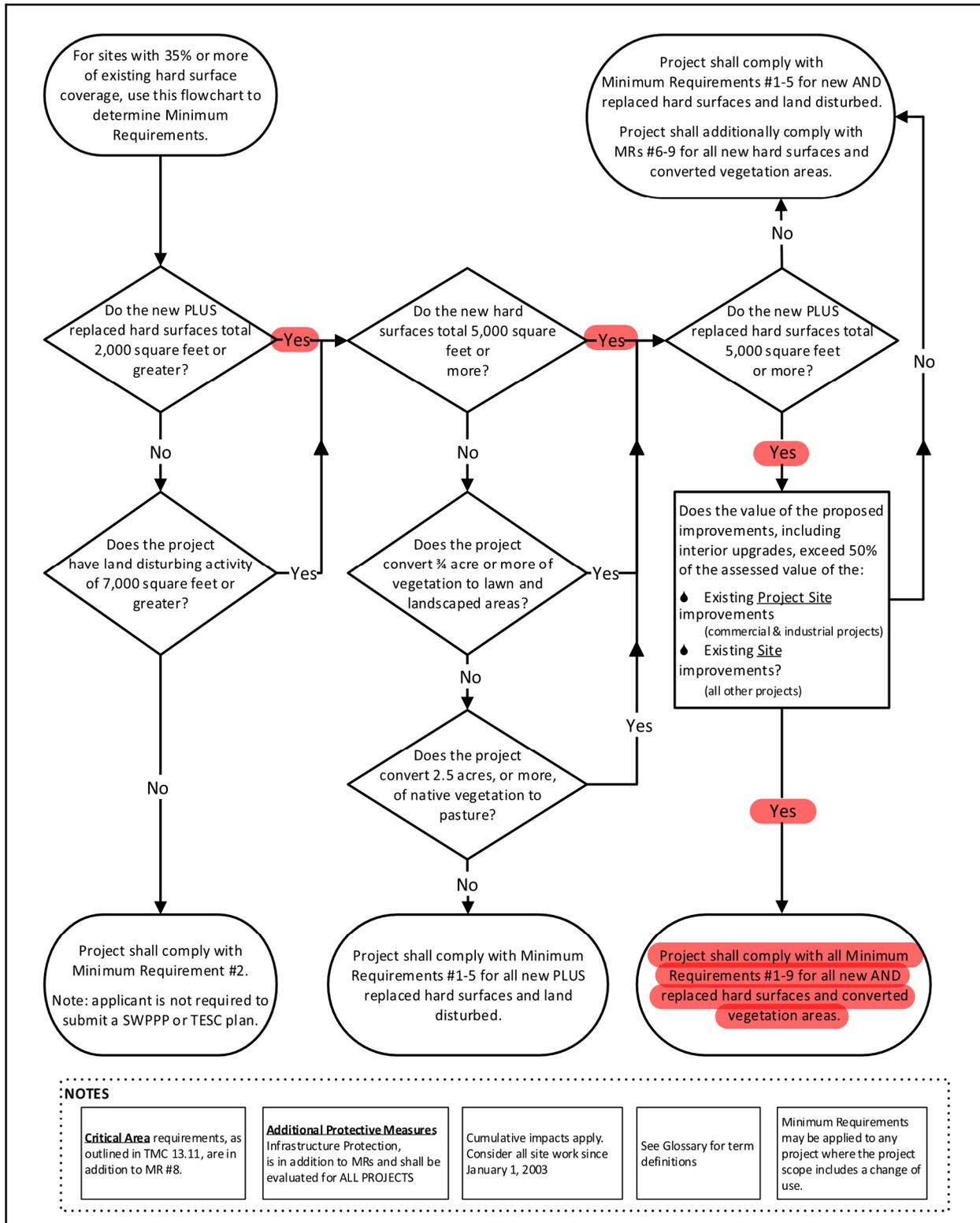


Figure 1 - 2: Redevelopment Flowchart

Table 1 - 1: The List Approach for MR #5 Compliance

List #1 For MR #1 - #5 Only Projects That Are Not Flow Control Exempt	List #2 For MR #1- #9 Projects That Are Not Flow Control Exempt	List #3 Flow Control Exempt Projects
Surface Type: Lawn and Landscaped Areas		
BMP L613: Post-Construction Soil Quality and Depth	BMP L613: Post-Construction Soil Quality and Depth	BMP L613: Post-Construction Soil Quality and Depth
Surface Type: Roofs		
1. BMP L614: Full Dispersion, or BMP L602: Downspout Full Infiltration	1. BMP L614: Full Dispersion, or BMP L602: Downspout Full Infiltration	1. BMP L602: Downspout Full Infiltration
2. BMP L601: Rain Gardens, or BMP L630: Bioretention	2. BMP L630: Bioretention	2. BMP L603: Downspout Dispersion
3. BMP L603: Downspout Dispersion	3. BMP L603: Downspout Dispersion	3. BMP L604: Perforated Stub-Out Connections
4. BMP L604: Perforated Stub-Out Connections	4. BMP L604: Perforated Stub-Out Connections	

Table 1 - 1: The List Approach for MR #5 Compliance

List #1 For MR #1 - #5 Only Projects That Are Not Flow Control Exempt	List #2 For MR #1- #9 Projects That Are Not Flow Control Exempt	List #3 Flow Control Exempt Projects
Surface Type: Other Hard Surfaces		
1. BMP L614: Full Dispersion	1. BMP L614: Full Dispersion	1. BMP L612: Sheet Flow Dispersion, or BMP L611: Concentrated Flow Dispersion
2. BMP L633: Permeable Pavements, or BMP T1050: Compost-Amended Vegetated Filter Strip (CAVFS), or BMP L601: Rain Gardens, or BMP L630: Bioretention	2. BMP L633: Permeable Pavements, or BMP T1050: Compost-Amended Vegetated Filter Strip (CAVFS)	
3. BMP L612: Sheet Flow Dispersion, or BMP L611: Concentrated Flow Dispersion	3. BMP L630: Bioretention	
	4. BMP L612: Sheet Flow Dispersion, or BMP L611: Concentrated Flow Dispersion	
<p>Notes:</p> <ol style="list-style-type: none"> 1. Size Bioretention and Rain Gardens used in the List Approach to have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it. 2. It is not a requirement to pave surfaces to meet the intent of using Permeable Pavement. If pavement is proposed, it must be permeable to the extent feasible unless BMP L614: Full Dispersion is employed. 3. Where there is an "or" statement in a box, the "or" indicates that either BMP may be used to satisfy the requirement though all BMPs must be evaluated for infeasibility. BMPs must be evaluated in the numbered order. 4. Compost Amended Vegetated Filter Strips may only be used for sidewalks, walkways, and trails and shall follow the criteria within BMP T1050: Compost-Amended Vegetated Filter Strip (CAVFS) specific to compliance with Minimum Requirement #5: Onsite Stormwater Management. 		

1.4.5.3 Objective

To use stormwater management practices on individual properties to reduce the amount of disruption to the natural hydrologic characteristics of the site.

Appendix C

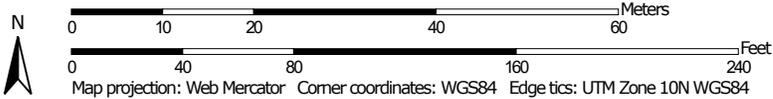
Reports

C-1.....NRCS Soil Survey

Soil Map—City of Tacoma, Washington



Map Scale: 1:825 if printed on A portrait (8.5" x 11") sheet.



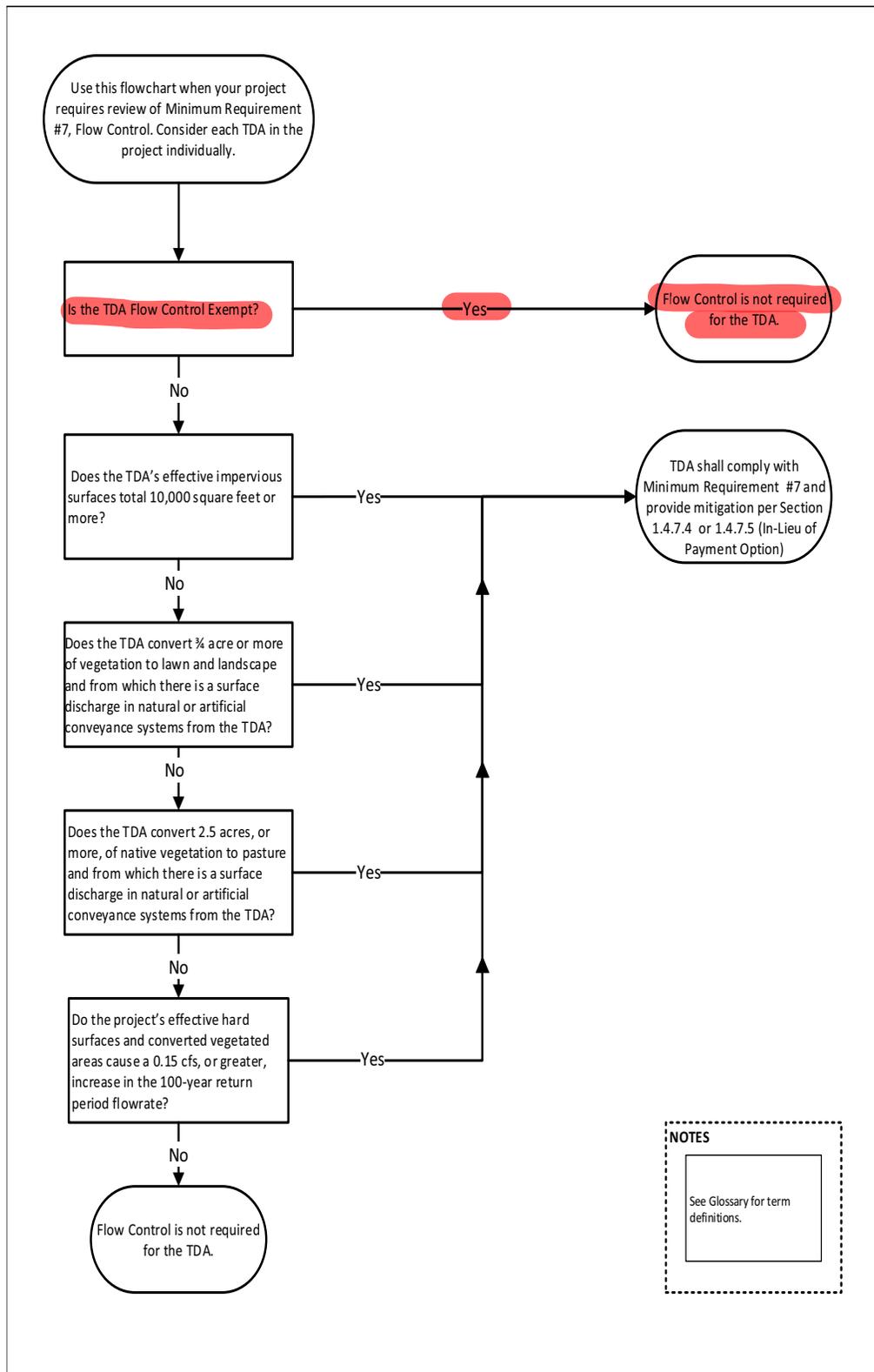


Figure 1 - 6: Flow Control Flowchart

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: City of Tacoma, Washington

Survey Area Data: Version 4, Sep 9, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 5, 2020—Aug 10, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3055	Urban land-Alderwood complex, 0 to 5 percent slopes	2.7	97.7%
3056	Urban land-Alderwood complex, 5 to 12 percent slopes	0.1	2.3%
Totals for Area of Interest		2.7	100.0%

Appendix D

Civil Engineering Plans